Main Roads Western Australia

Report for Brand Highway Upgrade at 61.50 to 63.40 SLK

Environmental Impact Assessment

March 2007

FINAL DRAFT

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Executive Summary

The Brand Highway links Bullsbrook (north of Perth) to Geraldton. Main Roads Western Australia (WA) proposes to install ten new passing lanes and extend an existing passing lane along a 115 km section of the Highway from Gingin in the south to Eneabba in the north. The main objective is to improve road user safety particularly with the interaction of smaller vehicles and the large road trains that use the route to cart mineral sands and oil from the Dongara, Eneabba and Cataby areas.

This report covers the proposed upgrades from 61.50 to 63.40 Standard Length Kilometres (SLK), which consists of the construction of a south bound passing lane of 1.9 km in length, at Red Gully, approximately 30 km north of Gingin. The report refers to this area as the Site and the roadworks and associated activities as the Project.

The construction works for this upgrade will require the clearing of approximately 1.9 ha of native vegetation along the existing road edge and as such Main Roads WA, as specified under their existing clearing permit (CPS 818/1), was required to undertake a Preliminary Environmental Impact Assessment (PEIA). Where the outcome of the PEIA indicates that the proposed clearing "may be at variance or seriously at variance with one or more of the clearing principles", Main Roads WA must undertake an Environmental Impact Assessment (EIA) (DEC, 2005 - Main Roads WA Purpose Permit CPS 818/1, Condition 7d). Condition 7n of the purpose permit then states "where the results of the EIA indicate that clearing for the Site may be seriously at variance with the clearing principles, the permit holder must apply to the CEO for a clearing permit in respect of that clearing".

GHD developed a series of PEIAs for the ten proposed passing lanes, each requiring clearing of native vegetation in good or better condition, for Main Roads WA in April 2006. These PEIA's identified that all of the proposed passing lanes may potentially be at variance with one or more of the "Ten Clearing Principles", therefore, the formal EIA process was triggered (GHD, 2006).

GHD Pty Ltd (GHD) was commissioned by Main Roads WA to prepare an Environmental Impact Assessment and Environmental Management Plan (EIA and EMP), including field surveys to assess the vegetation and habitat values, for the proposed road upgrades.

The field survey for the Site located at 61.50 to 63.40 SLK was conducted on the 22nd September 2006, by an experienced and qualified botanist/zoologist and an experienced field ecologist. The results of the assessment concluded that:

» The majority of the site is low open woodland of *Banksia* species and *Eucalyptus todtiana*. The Banksia low woodland in the northern section of the site is very open, and contains mainly shrubland species. In the upland areas in the south of the site there is a higher coverage of *Banksia* species and *Eucalyptus todtiana.* In the northern section of the site there is remnant vegetation adjacent to the highway, including a section of Marri-Wandoo woodland along a ridgeline.

- The vegetation at the site was largely intact with disturbance restricted to the edge of the shoulder. There is good quality vegetation away from the highway, including sections that are between Condition 1 ('Pristine') to Condition 2 ('Excellent'). In the south of the site the vegetation was rated Condition 2 ('Excellent') to Condition 3 ('Very Good'). However, the vegetation adjacent to the highway has been disturbed by roadworks and a power-line easement and this vegetation was rated Condition 2 ('Excellent') to Condition 3 ('Very Good').
- The extent and status of Heddle et al. (1980) vegetation complexes are described in the EPA's *Guidance for the Assessment of Environmental Factors: Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1* (EPA, 2006). It can be seen from this data that the vegetation complex at the study site has more than 30 % of its original distribution remaining indicating is above the 'threshold level'. The vegetation types recorded during the survey were also compared with those of Shepherd (*pers comm*., 2005). This comparison indicated that the vegetation type at the site, 'Low woodland; Banksia'; has more than 30 % of its original distribution remaining indicating that it is above the 'threshold level'. The 'Medium Woodland: Marri & Wandoo' vegetation association is classified as below the 30% 'threshold level'. Clearing of the Marri - Wandoo woodland will be avoided where the clearing width is restricted to 10 metres and clearing results in no disturbance to the adjacent woodland. It is recommended that any mature Marri/Wandoos within the 10m be retained where possible (for habitat purposes).
- No evidence of plant diseases was observed during the survey. Based on patterns of health of susceptible plants there was no indication of the occurrence of dieback (*Phytophthora cinnamoni*) within the site.
- A section on the western portion of the road reserve within the relevant SLKs had been recently burnt so the number of plants recorded in this area was limited to those that rapidly germinate and sprout post-fire. The survey assumed that this area was floristically similar to the surrounding area.
- The site has good species diversity with a total of 136 taxa (114 native taxa) from 41 families recorded within the surveyed area.
- No DRF or Priority species were identified during the survey.
- The Site would be expected to support a number of bird and herpetofauna species. The Site would also be expected to support a number of mammals, although not likely to use the vegetation adjacent to the highway.
- The Site contains two main habitat types, Banksia woodland and Marri-Wandoo woodland. The vegetation of these habitats was in good condition but there are large areas of habitat in better condition to the west and north of the study area. The Marri – Wandoo woodland would provide habitat for a number of species, including potential feeding and nesting habitat for the Endangered Carnaby's Cockatoo. If the clearing required for these works will be confined to around 10 m of vegetation adjacent to the shoulder, as proposed, and if mature Wandoo trees

can be retained wherever possible, clearing impacts on this habitat will be minimal.

» A number of significant species have been recorded in the general area but the main species that would be likely to use the Site is Carnaby's Cockatoo, which could use the Site for foraging. The extent of clearing required for this project would not significantly impact on the habitat of this species and no significant impacts on other significant fauna species would be expected from the project.

» The clearing of vegetation that is required for this project will reduce the amount of habitat available to fauna, but the extent of clearing is minor and the majority of the road reserve vegetation will be retained and can continue to be utilised by fauna.

» The amount of clearing required for this project is minimal and the project has been assessed as not being at variance with any of the "Ten Clearing Principles".

No environmental impacts identified during the preparation of this EIA and EMP are considered to warrant the referral of the project to the Commonwealth Minister for the Environment under the provisions of the *Environment Protection and Biodiversity Conservation Act, 1999*, or the *Western Australian Environmental Protection Act 1986.*

1. Introduction

1.1 Background

GHD Pty Ltd (GHD) was commissioned by Main Roads WA to prepare an Environmental Impact Assessment and Environmental Management Plan (EIA and EMP) for a proposed road upgrade of sections of the Brand Highway.

Main Roads WA proposes to improve road user safety by constructing ten new passing lanes and extend an existing lane along southern sections of the Brand Highway, between Gingin and Eneabba. This report covers the proposed upgrades at 61.50 to 63.40 SLK, which consists of the construction of a southbound passing lane of 1.9 km in length, at Red Gully, approximately 30 km north of Gingin.

In April 2006, a Preliminary Environmental Impact Assessment (PEIA) report for each of the ten proposed passing lanes was completed by GHD for Main Roads WA (GHD, 2006). The location of each of the ten passing lanes is identified in **Figure 1.**

The PEIA involved a desktop study to assess each of the proposed clearing areas to determine the likelihood that the clearing may be at variance with the "Ten Clearing Principles" defined in Schedule 5 of the *Environmental Protection Act 1986,* as required by Main Roads WA clearing permit CPS 818/1.

Where the outcome of the PEIA indicates that the proposed clearing "may be at variance or seriously at variance with one or more of the clearing principles", Main Roads WA must undertake an EIA (DEC, 2005).

This EIA and EMP has been prepared as a result of the PEIA findings for the site, which indicated that the proposed clearing may be at variance with one or more of the "Ten Clearing Principles" outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003.*

1.2 Study Area

The Site consists of a 1.9km southbound passing lane from 61.50 to 63.40 SLK. This site is located approximately 30 km north of Gingin, south of Red Gully Road, Red Gully. The survey location is shown at **Figure 1**, identified as Main Roads WA Site 2.

The field surveys considered the whole area of vegetated road reserve along the entire length of the survey area; however, effort was concentrated on the area of road widening required. Additional to the survey of the road reserve, any significant biological aspects outside of the Site were considered for any potential indirect impacts from the proposed works.

1.3 Field Survey Scope

The field survey was conducted to verify the desktop study and to provide a detailed assessment of the existing environment at the Site and its relationship to adjoining areas. The field survey considered the following aspects:

- Assessment of plant species located at the Site, including consideration of rare and protected species and introduced species;
- An assessment of the vegetation type and condition of the Site and a review of the significance of the vegetation communities at the Site;
- An assessment of the potential presence of any plant pests and diseases at the Site;
- An assessment of the clearing against the “Ten Clearing Principles”;
- An inventory and review of the vertebrate fauna species in the survey area, particularly protected fauna species. A review of presence and abundance of introduced fauna species;
- Identification of any habitats of significance; and
- Assessment of habitat linkages.

1.4 Purpose of this Document

This document has been prepared in accordance with the Main Roads WA Clearing Permit CPS 818/1 and the Supplementary Guidance on Environmental Impact Assessment (Main Roads WA, 2006) and describes the significant aspects of the existing natural and social environment in the Project area and examines the environmental and social impacts of the proposed works.

Actions to manage and minimise the identified impacts have been proposed and incorporated as part of this document with the objective to develop an effective EMP that can be utilised during all phases of the Project.

The EIA and EMP has been prepared based on:

- A field based flora and fauna survey, as descrided in Section 1.3;
- A review of relevant design documents prepared for the Project;
- Discussions with the Main Roads WA Project Manager;
- Discussions with officers from the Department of Environment and Conservation (DEC);
- A search of CALM’s Declared Rare and Priority Flora, Threatened Ecological Communities and Threatened Fauna databases; and
- A relevant literature and database review.

2. Project Details

2.1 Proposal in a Regional Context

The proposal to upgrade the Brand Highway is a State Government initiative implemented through Main Roads WA.

The proposal includes the construction of ten new passing lanes and the extension of an existing lane along southern sections of the Brand Highway. The works are located within the Shire of Gingin and Dandaragan, from approximately 18 km north of the Gingin turn-off to 55 km south of Eneabba, as shown in **Figure 1.**

2.2 Description of the project

This report covers the proposed upgrade from 61.50 to 63.40 SLK, which consists of the construction of a 1.9 km southbound passing lane (eastern side of the Brand Highway) at Red Gully, approximately 30 km north of Gingin.

Key characteristics are summarised in Table 1.

Table 1 Key Characteristics of the Upgrades

Issue	Description
Lane Length	South bound – 1.9 km (from 61.50 to 63.40 SLK)
Lane Width	3.5 m
Sealed Shoulder	1.0 m
Unsealed Shoulder	1.0 m
Tapered Shoulder	2.1 m
Table Drain	1:6
Fill Slope or Batter	1:6
Fill Details	Fill material required for construction of the road will be sourced by the Contractor in accordance with criteria set in the Contract, for approval by the Superintendent. The volume of fill material required will depend on whether the construction works are on the basis of widening in fill or in cut.
Side Road Intersections	South of Red Gully Road
Clearing	1.9 ha
Revegetation Area	N/A
Land Acquisition	N/A

2.3 Need for the Proposal

The objective of the passing lanes at this Site, and the other proposed upgrades in the region (discussed in Section 2.1), is to improve road user safety particularly with the interaction of smaller vehicles and the large road trains that use the route to cart mineral sands and oil from the Dongara, Eneabba and Cataby areas.

2.4 Proposal Schedule

It is anticipated that clearing for the Project will commence in 2007/2008 and will be completed under contract by a private contractor, on the behalf of Main Roads WA within approximately 12 weeks.

3. Existing Environment

3.1 Climate

The climate of the Project area is best described as Mediterranean with warm dry summers and cool wet winters. The Bureau of Meteorology weather-recording station located closest to the Project area is Lancelin, approximately 40 km northwest of the Project area. The Lancelin weather averages come from intermittent readings collected from 1965 to 2004, and are summarised in Table 2 below.

Table 2 Climate Readings at Closest Weather Stations (BOM, 2007)

Climate Statistic	Lancelin
Mean Annual Maximum Daily Temperature Range (°C)	29.7 (February) to 19.1 (July/Aug)
Mean Annual Minimum Daily Temperature Range (°C)	17.9 (February) to 9.8 (August)
Mean Annual Rainfall (mm)	619.9
Mean Annual Rain days per year (days)	108.3
Highest Recorded Daily Rainfall (mm)	85.8 (January)
Highest Monthly Rainfall (mm)	219.2 (June)

(Source: Bureau of Meteorology – Climatic Averages for Australian Sites, 2004).

3.2 Geology and Soils

The Site forms part of the Perth Sedimentary Basin. The Geological Survey of Western Australia (GSWA, 1978) identifies the main geological unti in the area as colluvium, soil and undifferentiated sand over laterite of Coastal Plain includes minor alleviated areas.

To the west and northern portion of the site are the Bassendean Sands that consist of deflated low ridges of siliceous sand with intervening swampy depressions and soils characterised by leached dunes of quartz sand. Massive laterite also exists in areas to the east of the Brand Highway (GSWA, 1978).

3.2.1 Acid Sulphate Soils

The project area has not been mapped for potential acid sulphate soils as part of the Western Australian Planning Commission's (2003) Planning Bulletin No. 64, although areas 15 km to the south of the site have been mapped.

Those areas mapped identify inundated areas as posing a high risk of actual or potential acid sulphate soils less than 3 m from the surface, with surrounding higher areas considered as having a moderate to low risk of having actual or potential acid sulphate soils generally at depths of greater than 3 m from the surface.

It is considered that the site would fall into the latter category, with it likely that the project area would contain Acid Sulphate Soils at depth owing to the proximity of the

project area to various wetlands, including Six Mile Swamp and Whitfield Brook, with the ephemeral creekline, Red Gully Creek line located approximately 70 metres to the north of the site (riparian vegetation approximately 20 metres to the north). However, as the roadworks associated with the project are not expected to require deep excavation, with the design (SKM, 2006) indicating no excavation required within 200 metres of the creekline, it is considered unlikely that Acid Sulphate Soils will be encountered during the roadworks.

3.3 Rivers and Wetlands

As discussed above the Red Gully Creek crosses the Brand Highway to the north, but is outside of the proposed roadworks site.

This upgrade is within the Moore River surface water catchment area, of which some tributaries are proclaimed under the *Rights in Water and Irrigation Act 1914*. The DEC has advised that the Project area does not fall within the proclaimed portion of the catchment.

