

Main Roads Western Australia

**South Coast Highway Treatment 1
(SLK 291.16 to 293.00) and
Ravensthorpe Hopetoun Rd (SLK
0.53 to 9.90) Upgrades**

Environmental Impact Assessment and
Environmental Management Plan

Report

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Executive Summary

GHD Pty Ltd (GHD) was commissioned by Main Roads WA Great Southern Region (Main Roads) to prepare an Environmental Impact Assessment and Environmental Management Plan (EIA and EMP) for the upgrades of South Coast Highway Treatment 1 (291.16 – 293.00) and Ravensthorpe Hopetoun Road (SLK 0.53 – 9.90). Main Roads proposes to widen both project areas by up to five meters in width, on one side of the existing seal where possible, in order to improve the general safety of both roads. These upgrades are part of an overall five year upgrade strategy for the South Coast Highway, between Ravensthorpe and Esperance, and Ravensthorpe Hopetoun Road. The South Coast Highway Treatment 1 (291.16 – 293.00) and Ravensthorpe Hopetoun Road (SLK 0.53 – 9.90) upgrades both occur within a sparsely populated rural area within the Shire of Ravensthorpe.

This EIA and EMP has been prepared congruent with Main Roads brief for the project and:

- Describes the significant aspects of the existing project environment
- Details the primary environmental and social impacts of the proposed works; and
- Details actions to manage and minimise the identified impacts.

One waterway, Catlin Creek, is located within the South Coast Highway Treatment 1 project area at SLK 292.83. Cordingup Creek is situated within the Ravensthorpe Hopetoun Road project area, traversing the existing road and connecting to Cordingup Dam, located 100m to the south of SLK 4.35, and a smaller dam, located 60m to the south of SLK 7.30.

The existing road reserve of the South Coast Highway Treatment 1 upgrade project area varies from 20m to 40m and is bounded by 'C' Class Reserves and UCL. Acquisition of land is not anticipated from these reserves or UCL.

The existing road reserve of the Ravensthorpe Hopetoun Road varies in width also and traverses several 'C' Class reserves and areas of UCL. One area of adjacent UCL (from SLK 4.35 to SLK 6.55) has been proposed as a miscellaneous conservation reserve under CALM's draft South Coast Regional Management Plan 1992 – 2002. It is expected that 0.012 ha land will need to be acquired from UCL and 0.05 ha of land from the Old Copper Smelter Site, a 'C' Class reserve (R 9977).

Both project areas occur within the Eyre Botanical District and the Ravensthorpe Vegetation System (Beard 1979). It is anticipated that a maximum of 3.75 ha of land, comprising mostly native vegetation, will be cleared to provide for the proposed roadworks. It is expected that the South Coast Highway Treatment 1 will require a maximum of 1.09 ha of clearing and Ravensthorpe Hopetoun Road upgrade a maximum of 2.66 ha of clearing.

The clearing of vegetation for both the proposed upgrades will not impact on any vegetation that is considered regionally poorly represented.

The vegetation of both upgrade project areas was assessed according to the Bush Forever (2002) Condition Rating Scale. Within the South Coast Highway Treatment 1 upgrade project area, approximately 30.66% (0.33 ha) of the vegetation is in a good condition (Vegetation Condition Rating 3), 59.2% (0.65 ha) of the vegetation is in a moderate condition (Vegetation Condition Rating 4) and the remaining 10.18% (0.11 ha) of vegetation is described as degraded to severely degraded (Vegetation Condition Rating 5 – 6).

In the Ravensthorpe – Hopetoun Road project area, approximately 16.3% (0.43 ha) of the vegetation is in a pristine condition (Condition Rating 1) and 44.04% (1.17 ha) is in good condition (Condition Rating 3). Approximately 31.23% (0.83 ha) of the project area contains vegetation of moderate condition (Condition Rating 4) and the remaining 8.43% (0.22 ha) of vegetation could be described as degraded to severely degraded (Vegetation Condition Rating 5 – 6).

A search of CALM's Threatened Flora database revealed that 89 threatened flora species may possibly occur within, or adjacent to, the project areas of both upgrades. Within the project area of the South Coast Highway Treatment 1, populations of a Priority 3 species, *Acacia bifaria*, were observed.

Within the project area of the Ravensthorpe Hopetoun Road one Priority 1 species (*Goodenia phillipsiae*), one Priority 2 species (*Daviesia newbeyi*), two priority 3 species (*Acacia bifaria*, *Acacia errabunda*), one priority 4 species (*Eucalyptus desmondensis*) and one species of significance (*Cryptandra sp.* Ravensthorpe GF Craig 6309) were observed. Each of these species and their locations has been discussed in Section 3.1.5. Roadworks have been designed to avoid impacting on the Priority one species, *Goodenia phillipsiae* and the *Cryptandra sp.* Ravensthorpe. Roadworks are expected to impact, to some extent, on the remaining species.

No Threatened Ecological Communities were identified within either of the project areas.

Both project areas occur within the 400 – 600 mm rainfall isohyet and a number of water gaining sites may potentially exist during the wetter months. Therefore, the implementation of vehicle and hygiene measures will ensure that no soil pathogens are transported to, or from, each section of construction works.

Numerous common and pasture weed species were observed during the botanical survey of both project areas. Of these one declared plant, Saffron Thistle, was located within both project areas.

Desktop investigations into the presence of conservation significant fauna indicated that 11 species identified by the *Wildlife Conservation Notice (2004)*, potentially exist in the vicinity of the project areas. An opportunistic fauna survey was conducted in conjunction with the botanical survey of both project areas. It appears that none of the listed conservation significant fauna are likely to be adversely impacted by the proposed roadworks.

An Aboriginal Heritage Survey was conducted within the vicinity of both project areas. Roadworks will impact on the ceremonial site identified at SLK 291.17 – 291.65 in the project area of South Coast Highway Treatment 1 and are expected to impact Cordingup Creek, a tributary of Jerdacuttup River, crossing Ravensthorpe Hopetoun Road at 4.35 SLK and 7.25 SLK. Main Roads will further consult the Aboriginal community regarding all three locations, prior to making applications under Section 18 of the *Aboriginal Heritage Act (1972)* for consent to use lands that may contain Aboriginal sites.

The Australian Heritage Commission lists the Ravensthorpe Range Area on the Register of National Estate. This area occurs within the Ravensthorpe Hopetoun Road project area. Impacts on this site through any land acquisition do not warrant the referral of the project to the Department of Environment and Heritage under the provisions of the *Environmental Protection Biodiversity Conservation Act 1999*.

The Western Australian Heritage Council and the Shire of Ravensthorpe's Municipal Inventories of Heritage Places list several sites located within and adjacent to both project areas. Roadworks are not expected to impact on the Hopetoun / Ravensthorpe Railway (13984) Plaques located adjacent to South Coast Highway Treatment 1 project area. Main Roads will consult with the Ravensthorpe Shire before

impacting / removing any mature Salmon Gum trees located within the project area of South Coast Highway Treatment 1. Similarly, Main Roads will consult the Shire of Ravensthorpe further in regard to the expected impact on 15 – 18 Salmon Gum Trees, which are located within the Ravensthorpe Hopetoun Road road reserve and apart of the heritage listed 'Avenue of Old Salmon Gums' site. It is expected that acquisition of land from the No. 2 Government Smelter – Cordingup Smelter (13997) heritage site will not impact on the heritage values of this site. The impact of roadworks on Cordingup Dam is also not expected to impact its heritage value.

No potential contaminated sites were identified in the either project area.

It is expected that no land will be acquired from private property within the South Coast Highway Treatment 1 project area. As stated previously, it is expected that 0.012 ha of land from UCL and 0.05 ha of land from the Government Smelter 'C' Class Reserve is to be acquired within the Ravensthorpe Hopetoun Road project area. Acquisition of land from the reserve and UCL should take into account the Commonwealth *Native Title Act (1993)* requirements.

A detailed noise study was not deemed necessary as part of this EIA as it is unlikely that there will be a perceptible increase in noise at residential properties adjacent to either project area.

No environmental impacts identified during the preparation of this EIA and EMP indicate the need for referral of either projects to the Commonwealth Minister for the Environment under the provisions of the *EPBC Act (1999)*.

Main Roads has recently been granted an exemption to the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, until January 2006, when clearing outside of environmentally sensitive areas. Thus, a 'Clearing Permit' is not required for this project if the clearing is completed before this date. It should also be noted that Main Roads is currently undertaking consultation with the DoE regarding a state wide Purpose Permit for clearing and it is likely this will be in place prior to the current exemption expiring.

The requirement for a 'Clearing Permit' will need to be reassessed prior to the commencement of clearing for roadworks, to ensure that the requirements have been met or that the exemptions are current and in place.

To ensure that the Department of Environment are aware of the proposed roadworks a copy of this EIA and EMP should be sent to the Albany Office of the Department for their information.

1. Introduction

GHD Pty LTD (GHD) were commissioned by Main Roads WA South Coast Region (Main Roads) to prepare an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed widening of South Coast Highway (Treatment 1) and Ravensthorpe -Hopetoun Road. This document details the requested EIA and EMP for these two road upgrades, located east and south of Ravensthorpe, as shown at Figure 1 as T1 and T4 respectively.

Main Roads proposes to widen South Coast Highway Treatment 1 (SLK 291.16 to 293.00) and Ravensthorpe Hopetoun Road (SLK 0.53 to 9.90) by up to five metres in width, on one side of the existing road seal, where possible, in order to improve the general safety of both roads. These roadworks are congruent with Main Roads 5-year improvement strategy for the South Coast Highway, between Ravensthorpe and Esperance, and Ravensthorpe Hopetoun Road. The 5-year improvement strategy is shown in Figure 1. The project areas are situated within the Shire of Ravensthorpe and traverse a sparsely populated rural area.

This EIA and EMP has been prepared congruent with Main Roads brief for the project and:

- Describes the significant aspects of the existing project environment
- Details the primary environmental and social impacts of the proposed works; and
- Details actions to manage and minimise the identified impacts.

The EIA and EMP has been prepared based on:

- Discussions with MRWA Project Manager
- Previous consultation with the Environmental Protection Authority (EPA) Service Unit
- A rare flora database search of the project area by botanists from the Department of Conservation and Land Management (CALM)
- A rare flora and opportunistic fauna survey of the project area by GHD in spring 2004
- Inspection of the project site; and
- A relevant literature and database review.

Environmental and social aspects identified as requiring consideration during the proposed roadworks and addressed in this report are:

- Rivers, water catchment and drainage
- Vegetation – Declared Rare and Priority Flora, Clearing
- Reserves and Conservation Areas
- Weed Management
- Dieback Disease
- Topsoil Management
- Fauna
- Aboriginal Heritage

- ▶ European Heritage
- ▶ Land use
- ▶ Contaminated sites
- ▶ Visual Amenity; and
- ▶ Construction phase impacts – Damage to public property, noise and vibration, local community consultation and complaints management, dust, traffic safety and access, fire management, fuel and chemical storage, and rubbish disposal.

Long term impacts on air quality and groundwater were not considered issues relevant to this project and therefore not discussed within this EIA and EMP.

2. Project Description and Justification

The South Coast Highway provides an east-west link between the Goldfields Esperance Region and the Great Southern Region. The road provides a strategic freight route for industry from Ravensthorpe, west to the Port of Esperance. The Ravensthorpe to Esperance section of the South Coast Highway is sealed and 185.44 km in length. It is the major road linking Ravensthorpe townsite to Hopetoun townsite. The Ravensthorpe Hopetoun Road is 47.5 km in length and is entirely sealed.

The impact of industry, particularly the mining and grain industries, along South Coast Highway, between Ravensthorpe and Esperance, places a significant strain on the transport task of all road users between Albany and Esperance. The topography of the alignment, along with the projected delays from the heavy vehicles using South Coast Highway, has the potential to increase driver frustration.

In 2007, the Ravensthorpe Nickel Operation is scheduled to commence production and this is expected to result in an additional 50 road train movements per day to the existing 120 heavy vehicle movements per day on this section of South Coast Highway. It is also expected that many of the incoming mine workers and their families will be accommodated in Hopetoun.

The upgrade to South Coast Highway and Ravensthorpe Hopetoun Road, as part of the overall 5-year upgrade strategy, will improve the general safety of this route between the two towns and the safety of South Coast Highway, thus safely providing for the increase in traffic on both roads. The upgrade strategy is focussed on safety improvements to both roads and will include the construction of at least six passing lanes on South Coast Highway over the next few years.

Roadworks assessed within this EIA and EMP include the proposed widening of South Coast Highway Treatment 1 and Ravensthorpe Hopetoun Road between Ravensthorpe townsite (SLK 0.53) to just north of Ravensthorpe Hopetoun Road and Elverdton Road intersection (SLK 9.90). The upgrades of both roads will require widening of the existing road formations and road seals by up to 5 m, on one side of the existing road seal edge where possible. Aerial photographs of each project area are shown at Figures 2 and 3 of this report.

The South Coast Highway Treatment 1 and Ravensthorpe Hopetoun Road Projects are summarised in the Key Characteristics Table below:

Table 1: South Coast Highway Treatment 1 and Ravensthorpe Hopetoun Road Projects Key Characteristic Table

Issue	Description
South Coast Highway Treatment 1 (SLK 291.16 to 293.00)	
Length	1.84 km
Clearing	1.09 ha
Lane Width	3.5 m
Sealed Shoulder	0.5 m
Unsealed Shoulder	1.5 m
Road Reserve Width	Between 20 and 40 m
Land Acquisition	No land expected to be acquired.
Ravensthorpe Hopetoun Rd (SLK 0.53 to 9.90)	
Length	9.37 km
Clearing	2.66 ha
Lane Width	3.5 m
Sealed Shoulder	1m of new seal
Unsealed Shoulder	1 – 1.2 m
Batters	4:1
Side Road Intersections	Coleman St Four unnamed roads Elverdton Road
Road Reserve Width	Varying between 20 m and 100 m, average 40 m
Land Acquisition	0.012 ha of UCL expected to be acquired.

Both project areas occur within the Shire of Ravensthorpe. Both projects will primarily occur within the existing road reserve.

Main Roads has programmed the construction of these upgrades for the summer of 2005/2006. Roadworks are expected to be completed by a private construction contractor on behalf of Main Roads.

3. Environmental Impacts and Management

The following section identifies and discusses those environmental and social aspects considered relevant to the upgrade projects and those issues considered necessary to describe the project sites. This section also details actions necessary to adequately manage the impacts of roadworks. An Environmental Aspects Table detailing potential environmental impacts of the works is included at Appendix A. Relevant environmental management measures and responsibilities are summarised in an Environmental Management Responsibilities Table included at Appendix B. Appendix B is designed to be used as a 'stand alone' EMP during the design and implementation of the project. Photographs of both project sites are included at Appendix C.

3.1 Natural Environment

3.1.1 Climate

The closest Bureau of Meteorology weather-recording station to the South Coast Highway Treatment 1 and Ravensthorpe Hopetoun Road project sites is located at Ravensthorpe Weather Station, located 0.5 km west and northwest of the project areas. The recorded climate data at Ravensthorpe is summarised below:

Ravensthorpe Weather Station

Mean Annual Maximum Temperature Range	29.0 °C (January) to 16.2 °C (July)
Mean Annual Minimum Temperature Range	14.5 °C (February) to 6.6 °C (August)
Mean Annual Rainfall	424.9 mm
Mean Annual Raindays per year	110.4

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

3.1.2 Geomorphology, Landform and Soils

The relief of the country is related to its geological structure. Both project areas occur within an area where the underlying structure is known as greenstone belts. The rocks within this belt have been relatively resistant to erosion and the country is therefore hilly (Beard 1979). The soils of the greenstone belts vary from skeletal, shallow and rocky on the more broken ground to mature deeply weathered red loams on the lower more even ground (Beard 1979).