The Moore River has been defined as saline, having recorded a mean salinity level of 7200 mg/L TDS between 1993 and 2002 (Department of Environment, 2005).

No *Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004* wetlands or wetlands listed under the Ramsar Convention (1971) occur within the Project area. Several permanently and seasonally inundated wetlands occur approximately 2 km to the west of the Project area. These wetlands have been identified by the *Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004*.

3.4 Groundwater

The Project area is located within a proclaimed groundwater area, being the Gingin Interim Groundwater Area. The area is identified to have average groundwater salinity levels of between 1000 and 3000 mg/L total dissolved solids (TDS) Department of Water (DoW) (2006).

The area is not located within any gazetted Public Drinking Water Supply Area.

3.5 Reserves and Conservation Areas

The site is adjacent to Moore River National Park, a significant conservation reserve under the management of CALM (Department of Land Information, 2006).

The Shire of Gingin Town Planning Scheme No. 8 does not recognise any additional local Parks and Recreation reserves in the vicinity of the roadworks.

3.6 Contaminated Sites

A search for Potentially Contaminated Sites through the DEC Water Information (WIN) database was conducted. This search concluded that no previously recorded contaminated sites occur in close vicinity to the Site, which is consistent with the pattern of historical land use in the Site.

The presence of unexpoded ordinance contamination (UXO) was identified as possible in the Site area. Main Roads WA commissioned BACTEC to undertake a survey of the area. The reader is referred to Main Roads WA for the results of this survey.

3.7 Flora and Vegetation

3.7.1 Background

The PEIA undertaken for this Site in April 2006, identified a potential variance with one or more of the "Ten Clearing Principles" outlined in Schedule 5 of the *Environmental Protection Act 1986*. As a result of these findings, a vegetation, rare flora and opportunistic fauna survey of the Site was required for inclusion in an EIA document.

3.7.2 Field Survey Methods

The field survey for the Site was conducted on the 22nd September 2006, by an experienced and qualified botanist and an experienced field ecologist. The Site was surveyed by traversing the area on foot and by conducting extensive searching of 10 m by 10 m quadrats.

The surveys were conducted with regard to the Environmental Protection Authority Guidance Statement No. 51 – *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (2004),* where possible.

The survey recorded and mapped vegetation types present at the Site. Aerial photography was used to assist in the delineation of vegetation types. Dominant species in each vegetation type was noted and a full list of species was generated for the Site. Targeted searches for Declared Rare or Priority Flora were conducted, with reference to Declared Rare and Priority Flora species lists for the area, generated from the DEC and the West Australian Herbarium. The condition and weed status of the vegetation were noted and the significance of the vegetation type in a regional context was assessed. Where identification of species was uncertain, confirmation was made at the Western Australian State Herbarium, using published keys and with reference to experts, where required.

Part of the road reserve within the study area, west of the highway, had been recently burnt so the number of plants recorded in this area was limited to those that rapidly germinate and sprout post-fire. It was not possible to comprehensively assess the vegetation of this section; however, it was assumed that this area was similar to the surrounding unburnt areas.

Nomenclature of the species follows that of *FloraBase* (2006) for plant species and *FaunaBase* (2006) for fauna species.

3.7.3 Vegetation Description

Mapped Descriptions

Beard (1979) has mapped the vegetation of the general area at a scale of 1:250,000. The Site vegetation is within the Darling Botanical District, in the Drummond sub-district of the South Western Botanical Province as recognised by Beard (1979). The vegetation of the majority of the site has been mapped as a mosaic of Mixed Scrub-

heath and Heath with *Dryandra* species dominant. The northern end of the site is a small section that has been classified as open Marri woodland. The site is adjacent to a mosaic of *Banksia* low woodland and Heath with *Dryandra* species dominant.

Mapping by Heddle *et al.* (1980) shows the site to be within the Regan Complex on the Gingin Scarp. Vegetation ranges from a low open woodland of *Banksia* species and *Eucalyptus todtiana* to closed heath, depending on the soil. Just to the west of the site is the Coonambidgee Complex which has been defined as vegetation ranging from a low open forest and low woodland of *Eucalyptus todtiana, Banksia attenuata, Banksia Menziesii, Banksia ilicifolia* with localised admixtures of *Banksia prionotes* to an open woodland of *Corymbia calophylla – Banksia* species.

Survey Descriptions

The majority of the site is low open woodland of *Banksia* species and *Eucalyptus todtiana*. The Banksia low woodland in the northern section of the site is very open, and contains mainly mid- and under-storey species. In the upland areas in the south of the site there is a higher coverage of *Banksia* species and *Eucalyptus todtiana.*

In the northern section of the site the vegetation close to the road is dominated by disturbance species such as Woolly bush (*Adenanthos cygnorum*), Stinkwood *(Jacksonia sternbergiana*), Golden Wattle (*Acacia pycnantha* - introduced) and Two-leafed Hakea (*Hakea trifurcata*).

In the northern section of the site there is remnant vegetation adjacent to the highway, including a section of Marri-Wandoo woodland along a ridgeline. A powerline easement passes through the woodland, approximately 40 m from the highway. The woodland was in good condition to the east of the powerline but the structure of the woodland between the powerlines and highway was no longer intact due to previous clearing and disturbance, and the vegetation in this area was dominated by disturbance-specialist species.

The native vegetation to the west of the study site (in Moore River National Park) has been burnt recently but would have been similar vegetation to the study site, a low open woodland of *Banksia* species and *Eucalyptus todtiana*.

There are a number of Marri (*Corymbia calophylla*) trees in the farmland adjacent to the southern section of the alignment and this area may once have contained Marri woodland, but this is no longer apparent in the study site.

On the northern end of the site, but outside of the survey area, is a creekline with riparian vegetation, including *Melaleuca.* Impacts on the riparian vegetation should be avoided.

The vegetation communities were mapped during the field survey and are shown in **Figure 2**. A description of the vegetation types, with photographs, is provided in **Appendix A**.

3.7.4 Vegetation Condition

The vegetation at the Site was given a condition rating based on the Bush Forever (Government of Western Australia, 2000) vegetation condition ratings scale. This scale recognises a level of intactness of vegetation, which is defined by the following:

» Completeness of structural levels;

» Extent of weed invasion;

» Historical disturbance from tracks and other clearing or dumping;

» The potential for natural or assisted regeneration.

The ratings in this scale are described in Table 3.

Table 3 Government of Western Australia (2000) Vegetation Condition Scale

Assigned Number	Classification	Description
1	*Pristine or nearly so*	No obvious signs of disturbance
2	*Excellent*	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species
3	*Very Good*	Vegetation structure altered, obvious signs of disturbance
4	*Good*	Vegetation structure significantly altered by very obvious signs of multiple disturbance, retains basic vegetation structure or ability to regenerate it
5	*Degraded*	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
6	*Completely degraded*	The structure of the vegetation is no longer intact and the area is completely or almost without native species

Much of the site shows evidence of previous disturbances, including clearing and earthworks from earlier roadworks and clearing for a powerline easement on the east of the highway. Directly adjacent to Brand Highway the vegetation structure is no longer intact. Disturbance specialist species, such as Woolly Bush (*Adenanthos cygnorum*) dominate close to the highway. There is also substantial weed invasion, particularly of grass species, along the edge of the highway adjacent to the shoulder.

The vegetation directly adjacent to the highway was rated between Condition 4 ('Good') and Condition 6 ('Very Degraded'). The vegetation adjacent to this area has also been disturbed by roadworks and a power-line easement and is dominated by disturbance specialists. This vegetation was rated Condition 2 ('Excellent') to Condition 3 ('Very Good'). There is good quality vegetation away from the highway, including sections that are between Condition 1 ('Pristine') to Condition 2 ('Excellent'). The area of Marri-Wandoo woodland in the centre of the site had been subject to a number of disturbances, including clearing for a powerline easement and was rated Condition 4 ('Good') between the powerline easement and the highway. East of the powerline easement this vegetation appears to be in excellent condition. The condition rating of the vegetation in the road reserve has been mapped at Figure 3.

The west side of Brand Highway had been recently burnt and so it was not possible to assess the condition of this section, it is assumed that this area was similar to the surrounding unburnt areas.

3.7.5 Significance of Vegetation

A vegetation type is considered to be underrepresented if there is less than 30 % of its original extent remaining. From a biodiversity perspective, and taking no account of any other land degradation issues, there are several key criteria applied to vegetation where clearing is still occurring (EPA Position Statement No. 2, December 2000):

» The "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European extent of the vegetation type. Vegetation communities where less than 30% of the original vegetation extent remain are referred to as "vulnerable"; and

» A level of 10% of the original vegetation extent is regarded as being a level representing an "endangered" vegetation community. Clearing which would put a vegetation type into this category should be avoided.

Such vegetation community status can be delineated into five (5) classes, where:

- Presumed extinct: Probably no longer present in the bioregion
- Endangered*: <10% of pre-European extent remains
- Vulnerable*: 10-30% of pre-European extent exists
- Depleted*: >30% and up to 50% of pre-European extent exists
- Least concern: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

* or a combination of depletion, loss of quality, current threats and rarity gives a comparable status

The extent and status of Heddle et al. (1980) vegetation complexes are described in the EPA's *Guidance for the Assessment of Environmental Factors: Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1* (EPA, 2006). The extent of vegetation remaining is described in the publication as both the percent remaining in this region and the percentage remaining in this area in secure tenure. Protection in 'secure tenure' includes National Parks, Nature Reserves, and 5(g) Reserves from DEC Managed Lands 2002 GIS Database. This database was examined to determine the extent of the vegetation remaining in the study area (Table 4).

It can be seen from this data that the vegetation in the study site are above the 30 % 'threshold' level, however, it should be noted that the percent remaining in secure tenure is very low, 1.9%.

Table 4 Vegetation extent and status for Heddle, *et al*. (1980) Vegetation Complexes within the Study site (EPA, 2006).

Vegetation Complex	Total pre-1750 extent (ha)	Present extent (1997/98) in the System 6/part System 1 area (ha)	% Remaining (1997/98) in the System 6/part System 1 area	Area in secure tenure (2002) (ha)	% remaining of pre-1750 extent in secure tenure (2002)
Regan Complex on the Gingin Scarp.	9097	3455	38	168	1.9

Native vegetation types represented in the study, their regional extent and reservation status can also be drawn from Shepherd (2002; *pers. comm.,* 2005*)* to give an indication of the regional impact of the proposed clearing. This information is presented in Table 5.

It can be difficult to assign the vegetation types described by Shepherd (*pers. comm.,* 2005) to the vegetation within the Site as the Shepherd mapping is based on the broad-scale (1:250,000) vegetation mapping produced by Beard (1979). As a result, boundaries of vegetation types may be considered to be somewhat obscure, particularly where pre-European vegetation has been inferred "on the evidence of relics on roadsides and paddocks with reference to topography and soil as seen in photo patterns" (Beard, 1979).

The vegetation types classified during the field surveys were extrapolated and found to generally match the vegetation classifications as indicated in Table 5.

Table 5 Regional Assessment of Vegetation Extent - Field surveys (Source: Shepherd, 2005)

Vegetation Association	Vegetation Community	Pre-European Extent (ha)	Current Extent (ha)	% Remaining	Status
949	Low woodland; Banksia	218,205	124,461	57.0	Least Concern
4	Medium woodland: Marri & Wandoo	15, 931	3, 291	20.7	Vulnerable

It can be seen from the above vegetation classifications that the vegetation, 'Low woodland; Banksia' at the Site is above 30 % which means it is above the 'threshold level'. 'The Medium Woodland: Marri & Wandoo'' is below the 'threshold level'. Marri Wandoo woodland will be avoided where the clearing width is restricted to 10 m, or 13m from the existing seal, as the woodland is no longer intact due to previous clearing and disturbance and clearing results in no disturbance to the adjacent woodland. It is recommended that any mature Marri or Wandoo treess within the 10m be retained where possible (for habitat purposes).

Shepherd mapping also identifies other Vegetation Associations in the vicinity of the Site, being 1015 (Mosaic: Shrublands, scrub-heath on the Swan Coastal Plain /

Shrublands; Dryandra Heath) and 37 (Shrublands: teatree thicket). The regional assessment indicates that 33.3% and 57.8% respectively of this vegetation remains Shepherd (2002; *pers. comm.,* 2005*).*

While the vegetation communities may have previously occurred on the site (and some sections may be degraded shrubland), the majority of the site can now be classified as a Banksia low woodland. There was no discrete community of Vegetation Association 1015 or 37 observed within this Site. Some areas have been disturbed (through previous roadworks/introduction of the power line) and so the original vegetation is no longer intact, which makes assigning it to vegetation communities difficult. The presence of these communities in the Shepherd data may also be due to the high scale at which this (Shepherd) mapping is conducted and can tend to be inaccurate.

Main Roads WA have advised that a maximum of 13 m is required from the edge of the existing seal to accommodate the proposed road works. The Site currently has a gravel shoulder of approximately 3 m in width, indicating an extra 10 m clearing will be required, along a 1.9 km section. This equates to a clearing area of approximately 19,000 m^2 (1.9 ha). The existing width of road reserve vegetation is (on average) around 25 m; therefore, more than half of the existing native vegetation in the road reserve will be retained.

3.7.6 Threatened Ecological Communities

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe, 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, that is, Presumed Totally Destroyed, Critically Endangered, Endangered, and Vulnerable. Some TECs are protected under the Commonwealth *Environmentl Protection and Biodiversity Conservation Act* 1999 (*EPBC Act*). Although TECs are not formally protected under the WA *Wildlife Conservation Act* 1950, the loss of, or disturbance to, some TECs triggers the *EPBC Act*. The EPA's position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

A search of DEC's TEC database indicated that there are no TECs within the vicinity of the Site. The closest community is approximately 10 km to the south-west of the site, which is SCP07 (Plot MRNP03) 'Herb rich saline shrublands in clay pans' (Morley, M. pers comm.). This TEC was not recorded during the field survey and no TECs were identified during the field survey.

3.7.7 Environmentally Sensitive Areas

Environmentally Sensitive Area's (ESAs) are subject to definition under Section 51B of the *Environmental Protection Act 1986* and may include areas such those requiring special management attention to protect important scenic values, fish and wildlife resources, historical and cultural values, and other natural systems or processes.

The Department of Environment and Conservation (2007) identifies an ESA adjacent to the western side of the Brand Highway, being the Moore River National Park. The road

works will be restricted to the road reserve on the eastern side of the Brand Highway, and are not expected to impact on the Moore River National Park.