The soils of South Coast Highway Treatment 1 project area are characterised by small ranges of hills, bare rock walls, granitic bosses and tors with shallow leached sands (Beard 1979).

The soils of Ravensthorpe Hopetoun Road Project area are both shallow and deeply weathered. From Ravensthorpe townsite to just south of Elverdtou Road, the relief is dominated by small ranges of hills and bare rock walls (Beard 1979).

3.1.3 Rivers, Wetlands and Drainage

Catlin Creek crosses South Coast Highway at SLK 292.83 from the north. Culverts and drainage lines currently existing within the project area and in this location especially, will be maintained and extended or replaced where required, to maintain all existing surface water flows including Catlin Creek.

Within the Ravensthorpe Hopetoun Road project area, one major waterway crosses the alignment, Cordingup Creek, at 4.35 SLK and again at 7.30 SLK. This creek is a tributary of Jerdacuttup River to the north. An existing culvert traverses the road at both these locations and connects the creek to Cordingup Dam, located 100m to the south of SLK 4.35 and a smaller dam, located 60m to the south of SLK 7.30.

The final drainage design will include floodways at both SLK 4.35 and SLK 7.30 where Cordingup Creek crosses the existing seal.

Action: Main Roads Project Manager / Main Roads Designer / Main Roads Construction Manager / Construction Contractor

Culverts and drainage lines currently existing within the South Coast Highway Treatment 1 project area and at least 25 also exist within Ravensthorpe Hopetoun Road project area.

Main Roads will design the works to maintain existing surface water drainage patterns by maintaining all existing cross road culverts and extend or replace them where required.

Action: Main Roads Project Manager / Main Roads Designer / Main Roads Construction Manager / Construction Contractor

The potential for, and occurrence of, erosion was evident during field investigations, at culverts and drainage lines of both project areas.

Main Roads will design and construct the widening and culvert extensions with appropriate erosion control measures to reduce the potential for scour.

Action: Main Roads Project Manager / Main Roads Designer / Main Roads Construction Manager / Construction Contractor

3.1.4 Reserves and Conservation Areas

South Coast Highway Treatment 1

The project area of Treatment 1 commences within the Ravensthorpe townsite. The existing road reserve varies from 20m to 40m and is bounded by various reserves and UCL as shown in Table 2 below.

Table 2: Reserves and UCL occurring within the South Coast Highway Treatment 1 project area.

Location	Side	Description
SLK 291.16 – 291.43	RHS	'C' Class Reserve vested in the DPI for the purpose of Sewage Treatment
SLK 291.24 – 291.43	LHS	UCL
SLK 291.43 – 292.05	RHS	UCL
SLK 292.05 – 292.16	RHS	'C' Reserve 11 141 vested in the DPI for the purpose of 'landuse – Government requirements'.

Ravensthorpe Hopetoun Road

The existing Ravensthorpe Hopetoun Road alignment traverses several reserves and areas of Unallocated Crown Land (UCL). All of the Reserves are 'C' Class reserves vested in the Department of Education, Department of Planning and Infrastructure (DPI) or the Water Corporation.

Two areas adjacent to the Ravensthorpe Hopetoun Road have been previously identified in the CALM South Coast Regional Management Plan 1992 – 2002 under draft proposal R6a but are yet to be formally reserved as miscellaneous conservation reserves as described in section 5(g) of the Conservation and Land Management Act 1894. These areas comprise a combination of part unallocated Crown Lands and part road reserve and their locations are as follows:

1. From Cordingup Dam (SLK 4.35) northwards along the Ravensthorpe Hopetoun Road for a distance of approximately 2.2 km (SLK 6.55) and with varying widths from the road.
2. From the southern boundary of Desmond townsite (outside of the project area) through to the intersection of Road No. 6236 north of Kundip townsite. The proposed reserve area is approximately 100 m wide on either side of the road.

It is expected that 0.012 ha of land will be acquired from UCL at the following locations:

- ▶ Approximate SLK 1.7 – 1.8 – RHS
- ▶ Approximate SLK 6.5 – LHS

It is also expected that 0.05 ha of land will be acquired from the State Smelter 'C' Class Reserve (R 9977) located at SLK 2.3.

3.1.5 Vegetation, Declared Rare and Priority Flora, Threatened Ecological Communities and Vegetation Clearing

Experienced field botanist, Dr Gillian Craig, and environmental scientists, Jodie Wood and Ben Deeley, conducted a site assessment of the project areas on the 9th and 10th February 2005. Field investigations included:

- ▶ Descriptions of vegetation community's and condition ratings based on the Bush Forever (2000) Vegetation Condition Rating
- ▶ Flora species identification, including Declared Rare Flora and Priority species, and Declared weeds
- ▶ Identification of any rare vegetation communities within or in close proximity to the project areas; and

- ▶ Recording of any fauna species observed during the botanical survey.

Both project areas occur within the Eyre Botanical District and within the Ravensthorpe Vegetation System (Beard 1979). This vegetation system comprises of thicket on the summit ridges, Mallee on the pediments of the ranges and low hilly country south of Ravensthorpe, and sclerophyll woodland in the broad valleys where the soil is at its deepest (Beard 1979).

South Coast Highway Treatment 1

The western sector of the South Coast Highway Treatment 1 project area comprises a *Eucalyptus oleosa* subsp. *corvina* tall mallee with a sparse understorey of shrubs. A degraded Salmon Gum woodland occurs adjacent to cleared farmland and Gilja (*Eucalyptus brachcalyx*) and *Eucalyptus myriadena* mallee with a chenopod shrub understorey occurs on low lying areas adjacent to large samphire flats. These communities are further discussed below and can be seen on Figure 4.

Floristic Assessment, Vegetation Condition and Clearing

Vegetation Community A: Salmon Gum woodland

A degraded Salmon Gum woodland occurs adjacent to cleared farmland. The road reserves are very narrow and the north reserve is largely devoid of native species and has been choked by weeds.

Vegetation Community B: Gilja mallee

A narrow strip of Gilja (*Eucalyptus brachcalyx*) and *E. myriadena* mallee with a chenopod shrub understorey occurs on low-lying areas adjacent to large samphire flats. This community is in good condition, although severely limited by the narrow road reserve.

Vegetation Community C: Samphire flat

The east end intersects a large samphire flat and chenopod shrubland in good condition. Many of the large trees (?salmon gums) have died, possibly as a result of increased salinity and waterlogging.

Vegetation Community D: *Eucalyptus oleosa* subsp. *corvina* tall mallee

The western sector comprises a *Eucalyptus oleosa* subsp. *corvina* tall mallee with a sparse understorey of shrubs. *Acacia bifaria*, a Priority 3 species, is frequent. The vegetation is generally in very good condition with native vegetation continuing beyond the road reserves.

Based on advice from Main Roads and the detailed design, the clearing area within the project area was determined. The clearing required is expected to be a total of 1.09 ha, comprising 30.66% (0.33 ha) of good condition vegetation (Vegetation Condition Rating 3), 59.2% (0.65 ha) of moderate condition vegetation (Vegetation Condition Rating 4) and 10.18% (0.11 ha) of degraded to severely degraded (Vegetation Condition Rating 5 - 6) vegetation based on the Bush Forever (2000) Vegetation Condition Rating System (detailed in Appendix D).

A full species list and the community boundaries are included at Appendix E and Figure 4 based on the botanical survey of Craig (2005).

Ravensthorpe Hopetoun Road

Within the project area, twelve vegetation communities were recognized, two of which were repeats. Salmon Gum woodlands and mallee scrub are dominant vegetation communities throughout the project area. These twelve vegetation communities are discussed below and shown on Figure 5.

Floristic Assessment, Vegetation Condition and Clearing

Vegetation Community A *Eucalyptus oleosa* subsp. *corvina* tall mallee

Typical species within this vegetation community include *Eucalyptus oleosa* subsp. *corvina*, *Melaleuca hamata*, *Melaleuca cuculata* and *Acacia bifaria*.

Vegetation Community B Salmon Gum woodland

Typical species within this vegetation community include *Eucalyptus salmonophloia*, *Eucalyptus occidentalis*, *Acacia cupularis* and *Acacia chrysellia*.

Vegetation Community C Mallee scrub

Typical species within this vegetation community include *Eucalyptus flocktoniae*, *Eucalyptus phenax*, *Eucalyptus suggrandis*, *Melaleuca acuminata*, *Melaleuca lateriflora*, *Melaleuca hamata* and *Acacia mimica* subsp. *angusta*.

Vegetation Community D Rock Sheoak woodland

Typical species within this vegetation community include *Allocasuarina huegeliana*, *Hakea laurina* and *Acacia errabunda*.

Vegetation Community E Yate woodland

Typical species within this vegetation community include *Eucalyptus occidentalis*, *Eucalyptus salmonophloia*, *Acacia chrysellia* and *Acacia bifaria*.

Vegetation Community F Mallee scrub

Typical species within this vegetation community include *Eucalyptus flocktoniae*, *Eucalyptus phenax*, *Eucalyptus suggrandis*, *Melaleuca lateriflora* and *Melaleuca hamata*.

Vegetation Community G Salmon Gum woodland

Typical species within this vegetation community include *Eucalyptus salmonophloia*, *Acacia bifaria*, *Acacia cupularis* and *Templetonia retusa*.

Vegetation Community H Yate woodland

Typical species within this vegetation community include *Eucalyptus occidentalis*, *Acacia errabunda* and *Lepidosperm spp.*

Vegetation Community I Sheoak and Mallee

Typical species within this vegetation community include *Allocasuarina huegeliana*, *Allocasuarina campestris*, *Eucalyptus desmondensis*, *Acacia mimica* and *Lepidosperma brunonianum*.

A full species list and vegetation community boundaries are given at Appendix E and Figure 5 based on the botanical survey of Craig (2005).

Based on advice from Main Roads the clearing area within the project area is expected to total 2.66 ha. The clearing area comprises of approximately 16.3% (0.43 ha) of vegetation of pristine condition (Vegetation Condition Rating 1) and 44.04% (1.17 ha) of vegetation of good condition (Vegetation Condition Rating 3). Approximately 31.23% (0.83 ha) of the project area contains vegetation of moderate condition (Vegetation Condition Rating 4) and the remaining 8.43% (0.22 ha) of vegetation

could be described as degraded to severely degraded (Vegetation Condition 5 - 6) based on the Bush Forever (2000) Rating System.

3.1.5.1 Declared Rare and Priority Flora

A search of the Department of Conservation and Land Management's (CALM) Threatened Flora database revealed that 89 threatened flora species, as prescribed under the *Wildlife Conservation Act 1950*, may possibly occur within, or adjacent to the project areas. These species are listed in Appendix F.

South Coast Highway Treatment 1

No Declared Flora was found during the botanical survey of the project area of South Coast Highway Treatment 1, although a Priority Three flora species was found. The locations of this species and its GPS co-ordinates are detailed at Figure 4 and Appendix G, and are discussed below.

Priority Three Flora

Acacia bifaria

This species is widespread in the *Eucalyptus longicornis* subsp. *corvina* low forest in the west sector of the project area (Vegetation Community D). This community continues through to the Ravensthorpe Hopetoun Road.

A. bifaria is well-represented in the Ravensthorpe region and is known to occur in the Cocanarup Timber Reserve and Water Reserves 7517 and 8941 to the west of the Ravensthorpe Hopetoun Road (Craig 2002).

As this species is widespread throughout the west sector of the project area, it is likely to be impacted upon by roadworks.

Ravensthorpe Hopetoun Road

During the botanical survey of the Ravensthorpe Hopetoun Road project area, one Priority 1 species, one Priority 2 species, two Priority 3 species, two Priority 4 species and two species of potential significance.

Priority One

Goodenia phillipsiae

This species appears to be a disturbance opportunist, with plants found widespread along the road verge or on the disturbed Telstra cable route between SLK 8 - 14. Within the project area 1 plant was observed within Vegetation Community I (Sheoak and Mallee) on the RHS, about 1 km north of Elverdton Road (SLK 8.873). Five other subpopulations were observed further south, outside of the project area.

Until recently *Goodenia phillipsiae* had only been collected once in 1962, but recent collections have been made from near Kundip and near the Bandalup gravel pits (South Coast Hwy) by Landcare Services (G.Cockerton, pers.comm.), although specimens have not yet been lodged in the herbarium. Craig (2003) found one plant on Jerdarcuttup Road verge, near Tamarine Road.

Clearing for roadworks in the vicinity of SLK 8.873 is to occur on the LHS of the existing seal and is not expected to impact on this species.

Priority Two

Daviesia newbeyi

This species is known from a few widespread populations in the Fitzgerald River National Park, 200 km to the north-east near Barker Lake and 300 km to the east near Mt Buraminy. At least two populations are known in the Ravensthorpe area.

A single plant occurs on the west side of the Hopetoun Road (SLK 2.894) within vegetation community C (Mallee Scrub) and was first found by Angela Sanders in 1998. From its position, it is difficult to determine whether *D. newbeyi* occurs naturally here, or whether it has been introduced. Roadworks are expected to impact this species at this location.

Priority Three

Acacia bifaria

This species is widespread in the northern sector of the Ravensthorpe Hopetoun Road, extending as far south as Elverdton Road. It is most evident in the *Eucalyptus oleosa* subsp. *corvina* low forest (Vegetation Community A) where these low shrubs are common in the sparse understorey.

A. bifaria is well-represented in the Ravensthorpe region and was also observed within the project area of South Coast Highway Treatment 1. As mentioned above it is known to occur in the Cocanarup Timber Reserve and Water Reserves 7517 and 8941 to the west of the Ravensthorpe Hopetoun Road (Craig 2002).

Due to its scattered locations throughout the northern sector of the project area and it being observed on both sides of the existing road, it is likely that this species will be impacted by the roadworks.

Acacia errabunda

A. errabunda has an extensive range, being known from Jerramungup, Broomehill and Ravensthorpe. It is known to occur in Water Reserve 7517 to the west of the Ravensthorpe Hopetoun Road (Craig 2002).

During the recent survey, *A. errabunda* was found from SLK 3.36 to SLK 8 on both sides of the existing road. It is particularly common as an understorey species in the Salmon Gum and Yate woodlands (Vegetation Community H) in winter moist areas.

Due to its scattered locations throughout the project area and it being observed on both sides of the existing road, it is likely that this species will be impacted by the roadworks.

Priority Four

Eucalyptus desmondensis

This species is restricted to the Ravensthorpe Range area, particularly on granite sands. Along the Ravensthorpe Hopetoun Road, this species is found just south of SLK 8 and extends southwards to near Elverdton Road Intersection, where the greatest density of plants are located.

It is expected that this species will be impacted by roadworks between SLK 9.45 and 9.84 where locations of this species were observed on both sides of the existing seal. Roadworks in this area are to occur on both sides of the existing seal.

Significant Species

Cryptandra sp. Ravensthorpe (GF Craig 6309)

This *Cryptandra* is frequent, although scattered, in the Salmon Gum - Yate woodland and Sheoak Scrub communities on the RHS of the Ravensthorpe Hopetoun Road, from SLK 2.04 to opposite the old copper smelter at SLK 2.329. The locations are shown on Figure 6 and GPS coordinates provided in Appendix G. No plants were found on the east (LHS) road reserve, possibly due to the high degree of disturbance and invasion by weeds.

A total of 92 plants of *Cryptandra sp.* Ravensthorpe were found, the majority (70 plants) occurring in an area covering 80 m x 25 m and situated directly opposite the southern entrance of the parking bay at the old copper smelter (SLK 2.329). The 70 plants observed at this location occur within 25m of the existing road edge and thus within the 'zone of disturbance' for the proposed widening of Ravensthorpe Hopetoun Road. Due to the low number of known plants, all plants should remain undisturbed and it has been recommended that *Cryptandra sp.* Ravensthorpe be listed as a Priority One species by CALM with Declared Rare Status considered.