3.7.8 Flora Species

The site has good species diversity with a total of 136 taxa (114 native taxa) from 41 families recorded within the surveyed area.

The dominant families recorded from the area were:

- Proteaceae 17 taxa
- Papilionaceae 15 taxa
- Myrtaceae 14 taxa
- Asteraceae 11 taxa
- Poaceae 8 taxa
- Haemodoraceae 6 taxa

Additionally, the dominant genera recorded were:

- *Acacia* 5 taxa
- *Hakea* 4 taxa
- *Stylidium* 4 taxa
- *Dryandra* 3 taxa
- *Conostylis* 3 taxa
- *Gompholobium* 3 taxa
- *Jacksonia* 3 taxa

See Table 10, **Appendix B** for a full list of flora species recorded in the Site.

Eight species were identified to genus only, due to lack of distinctive features, such as flowers. Additionally there were a number of plants that were tentatively identified to species; however, identification could not be completely certain due to lack of distinctive features. These species are indicated in **Appendix B**. Field surveys at different times of year would allow the identification of a greater number of plant species.

3.7.9 Significant Flora Species

Flora species that are considered to be significant are listed under the Western Australian *Wildlife Conservation Act 1950* and the *EPBC Act 1999.* Additionally, the DEC keeps a list of Priority species, that are not listed under legislation but for which the DEC feels there is cause for concern, or for which not enough information is known. A description of the DEC's conservation codes is provided in **Table 8, Appendix B**.

A search of the rare flora databases of the DEC and the Western Australian Herbarium was requested for the Site. This search indicated that there are no recorded Rare or Priority Flora species within 100 m of the project areas. However, a number of significant species have been recorded in the general region of the Site **(Table 9, Appendix B).**

During the field survey a thorough search for the DRF and Priority species known to occur in the vicinity was conducted.

No DRF or Priority species were identified during the survey. One species that was recorded in the study area, *Jacksonia alata,* was recorded as a slight Range Extension. This species is generally found in the south-west of Western Australia, though there are some records of this species to the north of Perth.

3.7.10 Weeds

Most of the vegetation in the road reserve was in good condition and had minimal weed invasion. The introduced species were mainly restricted to the edge of the highway and other disturbed areas, such as the powerline easement.

A total of 22 weed species were recorded within the Site search area, which represents about 16 % of the total species recorded. These were mainly grasses (Poaceae) and Daisies (Asteraceae). The majority of the weeds were agricultural weeds, rather than environmental weeds that invade intact bushland.

3.7.11 Plant Pests and Diseases

The project area can be considered as susceptible to the development of the pathogen, *Phytophthora cinnamomi,* commonly known as Dieback (Dieback Consultative Council, 2001).

Dieback-susceptible plant species, including *Banksia* and *Dryandra* species, occur in the survey area; however, there was no indication of the occurrence of Dieback within the Site based on patterns of health of susceptible plants.

No other plant pests or diseases were identified during the survey.

3.8 Fauna

3.8.1 Field Survey Methods

The reconnaissance survey for the presence of fauna was conducted on the 22nd September 2006, by an experienced and qualified botanist/zoologist and an experienced field ecologist, concurrently with the flora and vegetation survey. A consideration of fauna habitat was undertaken within the Site.

The fauna survey was limited to terrestrial and vertebrate species.

3.8.2 Fauna Species

The Site would be expected to support a number of bird species, particularly a number of bushland birds, not all of which were observed during the field survey. The general region is rich in bird species, and there would be a number of species that would be expected to utilise the site, though many of these would be vagrants. The site provides a variety of niches for bird species, including woodland and shrubland species.

The herpetofauna of the general region is relatively rich and a number of reptiles, particularly small lizard species, would be expected at the site. Additionally, a number

of amphibians may occur at the site, as there is a creekline to the north of the study area.

The general area of the site has the potential to support a number of mammal species as there are large areas of remnant vegetation in the area, including Moore River National Park. There is a creekline to the north of the study site which would provide a water source for the large fauna, such as Kangaroos, at certain times of the year. However, mammal species are unlikely to use the vegetation directly adjacent to the highway and would occur in the large, good quality vegetation to the west and north of the site.

A search of the WA Museum database (FaunaBase, 2006) for fauna records within a 5 km radius of the Site was conducted. The results of this search and from the opportunistic survey conducted at the site are shown in **Table 15, Appendix C.** The species recorded from the opportunistic survey include species observed either visually or through distinctive calls (particularly birds and amphibians), and species identified from signs, such as scats or tracks.

3.8.3 Significant Species

The conservation status of fauna species is assessed under State and Commonwealth Acts; in particular the Western Australian *Wildlife Conservation Act 1950*; *Wildlife Conservation (Specially Protected Fauna) Notice 2006,* and the Commonwealth *EPBC Act*.

The significance levels for fauna used in the *EPBC Act* are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). These levels are described in **Table 11, Appendix C.**

The EPBC Act also has lists of migratory species that are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA) and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals).

Listed migratory species also include any native species identified in an international agreement approved by the Commonwealth Environment Minister. The Minister may approve an international agreement for this purpose if satisfied that it is an agreement relevant to the conservation of migratory species.

In Western Australia, the *Wildlife Conservation (Specially Protected Fauna) Notice 2006* has classified Threatened Fauna in a series of Schedules **(Table 12 Appendix C).** The DEC also produces a supplementary list of Priority Fauna, being species that are not considered "threatened" under the Western Australian *Wildlife Conservation Act 1950* but for which the Department feels there is a cause for concern. These species have no special protection, but their presence would normally be considered to determine any potential impacts on these species. Levels of Priority are described in **Table 13, Appendix C**.

A listing of Significant Fauna from the *EPBC Act* Protected Matters Search Tool (2006) and Rare and Priority species from the DEC rare fauna database for the general Site are presented in, **Table 14, Appendix C.**

Some species that appear in the *EPBC Act* Protected Matters Search Tool are often not likely to occur within the specified area, as the search provides an approximate guidance to matters of national significance that require further investigation. The records from the DEC searches of Threatened Fauna provide more accurate information for the general area, however, some records of sightings or trappings can be out-dated and often misrepresent the current range of threatened species.

3.8.4 Introduced Species

A dead Fox was found on the highway and a Laughing Kookaburra was observed during the opportunistic survey.

3.8.5 Habitat Value

The habitat value of the Site was assessed during the survey. The Site contains two main habitat types, *Banksia* woodland and Marri-Wandoo woodland. The vegetation of these habitats was in *Good*, or better, condition but there are large areas of habitat in better condition to the west and north of the study area.

The Marri – Wandoo woodland would provide habitat for a number of species, including potential feeding and nesting habitat for the Endangered Carnaby's Cockatoo. If the clearing required for these works will be confined to around 10m of vegetation adjacent to the shoulder, as proposed, the impacts on this habitat will be minimal. A few mature Wandoos were noted within the 10m zone of vegetation to be cleared, these trees did not have hollows, however, have the potential to provide habitat and should be avoided where possible.

The clearing of vegetation that is required for this project will reduce the amount of habitat available to fauna, but the extent of clearing is minor and the majority of the road reserve vegetation will be retained and can continue to be utilised by fauna.

3.8.6 Habitat Linkages

Fauna corridors and habitat linkage are important to allow animals to move between areas of resource availability. Such corridors are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction.

This Site offers some value as a habitat linkage and fauna corridor; however, the vegetated area of the road reserve is fairly narrow in this area and there are large areas of contiguous bushland to the west of the site that could be used by fauna species.

The clearing required for this project will be minor and will not have any significant impact on the movement of fauna species throughout the region.

4. Social Environment

4.1 Surrounding Land Use

The project area is adjacent to the Moore River National Park at the northern end and general farming uses to the south. The National Park is zoned as “Parks and Recreation” and the remaining areas are zoned as “Rural”, under the Shire of Gingin Town Planning Scheme No. 8.

The Australian Government (2006) describes the immediate surround land uses as either ‘livestock grazing’ or ‘nature conservation’, with ‘dry land agriculture’ also in the vicinity.

4.2 Aboriginal Heritage

A search of the Department of Indigenous Affairs (DIA) Register of Aboriginal Sites was conducted to determine the likelihood of the project impacting on a listed Aboriginal heritage site.

The database indicated that no known Aboriginal Heritage sites occur within the vicinity of the proposed project site.

It may be possible that there are unregistered sites in the project area and it was recommended that the Main Roads WA Project Officer liaise with the Main Roads WA Heritage Liaison Officer and appropriate representatives of the local Aboriginal community to determine the presence of unregistered sites.

Main Roads WA and their contractors need to be aware of their obligations under the *Aboriginal Heritage Act (1972)* during the road construction.

4.3 European Heritage

A search of the Heritage Council of Western Australia’s (2006) Heritage Places database was conducted to determine the likelihood of the project impacting upon a listed heritage site.

No sites of European heritage were located in close vicinity to the Project area.

5. Environmental Aspects

The PEIA identified the primary environmental and social aspects for consideration for the Project. The PEIA identified aspects that required further investigation as part of this EIA and ERMP and those that were considered to be irrelevant to the Project. Those considered irrelevant would unlikely be impacted upon, by or otherwise be of concern during the proposed works. A justification for not including these factors is outlined in Table 6.

Environmental aspects considered relevant for this EIA are examined in more detailed in Section 6.

Table 6 Environmental Aspects Considered for the Project

Environmental Aspect	Yes	No	Comments
Air Quality		√	Lack of emissions sources therefore no impact on regional air quality.
Dust	√		Addressed in Section 6.5
Fauna	√		Addressed in Section 6.2
Vegetation – threatened species and communities	√		Addressed in Section 6.1
Vegetation – clearing	√		Addressed in Section 6.1.1
Vegetation – dieback and other diseases or pathogens	√		Addressed in Section 6.1.2
Vegetation – weeds	√		Addressed in Section 6.1.3
Vegetation – fire	√		Addressed in Section 6.8
European Heritage		√	No sites of European Heritage within Project Area.
Aboriginal Heritage	√		No registered Aboriginal Heritage sites identified within the Project area, however management measures will be implemented for potentially unregistered sites of significance. Addressed in Section 6.6
Surface Waters / Drainage (watercourses, erosion, stormwater, disposal, water quality, salinity)	√		Addressed in Section 6.3
Public Drinking Water Source Areas (PDWSA)		√	Project area not located within a PDWSA.
Groundwater	√		Addressed in Section 6.4
Wetlands	√		No actual wetlands occur on site, however, wetlands do occur within the vicinity. These are not expected to be impacted by the Project, but management measures have been addressed in Section 6.3

Environmental Aspect	Yes	No	Comments
Noise and Vibration		√	Lack of sensitive receptors within the area.
Visual Impacts		√	Minimal impact due to remote Project location and the fact that the highway already exists in the locality.
Public Safety and Risk	√		Addressed in Section 6.7.
Contaminated Sites		√	No contaminated sites identified within the Project area. UXO addressed in BACTEC report (2006).
Acid Sulphate Soil		√	As the roadworks associated with the Project are not expected to require excavation in the vicinity of the ephemeral Red Gully Creek, it is considered unlikely that Acid Sulphate Soils will be encountered during the Project.
Use of Hazardous Substances		√	No hazardous substances will be used.
Reserves and Conservation Areas		√	No reserves or conservation areas within the Project area. The Moore River National Park is located adjacent to the western boundary of the Brand Highway road reserve at this locality. As the road works are to be restricted to the eastern portion of the road reserve and strict environmental management measures will already be in place, additional measures are not considered to be warranted.

6. Environmental Impacts and Management

Those issues considered relevant for further assessment as identified in Section 5 are discussed below with a summary of the environmental and social impacts and management measures also detailed in the EMP in **Appendix E.**

6.1 Flora and Vegetation

6.1.1 Assessment Against the "Ten Clearing Principles"

The clearing of any native vegetation is regulated by the Environmental Protection Authority (EPA) and requires a permit under Part V of the *Environmental Protection Act (1998)*, except where exemptions apply under Schedule 6 of the Act or when the clearing is for exempt purposes, as prescribed in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, and not in an Environmentally Sensitive Area (ESA).

Applications to clear native vegetation are assessed against the "Ten Clearing Principles" outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003*.

The principles address three main environmental areas:

» Biodiversity significance;

» Land degradation; and

» Ground and surface water quality.

Main Roads WA was issued with a statewide vegetation clearing permit (Purpose Permit CPS 818/2), granted under section 51E of the *Environmental Protection Act (1986)*, on the 1st February 2006 by the Department of Environment and Conservation. The Purpose Permit allows Main Roads to clear of native vegetation for road realignment projects and associated construction activities. Any clearing of native vegetation must be assessed against the "Ten Clearing Principles" outlined in the permit. The Permit does not authorise the clearance of native vegetation for project activities where:

» The clearing may be seriously at variance with the clearing principles;

» Those project activities are incorporated in any proposal that is referred to and assessed under Part IV of the *Environmental Protection Act 1986* by the EPA; or

» Clearing occurs in an Environmentally Sensitive Area.

The Permit holder should engage in activities that minimise the amount of vegetation to be cleared and where clearing is assessed as being at variance with one or more of the "Ten Clearing Principles", then the permit holder must implement an offset in accordance with Part V of the Permit with respect to that native vegetation.

The Purpose Permit requires that Main Roads adhere to internal environmental processes of Environmental Assessment and Approval to ensure that they comply with the requirements of the Permit.

The clearing required at the Site for the upgrade project has been assessed against the "Ten Clearing Principles" below in **Table 7.**

Table 7 Assessment against the "Ten Clearing Principles".