Main Roads will restrict roadworks to the LHS of the existing seal, in the vicinity of the known *Cryptandra sp.* Ravensthorpe (GF Craig 6309) populations located on the RHS, opposite the old copper smelter (SLK 2.329).

Action: Main Roads Project Manager / Main Roads Designer / Main Roads Construction Manager / Construction Contractor

The locations of all these Priority species are shown at Figure 5 and GPS co-ordinates provided in Appendix G.

3.1.5.2 Threatened Ecological Communities

No Threatened Ecological Communities were identified within either of the project areas. All of the vegetation communities surveyed in both project areas, are well represented in the region (Craig, 2005).

3.1.5.3 Vegetation Clearing in a Regional Context

The site vegetation of both project areas was compared against the regional remnant vegetation assessment of Shepherd *et al.* (2002) to give an indication of the regional impact of the proposed roadworks clearing, as summarised in Table 3 and Table 4. It should be recognised that the site vegetation and its corresponding Shepherd (*et al*) classification is a best fit based on the Shepherd vegetation descriptions. This assessment does not include the vegetation dominated by cleared pastureland and/or areas devoid of vegetation.

Table 3: Regional Assessment of vegetation extent within the South Coast Highway Treatment 1 project area.

Site Vegetation Community	'Best Fit' Vegetation Classification	Pre-European Extent (ha)	Current Extent (ha)	% Remaining	% IUCN Reserved	% Other Reserves	Clearing Area (ha)
A	1096: medium woodland; yate and Salmon gum	427	177	41.5	0	0	0.22

Site Vegetation Community	'Best Fit' Vegetation Classification	Pre-European Extent (ha)	Current Extent (ha)	% Remaining	% IUCN Reserved	% Other Reserves	Clearing Area (ha)
B	925: Shrublands: Mallee scrub and red mallee	37 081	35 330	95.3	79.5	0	0.23
C	1111: medium woodland; yate (<i>E. occidentalis</i>)	981	704	71.8	97.8	0	0.06
D	521: medium woodland: Salmon gum and red-mallee	129 642	127 487	98.3	0.9	5.4	0.58

Table 4: Regional Assessment of vegetation extent within the Ravensthorpe Hopetoun project area.

Site Vegetation Community	'Best Fit' Vegetation Classification	Pre-European Extent (ha)	Current Extent (ha)	% Remaining	% IUCN Reserved	% Other Reserves	Clearing Area (ha)
A <i>Eucalyptus oleosa</i> subsp <i>corvina</i> tall mallee	925: Shrublands: mallee scrub, red mallee	37 081	35 330	95.3	79.5	0	0.413
B, G, E & H Salmon Gum woodland & Yate woodland	1096: Medium woodland; yate and Salmon gum	427	177	41.5	0	0	1.2115
C, F Mallee scrub	42: Shrublands: Mallee and Acacia scrub on south coastal dunes	370 327	357 275	96.5	46.8	0	0.5844
D Rock Sheoak woodland	36: Shrublands; thicket, acacia-casuarina alliance species	429 445	177 262	41.3	10.8	0	0.0837
I Sheoak and Mallee	693: Mosaic: low woodland: <i>Allocasuarina huegeliana</i> over mallee and Acacia scrub / <i>Allocasuarina campestris</i>	5 037	3 494	69.4	0	0	0.3687

Site Vegetation Community	'Best Fit' Vegetation Classification	Pre-European Extent (ha)	Current Extent (ha)	% Remaining	% IUCN Reserved	% Other Reserves	Clearing Area (ha)
	thicket						

The Environmental Protection Authority of Western Australia has established, through Position Statement No. 2 (Environmental Protection of Native Vegetation in Western Australia), a "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level. The "threshold level" is regarded as being at a level of 30% of the pre-clearing extent of the vegetation type (EPA, 2000). None of the vegetation classifications identified for clearing within either project area and detailed in Table 3 and Table 4 have less than 30% of their original regional extent remaining intact.

Main Roads will design and implement the upgrades of both project areas to minimise vegetation clearing whilst providing for the safe construction and operation of the roads.

Action: Main Roads Project Manager / Main Roads Designer / Main Roads Construction Manager / Construction Contractor

The recently enacted *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* now require the issuing of a permit by the Department of Environment prior to the clearing of any native vegetation. Main Roads has recently been granted an extension to their previous exemption to the regulation until January 2006. Thus, a 'Clearing Permit' is not required for this project if the clearing is completed before this date. It should also be noted that Main Roads is currently undertaking consultation with the DoE regarding a state wide Purpose Permit for clearing and it is likely that this will be in place prior to the exemption expiring.

The requirement for a 'Clearing Permit' will need to be reassessed prior to the commencement of clearing for roadworks, to ensure that the requirements have been met or that the exemptions are current and in place.

Action: Main Roads Project Manager

Clearing for roadworks should be conducted as detailed below.

During roadworks, damage to existing remnant vegetation will be avoided as far as practicable. Clearing should be restricted to 1 m from the edge of roadworks, or 5 m from the edge of the road seal, whichever is greater.

Action: Main Roads Construction Manager / Construction Contractor

Prior to the start of clearing operations the clearing line will be marked on the ground and checked by the Construction Manager to ensure that the clearing areas are correctly defined. Trees, of particular significance, to be conserved are to be clearly marked prior to the commencement of clearing.

Action: Main Roads Construction Manager / Construction Contractor

Trees to be removed will be felled in a manner that ensures they fall within the approved clearing area.

Action: Main Roads Construction Manager / Construction Contractor

Mature trees especially will be conserved as far as practicable and will not 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.

Action: Main Roads Construction Manager / Construction Contractor

Any damage caused by the Construction Contractor to the 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 Main Roads WA will withhold the payment of monies due to the contractor, where the extent of the damage exceeds \$5000, determined at the following rates:

- ▶ For damaged trees greater than 3 m in height - \$1000 each;
- ▶ For damaged trees and shrubs up to 3 m in height - \$500 each; and
- ▶ For damaged grassland, open soil areas, rock faces and landforms, and habitats in general - \$10 per square metre.

Action: Main Roads Construction Manager / Construction Contractor

All cleared timber will be disposed of off-site in private property. Cleared vegetation will be disposed of in existing gravel pits or unvegetated private property. No burning of cleared vegetation will be permitted within the road reserve.

Action: Main Roads Construction Manager / Construction Contractor

3.1.6 Weed Management

South Coast Highway Treatment 1

A number of weeds typical of farmland were found within the South Coast Highway road reserve, particularly in the northern, narrow road reserves that abut cleared land.

The extent of weed invasion is reflected in the Bush Forever Condition Rating of the vegetation within the project site as detailed at Appendix D.

Common weed species identified within the project site included:

- ▶ *Asparagus asparagoides* (bridal creeper) – a Weed of National Significance
- ▶ *Asphodelus fistulosus* (onion weed)
- ▶ *Avena fatua* (wild oat)
- ▶ *Briza spp.* (quaking grass)
- ▶ *Centaurea melitensis* (Maltese cockspur)
- ▶ *Chloris truncata* (windmill grass)
- ▶ *Cirsium vulgare* (spear thistle)
- ▶ *Conyza bonariensis* (fleabane)
- ▶ *Dittrichia graveolens* (stinkwort)
- ▶ *Ehrhata sp.* (veldt grass)

- ▶ *Eragrostis cilianensis* (stinkgrass)
- ▶ *Eragrostis curvula* (African lovegrass)
- ▶ *Hordeum sp.* (barley grass)
- ▶ *Hypochaeris sp.* (flatweed)
- ▶ *Lactuca saligna* (wild lettuce)
- ▶ *Lolium rigidum* (annual ryegrass)
- ▶ *Lycium ferocissimum* (African boxthorn)
- ▶ *Oenothera stricta* (common evening primrose)
- ▶ *Panicum capillare* (witchgrass)
- ▶ *Rapistrum rugosum* (turnip weed)
- ▶ *Rumex sp.* (dock)
- ▶ *Salix babylonica* (weeping willow)
- ▶ *Solanum nigrum* (black berry nightshade)
- ▶ *Sonchus sp.* (sowthistle)

One additional species that has been 'declared' in the Shire of Ravensthorpe under the *Agriculture and Related Resources Protection Act (1960)* was identified within the project area and is discussed below.

Ravensthorpe Hopetoun Road

Within the Ravensthorpe Hopetoun Road reserve, weeds were observed principally adjacent to culverts and areas bordering cleared land.

The extent of weed invasion is reflected in the Bush Forever Condition Rating of the vegetation within the project site as detailed at Appendix D.

Common weed species identified within the project site included:

- ▶ *Asparagus asparagoides* (bridal creeper) – a Weed of National Significance
- ▶ *Asphodelus fistulosus* (onion weed)
- ▶ *Avena fatua* (wild oat)
- ▶ *Centaurea melitensis* (Maltese cockspur)
- ▶ *Chloris truncata* (windmill grass)
- ▶ *Cirsium vulgare* (spear thistle)
- ▶ *Conyza bonariensis* (fleabane)
- ▶ *Ehrhata sp.* (veldt grass)
- ▶ *Eragrostis cilianensis* (stinkgrass)
- ▶ *Eragrostis curvula* (African lovegrass)
- ▶ *Lactuca saligna* (wild lettuce)
- ▶ *Rapistrum rugosum* (turnip weed)

- ▶ *Rumex* sp. (dock)
- ▶ *Solanum nigrum* (black berry nightshade)

One additional species that has been 'declared' in the Shire of Ravensthorpe under the *Agriculture and Related Resources Protection Act (1960)* was identified within the project area and is discussed below.

Saffron thistle (*Carthamnus lanatus*)

This is an erect annual to 70 cm tall, with spiny, rigid leaves. The yellow 'daisy' flowers are present in spring and summer. The plant dies off in late summer or autumn, however the seeds can survive for many years in the soil. It is a serious weed of agricultural areas and disturbed bushland.

Saffron thistle occurs at approximately:

South Coast Treatment 1:

51H 228563E 6281691N within Vegetation Community C (SLK 292.8 – 293.03) on the LHS of the road.

Ravensthorpe Hopetoun Rd:

51H 229178E 6279354N SLK 3.14, about 150m south of Cordingup Road, in the Mallee Scrub vegetation on the RHS of the road.

Landholder obligations to control Saffron Thistle (Department of Agriculture, 2005):

P4 Requirements: The infested area must be managed in such a way that prevents the spread of seed or plant parts within or from the property on or in livestock, fodder, grain, vehicles and/or machinery. This includes treatment to destroy and prevent the seed set of all plants within 100 metres of the boundaries of the infested property and those within 50 metres of roads, sheds, stockyards, houses and the high water mark of waterways. Treatment must be completed prior to seed set each year and properties with less than two hectares of infestation must treat the entire infestation. Additional areas may also be ordered to be treated.

Main Roads will advise its Term Network Contractor of the presence of the declared weed, Saffron Thistle, to arrange for control measures to be initiated.

Action: Main Roads Project Manager

As sections of both project areas are wholly or partly surrounded by pastureland, weed invasion in both areas is expected to continue to occur long term.

The machinery and vehicle hygiene measures described below will be included in the Construction works, and will avoid the inadvertent spread of weeds within and beyond the project areas.

- ▶ All site employees will be advised of the hygiene measures
- ▶ All clearing, topsoil stripping/spreading and gravel cartage activities will be conducted under dry soil conditions
- ▶ Dust adhering to the sides of vehicles does not need to be removed
- ▶ All road construction plant and machinery will be cleaned free of all soil and vegetative material prior to arrival and prior to departing the project sites

- ▶ All road construction plant and machinery will be cleaned free of all soil and vegetative material when moving from heavily weeded farmland sections to vegetated sections; and
- ▶ Clean down will comprise of the use of a brush and/or compressed air to remove clods of soil and/or soil water slurry. A metal bar or spade should be used to remove compacted soil where necessary.

Action: Main Roads Construction Manager / Construction Contractor

Longer-term management of weeds within the project area will be conducted during the annual herbicide and weed management program conducted by Main Roads Term Network Contractor.

Action: Main Roads Term Network Contractor

3.1.7 Topsoil Management

After completion of clearing activities, topsoil will be stripped and removed from site to an approved spoil site.

Action: Main Roads Construction Manager / Construction Contractor.

3.1.8 Dieback Disease

Areas within the 400 – 600 mm rainfall isohyet are only considered vulnerable to *Phytophthora cinnamomi* (Phytophthora dieback) if they are natural water gaining sites or sites that have become water gaining due to altered drainage (Dieback Consultative Committee 2001). The project areas occur within the 400 – 600 mm rainfall isohyet and a number of water gaining sites may potentially exist during the wetter months.

Discussions with Malcolm Grant of CALM, Ravensthorpe, concerning the construction of two passing lanes on South Coast Highway, have indicated that the Department requires vehicle hygiene practices to be put in place throughout the construction of all upgrades within the Ravensthorpe Region.

The vehicle and hygiene measures discussed above in Section 3.1.6 (Weed Management) will ensure that no soil pathogens are transported to, or from, each section of construction works.

Action: Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor

3.1.9 Fauna

The following species were observed, or evidence of their passage through the project areas, was recorded in conjunction with the botanical survey conducted by Dr Gillian Craig (2005).

South Coast Highway Treatment 1

Birds:

- ▶ Australian raven (*Corvus coronoides*)
- ▶ Grey currawong (*Strepera versicolor*)
- ▶ Emu (*Dromaius novaehollandiae*)
- ▶ Galah (*Cacatua roseicapilla*)

- ▶ Western ringneck (*Barnardius zonarius*)

Reptiles:

- ▶ Bobtail (*Teliqua rugosa*)
- ▶ Dugite (*Pseudonaja affinis*) (R. & R. Upton, pers. comm.)
- ▶ Rosenberg's monitor (*Varanus rosenbergii*)
- ▶ Skink (?*Morethia* sp.)
- ▶ Tiger Snake (*Notechis scutatus*) (R. & R. Upton, pers. comm.).

Marsupial:

- ▶ Western grey kangaroo (*Macropus fuliginosus*)

Ravensthorpe Hopetoun Road

Birds:

- ▶ Australian raven (*Corvus coronoides*)
- ▶ Grey currawong (*Strepera versicolor*)
- ▶ Emu (*Dromaius novaehollandiae*)
- ▶ Western ringneck (*Barnardius zonarius*)
- ▶ White-rumped miner (*Manorina flavigula*)
- ▶ New Holland honeyeater (*Phylidonyris novaehollandiae*)
- ▶ Blue-breasted wren (*Malurus pulcherrimus*)
- ▶ Willie wagtail (*Rhipidura leucophrys*)

Reptiles:

- ▶ Bobtail (*Teliqua rugosa*)
- ▶ Rosenberg's monitor (*Varanus rosenbergii*)
- ▶ Skink (?*Morethia* sp.)

Marsupial:

- ▶ Western grey kangaroo (*Macropus fuliginosus*)
- ▶ Western brush wallaby (*Macropus irma*)

Feral animals:

- ▶ rabbit (*Oryctolagus cuniculus*) - (active burrows in community I)
- ▶ red fox (*Canus vulpes*)
- ▶ Laughing kookaburra (*Dacelo gigas*)

CALM Listed Threatened Fauna

A desktop analysis of threatened fauna species believed to occur in the project area was conducted based on a search of the CALM's Threatened Fauna database. This search revealed that five Schedule

1 species, one Schedule 4 species and five Priority taxa, as prescribed under the *Wildlife Conservation Act 1950*, possibly occur within, or adjacent to the project areas. These species are listed below and discussed in detail at Appendix H.

Schedule 1 (Fauna that is rare or likely to become extinct):

- ▶ Chuditch (*Dasyurus geoffroi*)
- ▶ Numbat (*Myrmecobius fasciatus*)
- ▶ Dibbler (*Parantechinus apicalis*)
- ▶ Malleefowl (*Leipoa ocellata*)
- ▶ Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

Schedule 4 (Other specially protected fauna)

- ▶ Peregrine Falcon (*Falco peregrinus*)

Priority One

- ▶ *Lerista viduata*

Priority Four

- ▶ Western Brush Wallaby (*Macropus irma*)
- ▶ Western Mouse (*Pseudomys occidentalis*)
- ▶ Western Whipbird (sthn WA subsp.) (*Psophodes nigrogularis oberon*)

Priority Five

- ▶ Tammar Wallaby (*Macropus eugenii derbianus*)

Apart from Western Brush Wallaby (Priority 4), which was observed within the Ravensthorpe Hopetoun Project area, none of these species were identified during the opportunistic site surveys.

These listed species were recorded within the Ravensthorpe area, with many of the records being within the nearby Ravensthorpe Range and surrounding Kundip and Desmond Reserves.

South Coast Highway Treatment 1

Due to the level of disturbance and the lack of suitable habitat within this project area, it is unlikely that any of the listed threatened species would be adversely impacted by the proposed roadworks. However, a number of Salmon Gums (*Eucalyptus salmonophloia*) occur adjacent to the existing seal and may be used periodically by Carnaby's Black Cockatoo and other avifauna. None of the Salmon Gum's observed in the project area appeared to have significant hollows that could be used for breeding by Carnaby's Cockatoo. In addition, this species is known to breed primarily in the eastern Wheatbelt and not as far south as the Southern Coast. Hence, the removal of these trees within the project area is unlikely to result in an adverse impact to the Carnaby's cockatoo.

Ravensthorpe Hopetoun Rd

Based on the extent of clearing for roadworks and the size of the vegetated areas (Reserves 16119, 32874, 9977, 7517 and UCL) within the project area, it is unlikely that the roadworks clearing will threaten the survival of any of the conservation significant fauna species listed.

3.2 Social Environment

3.2.1 European and Natural Heritage

The Australian Heritage Commission lists the Ravensthorpe Range Area, illustrated in Figure 7, on the Register of the National Estate, under the provisions of the *Australian Heritage Council Act 2003* and the now repealed *Australian Heritage Commission Act 1975*. This area is described as a series of low hills of pre-Cambrian granite, migmatite, gneiss and greenstones. The site is significant due to the unique biological niche it provides within the State, containing many rare and endemic plant species and the only natural locality of several eucalypts.

Places listed on the Register of the National Estate may be afforded protection from an action under the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)* only if the Commonwealth Government owns the place and / or the Commonwealth Government or one of its agencies take the action. No other statutory protection is currently afforded to places listed on the Register of National Estate.

Hence, as the Ravensthorpe Range Area meets neither of these criteria, referral of the project to the Department of Environment and Heritage under the provisions of the *EPBC Act 1999*, is not deemed necessary in this case.

The WA Heritage Council and the Shire of Ravensthorpe's Municipal Inventories of Heritage Places list several sites located within or adjacent to the project areas. These are:

South Coast Highway Treatment 1

Hopetoun / Ravensthorpe Railway (13984)

The 54 km railway line linked Ravensthorpe to Hopetoun, passing through Elverdton Mine site. The passage of the railway line exists to the north (LHS) of South Coast Highway throughout the project area of Treatment 1 with the Station being located at the vehicle rest area (SLK 291.00). Photograph 22 (Appendix C) illustrates the route of the Hopetoun / Ravensthorpe Railway. There are a number of plaques strategically placed along the route, indicating significant features. The Council requests that care be taken by contractors in relocating these plaques where necessary.

These plaques will not be impacted on by the South Coast Highway Treatment 1 roadworks.

There are a number of large Salmon Gums (*Eucalyptus salmonophloia*) lining the South Coast Highway, especially close to the Ravensthorpe townsite. These trees are not listed as having Heritage value but a similar line of trees on Ravensthorpe Hopetoun Road (Avenue of Old Salmon gums – 13970) has been listed on the WA Heritage Council's database. This listing describes the trees significance as being "Around Ravensthorpe there are good stands of Salmon Gum trees which identify the area", hence these trees along South Coast Highway may also have some significance to the Ravensthorpe community.

Main Roads will consult with the Ravensthorpe Shire before impacting / removing any mature Salmon Gum trees located within the project area of South Coast Highway Treatment 1.

Action: Main Roads Project Manager

Ravensthorpe Hopetoun Road

Avenue of Old Salmon Gums (13970)

The Avenue of Old Salmon Gums is located within the road reserve of Ravensthorpe Hopetoun Rd, at SLK 5.56 - 6.58 on both sides of the highway. This area comprises a number of Salmon Gums (*Eucalyptus salmonopholia*) over the section, close to the road - some within 4 m of the road seal. These trees are described on the WA Heritage Council Places database by the following: "Around Ravensthorpe there are good stands of Salmon Gum trees which identify the area". The 'Avenue of Old Salmon Gums' is also listed on the Ravensthorpe's Council's 'Municipal Heritage Inventory' therefore the Council has stated that any requirement to impact / remove any of the trees would require full Council approval. The Shire of Ravensthorpe in discussing this project stated that it hoped the trees would not need to be impacted or removed.

Main Roads will consult the Shire of Ravensthorpe further in regard to the expected impact on 15 – 18 Salmon Gum Trees, which are located within the road reserve and are apart of the 'Avenue of Old Salmon Gums' heritage site.

Action: Main Roads Project Manager

No. 2 Government Smelter – Cordingup Smelter (13997)

Located on Ravensthorpe Hopetoun Rd, the No. 2 smelter was a project of enormous proportions but it had a short and chequered life with several owners. It was constructed in 1906. It is expected that 0.05 ha of land will be acquired for roadworks, from this 'C' Class Reserve (R 9977). No infrastructure exists on this site and as such it is expected that the roadworks will not impact on the heritage values of this site.

Cordingup Dam (13968)

Located 100m south of Ravensthorpe Hopetoun Rd (SLK 4.35) the dam was constructed in 1909 and has a pumping station. It is still in use today and in 1909 had a capacity of 20,000,000 gallons. The construction of a floodway at the location of where Cordingup Creek crossed Ravensthorpe Hopetoun Road will maintain existing flows into the Cordingup Dam.

3.2.2 Aboriginal Heritage

Ethnographic Survey

Mr Brad Goode conducted an ethnographic field survey on the 26th and 27th April 2005. The study area of this ethnographic survey comprised a corridor 25m either side of the existing road shoulders on South Coast Highway (SLK 290 - 415) and a Ravensthorpe Hopetoun Road (SLK 0 - 15).

As a result of the survey several recommendations were made:

- ▶ It is recommended that the three main river systems that run through the survey area (the Jerdacuttup River, the Oldfield River and the Young/Lort River systems) be registered as sites of mythological and domestic significance by the Department of Indigenous Affairs. As a result of this recommendation, it has been requested by the Aboriginal community that Main Roads avoid impacting these areas with any road works that would affect the water courses that cross the Ravensthorpe Hopetoun Road and the South Coast Highway.
- ▶ The Aboriginal community has identified a ceremonial area to the east of Ravensthorpe within the South Coast Highway Treatment 1 project area, at 291.17 – 291.65 SLK. This site occurs on the RHS; approximately 7 m back from the existing seal. It is recommended that this area be registered

as a site of ceremonial and historical significance by the Department of Indigenous Affairs. The Aboriginal community has requested that Main Roads avoid impacting upon this area. If this is not possible, it is further recommended that Main Roads conduct further consultations with the Aboriginal community prior to seeking approval under Section 18 of the *Aboriginal Heritage Act (1972)* for consent to use the land that may contain an Aboriginal site.

Roadworks are expected to impact Cordingup Creek, a tributary of Jerdacuttup River crossing Ravensthorpe Hopetoun Road at 4.35 SLK and 7.25 SLK and Main Roads will further consult the Aboriginal community prior to making an application under Section 18 of the *Aboriginal Heritage Act (1972)* for consent to use the land that may contain an Aboriginal site.

Action: Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor

It is expected that roadworks will impact on the ceremonial site identified at SLK 291.17 – 291.65. Main Roads should conduct further consultations with the Aboriginal community prior to seeking approval under Section 18 of the *Aboriginal Heritage Act (1972)* for consent to use the land that may contain an Aboriginal site.

Action: Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor

Archaeological Survey

An Archaeological survey for Aboriginal heritage significance was undertaken by Jacqueline Harris accompanied by traditional Aboriginal elder, Mr Wayne Webb, Bibbulman / Wadandi representative as field assistant. The study area was that of the ethnographic survey conducted by Mr Brad Goode. No archaeological sites were located within the South Coast Highway Treatment 1 and Ravensthorpe Hopetoun Rd project areas. However, the removal or excavation of large quantities of sediment increases the risk of disturbing archaeological sites, which may lie beneath the ground surface,

Main Roads will inform any project personnel of their obligation to report any archaeological material, should this be encountered during earthmoving, as outlined under Section 25 of the *Aboriginal Heritage Act 1972*.

Action: Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor

If during roadworks materials likely to be of interest to the Aboriginal community are uncovered then works will immediately cease within 50m of the material and the Department of Indigenous Affairs advised immediately. If skeletal material is uncovered during works then the WA Police Service will also be advised immediately.

Action: Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor

3.2.3 Land Use and Acquisition

South Coast Highway Treatment 1

As discussed in section 3.1.4, the Department of Land Information land online database indicates that Unallocated Crown Land (UCL), a 'C' Class Reserve and several private properties flank the South

Coast Highway Treatment 1 project area. The UCL and Reserve are vegetated and the private properties are mostly cleared for agricultural use.

The existing South Coast Highway Treatment 1 road reserve varies in width from 20m to 40m. Land is not expected to be acquired from private property located within the project area.

Ravensthorpe Hopetoun Road

The Ravensthorpe Hopetoun Road project area is flanked by Reserves, as mentioned in section 3.1.4, Unallocated Crown Land (UCL) and broad acre agriculture.

The existing Ravensthorpe Hopetoun Road road reserve varies in width from 20m to 100m. It is understood that sections of the existing road may not be within the gazetted road reserve, which is being rectified within a separate MRWA project. As discussed in Section 3.1.3, it is anticipated that 0.012 ha of land is to be acquired from UCL and 0.05 ha of land from the Government Smelter 'C' Class Reserve located within the project area.

Acquisition of land from reserve areas and areas of UCL will take account of the Commonwealth *Native Title Act (1993)*.

Action: Main Roads Project Manager / Main Roads Construction Manager

Impacts on adjacent private property landuse will be kept to a practicable minimum during roadworks.

Action: Main Roads Construction Manager / Construction Contractor

3.2.4 Contaminated Sites

A brief investigation of the types of current land use and recent history of the project area indicates that no likelihood of a contaminated site occurring within the project area. No evidence of industrial use or fuel storage centres / service stations were identified within the project area.

3.2.5 Visual Amenity

South Coast Highway Treatment 1

South Coast Highway Treatment 1 traverses an agricultural landscape and through the project area, the viewshed from the road is dominated by cleared landscape and remnant vegetation within the road reserves, adjacent property, UCL and 'C' Class reserves.

Ravensthorpe Hopetoun Road

Ravensthorpe Hopetoun Road similarly traverses an agricultural landscape in which the viewshed from the road is dominated largely by remnant vegetation within the road reserve, UCL and adjacent conservation reserves.

In general, the clearing required for the proposed roadworks will not significantly alter the existing visual character of either project areas. However, in both project areas old Salmon Gums line sections of the roads and loss of these trees in either project area may alter the visual character. This is reflected in the Council's request to minimise impacts on these trees and to consult with them prior to any impact on these trees occurring, Section 3.2.1.

3.2.6 Noise

A detailed noise study was not deemed necessary as part of this EIA as it is unlikely that there will be a perceptible increase in traffic noise at residential properties as no private residences occur within 100 m of the project areas.

3.3 Pre-construction Phase

Service relocations may be required prior to roadworks.

South Coast Highway Treatment 1

Telstra Cable warning signs were observed during field observations, on the northern side (LHS) between 15 m and 30 m from the road seal. A power line also crosses the existing road (north-south direction) at a driveway, approximately 292 SLK. The power pole on the northern side of the highway is only set back 5 m from the road.

Ravensthorpe Hopetoun Road

During field investigations, Telstra cable warning signs were observed on both sides of the existing seal throughout the project area. A power line exists south of the existing seal, from Ravensthorpe through to the Elverdton mine site. Powerlines cross over the seal at several locations and the relocation of power poles may be required to complete roadworks.

Main Roads will request that any required service relocations be conducted to ensure clearing of vegetation is minimised to that which is practicable.

Action: Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor

These pre-construction works will be carried out by other agencies prior to commencement of the roadworks.

Environmental management measures detailed in the EIA and EMP that are applicable for the works relating to the service re-locations should be complied with by the relevant service providers.

Action: Main Roads Project Manager / Service Providers

A copy of the EMP (Appendix B) will be provided to the various agencies and contractors responsible for the service relocations with a requirement to fulfil the specific environmental management measures during service re-location works.

Action: Main Roads Project Manager / Service Providers

3.4 Construction Phase

Both project areas occur just outside of Ravensthorpe townsite and traverse sparsely populated rural landscapes. Within either project areas, there are no private residences located within 50 m of roadworks.

The impact of the proposed roadworks to adjacent landowners and through traffic will be minimised by the management of temporary environmental and social impacts that are likely to occur during the road construction phase. The following issues will need to be considered:

- ▶ Damage to public property, noise and vibration
- ▶ Dust
- ▶ Traffic safety and access
- ▶ Fire management
- ▶ Fuel and chemical storage; and
- ▶ Rubbish disposal.

3.4.1 Damage to public property, noise and vibration

The Construction Contractor will nominate a person responsible for reviewing and monitoring all operations in order to prevent or minimise the impact of vibration, noise, dust and other forms of pollution on property and the public.

Action: Main Roads Construction Manager / Construction Contractor

No private residences occur within 100 m of the project area however, several buildings do occur within the 100m. Impacts on private property, vibration impacts and / or noise impacts from construction works may impact on adjacent landholders.

The Construction Contractor is required to observe its obligations under the *Environmental Protection Act (1986)*, the *Environmental Protection (Noise) Regulations (1997)* and Section 6 of the Australian Standard 2436 – 1981 “*Guide to Noise Control on Construction, Maintenance and Demolition Sites*”.

Action: Main Roads Construction Manager / Construction Contractor

3.4.2 Dust

There is likely to be some dust lift generated during the construction works and as a result of passing traffic.

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.

Action: Main Roads Construction Manager / Construction Contractor

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

Action: Main Roads Construction Manager / Construction Contractor

3.4.3 Traffic Access and Safety

To ensure the safe access of traffic through the construction sites the Construction Contractor will develop and implement a Traffic Management Plan (TMP) 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 *Traffic Management Requirements for Works on Roads*.

Action: Main Roads Construction Manager / Construction Contractor

The TMP will be submitted to Main Roads 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.

Action: Main Roads Construction Manager / Construction Contractor

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 publication *Traffic Management Requirements for Works on Roads*.

Action: Main Roads Construction Manager / Construction Contractor

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

Action: Main Roads Construction Manager / Construction Contractor.

3.4.4 Fire Management

The risk of igniting a fire during roadworks will be minimised and managed by compliance with the management measures detailed below.

No burning will be permitted within the project area.

Action: Main Roads Construction Manager / Construction Contractor

Machines and vehicles will be restricted to designated cleared areas.

Action: Main Roads Construction Manager / Construction Contractor

The Construction Contractor will conform to any specific requirements for fire prevention requested by the Shire of Ravensthorpe, Department of Conservation and Land Management and/or the Fire and Emergency Services Authority.

Action: Main Roads Construction Manager / Construction Contractor

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

- ▶ All plant and vehicles operating over vegetation should have exhaust systems in good working order
- ▶ All machinery should be shut down during periods of extreme fire hazard as advised by CALM or the Shire of Ravensthorpe
- ▶ All machinery to be fitted with fire extinguishers.