Principle Number	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	The remnant native vegetation is considered to contain a moderately high level of biological diversity but it is of a comparable (or lower) level of diversity to the remaining native vegetation in the area.	The proposal is not at variance with the Principle. Vegetation may be considered for clearing
(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.	The vegetation comprises habitat for a number of fauna species, but this habitat is not considered significant habitat for fauna indigenous to Western Australia. The Marri-Wandoo woodland to the east of the site has the potential to contain Carnaby's Cockatoo nesting area. However, if the clearing is confined to the minimum necessary for the widening of the highway and mature Wandoo trees are avoided, there should be no significant impacts on this habitat area. Note, a few mature Wandoo's occur within the proposed clearing zone. These do not contain nesting hollows, but should also be retained, where possible, for habitat pruposes.	The proposal is not at variance with the Principle. Mitigation measures should be implemented to minimise the impacts on fauna from the clearing of this vegetation, this will include avoiding clearance of mature Wandoo trees.
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No Declared Rare or Priority Flora were recorded during this survey.	The proposal is not at variance with the Principle. Vegetation may be considered for clearing
(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.	No Threatened Ecological Communities were recorded during this survey, and there are none recorded within 10 km of this Site.	The proposal is not at variance with the Principle. Vegetation may be considered for clearing

Principle Number	Principle	Assessment	Outcome
(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.	The amount of clearing required for this project is minimal. A large area of remnant vegetation will be retained within the rest of the road reserve. Additionally, there are large areas of remnant vegetation to the west of the Site. The extent of Marri-Wandoo woodland remaining (from Shepherd, 2005 data) is below the recommended extent and clearing in this area should be avoided. If the clearing is confined to the minimum necessary for the widening of the highway then impacts on this woodland should be avoided. It is recommended that removal of mature Wandoo/Marri trees be avoided where possible. This site is within the System 6 region and so the data for vegetation extents from the EPA Guidance Statement 10 is applicable for this area. The vegetation extent for the Regan Complex on the Gingin Scarp is above the threshold level according to the EPA Guidance Statement 10.	The proposal is not at variance with the Principle. Where possible, the amount of vegetation clearing should be minimised and the disturbed area adjacent to the existing highway shoulder should be used.
(f)	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	There are no watercourses or wetlands within the Site, however, the Red Gully Creek is located immediately north of the project site. Impacts on the riparian vegetation (*Melaleuca* community) should be avoided.	The proposal is not at variance with the Principle, provided no wetland habitat associated with the Red Gully to the north of the site is to be impacted.
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	Partial clearing within the Site is likely to cause some, but not considerable, land degradation to adjacent bushland areas. Impacts are already present due to the existing highway and impacts are not expected to increase significantly.	The proposal is not at variance with the Principle. Appropriate management plans should mitigate potential impacts
(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.	The Moore River National Park is located to the west of Brand Highway. As the project site is on the eastern portion of the Brand Highway, there are not expected to be any direct impacts on the national park.	The proposal is not at variance with the Principle. Vegetation may be considered for clearing

Principle Number	Principle	Assessment	Outcome
(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	Vegetation clearing is not likely to cause increased deterioration in the quality of surface or underground water. Any impacts from run-off etc would already be present due to the existing highway.	The proposal is not at variance with the Principle. Appropriate management plans should mitigate potential impacts.
(j)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	The clearing of native vegetation is not expected to cause, or exacerbate the incidence or intensity of flooding. The increased road surface from the additional lane may increase run-off immediately adjacent to the highway but this will not be significant.	The proposal is not at variance with the Principle. Appropriate management plans should mitigate potential impacts.

The amount of clearing required for this project is minimal and the project has been assessed as not being at variance with any of the "Ten Clearing Principles".

The Main Road Purpose Permit does not authorise the permit holder to clear native vegetation for project activities where the clearing may be seriously at variance with the clearing principles and does not permit Main Road to clear within an Environmentally Sensitive Area (ESA).

This EIA has determined that the proposed clearing is not at variance with any of the "Ten Clearing Principles" and not within an ESA, therefore, the Site may be considered for clearing. However, clearing at the Site will be minimised and managed in accordance with the project EMP provided in **Appendix E**.

6.1.2 Disease Management

The field flora survey at the Site indicated no evidence of plant diseases. There was no indication of the occurrence of dieback within the Site normally shown by patterns of death of susceptible plants.

Condition 15a of the Main Roads WA Clearing Permit relating to dieback hygiene measures will be adhered to during roadworks, incorporating the following steps:

» Clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;

» Avoid the movement of soil in wet conditions;

» If movement of soil in wet conditions is necessary, the permit holder must prepare, implement and adhere to a dieback management plan, developed in consultation with the DEC;

» Ensure that no dieback affected road building materials, mulches or fill are brought into an area that is not affected by dieback; and

» Restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

Management measures are included in the Environmental Management Plan provided as **Appendix E**.

6.1.3 Weed Management

Machinery and vehicle hygiene measures detailed at Section 6.1.2 will avoid the inadvertent spread of weeds throughout the site, and from the site to other sites. Management for this project will be also undertaken in accordance with the Main Roads WA clearing permit.

6.2 Fauna

The habitat requirements of the protected species listed under the *EPBC Act,* the *Wildlife Conservation Act 1950* and listed as Priority species by the DEC, and the likelihood of their occurrence at the Site (after consideration of the habitat during the opportunistic fauna survey) is considered below, based on the findings of the field survey.

***Calyptorhynchus latirostris* – Carnaby's Cockatoo**

Carnaby's Cockatoo, also known as the Short-billed Black-Cockatoo, is distributed across the south-west of Western Australia in uncleared or remnant areas of eucalypt woodland and shrubland or kwongan heath. Breeding usually occurs in the Wheatbelt region of Western Australia, with flocks moving to the higher rainfall coastal areas to forage after the breeding season. These black cockatoos feed on the seeds of a variety of native plants, including *Allocasuarina, Banksia, Dryandra, Eucalyptus, Grevillea* and *Hakea,* and some introduced plants, including *Pinus.* They will also feed on the nectar from flowers of a number of species, and on insect larvae.

Habitat Assessment The site contains plant species that are feed species of Carnaby's Cockatoo and this species may utilise the Site for foraging. There is potential breeding habitat for Carnaby's Cockatoo to the east of the site. However, the clearing of mature Wandoo trees can largely be avoided, so there should be no significant impacts on this species. There are large areas of feeding habitat in the general area and the minimal clearing required for this project should not have a significant impact on this species.

***Calyptorhynchus baudinii* - Baudin's Cockatoo**

Baudin's Cockatoo, also known as the Long-billed Black-Cockatoo, is found in the south-west of Western Australia in the forest and woodlands of Jarrah (*Eucalyptus marginata)*, Karri *(E. diversicolor)* and Marri *(Corymbia calophylla).* The primary food source of this cockatoo is the seeds of the Marri (Garnett and Crowley, 2000). This species has been impacted by the removal of large Marri throughout its range as this species is its principal food source. Baudin's Cockatoo has been listed as Endangered under the Federal *EPBC Act.*

Habitat Assessment The site occurs at the very northern extent of Baudin's Cockatoo range and this species would be highly unlikely to occur at the site.

***Pseudocheirus occidentalis* - Western Ringtail Possum**

The Western Ringtail Possum (*Pseudocheirus occidentalis)* is found in the south-west of Western Australia, with a patchy occurrence from the Collie River to Two Peoples

Bay (Jones, *et al.,* 1994). Urban populations of this species are located in Busselton, as well as East Augusta and Albany.

Habitat Assessment This species is not known from the Brand Highway region, and the record of this species is from subfossil material. It would be highly unlikely to occur at the site.

***Dasyurus geoffroii* – Chuditch**

The Chuditch is the largest carnivorous marsupial in Western Australia. This species occupies a wide range of habitats including woodlands, riparian vegetation, beaches and deserts. The densest populations of Chuditch have often been found in riparian vegetation (Orell and Morris, 1992). The Chuditch formerly ranged over nearly 70 % of Australia but now retains only a patchy distribution through the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-western WA (CALM, 2005a).

Habitat Assessment It is unlikely that the Chuditch would occur in the study site, though there is a very low likelihood that this species may occur as a vagrant in the area.

***Pseudomys shortridgei* - Heath Mouse (Dayang)**

This small native mouse inhabits long unburnt heath and mallee scrub on sandy soil and was once found in coastal heath and mallee in the south west of Western Australia, from Jurien Bay to Bremer Bay. However, this species is now only known to occur in two populations, one in south-west Victoria and the other in south-western Western Australia.

Habitat Assessment This species no longer occurs in the Brand Highway region, and the record of this species is from subfossil material. It would be highly unlikely to occur at the site.

***Leipoa ocellata* – Malleefowl**

Malleefowl are large ground-dwelling birds that build nests from a large mound of soil over leaf litter. Malleefowl were originally distributed in the mallee regions of southern Australia but its range has now been reduced and highly fragmented (CALM, 2006). In WA they are found in a number of national parks and in reserves in the Wheatbelt. The habitat of Malleefowl includes arid and semi-arid woodlands dominated by mallee eucalyptus on sandy soils, Mulga and other sclerophyllous associations (CALM, 2006). In WA they can also be found in some coastal heaths (CALM, 2006).

Habitat Assessment The Site occurs within the historical distribution of this species but its range has been significantly reduced and it is now highly unlikely to occur at the Site.

***Hylaeus globuliferus* (native bee)**

This native bee feeds on the flowers of *Adenanthos cygnorum* in particular but also has been collected from *Grevillea cagiana, Banksia grossa* and *Banksia attenuata.*

Habitat Assessment This species is known from the Moore River National Park, which is adjacent to the study site, and flora species on which it feeds were identified in the flora and vegetation survey. This species may occur in the study site.

***Leioproctus contrarius* – (native bee)**

This native bee has been collected on a number of occasions in Moore River National Park. It is apparently dependent on flowers of Goodeniaceae and possibly *Lechenaultia stenosepala.*

Habitat Assessment This species is known from Moore River National Park, which is adjacent to the study site. *Lechenaultia stenosepala* was not identified during the flora survey but other members of the Goodeniaceae family were. This species may occur in the study site.

***Macropus irma* – Western Brush Wallaby**

The Western Brush Wallaby, a medium sized macropod, is a grazer found primarily in open forest and woodland. This species was once very common in the south-west of Western Australia but has undergone a reduction in range and a significant decline in abundance in its current habitat. The decline in populations of this species has resulted from extensive clearing within its original distribution, and from predation of juvenile Western Brush Wallabies by foxes (CALM, 2005b). There are dated records (the last from 1989) of this species from Moore River National Park and Namming Nature Reserve, to the north and east of the site.

Habitat Assessment This species also requires large patches of vegetation to sustain its populations, and would be unlikely to occur at the Site.

***Hydromys chrysogaster* - Water-rat (Rakali)**

The water rat occupies habitat in the vicinity of permanent water and nests are constructed in logs or at the end of tunnels dug into banks. Unlike many other Australian rodents, the water rat is not entirely nocturnal, with activity usually high at sunset, though animals have been seen foraging during the day. The water rat is an opportunistic predator, feeding upon large aquatic insects, fish, crustaceans and mussels. They are also known to feed on frogs, lizards, small mammals, fresh carrion, and birds (CALM, 2005c).

Habitat Assessment There are no permanent waterways within the site and the Water-rat would be highly unlikely to occur in this site.

***Oreoica gutturalis gutturalis* - Crested Bellbird (southern)**

The Crested Bellbird is found across much of Australia and inhabits the drier mallee woodlands and heaths of the southern parts of the State. This species is sedentary and solitary

Habitat Assessment The species could potentially occur within the study area.

***Galaxiella munda* - Western Mud Minnow**

The Western Mud Minnow is endemic to south-western West Australia, originally ranging from Moore River to Two Peoples Bay. However, the distribution of this species has been much reduced and is now not known from the northern part of its original range, apart from a very small population in Gingin Brook.

Habitat Assessment The distribution of this species has been much reduced and it is unlikely to occur in the general area. There are no waterways within the site

(although there is to the north of the study site) and this species would not occur at the study site.

***Throscodectes xederoides* - Mogumber Bush Cricket**

This species is associated with heath and grassland and has a limited distribution around New Norcia and Mogumber.

Habitat Assessment This species has a limited distribution to the east of the Brand Highway and the likelihood of its occurrence at the site is low.

***Ardeotis australis* - Australian Bustard**

The Australian Bustard occurs across much of Australia, including across most of WA, excepting heavily wooded areas in the south. This species is now scarce on WA's mid-west coast. The Australian Bustard occurs mainly in open country, such as low heath or lightly wooded grassland. This species are often found in recently burnt areas.

Habitat Assessment Australian Bustards may occur in the general area and may be occasional visitors to the site but they tend to prefer more open habitat.

***Isoodon obesulus fusciventer* - Quenda**

The Quenda is an omnivorous marsupial that occurs in the south-west of Western Australia. This species prefers areas with dense understorey vegetation, particularly around swamps and along watercourses. However, it also occurs in woodlands, and may use less ideal habitat where this habitat occurs adjacent to the thicker, more desirable vegetation. On the Swan Coastal Plain Quenda are often associated with wetlands (CALM, 2005d). There is a population of this species around Guilderton, and this is currently the known northern extent of this species.

Habitat Assessment The site is north of the known northern extent of this species, and while it was historically recorded in this area (the record is from subfossil material) it is now highly unlikely to occur at the site.

Assessment

Based upon the nominal clearing area associated with the Project, it is considered unlikely that the Project will significantly impact upon the long-term survival of any species of threatened fauna that may occur in the area. The Site contains vegetation that is in Good (and better) condition, and which would provide high value as fauna habitat. However, the extent of clearing required for this project is minor and the majority of the vegetation in the road reserve will be retained. Impacts on the Marri – Wandoo woodland should be minimised and clearing of Mature Wandoo trees should be avoided.

Impacts on the remaining vegetation and on significant and other indigenous fauna species at the Site can be managed through appropriate mitigation measures, as outlined in the EMP. Clearing of vegetation, however should be minimised to that which is practicable for the safe construction and operation of the road.

6.3 Drainage

Roadside drainage will replicate the existing drainage by the use of table drains, off-shoot drains and culverts. Existing surface water flows will be maintained by replacing and / or extending existing crossroad culverts.

6.4 Groundwater

Construction of bores and abstraction of groundwater or surface water will require a 26D Licence under the *Rights in Water and Irrigation Act 1914*.

The Construction Contractor is responsible for the supply and delivery of water required for the Project. The Construction Contractor (subject to the approval of the Superintendent) is also responsible for ensuring that all water abstraction and use is licensed and all approvals have been obtained.

6.5 Dust

There is likely to be some dust lift generated during the construction works and from passing traffic, which has the potential to settle on and cause impacts to adjacent vegetation. During construction, regular watering of the road will be undertaken to ensure the base material is at or near the Optimum Moisture Content to achieve sufficient compaction levels. This will assist in reducing dust generation. The Construction Contractor will provide for the management of dust such as by watering of the works area and of roads, streets and other areas immediately adjacent to the works as required.

Where it is found that vehicles leaving the site have dropped excessive soil material onto adjacent sections of Brand Highway these sections will be swept to reduce the potential for dust generation and maintain traffic safety.

6.6 Aboriginal Heritage

Main Roads WA and their contractors need to be aware of their obligations under the *Aboriginal Heritage Act 1972* during the road construction.

If during roadworks, the Construction Contractor uncovers any materials that could be considered significant to Aboriginal people, works will immediately cease within 50 m of the material and the DIA will be notified immediately.

6.7 Public Safety

To ensure the safe access of traffic through the Site during construction the Construction Contractor will develop and implement a Traffic Management Plan (TMP) congruent with the current *Australian Standard Manual 1742.3: Uniform Traffic Control Devices: Part 3 Traffic Control Devices for Works OnRoad (Standards Australia)* and the current Main Roads *Traffic Management Requirements for Works on Roads* (2002).

The TMP should be submitted to the Construction Manager for approval within twentyeight days of Award of Contract or within ten days of Possession of Site being granted or prior to the commencement of works, whichever is earlier.

The Construction Contractor must submit with the TMP a Certificate of Compliance certifying that the TMP has been prepared and/or reviewed by an appropriately qualified person as defined in the current Main Roads WA publication *Traffic Management Requirements for Works on Roads*.

All traffic control measures will be in place and fully operational before the Construction Contractor commences any work activity that affects existing roadways.

6.8 Fire Management

The risk of igniting a fire during construction activities will be minimised to reduce the potential impacts on public safety, buildings and equipment, and the environment the immediate and near the Project area. The Construction Contractor will conform to any specific requirements for fire prevention requested by Main Roads WA, Shire of Gingin, DEC and/or the Fire and Emergency Services Authority.

During road construction activities, the following fire management requirements will be complied with:

- Machines and vehicles will be restricted to designated cleared areas;
- All plant and vehicles operating over vegetation will have exhaust systems in good working order;
- All machinery will be shut down during periods of extreme fire hazard as advised by the DEC or the Shire of Gingin;
- All machinery will be fitted with fire extinguishers.
- Smoking on site will be controlled and all cigrettes will be disposed of in an appropriate vessel; and
- All glass (and other wastes) will be collected and removed off site on a daily basis.

6.9 Hydrocarbon and Chemical Storage

No on-site storage of large quantities of fuel, oils, chemicals and other contaminant materials will be permitted during road construction. Equipment required for the cleanup of any accidental spillages will be maintained on-site.

Major vehicle and plant servicing will not be conducted within the Project area.

6.10 Waste Management

All domestic rubbish and other rubbish will be disposed of on a daily basis offsite for final disposal to an authorised waste disposal site, or a site agreed with the Shire of Gingin.

7. Environmental Management Plan

The Environmental Management Plan (EMP) for this Project is presented in **Appendix E**. The EMP presents commitments and management measures that Main Roads WA will implement to ensure the Project is environmentally acceptable. Under each environmental aspect identified in the EIA, the EMP also outlines who is responsible for each commitment and the applicable design, construction or operational stage for which management is required. The commitments outlined in the EMP aim to provide a basis for which performance and compliance can be measured throughout the Project.

7.1 Environmental Monitoring and Compliance

Environmental management commitments detailed in this EMP will be included in relevant contract documents and the Technical Specification prepared for the Project. All Main Roads WA employees, contractors and other personnel employed on the Project will be made aware of the EMP through the site induction process.

During the Project construction phase, compliance with environmental management measures will be regularly monitored. Any non-conformances should be addressed at the first opportunity, while the non-conformance and any improvement actions implemented should be detailed in appropriate construction superintendence documentation.

7.1.1 Environmental Management and Quality Plan

The Construction Contractor will prepare a Quality Plan for the Project, which will address the Construction Contractor's management responsibility, authority and communication requirements and clearly detail the Contractor's 'Quality Management Representative (QMR)' role with respect to the Contract in accordance with AS/NZS ISO 9001.

The Quality Plan will be submitted to the Construction Manager for approval within twenty-eight days of award of the Contract or ten days of Possession of Site being granted whichever is the earlier.

8. Consultation

Consultation was undertaken with the following parties, as part of the PEIA process:

» Ms Annaleisha Sullivan, Geraldton Regional Office Department of Environment.

» Ms Natalie Lauritsen, Geraldton Regional Office Department of Environment.

» Ms Jacqui Maguire, Conservation Officer Swan District Office Department of Conservation and Land Management.

» Mr Frank Rickwood, Moora District Office, Department of Agriculture.

» Mr Frank Vallentine, Works Officer, Shire of Gingin.

» Mr Andrew Arnold – UXO Liaison Officer, Fire and Emergency Services Authority.

» Mr Gerard Connell – Lands Officer, Agility Management Pty Ltd (Operator of the Parmelia Gas Pipeline).

Comments received during this consultation are provided in **Appendix F**.

Further consultation was not considered warranted, as the proposal was not considered to be at variance with the “Ten Clearing Principles”.

9. Conclusions

The PEIA undertaken for this Site in April 2006 identified a potential variance with one or more of the "Ten Clearing Principles" outlined in Schedule 5 of the *Environmental Protection Act 1986*. As a result of these findings, a vegetation, rare flora and opportunistic fauna survey of the Site was required for inclusion in an EIA document.

A field biological assessment of the Brand Highway Upgrade at 61.50 to 63.40 SLK was conducted in early September and the results of the assessment concluded that:

- The vegetation of the majority of the site has been mapped as a mosaic of Mixed Scrub-heath and Heath with *Dryandra* species dominant. The northern end of the site is a small section that has been classified as open Marri woodland. The site is adjacent to a mosaic of *Banksia* low woodland and Heath with *Dryandra* species dominant.
- Vegetation disturbance is restricted to the edge of the shoulder and after a few metres in from the shoulder there is little indication of disturbance factors. There is good quality vegetation away from the highway, including sections that are between Condition 1 ('Pristine') to Condition 2 ('Excellent'). However, the vegetation adjacent to the highway has been disturbed by roadworks and a power-line easement and this vegetation was rated Condition 2 ('Excellent') to Condition 3 ('Very Good'), and is dominated by disturbance – specialist species. More than half of the existing native vegetation in the road reserve will be retained
- The extent and status of Heddle et al. (1980) vegetation complexes are described in the EPA's *Guidance for the Assessment of Environmental Factors: Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1* (EPA, 2006). It can be seen from this data that the vegetation complex at the study site has more than 30 % of its original distribution remaining indicating is above the 'threshold level'. The vegetation types recorded during the survey were also compared with those of Shepherd (*pers comm*., 2005). This comparison indicated that the vegetation type at the site, 'Low woodland; Banksia; has more than 30 % of its original distribution remaining indicating that it is above the 'threshold level'. The Medium Woodland: Marri & Wandoo vegetation association is classified as below the 30% 'threshold level'. Clearing in the Marri & Wandoo woodland will be avoided where the clearing width is restricted to 10 metres and clearing results in no disturbance to the adjacent woodland. It is recommended that any mature Marri/Wandoos within the nominal 10m clearing zone be retained where possible (for habitat purposes).
- No evidence of plant disesases were observed during the survey. Based on patterns of health of susceptible plants there was no indication of the occurrence of dieback (*Phytophthora cinnamoni*) within the site.
- A section of the Site had been recently burnt so the number of plants recorded in this area was limited to those that rapidly germinate and sprout post-fire. The survey assumed that this area was floristically similar to the surrounding area.

- The site has good species diversity with a total of 136 taxa (114 native taxa) from 41 families recorded within the surveyed area.
- No DRF or Priority species were identified during the survey
- The Site would be expected to support a number of bird and herpetofauna species. The Site would also be expected to support a number of mammals, although not likely to use the vegetation adjacent to the highway.
- A number of significant species have been recorded in the general area but the main species that would be likely to use the Site is Carnaby's Cockatoo, which could use the Site for foraging. The extent of clearing required for this project would not significantly impact on the habitat of this species and no significant impacts on other significant fauna species would be expected from the project.
- The Site contains vegetation that is in very good condition, and which would provide high value as fauna habitat. However, the extent of clearing required for this project is minor and the majority of the vegetation in the road reserve will be retained. Impacts on the remaining vegetation and on fauna species at the Site can be managed through appropriate mitigation measures, as outlined in the EMP.

The amount and type of clearing required for this Project has been assessed as not being at significant variance with any of the "Ten Clearing Principles".

10. Limitations

10.1 Survey Limitations

This survey was carried out during only one season, and in one year. Complete surveys require multiple surveys, at different times of year, and over a period of a number of years, to enable full survey of all species present. Some flora species, such as annuals, are only available for collection at certain times of the year, and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to above factors. Therefore, while this flora survey was relatively exhaustive, and was conducted at a time of year when the majority of the flora species would be able to be identified, there is the possibility that some species with low abundance in the area have been overlooked.

The flora surveys were also restricted to predominantly flowering plants, with consideration of some other vascular plants such as cycads. Non-vascular plants were not systematically searched for as the information available in Western Australia on these species is limited, and requires specialist attention.

A section of the Site had been recently burnt so the number of plants recorded in this area was limited to those that rapidly germinate and sprout post-fire. The survey assumed that this area was floristically similar to the surrounding area.

Some fauna species are cryptic or only active at certain times (such as during the night), or may occur at the Site only as occasional visitors. The fauna survey was restricted to an opportunistic survey only, which means that some fauna species that may utilise the Site may have been overlooked.

The fauna survey was limited to terrestrial and vertebrate species.

10.2 Report Limitations

This report presents the results of a flora and fauna investigation prepared for the purpose of this commission. The data and advice provided herein relate only to the project described herein and must be reviewed by a competent scientist before being used for any other purpose. GHD Pty Ltd accepts no responsibility for other use of the data.

Where reports, searches, any third party information and similar work have been performed and recorded by others the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

For these investigations GHD has conducted desktop data searches and field surveys. The conclusions of this report were based on the information gathered during these investigations and thus reflect the environment of the Site at the time of survey. GHD accepts no responsibility for any variation in the flora and fauna present at the Site due to natural and seasonal variability.

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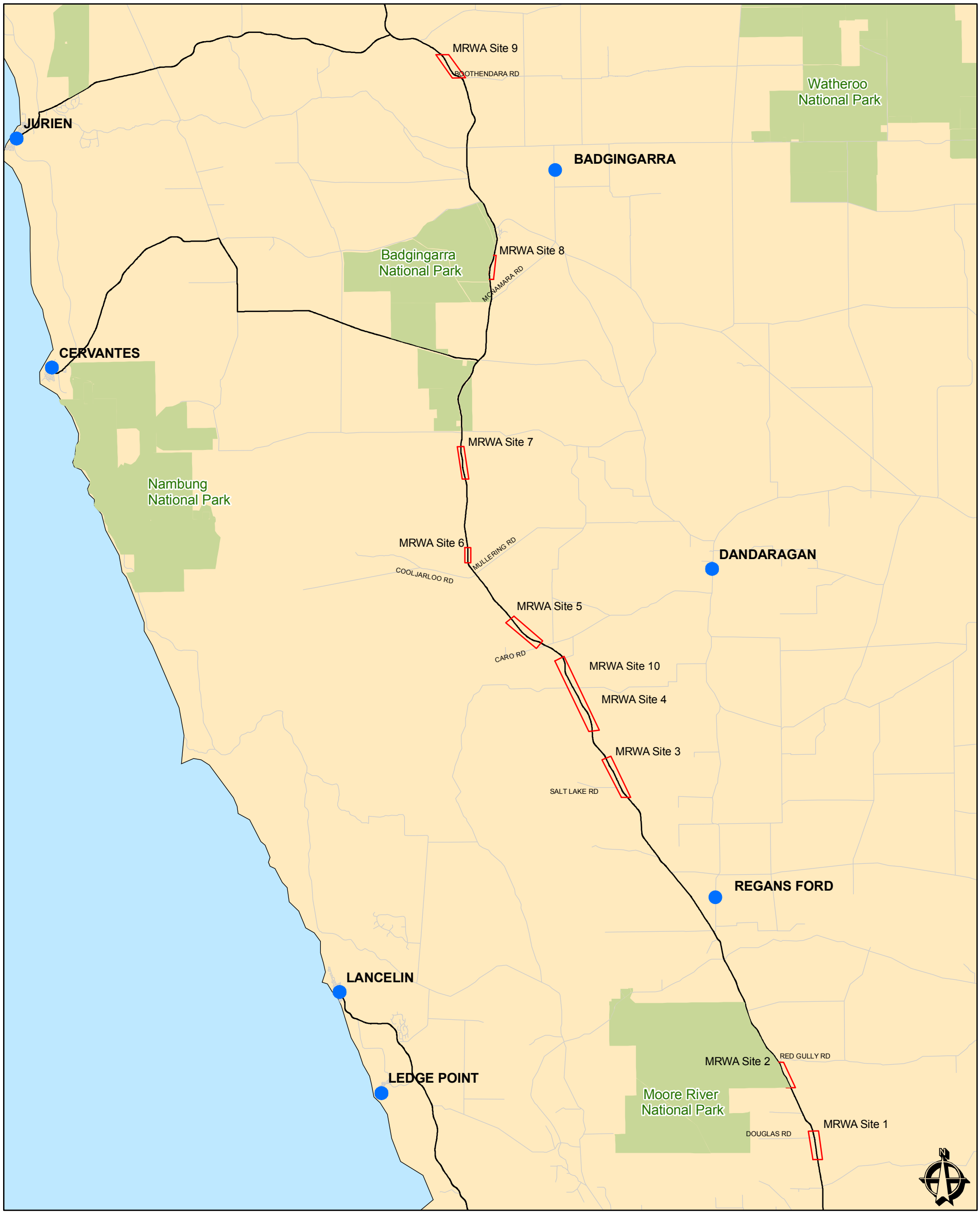
Figures



LEGEND

- Site Boundaries
- Major Roads
- Minor Roads
- Towns
- National Park

NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS

SCALE

0 2.5 5 10 15 Km

1:360 000 at A3

LOCALITY MAP

WESTERN AUSTRALIA

CREATED BY	CHECKED	APPROVED
PN		

HORIZONTAL DATUM: GDA 94 **PROJECTION:** MGA ZONE 50
HEIGHT DATUM: NA **METADATA RECORDED:** 100%

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REVISION	**DRAWING NO**
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GHD CLIENTS | PEOPLE | PERFORMANCE

Proposed Passing Lanes, Brand Highway Gingin to Eneabba

382000

383000

RED GULLY RD

63.40 SLK

6560000

6559000

61.50 SLK

BRAND HWY

6558000

382000

383000

N

LEGEND

- MRWA Site 2 : 61.50 - 63.40
- Major Roads
- Local Roads
- Low open woodland of *Banksia* and *Eucalypt todtiana*
- Scattered Marri trees over cleared farmland
- Riparian Vegetation
- Marri-Wandoo woodland