Action: Main Roads Construction Manager / Construction Contractor

3.4.5 Fuel and Chemical Storage

On-site storage sites for fuels, oils and other contaminant materials and plant maintenance areas shall be bunded to ensure the containment of any accidental spillage, as described within the *Water Quality Protection Note: Temporary Above Ground Chemical Storage in Public Drinking Water Source Areas* (WRC, 2000). The Contractor is required to maintain on hand adequate quantities of suitable material to

counteract any chemical spillages. Any such spillages shall be cleaned up and contaminated soils shall be disposed of in an appropriate manner.

Action: Main Roads Construction Manager / Construction Contractor

Major vehicle and plant servicing will not be conducted on the project site.

Action: Main Roads Construction Manager / Construction Contractor

3.4.6 Rubbish Disposal

Domestic site rubbish will not be disposed of by burning. All domestic rubbish, campsite effluent and other rubbish should be disposed of at an authorised waste disposal site, or a site agreed upon with the Shire of Ravensthorpe.

Action: Main Roads Construction Contractor / Construction Contractor

4. Consultation

4.1 Community Consultation

No formal public consultation program has been conducted for the South Coast Highway Treatment 1 and Ravensthorpe Hopetoun Road Project.

Main Roads will prepare and distribute a press release, within local print media, advising the local community of the proposed roadworks and project timing.

Action/Responsibility: Main Roads Project Manager

4.2 Government Agency Consultation

During the development of this EIA and EMP, GHD consulted with the following State agencies and individuals as discussed below.

4.2.1 Environmental Protection Authority Service Unit

Mr Mark Jefferies – Manager EPA Service Unit. Mr Jefferies was consulted by phone in late 2004, regarding the construction of two passing lanes on South Coast Highway and need for formal EPA referral of this project. It was concluded that the clearing impact of this project would be assessed through the application of a “Clearing Permit” through Department of Environment and advising the EPA Service Unit of the submission of the application was requested.

Mr Jefferies also raised the issue of environmental offsets for the proposed clearing and the need for Main Roads to develop Regional Environmental Offset Strategies.

Since this discussion took place, Main Roads have been granted an exemption from requiring a “Clearing Permit” until January 2006.

4.2.2 Department of Environment

Ms Melanie Price – Senior Natural Resource Officer, Department of Environment Albany. The issue of road projects in the Ravensthorpe area was discussed by telephone with Ms Price. It was noted that Main Roads should forward any EIA and PEIA documents for these works to Ms Price for her information and comment.

4.2.3 Department of Conservation and Land Management

Ms Christine Freegard of CALM's Nature Conservation Division – Wildlife Branch. Ms Freegard provided details of rare or specially protected fauna species expected in the area and listed on CALM's database.

Ms Kelly Poultney of CALM's Como Office. Ms Poultney provided details of rare or specially protected flora species expected in the area and listed on CALM's database.

Mr Malcolm Grant of CALM Ravensthorpe, Senior Operations Officer – Nature Conservation. Previous discussions with Mr Grant, regarding the South Coast Highway Passing Lanes project, concluded that the Department would not require any conditions be set regarding flora and that vehicle hygiene measures be practised during construction to reduce the risk of *Phytophthora cinnamomi* infection. It was

also noted that the 20 000L water tanker would be more than suitable to provide fire prevention requirements.

Mr Lawrie Anderson of CALM Albany, Wildlife Officer – Nature Conservation. Mr Anderson requested that the identity and location of any DRF and Priority species located as a result of the botanical survey be forwarded to the Department. Mr Anderson advised that the proposed Ravensthorpe Hopetoun Road roadworks may impact two proposed section 5(g) reserves, identified within the CALM South Coast Regional Management Plan 1992 – 2002. In view of these outstanding conservation reservation proposals, it is requested that the proposed roadworks are undertaken with the utmost minimal disturbance of the soil profile and native vegetation adjacent to the road. It was also requested that the proposed roadworks retain the greatest number of 'old-growth' salmon gums that line the road between Ravensthorpe and Desmond townsite.

4.2.4 Shire of Ravensthorpe

Mr Stuart Taylor, CEO Shire of Ravensthorpe. Mr Taylor was emailed requesting his comments on the proposed project. No comments were provided.

Mr Russell Weston of Shire of Ravensthorpe - Manager of Works. Mr Weston indicated by phone and email that the Ravensthorpe Heritage Trail is located within the project area of South Coast Highway Treatment 1, with a number of strategically placed plaques known to occur. The Council has requested that these plaques be relocated, if necessary, with care and to a location within close proximity from where they are currently located. The 'Avenue of Old Salmon Gums' was also identified, within the Ravensthorpe Hopetoun Road project area. The 'Avenue of Old Salmon Gums' is listed on the Council's Municipal Heritage Inventory and that any impact on these trees should be avoided. Where impact on or removal of these trees is required, Main Roads should seek full Council approval prior to the disturbance occurring.

4.2.5 Department of Agriculture

Ms Bianca Donald, Department of Agriculture – Development Officer Ravensthorpe. Ms Donald was contacted via phone and email and her comments requested. Ms Donald's only concern was the management of any Declared Plants observed within the project area.

4.3 Government Databases

In preparation of this EIA and EMP, GHD sought information from the following databases:

1. Environment Australia web site (www.ea.gov.au) was reviewed for any potential issues relating to the project areas. This search indicated the project areas occur within the same catchment of two RAMSAR wetlands (Lake Gore and lake Warden System). It also indicated that a number of protected fauna species potentially occur in the project areas. A natural place, listed on the Register of National Estate (Ravensthorpe Range Area) occurs within the Ravensthorpe Hopetoun Road project area.
2. Department of Indigenous Affairs web site (www.dia.wa.gov.au) was reviewed for any potential issues relating to Aboriginal Heritage Sites. The investigation identified no sites within or adjacent to the South Coast Highway Treatment 1 project area. Several sites exist to the east, west and

south of the Ravensthorpe Hopetoun Road project area but none within or directly adjacent to the project area.

3. The Heritage Council of Western Australia website (www.heritage.wa.gov.au) was reviewed for any heritage sites located within the project areas. Several sites were registered within and adjacent to the project area of South Coast Highway Treatment 1. Several sites were also registered within the project area of Ravensthorpe Hopetoun Road.

5. Environmental Approvals

5.1 Commonwealth Approvals

No environmental impacts identified during the preparation of this EIA and EMP warrant the referral of the projects to the Commonwealth Minister for the Environment under the provisions of the *Environmental Protection and Biodiversity Conservation Act (1999)*.

5.2 Government of Western Australia

5.2.1 Environmental Protection Authority / Department of Environment

A definitive decision to formally assess the South Coast Highway Treatment 1 and Ravensthorpe Hopetoun Road projects can only be made by the Environmental Protection Authority on formal referral of the project under the provisions of the WA *Environmental Protection Act (1986)*.

There appear to be no issues within either project area that would prompt formal assessment of the project by the EPA.

As noted in Section 3.1.5.3, Main Roads has recently been granted an extension to their previous exemption to the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, until January 2006. Thus, a 'Clearing Permit' is not required for this project if the clearing is completed before this date. It should also be noted that Main Roads is currently undertaking consultation with the DoE regarding a state wide Purpose Permit for clearing and it is likely this will be in place prior to the exemption expiring.

The requirement for a 'Clearing Permit' will need to be reassessed prior to the commencement of clearing for roadworks, to ensure that the requirements have been met or that the exemptions are current and in place.

Action: Main Roads Project Manager

To ensure that the Department of Environment are aware of the proposed roadworks a copy of this EIA and EMP will be sent to the Albany office of the department for their information.

Action: Main Roads Project Manager

6. Environmental Compliance and Monitoring

Main Roads Great Southern Region is responsible for construction of the South Coast Highway Treatment 1 (291.16 – 293.00) and Ravensthorpe Hopetoun Road (0.53 – 9.90 SLK) projects in line with the environmental management measures detailed in this EIA and EMP.

Action: Main Roads Project Manager

Relevant pre-construction phase management measures should be followed during the design of the upgrade projects.

Action: Main Roads Project Manager / Service Authorities

Environmental management measures detailed in this EMP should be included in the Technical Specification prepared for the project.

Action: Main Roads Project Manager

During the project construction phase, 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 superintendence documentation.

Action: Main Roads Project Manager / Main Roads Construction Manager

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Figure 1
Proposed Roadworks to be Completed as
Part of the Five Year Highway
Improvement Strategy (Source: Main
Roads WA)

Figure 2
South Coast Highway Treatment 1
Aerial Photo and Locality Plan

Figure 3
Ravensthorpe Hopetoun Road
Aerial Photo and Locality Plan

Figure 4

**South Coast Highway Treatment 1
Location of Vegetation Communities, DRF
and Priority Flora Species observed during
the 2005 Botanical Survey, within the
Project Area.**

Figure 5

Ravensthorpe Hopetoun Road
Location of Vegetation Communities, DRF
and Priority Flora Species observed during
the 2005 Botanical Survey, within the
Project Area.

Figure 6

Locations of *Cryptandra* sp. Ravensthorpe (G.F. Craig 6309) observed within the Ravensthorpe Hopetoun Road Project Area during the 2005 Botanical Survey.

Figure 7
Ravensthorpe Hopetoun Road Register
of National Estate – Ravensthorpe Range
Area

Appendix A
Project Environmental Aspects Table

South Coast Highway Treatment 1 and Ravensthorpe Hopetoun Road Projects – Environmental Aspects Table

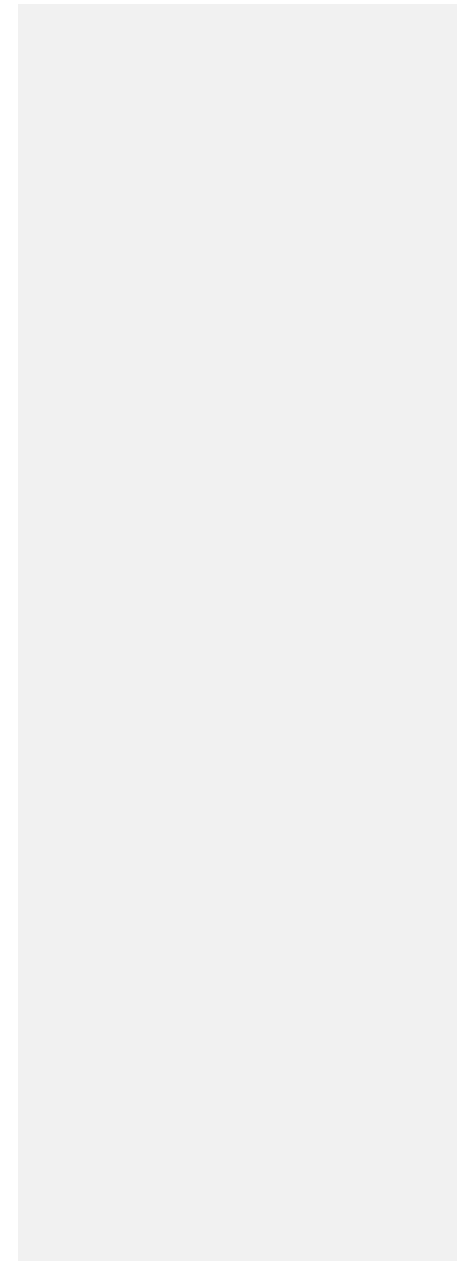
Environmental Aspect	Impact	Management Measure	Timing
Rivers, Wetlands and Drainage	<p>Catlin Creek crosses the project area of South Coast Highway Treatment 1 at SLK 292.83.</p> <p>Cordingup Creek crosses Ravensthorpe Hopetoun Rd at SLK 4.35 and at 7.30. At both locations, dams are located south of the existing road.</p> <p>Potential for and occurrence of erosion was evident during field investigations, at culverts and drainage lines of both project areas.</p>	Design and construct the works to maintain existing surface water drainage patterns.	Design
Reserves and Conservation Areas	<p>The existing South Coast Highway Treatment 1 road reserve is bounded by a sewage treatment 'C' Class Reserve, UCL and 'C' Class Reserve 11 141.</p> <p>The existing Ravensthorpe Hopetoun road reserve is bounded by UCL, several 'C' Class Reserves and a conservation reserve proposed under the draft proposal R6a (CALM South Coast Regional Management Plan 1992-2002).</p> <p>It is anticipated that 0.012 ha of land will be acquired from UCL and 0.05 ha from a 'C' Class Reserve located within the Ravensthorpe Hopetoun Rd project area.</p>	Design and construct works to minimise impacts on adjacent UCL and reserves.	Design and Construction
Vegetation Clearing	Estimated 3.75 ha of vegetation clearing expected fro roadworks (South Coast Highway Treatment 1 – 1.09 ha; Ravensthorpe Hopetoun Rd – 2.66 ha)	<p>Minimise clearing as far as practicable.</p> <p>Apply for a 'Clearing Permit' from the Department of Environment.</p>	Design

Environmental Aspect	Impact	Management Measure	Timing
Declared Rare and Priority Flora	<p>One Priority 3 species (<i>Acacia bifaria</i>) is likely to be impacted on by South Coast Highway Treatment 1 roadworks.</p> <p>Within the project area of Ravensthorpe Hopetoun Rd one Priority 1 species (<i>Goodenia phillipsiae</i>), one Priority 2 species, 2 Priority 3 species (inc. <i>Acacia bifaria</i>) and one Priority 4 species were also observed. <i>Cryptandra sp.</i> Ravensthorpe was observed and recommended to be listed as a Priority 1 species.</p> <p>Roadworks have been designed to avoid impacting on the Priority 1 species (<i>Goodenia phillipsiae</i>) and the populations of <i>Cryptandra sp.</i> Ravensthorpe. Roadworks are expected to impact the remaining Priority species to some extent.</p>	Minimise clearing as far as practicable.	Design
Threatened Ecological Communities	No Threatened Ecological Communities identified in the project areas	N/A	N/A
Weed Management	<p>The Declared Plant, Saffron Thistle (<i>Carthamnus lanatus</i>), was observed within vegetation community C (SLK 292.8 – 293.03) of South Coast Highway Treatment 1 project area and at SLK 3.14 Ravensthorpe Hopetoun Rd in the mallee scrub vegetation on the right hand side of the road.</p> <p>As sections of both project areas are wholly or partly surrounded by pastureland, weed invasion in both areas is expected to continue to occur long term.</p>	<p>Advise the Term Network Contractor to arrange for control measures to be initiated</p> <p>Prepare and initiate a Topsoil and Weed Management Plan including machinery hygiene measures, to minimise the risk of spreading weeds</p> <p>Ensure that machinery is cleaned down prior to departing the project site.</p>	<p>Design</p> <p>Construction</p>

Environmental Aspect	Impact	Management Measure	Timing
Topsoil Management	Strip topsoil as a component of roadworks.	Manage topsoil stripping and spoiling	Construction
Dieback	Both project areas occur within the 400 –600 mm rainfall isohyet and a number of water gaining sites may potentially exist during the wetter months.	Vehicle and hygiene measures, as incorporated into a Topsoil and Weed Management Plan, to be initiated to ensure that no soil pathogens are transported to, or from, each section of construction works.	Design and Construction
Fauna	Roadworks are not expected to impact on any listed fauna species	Minimise vegetation clearing whilst providing for the safe construction and operation of the highway.	Design and Construction
European and Natural Heritage	<p>Register of National Estate listed site – Ravensthorpe Range Area – traverses Ravensthorpe Hopetoun Rd project area.</p> <p>Plaques associated with the heritage listed Hopetoun – Ravensthorpe Railway occurs adjacent to the project area of South Coast Highway Treatment 1 and will not be impacted on by roadworks.</p> <p>The heritage listed site, 'Avenue of Old Salmon Gums', occurs within the Ravensthorpe Hopetoun Rd project area. Old Salmon Gums also occur within the South Coast Highway Treatment 1 project area, but are not listed as having heritage value. It is expected that mature Salmon Gum trees in both project areas will be impacted with 15 – 18 trees within Ravensthorpe Hopetoun Rd project area to be removed.</p>	<p>Take measures to protect plaques in their existing locations, by denoting them on design drawings as environmentally sensitive areas and utilise temporary fencing during construction where necessary.</p> <p>Minimise the impact of roadworks on the Salmon Gums within both project areas as far as practicable. Where impact is likely, Main Roads should consult with the Shire of Ravensthorpe prior to impacting mature Salmon Gum trees within both project areas.</p>	Design and Construction
Aboriginal Heritage	Roadworks will impact on the ceremonial site identified at SLK 291.17 – 291.65 in the project area	Main Roads will further consult the Aboriginal community regarding all three locations, prior to	Design