NOTE THAT ROAD SURFACE IS NOT INCLUDED IN VEGETATION COVERAGE AT THIS SCALE
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE - 2003 LEDGE POINT GINGIN MOSAIC
REPRODUCED BY PERMISSION OF LANDGATE, PERTH,WESTERN AUSTRALIA, COPYRIGHT LICENCE 30/2004

SCALE

100 0 100 200 300m

1:10,000 at A3

LOCALITY MAP

Central West

CREATED BY	CHECKED	APPROVED
WD		

HORIZONTAL DATUM: GDA 94 **PROJECTION:** MGA ZONE 50
HEIGHT DATUM: NA **METADATA RECORDED:** 100%

DATE	FILE LOCATION
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REVISION	**DRAWING NO**
0	6118367-G24

mainroads WESTERN AUSTRALIA

GHD CLIENTS|PEOPLE|PERFORMANCE

BIOLOGICAL ASSESSMENT

Figure 2: Site 2
Vegetation Type
SLK61.50 - SLK63.40

381750

382500

6560250

6559500

6558750

RED GULLY RD

63.40 SLK

2-3

2-3

1-2

BURNT: NOT ASSESSED

3-4

4-6

2-3

61.50 SLK

BRAND HWY

N

LEGEND

- MRWA Site 1 : 54.20 - 56.00
- Major Roads
- Local Roads

Vegetation Condition
1. Pristine or nearly so
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely degraded

NOTE THAT ROAD SURFACE IS NOT INCLUDED IN VEGETATION COVERAGE AT THIS SCALE
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE - 2003 LEDGE POINT GINGIN MOSAIC
REPRODUCED BY PERMISSION OF LANDGATE, PERTH,WESTERN AUSTRALIA, COPYRIGHT LICENCE 30/2004

SCALE

75 0 75 150 225m

1:7,500 at A3

LOCALITY MAP

Central West

CREATED BY	CHECKED	APPROVED
WD		

HORIZONTAL DATUM: GDA 94 **PROJECTION:** MGA ZONE 50
HEIGHT DATUM: NA **METADATA RECORDED:** 100%

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mainroads WESTERN AUSTRALIA

GHD CLIENTS|PEOPLE|PERFORMANCE

BIOLOGICAL ASSESSMENT

Figure 3
Vegetation Condition
SLK61.50 - SLK63.40

Appendix A

Vegetation Descriptions and Photos

Vegetation Community Descriptions

JOB:	Brand Highway Upgrade, Main Roads Western Australia
SITE:	Site 2: 61.50 to 63.40 SLK
DATE OF SURVEY:	22nd September 2006
SURVEYED BY:	J. Foster, M. Dilly

Banksia and Eucalyptus todtiana woodland

Plate 1: Vegetation of Quadrat 1 – Banksia low woodland. Close to the road the vegetation is dominated by disturbance specialists such as Adenanthos

Vegetation Type:

Low open *Banksia* and *Eucalyptus todtiana* woodland: *Banksia menziesii, Banksia ilicifolia* and *Eucalyptus todtiana over Jacksonia floribunda, Jacksonia sternbergiana, Calothamnus sanguineus, Eremaea pauciflora, Acacia pulchella, Hibbertia hypericoides, Phyllanthus calycinus* over *Lyginia barbata, Phlebocarya ciliata* and *Desmocladus flexuosus.*

Marri - Wandoo woodland

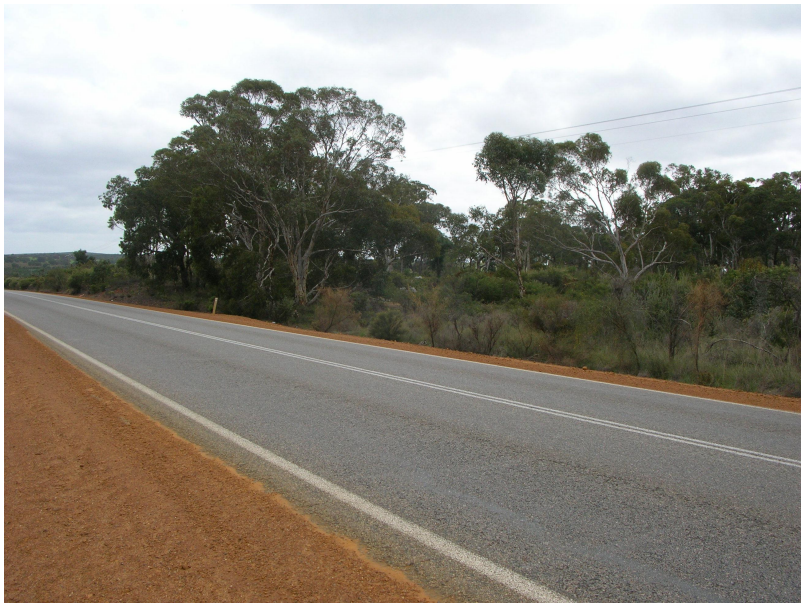

Plate 2: Vegetation at top of hill, east side of road, shows Marri - Wandoo woodland along ridgeline. Woodland starts about 10 m from the road. Area close to the road is degraded. Photo taken looking north-east.

Banksia woodland

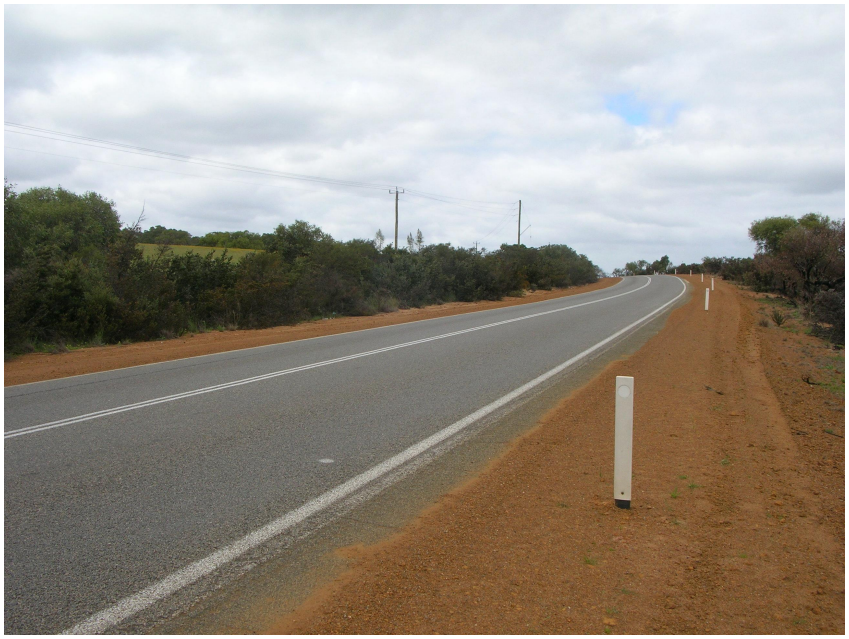

Plate 3: Southern section of site showing low open Banksia woodland. The road reserve vegetation is quite narrow at this point. Photo taken looking south - east.

Appendix B

Flora and Vegetation

Table 8 Conservation Codes and Descriptions for the DEC Declared Rare and Priority Flora Species

Table 9 Significant Flora Species Previously Recorded within the General Vicinity of the Site (Source: The DEC and the WA Herbarium)

Table 10 Flora List for the Site: 61.50 to 63.40 SLK

Table 8: Conservation Codes and Descriptions for the DEC Declared Rare and Priority Flora Species.

Conservation Code	Description
R: Declared Rare Flora – Extant Taxa	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
P1: Priority One – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2: Priority Two – Poorly Known Taxa	Taxa which are known from one or a few (generally<5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3: Priority Three – Poorly Known Taxa	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.
P4: Priority Four – Taxa in need of monitoring	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.

Table 9: Significant Flora Species Previously Recorded within the General Vicinity of the Site (Source: The DEC and the WA Herbarium)

Species	Common Name	Conservation Code
Acacia plicata		P3
Baeckea sp. Moora (R. Bone 1993/1)		P3
Beaufortia eriocephala	Woolly Bottlebrush	P3
Drosera marchantii subsp. *prophylla*		P1
Eucalyptus macrocarpa subsp. *elachantha*	Small-leaved Mottlecah	P4
Grevillea florida		P3
Grevillea saccata	Pouched Grevillea	P4
Grevillea synapheae subsp. *minyulo*		P1
Grevillea thyrsoides subsp. *thyrsoides*		P3
Haemodorum loratum		P3
Hypocalymma tetrapterum		P3
Jacksonia carduacea		P3
Melaleuca clavifolia		P1
Spirogardnera rubescens	Spiral Bush	DRF
Stenanthemum reissekii		P3
Stylidium aeonioides		P2
Thelymitra apiculata		P4
Thysanotus glaucus		P4
Tricoryne sp. Eneabba (E.A. Griffin 1200)		P2

Table 10: Flora List for the Site: 61.50 to 63.40 SLK (Results from field survey conducted 22nd September 2006)

Family	Genus	Species	Common Name	Status
Amaranthaceae	*Ptilotus*	*polystachyus*	Prince of Wales Feather	
Anthericaceae	*Corynotheca*	*micrantha*	Sand Lily	
Anthericaceae	*Thysanotus*	*manglesianus*	Fringed Lily	
Anthericaceae	*Thysanotus*	*triandrus*		
Apiaceae	*Coriandrum*	*sativum*	Coriander	*
Asphodelaceae	*Asphodelus*	*fistulosus*	Onion Weed	*
Asteraceae	*Blennospora*	*drummondii*		
Asteraceae	*Brachyscome*	*?iberidifolia*		
Asteraceae	*Arctotheca*	*calendula*	Cape Weed	*
Asteraceae	*Hypochaeris*	*glabra*	Smooth Catsear	*
Asteraceae	*Monoculus*	*monstrosus*	Stinking Roger	*
Asteraceae	*Ozothamnus*	*cordatus*		
Asteraceae	*Podolepis*	*lessonii*		
Asteraceae	*Podotheca*	*gnaphalioides*	Golden Long-heads	
Asteraceae	*Siloxerus*	*humifusus*	Procumbent Siloxerus	
Asteraceae	*Urospermum*	*picroides*	False Hawkbit	*
Asteraceae	*Ursinia*	*anthemoides*	Ursinia	*
Brassicaceae	*Raphanus*	*raphanistrum*	Wild Radish	*
Caryophyllaceae	*Petrorhagia*	*dubia*		*
Caryophyllaceae	*Silene*	*gallica*	French Catchfly	*
Casuarinaceae	*Allocasuarina*	*humilis*	Dwarf Sheoak	
Colchicaceae	*Burchardia*	*bairdiae*		
Crassulaceae	*Crassula*	*colorata* var. *acuminata*	Dense Stonecrop	
Cucurbitaceae	*Cucumis*	*myriocarpus*	Prickly Paddy Melon	*
Cupressaceae	*Actinostrobus*	*arenarius*	Sandplain Cypress	
Cyperaceae	*Caustis*	*dioica*		
Cyperaceae	*Mesomelaena*	*pseudostygia*		
Dilleniaceae	*Hibbertia*	*acerosa*	Needle Leaved Guinea Flower	
Dilleniaceae	*Hibbertia*	*subvaginata*		
Droseraceae	*Drosera*	*erythrorhiza*	Red Ink Sundew	

Family	Genus	Species	Common Name	Status
Droseraceae	*Drosera*	*pallida*	Pale Rainbow	
Epacridaceae	*Andersonia*	*heterophylla*		
Epacridaceae	*Astroloma*	*pallidum*	Kick Bush	
Epacridaceae	*Astroloma*	*xerophyllum*		
Epacridaceae	*Conostephium*	*pendulum*	Pearl Flower	
Epacridaceae	*Lysinema*	*ciliatum* forma N of Perth	Curry Flower	
Goodeniaceae	*Dampiera*	*teres*	Terete-leaved Dampiera	
Goodeniaceae	*Lechenaultia*	*biloba*	Blue Leschenaultia	
Goodeniaceae	*Scaevola*	*anchusifolia*	Silky Scaevola	
Goodeniaceae	*Scaevola*	*canescens*	Grey Scaevola	
Haemodoraceae	*Anigozanthos*	*humilis*	Catspaw	
Haemodoraceae	*Conostylis*	*aculeata*	Prickly Conostylis	
Haemodoraceae	*Conostylis*	*juncea*		
Haemodoraceae	*Conostylis*	*setigera*	Bristly Cottonhead	
Haemodoraceae	*Haemodorum*	sp.		
Haemodoraceae	*Phlebocarya*	*ciliata*		
Iridaceae	*Patersonia*	*occidentalis*	Purple Flag	
Iridaceae	*Romulea*	*rosea*	Guildford Grass	*
Lauraceae	*Cassytha*	*aurea* var. *hirta*		
Lauraceae	*Cassytha*	sp.		
Loganiaceae	*Phyllangium*	*paradoxum*		
Mimosaceae	*Acacia*	*pulchella* var. *pulchella*	Prickly Moses	
Mimosaceae	*Acacia*	*pycnantha*	Golden Wattle	*
Mimosaceae	*Acacia*	*sp.*		
Mimosaceae	*Acacia*	*stenoptera*	Narrow Winged Wattle	
Mimosaceae	*Acacia*	*tetragonophylla*	Kurara	
Molluginaceae	*Macarthuria*	*australis*		
Myrtaceae	*Baeckea*	*robusta*		
Myrtaceae	*Beaufortia*	sp.		
Myrtaceae	*Calothamnus*	*sanguineus*	Silky-leaved Blood Flower	
Myrtaceae	*Calytrix*	*oldfieldii*		
Myrtaceae	*Eremaea*	*brevifolia*		
Myrtaceae	*Eremaea*	*pauciflora*		
Myrtaceae	*Eucalyptus*	*todtiana*	Coastal Blackbutt	

Family	Genus	Species	Common Name	Status
Myrtaceae	*Hypocalymma*	*angustifolium*	White Myrtle	
Myrtaceae	*Hypocalymma*	*xanthopetalum*		
Myrtaceae	*Kunzea*	*micrantha*		
Myrtaceae	*Leptospermum*	*erubescens*	Roadside Teatree	
Myrtaceae	*Melaleuca*	*rhaphiophylla*	Swamp Paperbark	
Myrtaceae	*Verticordia*	*nobilis*		
Myrtaceae	*Verticordia*	sp.		
Orchidaceae	*Caladenia*	*flava*	Cowslip Orchid	
Orchidaceae	*Diuris*	*?corymbosa*		
Orchidaceae	*Pterostylis*	sp.		
Oxalidaceae	*Oxalis*	*glabra*		
Papilionaceae	*?Bossiaea*	*eriocarpa*	Common Brown Pea	
Papilionaceae	*Daviesia*	*?incrassata*		
Papilionaceae	*Daviesia*	*divaricata*		
Papilionaceae	*Gastrolobium*	*calycinum*	York Road Poison	
Papilionaceae	*Gompholobium*	*marginatum*		
Papilionaceae	*Gompholobium*	*knightianum*		
Papilionaceae	*Gompholobium*	*tomentosum*	Hairy Yellow Pea	
Papilionaceae	*Isotropis*	*cuneifolia*	Granny bonnets	
Papilionaceae	*Jacksonia*	*alata*		Range extension
Papilionaceae	*Jacksonia*	*floribunda*	Holly Pea	
Papilionaceae	*Jacksonia*	*sternbergiana*	Stinkwood	
Papilionaceae	*Kennedia*	*prostrata*	Scarlet Runner	
Papilionaceae	*Lupinus*	*cosentinii*		*
Papilionaceae	*Sphaerolobium*	*sp.*		
Papilionaceae	*Trifolium*	*campestre*	Hop Clover	*
Poaceae	*Amphipogon*	*turbinatus*		
Poaceae	*Austrostipa*	*elegantissima*		
Poaceae	*Avena*	*fatua*	Wild Oats	*
Poaceae	*Briza*	*maxima*	Blowfly Grass	*
Poaceae	*Ehrharta*	*calycina*	Perennial Veldt Grass	*
Poaceae	*Eragrostis*	*curvula*	African Lovegrass	*
Poaceae	*Lolium*	*rigidum*	Wimmera Ryegrass	*
Poaceae	*Neurachne*	*alopecuroidea*	Foxtail Mulga Grass	

Family	Genus	Species	Common Name	Status
Polygalaceae	*Comesperma*	*virgatum*	Milkwort	
Primulaceae	*Anagallis*	*arvensis*	Pimpernel	*
Proteaceae	*Adenanthos*	*cygnorum*	Common Woollybush	
Proteaceae	*Banksia*	*menziesii*	Firewood Banksia	
Proteaceae	*Banksia*	*prionotes*	Acorn Banksia	
Proteaceae	*Conospermum*	*stoechadis*	Common Smokebush	
Proteaceae	*Dryandra*	?lindleyana		
Proteaceae	*Dryandra*	*shuttleworthiana*	Bearded Dryandra	
Proteaceae	*Dryandra*	*squarrosa*	Pingle	
Proteaceae	*Hakea*	*candolleana*		
Proteaceae	*Hakea*	*obliqua* subsp. *parviflora*		
Proteaceae	*Hakea*	*smilacifolia*		
Proteaceae	*Hakea*	*trifurcata*	Two-leaf Hakea	
Proteaceae	*Isopogon*	*teretifolius* subsp. *teretifolius*	Nodding Coneflower	
Proteaceae	*Lambertia*	*multiflora*	Many-flowered Honeysuckle	
Proteaceae	*Petrophile*	*linearis*	Pixie Mops	
Proteaceae	*Petrophile*	*serruriae*		
Proteaceae	*Stirlingia*	*latifolia*	Blueboy	
Proteaceae	*Synaphea*	*spinulosa* subsp. *spinulosa*		
Restionaceae	*Desmocladus*	*flexuosus*		
Restionaceae	*Hypolaena*	*exsulca*		
Restionaceae	*Lyginia*	*barbata*		
Rubiaceae	*Opercularia*	*vaginata*	Dogweed	
Rutaceae	*Boronia*	*ramosa* subsp. *ramosa*		
Rutaceae	*Boronia*	*scabra* subsp. *scabra*	Rough Boronia	
Rutaceae	*Philotheca*	*spicata*	Pepper and Salt	
Santalaceae	*Leptomeria*	*empetriformis*		
Solanaceae	*Nicotiana*	*?occidentalis*	Native Tobacco	
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush	
Solanaceae	*Solanum*	*nigrum*	Black Berry Nightshade	*
Stackhousiaceae	*Stackhousia*	*monogyna*		
Stylidiaceae	*Stylidium*	*repens*	Matted Triggerplant	
Stylidiaceae	*Stylidium*	*rigidulum*		

Family	Genus	Species	Common Name	Status
Stylidiaceae	*Stylidium*	*schoenoides*	Cow Kicks	
Stylidiaceae	*Stylidium*	*sp.*		
Tremandraceae	*Tetratheca*	*confertifolia*		
Violaceae	*Hybanthus*	*calycinus*	Wild Violet	
Xanthorrhoeaceae	*Xanthorrhoea*	*preissii*	Grass Tree	

***** Introduced species

NF No flowers (so identification to species was not possible)

? Identification to species was not completely certain due to lack of distinctive features

Appendix C

Fauna

Table 11 ***Environment Protection and Biodiversity Conservation Act 1999*** **Fauna Conservation Categories**

Conservation Category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild	Taxa known to survive only in captivity
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term
Near Threatened	Taxa that risk becoming Vulnerable in the wild
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened

EPBC Act **Categories**

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

» Lead to a long-term decrease in the size of a population, or

» Reduce the area of occupancy of the species, or

» Fragment an existing population into two or more populations, or

» Adversely affect habitat critical to the survival of a species, or

» Disrupt the breeding cycle of a population, or

» Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or

» Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or

» Interfere with the recovery of the species.

** Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- Lead to a long-term decrease in the size of an important population of a species, or
- Reduce the area of occupancy of an important population, or
- Fragment an existing important population into two or more populations, or
- Adversely affect habitat critical to the survival of a species, or
- Disrupt the breeding cycle of an important population, or
- Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- Result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or
- Interferes substantially with the recovery of the species.

An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- Key source populations either for breeding or dispersal,
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

** Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.*

Table 12 *Western Australian Wildlife Conservation Act 1950* Fauna Conservation Codes

Conservation Code	Description
Schedule 1	"…fauna that is rare or likely to become extinct, are declared to be fauna that is in need of special protection."
Schedule 2	"…fauna that is presumed to be extinct, are declared to be fauna that is in need of special protection."
Schedule 3	"…birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection."
Schedule 4	"…fauna that is in need of special protection, otherwise than for the reasons mentioned [in Schedule 1 – 3]"

Table 13 The DEC Priority Fauna Conservation Codes.

(Species not listed under the *Wildlife Conservation Act 1950*, but for which there is some concern)

Conservation Code	Description
Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc.
Priority 3	Taxa which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation.
Priority 4	Rare taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.
Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Table 14 - Priority Fauna Database search results and WA Museum FaunaBase search in a 5 km radius of the Site)

Genus	Species	Common Name	DEC / Wildlife Conservation Act 1950 Rating	EPBC Act Rating	CALM Database	EPBC Act Protected Matters search	*Faunabase* search
Calyptorhynchus	*latirostris*	Carnaby's Cockatoo	Endangered / Schedule 1	Endangered	x		
Calyptorhynchus	*baudinii*	Baudin's Cockatoo	Endangered / Schedule 1	Vulnerable		x	
Pseudocheirus	*occidentalis*	Western Ringtail Possum	Vulnerable / Schedule 1	Vulnerable	x		
Dasyurus	*geoffroii*	Chuditch	Vulnerable / Schedule 1	Vulnerable	x	x	
Pseudomys	*shortridgei*	Heath Mouse (Dayang)	Vulnerable / Schedule 1	Vulnerable	x		
Leipoa	*ocellata*	Malleefowl	Vulnerable / Schedule 1	Vulnerable	x		x
Hylaeus	*globuliferus*	*Hylaeus globuliferus* (native bee)	Priority 3		x		
Leioproctus	*contrarius*	*Leioproctus contrarius* (native bee)	Priority 3		x		
Macropus	*irma*	Western Brush Wallaby	Priority 4		x		
Hydromys	*chrysogaster*	Water-rat (Rakali)	Priority 4		x		
Ardeotis	*australia*	Australian Bustard	Priority 4		x		
Oreoica	*gutturalis gutturalis*	Crested Bellbird (southern)	Priority 4		x		
Galaxiella	*munda*	Western Mud Minnow	Priority 4		x		
Throscodectes	*xederoides*	Mogumber Bush Cricket	Priority 4		x		
Isoodon	*obesulus fusciventer*	Quenda	Priority 5		x		
Haliaeetus	*leucogaster*	White-bellied Sea-eagle		Migratory		x	

Genus	Species	Common Name	DEC / Wildlife Conservation Act 1950 Rating	EPBC Act Rating	CALM Database	EPBC Act Protected Matters search	*Faunabase* search
Apus	*pacificus*			Migratory		x	
Merops	*ornatus*	Rainbow Bee-eater		Migratory		x	

Table 15 Fauna species that may occur at Brand Highway 54.20 to 56.00 SLK (Source: Western Australian Museum *FaunaBase* search of 5 km radius of the Site); and those recorded during the opportunistic fauna surveys.

Family	*Genus*	*Species*	Common Name	Status	WAM	Field Survey
Birds						
Halcyonidae	*Dacelo*	*novaeguineae*	Laughing Kookaburra	*		+ (obs)
Megapodiidae	*Leipoa*	*ocellata*	Malleefowl	Schedule 1 / Vulnerable & Migratory	+	
Meliphagidae	*Phylidonyris*	*novaehollandiae*	New-Holland Honeyeater			+ (obs)
Pardalotidae	*Pardalotus*	*striatus*	Striated Pardalote		+	
Psittacidae	*Calyptorhynchus*	*latirostris*	Carnaby's Cockatoo	Schedule 1 / Endangered		+ (signs)
Psittacidae	*Platycercus*	*icterotis*	Western Rosella		+	
Psittacidae	*Platycercus*	*zonarius*	Australian Ringneck / Ring-necked Parrot		+	
Mammals						
Canidae	*Vulpes*	*vulpes*	Red Fox	*		+ (obs)
Reptiles						
Scincidae	*Tiliqua*	*rugosa rugosa*	Southwestern Bobtail			+ (obs)
Varanidae	*Varanus*	*gouldii*	Gould's Sand Monitor		+	
Amphibia						
No records						

* Introduced

Appendix D

Summary of Environmental Impacts and Management

Table 16 Environmental Impacts Summary

Environmental Aspect	Potential Impact	Management Measure (EMP Reference)	Timing
Native Vegetation Clearing	Clearing 1.9 ha of native vegetation. No clearing in the under-represented Marri Wandoo woodland community should be required, provided the clearing is restricted to 10 m as advised by Main Roads WA. It is recommended that any individual Mature Marri/Wandoo trees be retained where possible. No clearing in the Melaleuca community associated with the Red Gully Creek should be required, provided the northern extent of the clearing is approximately 70 m to the south of the creekline as designed by Main Roads WA (SKM, 2006). No DRF or Priority species were identified. The proposed clearing is not considered to be at variance with any of the ten clearing principles.	EMP Commitments – 5	Design and Construction
Dieback Disease	The Project area shows no indicating of being infected with dieback. The Project area is however, at risk from the introduction of dieback disease due to its location and annual average rainfall.	EMP Commitments – 6	Design and Construction
Weeds	Most of the vegetation in the road reserve was in good condition and had minimal weed invasion.	EMP Commitments – 7	Construction
Fire Management	Fire caused by ignition sources has the potential to impact on public safety, buildings and equipment and the environment in the immediate area and near the Project area.	EMP Commitments – 8	Construction
Fauna	Due to the minimal clearing it is unlikely that there will be a significant impact on the long-term survival of any species of threatened fauna that may occur within the Project area.	EMP Commitments – 5 and 9	Design and Construction

Environmental Aspect	Potential Impact	Management Measure (EMP Reference)	Timing
Drainage	Disturbance to existing surface water flows.	EMP Commitments – 4	Design and Construction
Groundwater	Non-sustainable use of local groundwater.	EMP Commitments – 2	Construction
Dust	Impacts to surrounding vegetation from dust generated during road construction.	EMP Commitments – 10	Construction
Hydrocarbon and Chemical Storage	Accidental spillages of hydrocarbons and/ or other chemicals that may cause contamination.	EMP Commitments – 11	Construction
Waste Management	Incorrect disposal or containment of waste may contaminate the environment.	EMP Commitments – 12	Construction
Aboriginal Heritage	The potential for unregistered sites to be encountered during the Project.	EMP Commitments – 13	Construction
Public Safety	Accident / incidents involved with altered traffic flow during road construction	EMP Commitments – 14	Prior to Construction

Appendix E

Environmental Management Plan

Table 17 Environmental Impacts and Management Commitments

	Commitment	Expected Outcome	Responsibility	Timing Of Project
Project Environmental Management				
1.1	Main Roads WA will implement the upgrade of Brand Highway (61.50-63.40 SLK) in line with the environmental management measures detailed in this EIA and EMP.	All issues will be identified and managed to ensure minimal environmental impact.	Project Manager	All
1.2	Environmental management measures detailed in this EMP will be included in relevant contract documents and the Technical Specification prepared for the Project.	The contractor undertaking the construction will be aware of environmental concerns and their obligations, to ensure minimal environmental impact.	Project Manager	Pre-Construction
1.3	Environmental issues and management measures will be included in site inductions for Main Roads WA and contract staff.	The staff involved with the Project will be aware of environmental concerns and their obligations, to ensure minimal environmental impact.	Project Manager	All of Project
Approvals				
2.1	Main Roads WA to undertake an EIA to determine the significance of clearing.	Compliance with the *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004, Main Roads WA clearing permit and internal standards.	Project Manager	Pre-Construction
2.2	Approvals will be sought, and conditions complied with, should groundwater bore construction and abstraction be required. Should Main Roads WA utilise an existing bore, they will do so in accordance with the existing abstraction licence.	Compliance with the *Rights in the Water and Irrigation Act 1914*.	Project Manager	Pre-Construction