Environmental Aspect	Impact	Management Measure	Timing
	of South Coast Highway Treatment 1 and are expected to impact Cordingup Creek, a tributary of Jerdacuttup River, crossing Ravensthorpe Hopetoun Road at 4.35 SLK and 7.25 SLK.	making applications under Section 18 of the <i>Aboriginal Heritage Act (1972)</i> for consent to use lands that may contain Aboriginal sites.	
Land Use	Potential impact on adjacent landuse	Manage works to minimise impact and maintain adjacent landuse.	Design and Construction
Contaminated sites	No potential sites identified	N/A	N/A
Land acquisition	No land is to be acquired from the South Coast Highway Treatment 1 project area. 0.012 ha of land from UCL and 0.05 ha of land from a 'C' Class Reserve is to be acquired for the Ravensthorpe Hopetoun roadworks to occur.	Land acquisition from reserves and UCL will take account of the Commonwealth <i>Native Title Act (1993)</i> .	Design
Traffic noise	No expected increase in traffic noise at nearby properties	N/A	N/A
Visual amenity	In general, the clearing required for roadworks will not significantly alter the visual character of either project area. In both project areas old Salmon Gums line sections of the roads and loss of these trees in either project area may alter the visual character.	Minimise impacts on the old Salmon Gums lining both project areas. Consult the Council prior to any impact on these trees occurring.	Design and Construction
Pre-construction	Service re-locations	Comply with environmental management measures during pre-construction activities.	Pre-construction
Construction	Various impacts as a result of roadworks	Manage impacts of roadworks according to EMP.	Construction
Consultation	No public consultation conducted at present	Prepare and distribute a press release, within local print media, advising the community of the proposed	Design

Environmental Aspect	Impact	Management Measure	Timing
		roadworks and project timing.	
Monitoring	Monitor compliance with management measures	MRWA should regularly monitor compliances with environmental management measures outlined in the EMP.	Construction



Appendix B

Environmental Management Responsibilities and Actions Table (Environmental Management Plan)

Environmental Responsibilities and Actions Table (Environmental Management Plan)

	Management Measure	Expected Outcome	Responsibility
1.0	Overall Project		
Project Environmental Management			
1.1	Main Roads Great Southern Region is responsible for construction of the South Coast Highway Treatment 1 (291.16 – 293.00 SLK) and Ravensthorpe Hopetoun Road (0.53 – 9.90 SLK) projects in line with the environmental management measures detailed in this EIA and EMP.	Implement South Coast Highway Treatment 1 and Ravensthorpe – Hopetoun Road projects as detailed in this EIA and EMP.	Main Roads Project Manager
1.2	Relevant pre-construction phase management measures should be followed during the design of the projects.	Prepare design in line with design constraints identified in this EIA and EMP.	Main Roads Project Manager / Service Authorities
1.3	Environmental management measures detailed in this EIA and EMP should be included in the Technical Specifications prepared for the project.	Document in contract documentation / specification environmental management measures.	Main Roads Project Manager
1.4	Main Roads should advise its Term Network Contractor (TNC) of the presence of the declared weed, Saffron Thistle, to arrange for control measures to be initiated.	Advise TNC Contractor of the Declared Rare Plant populations so that it can be controlled	Main Roads Project Manager
2.0	Pre-Construction \ Design Phase		
Environmental Approvals			
2.1	The requirement for a 'Clearing Permit' will need to be reassessed prior to the commencement of clearing for roadworks, to ensure that the requirements have been met or that the exemptions are current and in place.	Satisfy environmental legislative requirements prior to clearing for roadworks.	Main Roads Project Manager

Management Measure	Expected Outcome	Responsibility	
2.2	To ensure that the Department of Environment are aware of the proposed roadworks a copy of this EIA and EMP will be sent to the Albany office of the department.	Satisfy environmental legislative requirements prior to clearing for roadworks.	Main Roads Project Manager
Rivers, Wetlands and Drainage			
2.3	The final drainage design will include floodways at both SLK 4.35 and 7.30 where Cordingup Creek crosses the existing seal.	Maintain existing surface water drainage patterns.	Main Roads Project Manager / Main Roads Designer / Main Roads Construction Manager / Construction Contractor
2.4	Main Roads will design the works to maintain existing surface water drainage patterns by maintaining all existing cross road culverts and extend or replace them where required.	Existing surface water drainage patterns will be maintained.	Main Roads Project Manager / Main Roads Designer / Main Roads Construction Manager / Construction Contractor
2.5	Main Roads will design and construct the widening and culvert extensions with appropriate erosion control measures to reduce the potential for scour.	Reduce the potential for scour using appropriate erosion control measures.	Main Roads Project Manager / Main Roads Designer / Main Roads Construction Manager / Construction Contractor
Declared Rare and Priority Flora			
2.6	Main Roads will restrict roadworks to the LHS of the existing seal, in the vicinity of the known <i>Cryptandra</i> sp. Ravensthorpe populations, located opposite the old copper smelter (SLK 2.329).	Reduce the potential of roadworks impacting a potential Priority 1 or Declared Rare flora species.	Main Roads Project Manager / Main Roads Designer / Main Roads Construction Manager / Construction Contractor

Management Measure	Expected Outcome	Responsibility	
Aboriginal Heritage			
2.7	Roadworks are expected to impact Cordingup Creek, a tributary of Jerdacuttup River crossing Ravensthorpe Hopetoun Road at 4.35 SLK and 7.25 SLK and Main Roads will further consult the Aboriginal community prior to making an application under Section 18 of the <i>Aboriginal Heritage Act (1972)</i> for consent to use the land that may contain an Aboriginal site.	Ensure that identified Aboriginal Heritage sites are not disturbed without appropriate approvals.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor
2.8	It is expected that roadworks will impact on the ceremonial site identified at SLK 291.17 – 291.65. Main Roads should conduct further consultations with the Aboriginal community prior to seeking approval under Section 18 of the <i>Aboriginal Heritage Act (1972)</i> for consent to use the land that may contain an Aboriginal site.	Ensure that identified Aboriginal Heritage sites are not disturbed without appropriate approvals.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor
Land Acquisition			
2.9	Acquisition of land from the reserve areas and areas of UCL should take account of the Commonwealth <i>Native Title Act (1993)</i> .	Ensure that land is acquired in accordance with appropriate legislation	Main Roads Project Manager / Main Roads Construction Manager
Service Relocations			
2.10	Main Roads will request that any required service relocations be conducted to ensure clearing of vegetation is minimised to that which is practicable.	Ensure clearing is kept to a minimum necessary for the safe and efficient construction and operation of the road.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor
2.11	Environmental management measures detailed in the EIA and EMP that are applicable for the works relating to the service relocations should be complied with by the relevant service	Implement Environmental management measures during service relocations.	Main Roads Project Manager / Service Providers

	Management Measure	Expected Outcome	Responsibility
	providers.		
2.12	A copy of the EMP (Appendix B) will be provided to the various agencies and contractors responsible for the service relocations with a requirement to fulfil the specific environmental management measures during service re-location works.	Implement Environmental management measures during service relocations.	Main Roads Project Manager / Service Providers
Traffic Access and Safety			
2.13	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 and local traffic movements.	Main Roads Construction Manager / Construction Contractor
Community Consultation			
2.14	Main Roads will prepare and distribute a press release, within local print media, advising the local community of the proposed roadworks and project timing.	Advise the local community of proposed works.	Main Roads Project Manager
3.0 Construction Phase			
Aboriginal Heritage			
3.1	Main Roads will inform any project personnel of their obligation to report any archaeological material, should this be encountered during earthmoving, as outlined under Section 25 of the <i>Aboriginal Heritage Act 1972</i> .	Ensure that previously unidentified Aboriginal Heritage Sites are not disturbed without appropriate approvals.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor
3.2	If during roadworks materials likely to be of interest to the Aboriginal community are uncovered then works will immediately cease within 50m of the material and the Department of Indigenous Affairs advised immediately. If skeletal material is uncovered during works then the WA Police	Ensure that previously unidentified Aboriginal Heritage Sites are not disturbed without appropriate approvals.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor

Management Measure	Expected Outcome	Responsibility	
Service will also be advised immediately.			
Vegetation and Clearing			
3.3	Main Roads will design and implement the upgrades of both project areas to minimise vegetation clearing whilst providing for the safe construction and operation of the roads.	Ensure clearing is kept to a minimum necessary for the safe and efficient construction and operation of the road.	Main Roads Project Manager / Main Roads Designer / Main Roads Construction Manager / Construction Contractor
3.4	During roadworks, damage to existing remnant vegetation will be avoided as far as practicable. Clearing should be restricted to 1 m from the edge of roadworks, or 5 m from the edge of the road seal, whichever is greater.	Ensure clearing is kept to a minimum necessary for the safe and efficient construction and operation of the road.	Main Roads Construction Manager / Construction Contractor
3.5	Prior to the start of clearing operations the clearing line will be marked on the ground and checked by the Construction Manager to ensure that the clearing areas are correctly defined. Trees, of particular significance, to be conserved are to be clearly marked prior to the commencement of clearing.	Ensure clearing is kept to a minimum necessary for the safe and efficient construction and operation of the road.	Main Roads Construction Manager / Construction Contractor
3.6	Trees to be removed will be felled in a manner that ensures they fall within the approved clearing area.	Minimise clearing impact.	Main Roads Construction Manager / Construction Contractor
3.7	Mature trees especially will be conserved as far as practicable and will not 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 impact.	Main Roads Construction Manager / Construction Contractor
3.8	Any damage caused by the Construction Contractor to the vegetation, landforms or fauna habitat outside of the works area will be rehabilitated at the contractor's cost. If environmental	Minimise clearing impact.	Main Roads Construction Manager / Construction Contractor

Management Measure	Expected Outcome	Responsibility	
<p>damage beyond the works area is identified Main Roads WA will withhold the payment of monies due to the contractor, where the extent of the damage exceeds \$5000, determined at the following rates:</p> <ul style="list-style-type: none"> ▶ For damaged trees greater than 3 m in height - \$1000 each; ▶ For damaged trees and shrubs up to 3 m in height - \$500 each; and ▶ For damaged grassland, open soil areas, rock faces and landforms, and habitats in general - \$10 per square metre. 			
3.9	<p>All cleared timber will be disposed of off-site in private property. Cleared vegetation will be disposed of in existing gravel pits or unvegetated private property. No burning of cleared vegetation will be permitted within the road reserve.</p>	Minimise clearing impact.	Main Roads Construction Manager / Construction Contractor
Weed Management			
3.10	<p>The machinery and vehicle hygiene measures described below will be included in the Construction works, and will avoid the inadvertent spread of weeds within and beyond the project areas.</p> <ul style="list-style-type: none"> ▶ All site employees will be advised of the hygiene measures ▶ All clearing, topsoil stripping/spreading and gravel cartage activities will be conducted under dry soil conditions ▶ Dust adhering to the sides of vehicles does not need to be removed ▶ All road construction plant and machinery should be cleaned free of all soil and vegetative material prior to arrival and 	Minimise the introduction and spread of weeds.	Main Roads Construction Manager / Construction Contractor

Management Measure	Expected Outcome	Responsibility	
<p>prior to departing the project sites</p> <ul style="list-style-type: none"> ▶ All road construction plant and machinery will be cleaned free of all soil and vegetative material when moving from heavily weeded farmland sections to vegetated sections; and ▶ Clean down will comprise of the use of a brush and/or compressed air to remove clods of soil and/or soil water slurry. A metal bar or spade will be used to remove compacted soil where necessary. 			
Topsoil Management			
3.11	After completion of clearing activities, topsoil will be stripped and removed from site to an approved spoil site.	Manage topsoil during works.	Main Roads Construction Manager / Construction Contractor.
Dieback			
3.12	The vehicle and hygiene measures discussed above in Section 3.1.6 (Weed Management) will ensure that no soil pathogens are transported to, or from, each section of construction works.	Minimise the introduction and spread of soil pathogens.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor
European and Natural Heritage			
3.13	Main Roads will consult with the Ravensthorpe Shire before impacting / removing any mature Salmon Gum trees located within the project area of South Coast Highway Treatment 1.	Minimise the impact of roadworks on mature Salmon Gums within the South Coast Highway Treatment 1 project area.	Main Roads Project Manager
3.14	Main Roads will consult with the Shire of Ravensthorpe further in regard to the expected impact on 15 – 18 Mature Salmon Gum trees, which are located within the Ravensthorpe Hopetoun Road	Minimise the impact of roadworks on mature Salmon Gums within the Ravensthorpe Hopetoun Road project area that area also part	Main Roads Project Manager

	Management Measure	Expected Outcome	Responsibility
	reserve and are apart of the 'Avenue of Salmon Gums' heritage site.	of a listed heritage site.	
Landuse			
3.15	Impacts on adjacent private property landuse will be kept to a practicable minimum during roadworks.	Minimise impacts of works on adjacent private property landowners.	Main Roads Construction Manager / Construction Contractor
Damage to Public Property, Noise and Vibration			
3.16	The Construction Contractor will nominate a person responsible for reviewing and monitoring all operations in order to prevent or minimise the impact of vibration, noise, dust and other forms of pollution on property and the public.	Minimise impacts on roadworks on property and the public	Main Roads Construction Manager / Construction Contractor
3.17	The Construction Contractor is required to observe its obligations under the <i>Environmental Protection Act (1986)</i> , the <i>Environmental Protection (Noise) Regulations (1997)</i> and Section 6 of the Australian Standard 2436 – 1981 " <i>Guide to Noise Control on Construction, Maintenance and Demolition Sites</i> ".	Minimise impacts on roadworks on property and the public	Main Roads Construction Manager / Construction Contractor
Dust			
3.18	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.	Minimise dust lift and impacts of dust on public.	Main Roads Construction Manager / Construction Contractor
3.19	Where it is found that vehicles leaving the site have dropped excessive soil material onto adjacent sections of South Coast	Minimise dust lift and impacts of dust on public.	Main Roads Construction Manager /

Management Measure	Expected Outcome	Responsibility
Highway and Ravensthorpe – Hopetoun Road, these sections will be swept to reduce the potential for dust generation and maintain traffic safety.		Construction Contractor
Traffic Access and Safety		
3.20	To ensure the safe access of traffic through the construction sites the Construction Contractor will develop and implement a Traffic Management Plan (TMP) congruent with the current <i>Australian Standard Manual 1742.3 of Uniform Traffic Control Devices: Part 3 Traffic Control Devices for Works On-Road</i> (Standards Australia) and the current Main Roads <i>Traffic Management Requirements for Works on Roads</i> .	Maintain safe access for through traffic and local traffic movements. Main Roads Construction Manager / Construction Contractor
3.21	The TMP will be submitted to Main Roads 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 and local traffic movements. Main Roads Construction Manager / Construction Contractor
3.22	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 publication <i>Traffic Management Requirements for Works on Roads</i> .	Maintain safe access for through traffic and local traffic movements. Main Roads Construction Manager / Construction Contractor
Fire Management		
3.23	No burning will be permitted within the project area.	Reduce the fire risk as a result of roadworks. Main Roads Construction Manager / Construction Contractor
3.24	Machines and vehicles will be restricted to designated cleared	Reduce the fire risk as a result of roadworks. Main Roads Construction Manager /

	Management Measure	Expected Outcome	Responsibility
	areas.		Construction Contractor
3.25	The Construction Contractor will conform to any specific requirements for fire prevention requested by the Shire of Ravensthorpe, Department of Conservation and Land Management and/or the Fire and Emergency Services Authority.	Comply with local fire management requirements.	Main Roads Construction Manager / Construction Contractor
3.26	<p>During road construction activities, the following fire management requirements will be complied with:</p> <ul style="list-style-type: none"> ▶ All plant and vehicles operating over vegetation should have exhaust systems in good working order ▶ All machinery should be shut down during periods of extreme fire hazard as advised by CALM or the Shire of Ravensthorpe <p>All machinery to be fitted with fire extinguishers.</p>	Reduce the fire risk as a result of roadworks.	Main Roads Construction Manager / Construction Contractor
Fuel and Chemical Storage			
3.27	On-site storage sites for fuels, oils and other contaminant materials and plant maintenance areas shall be bunded to ensure the containment of any accidental spillage, as described within the <i>Water Quality Protection Note: Temporary Above Ground Chemical Storage in Public Drinking Water Source Areas</i> (WRC, 2000). The Contractor is required to maintain on hand adequate quantities of suitable material to counteract any chemical spillages. Any such spillages shall be cleaned up and contaminated soils shall be disposed of in an appropriate manner.	Manage hazardous chemical storage on the project site and maintain chemicals required for the clean up of any accidental spillage.	Main Roads Construction Manager / Construction Contractor
3.28	Major vehicle and plant servicing will not be conducted on the	Avoid the occurrences of oil spillage from	Main Roads Construction Manager /

	Management Measure	Expected Outcome	Responsibility
	project site.	vehicle servicing on the site.	Construction Contractor
Rubbish Disposal			
3.29	Domestic site rubbish will not be disposed of by burning. All domestic rubbish, campsite effluent and other rubbish should be disposed of at an authorised waste disposal site, or a site agreed upon with the Shire of Ravensthorpe.	Ensure that rubbish is disposed of appropriately.	Main Roads Construction Contractor / Construction Contractor
Monitoring			
3.30	During the project construction phase, 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 superintendence documentation.	Ensure environmental management measures are complied with during the construction phase of the project.	Main Roads Project Manager / Main Roads Construction Manager
4.0 Post Construction			
Weed Management			
4.1	Longer-term management of weeds within the project area will be conducted during the annual herbicide and weed management program conducted by Main Roads Term Network Contractor.	Provide long-term management of weeds within the project area.	Main Roads Term Network Contractor

Appendix C
Photos of the Project Areas

Appendix D

Bush Forever Vegetation Rating Scale and Vegetation Rating Results for the Project Areas

Bush Forever Vegetation Condition Rating (Keighery B.J., 1994)

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

South Coast Highway Treatment 1

Vegetation Community	Description	Keighery (1994) Condition Rating	Area (Ha) LHS	Area (Ha) RHS	Total Area (Ha)
A	Salmon Gum woodland	3	-	0.023	0.023
		4	0.1044	0.089	0.1934
B	Gilja mallee	4	0.1119	0.1184	0.2303
C	Samphire flat	5-6	0.0466	0.0134	0.06
D	<i>Eucalyptus oleosa</i> subsp. <i>corvina</i> tall mallee	3	-	0.3111	0.3111
		4	0.2209	-	0.2209
		5	-	0.008	0.008
		6	0.0430	-	0.0430
		Total			1.0898

Ravensthorpe Hopetoun Road

Vegetation Community	Description	Keighery (1994) Condition Rating	Area (Ha) LHS	Area (Ha) RHS	Total Area (Ha)
A	Eucalyptus oleosa subsp. corvina tall mallee	3	0.137	0.047	0.184
		4	0.097		0.097
		5		0.0615	0.0615
		6	0.0512	0.0189	0.0701
B	Salmon Gum woodland	3	0.2535	0.1098	0.3633
C	Mallee scrub	3	0.1639	0.1808	0.3447
D	Rock Sheoak woodland	3	0.0421	0.0416	0.0831
E	Yate woodland	3	0.008	0.0832	0.0912
F	Mallee Scrub	3	0.0052	0.0332	0.0384
		4		0.2012	0.2012
G	Salmon Gum woodland	3	0.0076		0.0076
		4		0.1737	0.1737
		5	0.0919		0.0919
H	Yate woodland	1	0.0464	0.0181	0.0645
		3		0.0587	0.0587
		4	0.2266	0.1323	0.3589
		5	0.0014		0.0014
J	Sheoak & mallee	1	0.2736	0.0951	0.3687
		Total			2.66

Appendix E
Site Flora Species List

SOUTH COAST HIGHWAY TREATMENT 1					
		Euc. oleosa ssp. corvina tall mallee	Salmon Gum woodland	Gijja mallee	Samphire flat
	Vegetation Community	D	A	B	C
Taxon Name	Priority				
Family: Aizoaceae					
<i>Disphyma crassifolium</i>		x	x	x	
Family: Asparagaceae					
* <i>Asparagus asparagoides</i>		x	x		x
Family: Asteraceae					
* <i>Carthamus lanatus</i>					x
* <i>Conyza bonariensis</i>					x
* <i>Dittrichia graveolens</i>					x
* <i>Lactuca saligna</i>					x
<i>Olearia muelleri</i>		x			
Family: Brassicaceae					
* <i>Raphanus raphanistrum</i>					x
* <i>Rapistrum rugosum</i>			x		x
Family: Caesalpiniaceae					
<i>Senna artemisioides</i> subsp. <i>x. artemisioides</i>		x	x		
Family: Chenopodiaceae					
<i>Atriplex semibaccata</i>		x	x	x	x
<i>Atriplex vesicaria</i> subsp. <i>appendiculata</i>		x	x	x	x
<i>Enchylaena tomentosa</i>		x	x	x	x
<i>Halosarcia pergranulata</i>					x
<i>Maireana brevifolia</i>		x	x	x	x
<i>Maireana suaedifolia</i>		x			
<i>Rhagodia crassifolia</i>		x	x	x	
<i>Sarcocornia blackiana</i>					x
<i>Sclerolaena diacantha</i>			x	x	
<i>Sclerolaena uniflora</i>			x	x	
Family: Convolvulaceae					
<i>Wilsonia humilis</i>				x	x
Family: Cyperaceae					
<i>Lepidosperma</i> sp. Ravensthorpe (GF Craig 5188)		x			
Family: Lauraceae					
<i>Cassytha melantha</i>		x			
Family: Mimosaceae					
<i>Acacia bifaria</i>	3	x		x	
<i>Acacia cupularis</i>		x			
<i>Acacia cyclops</i>				x	x
<i>Acacia erinacea</i>					x
<i>Acacia lachnophylla</i>		x		x	
<i>Acacia redolens</i>		x	x		x
Family: Myrtaceae					
<i>Eucalyptus brachycalyx</i>				x	
<i>Eucalyptus conglobata</i>		x			

SOUTH COAST HIGHWAY TREATMENT 1		Euc. oleosa ssp. corvina tall mallee	Salmon Gum woodland	Gijja mallee	Sapphire flat
	Vegetation Community	D	A	B	C
Taxon Name	Priority				
<i>Eucalyptus myriadena</i>		x		x	x
<i>Eucalyptus occidentalis</i>					x
<i>Eucalyptus oleosa subsp. corvina</i>		x		x	
<i>Eucalyptus salmonophloia</i>		x	x		
<i>Melaleuca pauperiflora subsp. fastigiata</i>				x	
Family: Papilionaceae					
<i>Daviesia benthamii</i>		x			
<i>Daviesia nematophylla</i>		x		x	
<i>Templetonia battii</i>		x			
<i>Templetonia sulcata</i>		x	x	x	
Family: Phormiaceae					
<i>Dianella brevicaulis</i>		x			
Family: Poaceae					
<i>Austrostipa elegantissima</i>			x		x
<i>Austrostipa sp.</i>			x		
* <i>Avena fatua</i>		x	x	x	x
<i>Chloris truncata</i>					x
* <i>Eragrostis curvula</i>					x
* <i>Hordeum sp.</i>					x
* <i>Panicum capillare</i>					x
Family: Polygonaceae					
* <i>Rumex sp.</i>			x		
Family: Proteaceae					
<i>Hakea commutata</i>		x			
Family: Salicaceae					
* <i>Salix babylonica</i>		x			
<i>Santalum acuminatum</i>		x	x	x	
Family: Solanaceae					
* <i>Lycium ferocissimum</i>		x	x	x	x
Family: Zygophyllaceae					
<i>Zygophyllum glaucum</i>		x			
* = Alien species					

RAVENSTHORPE HOPETOUN ROAD	Euc oleosa ssp corvina tall mallee	Salmon Gum & Yate woodland	Mallee scrub	Rock Sheoak woodland	Yate woodland	Mallee scrub	Salmon Gum woodland	Yate woodland	Sheoak & mallee	Mallee scrub
	A	B	C	D	E	F	G	H	I	J
Vegetation Community										
Family: Aizoaceae										
<i>Disphyma crassifolium</i>		x			x		x			
Family: Asparagaceae										
* <i>Asparagus asparagoides</i>			x		x			x	x	
Family: Asphodelaceae										
* <i>Asphodelus fistulosus</i>									x	
Family: Asteraceae										
* <i>Centaurea melitensis</i>				x				x	x	
* <i>Cirsium vulgare</i>				x				x		
* <i>Conyza bonariensis</i>				x				x	x	
<i>Olearia imbricata</i>										x
<i>Ozothamnus lepidophyllus</i>			x			x		x		
<i>Vittadenia</i> sp.									x	
Family: Boraginaceae										
<i>Halgania andromedifolia</i>										x
Family: Brassicaceae										
* <i>Rapistrum rugosum</i>			x							
Family: Caesalpiniaceae										
<i>Labichea lanceolata</i>									x	
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		x					x		x	
Family: Casuarinaceae										
<i>Allocasuarina campestris</i>									x	
<i>Allocasuarina huegeliana</i>		x	x	x				x	x	
<i>Allocasuarina humilis</i>										
<i>Allocasuarina scleroclada</i>										x
<i>Allocasuarina thuyoides</i>										
Family: Chenopodiaceae										
<i>Atriplex semibaccata</i>		x					x	x		
<i>Chenopodium desertorum</i> subsp. <i>desertorum</i>		x								
<i>Enchylaena tomentosa</i>		x				x	x	x	x	
<i>Maireana brevifolia</i>							x		x	
<i>Rhagodia crassifolia</i>	x	x			x	x	x	x		
<i>Sclerolaena diacantha</i>		x					x	x		
<i>Sclerolaena uniflora</i>								x		
Family: Convolvulaceae										
<i>Wilsonia humilis</i>	x		x		x	x				
Family: Cyperaceae										
<i>Caustis dioica</i>										
<i>Chorizandra multiarticulata</i>									x	
<i>Gahnia ancistrophylla</i>			x						x	x
<i>Gahnia trifida</i>								x		
<i>Lepidosperma brunonianum</i>									x	x
<i>Lepidosperma leptostachyum</i>		x								
<i>Lepidosperma pubisquamum</i>								x		

RAVENSTHORPE HOPETOUN ROAD	Euc oleosa ssp corvina tall mallee	Salmon Gum & Yate woodland	Mallee scrub	Rock Sheoak woodland	Yate woodland	Mallee scrub	Salmon Gum woodland	Yate woodland	Sheoak & mallee	Mallee scrub
	A	B	C	D	E	F	G	H	I	J
Vegetation Community										
<i>Lepidosperma</i> sp.A2 Island Flatt(G.J.Keighery 7000)		x							x	
<i>Lepidosperma</i> sp.Z dark sheath(P.G.Wilson 10177)			x						x	x
<i>Lepidosperma</i> sp. Kundip (GF Craig 6011)								x		
<i>Lepidosperma</i> sp. Ravensthorpe (GF Craig 5188)								x		
<i>Lepidosperma</i> sp.						x				x
<i>Mesomelaena stygia</i>									x	
<i>Schoenus bifidus</i>			x							
<i>Schoenus subfascicularis</i>										
<i>Schoenus</i> sp. GFC 6338										
<i>Schoenus</i> sp. GFC 6341										
Family: Dasypogonaceae										
<i>Lomandra mucronata</i>		x						x	x	
Family: Dilleniaceae										
<i>Hibbertia acerosa</i>			x						x	x
<i>Hibbertia gracilipes</i>									x	
<i>Hibbertia recurvifolia</i>										x
Family: Epacridaceae										
<i>Acrotriche cordata</i>									x	x
<i>Acrotriche patula</i>										x
<i>Astroloma epacridis</i>									x	
<i>Astroloma serratifolium</i>									x	
<i>Brachyloma concolor</i>								x		
<i>Leucopogon conostephioides</i>									x	x
<i>Leucopogon dielsianus</i>								x		
<i>Leucopogon gibbosus</i>										
<i>Leucopogon hamulosus</i>			x							
<i>Leucopogon infuscatus</i>										x
<i>Lysinema ciliatum</i>										
Family: Goodeniaceae										
<i>Phyllanthus calycinus</i>									x	
Family: Goodeniaceae										
<i>Coopermookia polygalacea</i>										x
<i>Coopermookia strophiolata</i>								x	x	x
<i>Dampiera angulata</i>										x
<i>Goodenia laevis</i> subsp. <i>humifusa</i>			x							
<i>Goodenia phillipsiae</i>									x	x
<i>Goodenia scapigera</i>										
Family: Haemodoraceae										
<i>Conostylis bealiana</i>										
Family: Iridaceae										
<i>Patersonia drummondii</i>								x		
Family: Juncaceae										
<i>Juncus pallidus</i>			x							

RAVENSTHORPE HOPETOUN ROAD	Euc oleosa ssp corvina tall mallee	Salmon Gum & Yate woodland	Mallee scrub	Rock Sheoak woodland	Yate woodland	Mallee scrub	Salmon Gum woodland	Yate woodland	Sheoak & mallee	Mallee scrub
	A	B	C	D	E	F	G	H	I	J
Vegetation Community										
Family: Lamiaceae										
<i>Microcorys glabra</i>			x						x	x
<i>Pityrodia terminalis</i>									x	
<i>Westringia rigida</i>						x		x		
<i>Microcorys</i> sp. GFC 6364									x	
Family: Lauraceae										
<i>Cassytha melantha</i>		x	x					x	x	
<i>Cassytha micrantha</i>									x	x
Family: Loganiaceae										
<i>Logania buxifolia</i>										x
Family: Malvaceae										
<i>Lawrenzia spicata</i>									x	
Family: Mimosaceae										
<i>Acacia acanthoclada</i>			x							
<i>Acacia acuminata</i>		x								
<i>Acacia bifaria</i>	x	x	x		x		x		x	
<i>Acacia binata</i>		x	x							x
<i>Acacia brachyclada</i>								x		
<i>Acacia chrysell</i>		x			x		x	x		
<i>Acacia cupularis</i>		x					x			
<i>Acacia cyclops</i>		x			x	x	x	x		
<i>Acacia erinacea</i>			x			x				
<i>Acacia errabunda</i>			x	x			x	x		
<i>Acacia ferocior</i>										x
<i>Acacia glaucoptera</i>						x				x
<i>Acacia heterochroa</i>								x	x	
<i>Acacia ingrata</i>									x	
<i>Acacia mimica</i> var. <i>angusta</i>			x						x	x
<i>Acacia pinguiculosa</i> subsp. <i>pinguiculosa</i>										x
<i>Acacia pravifolia</i>			x						x	
<i>Acacia saligna</i>		x		x			x	x	x	
<i>Acacia</i> sp. Cape Arid (A.S. Weston 8164)									x	
<i>Acacia tetanophylla</i>			x							
<i>Acacia verrucula</i>								x		
Family: Myoporaceae										
<i>Eremophila densifolia</i>		x							x	
<i>Eremophila glabra</i>							x			
Family: Myrtaceae										
<i>Astartea</i> aff. <i>aspera</i>										x
<i>Baeckea corynophylla</i>			x							x
<i>Baeckea crispiflora</i>			x							
<i>Baeckea preissiana</i>									x	x
<i>Beaufortia micrantha</i>										x
<i>Beaufortia schaueri</i>										x