Environmental Management and Quality Plan				
3.1	The Construction Contractor will prepare an Environmental Management and Quality Plan for the Project, which will address the Construction Contractor's management responsibility, authority and communication requirements and clearly detail the Contractor's 'Quality Management Representative' (QMR) role with respect to the Contract in accordance with AS/NZS ISO 9001.	Environmental issues are adequately understood and managed throughout the project and environmental impacts are minimised.	Construction Contractor	Pre-Construction
3.2	The Environmental Management and Quality Plan will be submitted to the Construction Manager for approval within twenty-eight days of award of the Contract or ten days of Possession of Site being granted whichever is the earlier.	Environmental issues are adequately understood and managed throughout the project and environmental impacts are minimised.	Construction Contractor	Pre-Construction
Rivers, Wetlands and Drainage				
4.1	No rivers or wetlands exist on site, although the Red Gully Creek is located approximately 70 metres to the north of the proposed start of the south-bound passing lane. Existing surface water flows will be maintained by replacing and/or extending existing crossroad culverts and will enable *in-situ* infiltration.	Maintain existing surface water movements.	Project Manager / Construction Contractor	Design and Construction
4.2	No equipment to be stored, or works to be undertaken within 70m of the creekline. No significant excavation to occur within 200m of the creekline.	Maintain existing surface water movements and quality.	Project Manager / Construction Contractor	Design and Construction
Vegetation and Clearing				
5.1	During roadworks, clearing of existing remnant vegetation will be avoided as far as is practicable with clearing restricted to 13m from the edge of the existing seal.	Minimise clearing impacts.	Construction Contractor	Construction
5.2	Prior to the start of clearing operations the Construction Contractor will mark out the clearing line and this will be checked by the Project Manager to ensure that it is correctly defined – with particular regard to the Marri and Wandoo woodland community and the Melaleuca riparian community, located to the east and north respectively, of the proposed upgrade. Trees of particular habitat significance to be conserved will be clearly marked prior to the commencement of clearing.	Minimise clearing impacts.	Construction Contractor	Pre-Construction
5.3	No vegetation is to be disturbed for temporary works such as access tracks, spoil areas or site offices. Vehicles and equipment will not be parked or driven over tree roots.	Minimise clearing impacts.	Construction Contractor	All

5.4	Trees to be removed will be felled in a manner that ensures they fall within the approved clearing area.	Minimise clearing impacts.	Construction Contractor	Construction
5.5	Cleared vegetation suitable for rehabilitation of any degraded locations on/ or adjacent to the Site will be re-used or otherwise appropriately disposed of.	Minimise clearing impacts.	Construction Contractor	Construction/ Post-Construction
5.6	Any damage caused by the Construction Contractor to vegetation, landforms or fauna habitat outside of the works area will be rehabilitated at the Contractor's cost. If environmental damage beyond the works area is identified, the Project Manager may withhold the payment of monies due to the Contractor, where the extent of damage exceeds $5,000, determined at the following rates: » For damaged trees greater than 3m in height - $1,000 each. » For damaged trees and shrubs up to 3m in height - $500 each. » For damaged grassland, open soil areas, rock faces and landforms, and habitats in general - $10 per square metre.	Minimise clearing impacts.	Construction Contractor	Post-Construction
Dieback Disease				
6.1	The following management measures will be implemented during the design and construction of works. » Clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared; » Avoid the movement of soil in wet conditions; » If movement of soil in wet conditions is necessary, the Main Roads WA must prepare, implement and adhere to a dieback management plan, developed in consultation with the DEC; » Ensure that no dieback affected road building materials, mulches or fill are brought into an area that is not affected by dieback; and » Restrict the movement of machines and other vehicles to the limits of the areas to be cleared.	The risk of introducing Dieback disease into uninfected areas will be minimised.	Project Manager Construction Contractor	Design/ Construction
6.2	Existing drainage lines to be used over the length of the Site.	The risk of introducing Dieback disease into uninfected areas will be minimised.	Project Manager Construction Contractor	Design/ Construction

Weed Management				
7.1	Machinery and vehicle hygiene measures (outlined at 6.1) will avoid the inadvertent spread of weeds throughout the Site, and from the Site to other sites.	Minimise the introduction and spread of weeds within and from the Site.	Project Manager Construction Contractor	Pre-construction/ Construction
7.2	Any declared weeds on Site will be managed as required by the Agriculture and Related Resources Protection Act 1976.	Minimise the introduction and spread of weeds within and from the Site.	Project Manager / Construction Contractor	Pre-construction/ Construction
Fire				
8.1	No burning will be permitted within the Project area.	No fires will occur as a result of the Project and the Project will not increase the risk to the surrounding area.	Construction Contractor	All
8.2	Machines and vehicles will be restricted to designated cleared areas.	Reduce the fire risk as a result of the Project.	Construction Contractor	All
8.3	The Construction Contractor will conform to any specific requirements for fire prevention requested by Main Roads WA, Shire of Gingin, Department of Conservation and Land Management and/or the Fire and Emergency Services Authority.	Comply with local fire management requirements.	Construction Contractor	All
8.4	During road construction activities, the following fire management requirements will be complied with: » All plant and vehicles operating over vegetation will have exhaust systems in good working order. » All machinery will be shut down during periods of extreme fire hazard as advised by the DEC or Main Roads WA or the Shire of Gingin. » All machinery to be fitted with fire extinguishers. » Smoking on site will be controlled and all cigarettes will be disposed of in an appropriate vessel. » All glass (and other wastes) will be collected and removed off site on a daily basis.	Reduce the fire risk as a result of the Project.	Construction Contractor	Construction

Fauna				
9.1	Clearing of vegetation will be minimised to that which is practicable for the safe construction and operation of the road as discussed in detailed in Commitments 5.1 to 5.6.	Minimise impacts to fauna and fauna habitats.	Project Manager Construction Contractor	Design/ Construction
9.2	Works will cease on sighting an animal in the construction site. Works will commence once the animal has moved on.	Minimise direct impacts on fauna.	Construction Contractor	Construction
9.3	The work site will be left in a safe condition at the end of each working day to ensure animals are not subject to harm from the site works.	Minimise direct impacts on fauna.	Construction Contractor	Construction
Dust				
10.1	The Construction Contractor will employ construction methods that will keep dust lift to a minimum, and as required provide for the management of dust such as by watering of the works area and of roads, streets and other areas immediately adjacent to the works. Note, dust suppression waters will not be sprayed directly onto native vegetation.	Dust lift will be minimised, minimising inconvenience to road users and risks of impacts to surrounding vegetation and public safety.	Construction Contractor	Construction
10.2	Where it is found that vehicles leaving the site have dropped excessive soil material onto adjacent sections of Brand Highway these sections will be swept to reduce the potential for dust generation and maintain traffic safety.	Dust lift will be minimised, minimising inconvenience to road users and risks of impacts to surrounding vegetation and public safety.	Construction Contractor	Construction
Hydrocarbon and Chemical Storage				
11.1	No storage of large quantities of fuel, oils or chemicals within the Project area. Spill containment equipment will available in the event of a spill of minor fuels stored in vehicles and equipment.	No site contamination will occur as a result of this Project.	Construction Contractor	All
11.2	Major vehicle and plant servicing will not be conducted within the Site.	No site contamination will occur as a result of this Project.	Construction Contractor	All

Waste				
12.1	Domestic site rubbish other rubbish will be disposed of on a daily basis offsite for final disposal to an authorised waste disposal site.	Waste is disposed and contained of appropriately in order to avoid contamination of the environment.	Construction Contractor	All
Aboriginal Heritage				
13.1	If during roadworks, any materials of significance to Aboriginal people are uncovered by the Construction Contractor, works will immediately cease within 50 m of the material and the DIA will be notified as soon as practicable.	Aboriginal Heritage sites are not disturbed without appropriate approvals.	Project Manager Construction Contractor	Construction
13.2	If skeletal material is uncovered during works then the WA Police Service will also be advised immediately.	Aboriginal Heritage sites are not disturbed without appropriate approvals.	Project Manager Construction Contractor	Pre-Construction/ Construction
13.3	Recommendations made by O'Connor (2006) and Quartermaine (2006) are addressed.	Aboriginal Heritage sites are not disturbed without appropriate approvals.	Project Manager Construction Contractor	Pre-Construction/ Construction
Public Safety				
14.1	To ensure the safe access of traffic through the construction site the Construction Contractor will be required to develop and implement a Traffic Management Plan congruent with the current Australian Standard *Manual 1742.3 of Uniform Traffic Control Devices: Part 3 Traffic Control Devices for Works On-Road* (Standards Australia) and the current Main Roads WA *Traffic Management Requirements for Works on Roads*.	Maintain safe access for through traffic movements.	Construction Contractor	All
14.2	The Traffic Management Plan (TMP) will conform to the current Main Roads WA *Traffic Management Requirements for Works on Roads* and the current Australian Standard *Manual 1742.3 of Uniform Traffic Control Devices: Part 3 Traffic Control Devices for Works On-Road* (Standards Australia). The TMP will be submitted to the Construction Manager for approval within twenty-eight days of Award of Contract or within ten days of Possession of Site being granted or prior to the commencement of works, whichever is earlier.	Maintain safe access for through traffic movements.	Construction Contractor	All

14.3	The Construction Contractor must submit with the TMP a Certificate of Compliance certifying that the TMP has been prepared and/or reviewed by an appropriately qualified person as defined in the current Main Roads WA publication *Traffic Management Requirements for Works on Roads*.	Maintain safe access for through traffic movements.	Construction Contractor	All
14.4	All traffic control measures will be in place and fully operational before the Construction Contractor commences any work activity that affects existing roadways.	Maintain safe access for through traffic movements.	Construction Contractor	All
14.5	Recommendations made by BACTEC (2006) relating to unexploded ordinance are addressed.	UXO materials are not disturbed.	Project Manager Construction Contractor	Pre-Construction/ Construction

Monitoring				
15.1	During the project compliance with environmental management measures will be regularly monitored. Any non-conformances will be addressed at the first opportunity, while the non-conformance and any improvement actions implemented will be detailed in appropriate construction superintendent's documentation.	Compliance with this EMP and relevant legislation.	Project Manager Construction Contractor	All

Appendix F

PEIA Consultation Results

During the preparation of this PEIA GHD contacted the following stakeholders. The responses to our request for comments are detailed below.

Ms Annaleisha Sullivan, Geraldton Regional Office Department of Environment.
Ms Sullivan advised that the highway doesn't cross any gazetted Public Drinking Water Supply Areas, however, the proposal is within the proclaimed Gingin Groundwater Area. Construction of bores in this area require a 26D licence under the *Rights in Water and Irrigation Act (1914)*. Taking water (eg for dust suppression) will also require a licence. The project site is within a proclaimed portion of the Moore River Catchment. Ms Sullivan also advised that should the lane extension involve interference with the bed and banks of the Red Gully Creek, a permit will be required.

Ms Natalie Lauritsen, Geraldton Regional Office Department of Environment.
Ms Lauritsen provided information on a basic check as for any clearing permit, consisting of a review of Environmentally Sensitive Areas, Threatened Ecological Communities and proximity to reserves. Ms Lauritsen advised that their records identify a poorly known taxa at this site, and identified the site as adjacent to an Environmentally Sensitive Area, being the Moore River National Park. Ms Lauritsen advised measures should be taken to prevent adverse impacts upon the ESA; such as the prevention of stormwater from entering these areas, and maintaining the hygiene of equipment if any is stored or travels through these areas. Ms Lauritsen advised that it will be necessary for Main Roads WA to apply for a clearing permit as the previous exemption that applied to this activity has now expired, however, GHD advised of Main Roads WA's new purpose clearing permit.

Ms Jacqui Maguire, Conservation Officer Swan District Office Department of Conservation and Land Management.
Ms Maguire strongly recommended that a vegetation assessment be conducted by Main Roads WA prior to determination of site boundaries. These surveys should target threatened flora species and ecological communities known or likely to occur in the vicinity of the site. Ms Maguire suggested that particular survey emphasis should be given to this site, as it is adjacent to Moore River National Park, which contains many species of DRF and it is likely these may also exist within the road reserve. Further to this vegetation assessment CALM would also request that appropriate *Phytophthora cinnamomi* (Dieback)
Hygiene procedures are followed by Main Roads WA during installation of the passing lanes. Correct *Phytophthora* hygiene procedures to be adhered to include a

requirement that all machines and vehicles to be clean on entry to each site, and that contractors be made aware of this requirement. Ms Maguire also concurred with previous comments from Ms Gina Broun of the Moora District Office, which also included a recommendation to survey the area for Carnaby's Cockatoo nesting and feeding habitat, undertake remedial actions such as seed harvesting/propagule collection and ensure all staff involved in the works are aware of their duty of care in regards to Environmentally Sensitive Areas (as defined in the new clearing legislation attached to the *Environment Protection and Biodiversity Conservation Act (1999)* this includes both TECs and rare plants) and the *Wildlife Conservation Act (1950)* which specifically protects DRF as well as provides protection to native flora species.

Mr Frank Rickwood, Moora District Office, Department of Agriculture.

Mr Rickwood advised that information received indicates that this site has no problems with declared weeds. He recommended the adoption of a biosecurity protocol to ensure weeds are not spread to other locations from the sites and, new weeds are not introduced to the sites through road materials and machinery. He indicated the site has remnant vegetation and Main Roads WA would need to seek clearances through DoE and CALM, particularly as this site is in the immediate vicinity of a CALM Nature Reserve. He further stated the road works were not expected to interfere with the Red Gully Creek in the vicinity of the works.

Mr Frank Vallentine, Works Officer, Shire of Gingin.

Mr Vallentine advised that the only concern the Shire had with this site was the proximity to the Red Gully Creek, which would require careful development, or preferably be avoided with a significant buffer from the roadworks. Mr Vallentine had no additional concerns with the proposed works from the Shire of Gingin perspective, and welcomed the construction of the new passing lane.

Mr Andrew Arnold – UXO Liaison Officer, Fire and Emergency Services Authority.

Mr Arnold advised that this site lies well within the Red Gully Artillery Range unexploded ordinance (UXO) contamination site. Mr Arnold advised that numerous UXO have been found over the past 50 years, some in very close proximity to Brand Highway by former elements of UXO Services during the construction of the gas pipeline in the early 1980s. Mr Arnold recommended the site be fully searched for

UXO as it lies well within the impact area. Mr Arnold has offered to assist with the development of a "Scope of Works and Area Details" document to assist Main Roads WA with the appointment of an accredited UXO Contractor.

Mr Gerard Connell – Lands Officer, Agility Management Pty Ltd (Operator of the Parmelia Gas Pipeline).

Mr Connell provided details of the gas pipeline infrastructure crossing in the vicinity of the project area. There is a gas crossing of approximately 1km to the north of the project site and Mr Connell has suggested Agility would be interested in receiving information about roadworks at this locality. Mr Connell has advised that prior to any works commencing, Agility would be pleased to receive plans and work methodology. Each crossing will require a letter of conditions to be sent out to the main proponent for agreement and signing off on the site specific conditions.

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