RAVENSTHORPE HOPETOUN ROAD	Euc oleosa ssp corvina tall mallee	Salmon Gum & Yate woodland	Mallee scrub	Rock Sheoak woodland	Yate woodland	Mallee scrub	Salmon Gum woodland	Yate woodland	Sheoak & mallee	Mallee scrub
	A	B	C	D	E	F	G	H	I	J
Vegetation Community										
<i>Calothamnus gracilis</i>									x	
<i>Calothamnus quadrifidus</i>										x
<i>Chamelaucium ciliatum</i>										x
<i>Eucalyptus annulata</i>			x							
<i>Eucalyptus austrina ms</i>								x	x	
<i>Eucalyptus cernua</i>			x						x	x
<i>Eucalyptus conglobata</i>			x							
<i>Eucalyptus desmondensis</i>									x	
<i>Eucalyptus flocktoniae</i>			x			x		x		x
<i>Eucalyptus incrassata</i>										x
<i>Eucalyptus leptocalyx</i>										x
<i>Eucalyptus myriadena</i>	x									
<i>Eucalyptus occidentalis</i>		x	x		x		x	x		
<i>Eucalyptus oleosa subsp. corvina</i>	x					x				
<i>Eucalyptus phaenophylla</i>									x	x
<i>Eucalyptus phenax</i>			x			x		x	x	x
<i>Eucalyptus pileata</i>										x
<i>Eucalyptus pleurocarpa</i>										
<i>Eucalyptus pluricaulis</i>			x							x
<i>Eucalyptus pluricaulis</i>										
<i>Eucalyptus salmonophloia</i>		x			x		x	x		
<i>Eucalyptus suggrandis</i>			x			x				x
<i>Eucalyptus tetraptera</i>										x
<i>Eucalyptus uncinata</i>										x
<i>Kunzea micromera</i>										
<i>Kunzea strigosa ms</i>										x
<i>Leptospermum erubescens</i>			x							x
<i>Leptospermum spinescens</i>										
<i>Melaleuca acuminata</i>		x	x			x		x		
<i>Melaleuca bracteosa</i>										x
<i>Melaleuca cf. bracteosa</i>										x
<i>Melaleuca calycina</i>										x
<i>Melaleuca carrii</i>										x
<i>Melaleuca cliffortioides</i>									x	x
<i>Melaleuca cucullata</i>	x		x			x				x
<i>Melaleuca elliptica</i>								x		
<i>Melaleuca glaberrima</i>			x					x	x	x
<i>Melaleuca hamata</i>	x	x	x	x		x		x	x	x
<i>Melaleuca lateriflora</i>						x		x	x	x
<i>Melaleuca rigidifolia</i>			x							x
<i>Melaleuca societatis</i>										x
<i>Melaleuca subfalcata</i>										x
<i>Melaleuca subtrigona</i>										
<i>Melaleuca thapsina</i>			x							

RAVENSTHORPE HOPETOUN ROAD	Euc oleosa ssp corvina tall mallee	Salmon Gum & Yate woodland	Mallee scrub	Rock Sheoak woodland	Yate woodland	Mallee scrub	Salmon Gum woodland	Yate woodland	Sheoak & mallee	Mallee scrub
	A	B	C	D	E	F	G	H	I	J
Vegetation Community	A	B	C	D	E	F	G	H	I	J
<i>Melaleuca undulata</i>	x							x		x
<i>Taxandria spathulata</i> ms									x	x
<i>Verticordia densiflora</i> subsp. <i>cespitosa</i>										
Family: Papilionaceae										
<i>Bossiaea preissii</i>									x	
<i>Chorizema nervosum</i>										x
<i>Daviesia anceps</i>									x	x
<i>Daviesia benthamii</i>	x				x	x		x	x	x
<i>Daviesia decurrens</i>										x
<i>Daviesia nematophylla</i>	x					x				x
<i>Daviesia nematophylla</i>										
<i>Daviesia nematophylla</i>										
<i>Daviesia newbeyi</i>				x						
<i>Daviesia pachyphylla</i>									x	
<i>Eutaxia microphylla</i>		x						x		
<i>Gastrolobium parviflorum</i>			x							x
<i>Gastrolobium tetragonophyllum</i>			x					x	x	
<i>Gompholobium marginatum</i>								x		
<i>Kennedia eximia</i>			x					x		
<i>Mirbelia viminalis</i>		x								x
<i>Nemcia carinata</i>									x	
<i>Pultenaea conferta</i>						x				
<i>Pultenaea empetrifolia</i>										
<i>Templetonia battii</i>			x			x				
<i>Templetonia retusa</i>	x	x					x	x		
Family: Phormiaceae										
<i>Dianella brevicaulis</i>		x			x				x	x
Family: Pittosporaceae										
<i>Marianthus bicolor</i>					x			x	x	x
<i>Sollya fusiformis</i>		x						x	x	
Family: Poaceae										
<i>Austrodanthonia</i> sp.					x					
<i>Austrostipa elegantissima</i>					x	x	x	x		
<i>Austrostipa</i> sp.								x		
* <i>Avena fatua</i>	x	x						x		
* <i>Chloris truncata</i>								x		
* <i>Ehrharta brevifolia</i>								x		
* <i>Eragrostis curvula</i>	x		x							
<i>Spartochloa scirpoidea</i>									x	
Family: Polygonaceae										
* <i>Rumex</i> sp.			x							
Family: Proteaceae										
<i>Adenanthos oreophilus</i>								x		
<i>Banksia lemniiana</i>										x

RAVENSTHORPE HOPETOUN ROAD	Euc oleosa ssp corvina tall mallee	Salmon Gum & Yate woodland	Mallee scrub	Rock Sheoak woodland	Yate woodland	Mallee scrub	Salmon Gum woodland	Yate woodland	Sheoak & mallee	Mallee scrub
	A	B	C	D	E	F	G	H	I	J
Vegetation Community										
<i>Banksia media</i>										x
<i>Dryandra cirsioides</i>										x
<i>Dryandra cuneata</i>										
<i>Dryandra tenuifolia</i> var. <i>tenuifolia</i>										x
<i>Grevillea acuaria</i>			x							
<i>Grevillea concinna</i> subsp. <i>lemanniana</i>										
<i>Grevillea huegelii</i>			x					x		
<i>Grevillea nudiflora</i>										x
<i>Grevillea patentiloba</i>										x
<i>Grevillea pauciflora</i>										x
<i>Grevillea pectinata</i>	x				x	x				
<i>Grevillea punctata</i>										x
<i>Hakea commutata</i>					x	x		x		x
<i>Hakea laurina</i>				x				x		x
<i>Hakea lissocarpa</i>			x						x	
<i>Hakea marginata</i>									x	x
<i>Hakea pandanicarpa</i>										x
<i>Hakea preissii</i>		x								
<i>Hakea trifurcata</i>										
<i>Hakea verrucosa</i>								x		x
<i>Isopogon axillaris</i>										x
<i>Isopogon polycephalus</i>										
<i>Persoonia teretifolia</i>										x
<i>Petrophile fastigiata</i>								x		x
<i>Petrophile squamata</i>										x
<i>Synaphea interioris</i>										
Family: Rhamnaceae										
<i>Cryptandra nutans</i>								x		x
<i>Cryptandra pungens</i>									x	
<i>Cryptandra recurva</i>			x							
<i>Cryptandra</i> sp. Ravensthorpe (GF Craig 6309)		x								
<i>Spyridium cordatum</i>										x
Family: Rutaceae										
<i>Boronia crassifolia</i>										x
<i>Boronia inornata</i>								x		
<i>Microcybe albiflora</i>										x
Family: Santalaceae										
<i>Choretrum lateriflorum</i>										x
<i>Santalum acuminatum</i>	x					x		x	x	
Family: Sapindaceae										
<i>Dodonaea caespitosa</i>										x
<i>Dodonaea concinna</i>										x
<i>Dodonaea pinifolia</i>		x						x	x	x
<i>Dodonaea ptarmicaefolia</i>		x								x

RAVENSTHORPE HOPETOUN ROAD	Euc oleosa ssp corvina tall mallee	Salmon Gum & Yate woodland	Mallee scrub	Rock Sheoak woodland	Yate woodland	Mallee scrub	Salmon Gum woodland	Yate woodland	Sheoak & mallee	Mallee scrub
	A	B	C	D	E	F	G	H	I	J
Family: Sterculiaceae										
<i>Lasiopetalum indutum</i>		x						x	x	
<i>Lasiopetalum quinquenervium</i>									x	
<i>Thomasia angustifolia</i>		x								
Family: Violaceae										
<i>Hybanthus floribundus</i>		x								x
Family: Xanthorrhoeaceae										
<i>Xanthorrhoea platyphylla</i>										
Unknown GFC 6339										

* = Alien species

Appendix F

Declared Rare and Priority Flora Potentially Occurring within the Project Area

Declared Rare and Priority species potentially occurring on the South Coast Highway, east of Ravensthorpe

Declared Rare – 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.

<i>Acacia rhamnophylla</i>	Ravensthorpe Range
<i>Anigozanthos bicolor</i> subsp. <i>minor</i>	Ravensthorpe-Esperance, Newdegate, Mount Baring
<i>Conostylis lepidospermoides</i>	E, NE and NW of Ravensthorpe
<i>Darwinia acerosa</i>	Mogumber, Ravensthorpe, Ongerup, Pine Hill
<i>Daviesia megacalyx</i>	Ravensthorpe Range
<i>Eremophila denticulata</i> subsp. <i>denticulata</i>	W of Ravensthorpe
<i>Eremophila verticillata</i>	NW of Ravensthorpe
<i>Eucalyptus steedmanii</i>	Ravensthorpe
<i>Marianthus villosus</i>	Ravensthorpe
<i>Thelymitra psammophila</i>	Stirling Range-Ravensthorpe, Kamballup, Nalyerlup

Priority One – Poorly Known Taxa

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

<i>Astartea</i> sp. Jerdacuttup (A Strid 21898)	Ravensthorpe, Jerdacuttup
<i>Beyeria</i> sp. A Ravensthorpe (AS George 9474)	Ravensthorpe Range, Bandalup Hill
<i>Dryandra corvijuga</i>	Mt Short, Ravensthorpe Range, Mt Desmond
<i>Eucalyptus purpurata</i>	Ravensthorpe Range
<i>Goodenia phillipsiae</i>	Ravensthorpe, Bandalup Hill, Kundip
<i>Guichenotia apetala</i>	Mt Desmond, Ravensthorpe Range
<i>Kunzea acicularis</i> ms	Ravensthorpe
<i>Melaleuca similis</i>	Young River, Ravensthorpe
<i>Melaleuca stramentosa</i>	Ravensthorpe
<i>Melaleuca</i> sp. Kundip (G.F. Craig 6020)	Kundip
<i>Microcorys pimeleoides</i>	Ravensthorpe Range, Bandalup Hill
<i>Neofuscelia subimitatrix</i>	Bandalup Creek
<i>Pultaneae calycina</i> subsp. <i>proxena</i>	Bandalup Creek

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>Acacia disticha</i>	Kundip
<i>Acacia loricata</i> var. <i>crassifolia</i>	Mt Desmond, Mt Short, Ravensthorpe Range, Kundip
<i>Acacia papulosa</i>	Ravensthorpe
<i>Austrostipa exilis</i>	Cocklebiddy, Marra Bridge-Pallinup River, Ravensthorpe, Fitzgerald River NP, Needilup, SE of Lake Grace, Wickepin, Coyrecup Lake, Wandina
<i>Dampiera orchardii</i>	Tone R., Oldfield R., Ravensthorpe, Lake King, Lake Johnston
<i>Daviesia newbeyi</i>	near Barker Lake, Fitzgerald River NP, Ravensthorpe, Near Mt Buraminya
<i>Daviesia pauciflora</i>	Cascades, Ravensthorpe, Esperance, Scaddan
<i>Dryandra foliosissima</i>	Tarin Rock, Ravensthorpe
<i>Eucalyptus petita</i>	Ravensthorpe
<i>Gyrostemon sessilis</i>	Ravensthorpe
<i>Hakea accuminata</i>	Ravensthorpe
<i>Levenhookia pulcherrima</i>	Mt Gibbs, Ravensthorpe
<i>Melaleuca penicula</i>	Fitzgerald River N.P., Ravensthorpe
<i>Opercularia hirsuta</i>	Ravensthorpe, Peak Charles, Esperance
<i>Thysanotus brachiatus</i>	Munglinup, Ravensthorpe, Hopetoun, Dalyup
<i>Thysanotus parviflorus</i>	Ravensthorpe Range

Priority Three: Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat.

<i>Acacia bifaria</i>	Ravensthorpe, Fitzgerald
<i>Acacia durabilis</i>	Ravensthorpe Range, Jerdacuttup
<i>Acacia errabunda</i>	Ravensthorpe, Jerramungup, Broomehill
<i>Acacia improcera</i>	Ravensthorpe, Frank Hann N.P., Lake King, Mount Glasse, Grass Patch, Sheoak Hill

<i>Acacia newbeyi</i>	Nyabing, Boxwood Hills, Ravensthorpe, Ongerup, Dragon Rocks
<i>Acacia ophiolithica</i>	Ravensthorpe Range, Oldfield River, Bandalup Hill
<i>Acacia sp.</i> Ravensthorpe Range (BR Maslin 5463)	Ravensthorpe Range
<i>Adenanthos glabrescens</i> subsp. <i>exasperatus</i>	Ravensthorpe
<i>Boronia oxyantha</i> var. <i>brevicalyx</i>	Ravensthorpe, Ongerup, Boxwood Hill, Fitzgerald River N.P., Bandalup Hill
<i>Dryandra ferruginea</i> subsp. <i>chelomacarpa</i>	Newdegate, Ravensthorpe
<i>Dryandra ferruginea</i> subsp. <i>flavescens</i>	Ravensthorpe, Lake King, Frank Hann, Forrestania, Hatters Hill, Bodallin
<i>Dryandra meganotia</i>	Kulin-Pingrup, Yilliminning, Ravensthorpe, Nyabing, Harrismith, Badgebup, Wandering
<i>Dodonaea trifida</i>	Ravensthorpe
<i>Eucalyptus angustissima</i> subsp. <i>quaerenda</i>	Lake Chinokup, Ravensthorpe, Hatters Hill, Pallarup, Pingrup, Phillips River
<i>Eucalyptus depauperata</i>	Lake Ace, Lake King, Ravensthorpe, Lort River, Lake Magenta NR, Lort River
<i>Eucalyptus famelica</i>	Hopetoun
<i>Eucalyptus ovularis</i>	Ravensthorpe
<i>Grevillea fulgens</i>	Mt Desmond, Ravensthorpe Range
<i>Hakea brachyptera</i>	Lake Magenta, Lake Cairlocup, Ravensthorpe, ?Tambellup, ?Ongerup
<i>Lechenaultia acutiloba</i>	Jerramungup, Ravensthorpe, Cairlocup, Lake Magenta, Hopetoun, West River
<i>Levenhookia octomaculata</i>	Kalbarri, Northampton, Bolgart, Canna, Lesueur, Ravensthorpe, Wicherina, Dinninup, Perenjori
<i>Melaleuca sculponeata</i>	W of Ravensthorpe, Lake King
<i>Micromyrtus triptycha</i> subsp. <i>carinata</i> ms	Ravensthorpe
<i>Persoonia brevirhachis</i>	Lake Grace, Ravensthorpe
<i>Sphaerolobium validum</i> ms	Bremer Bay, Wellstead, Fitzgerald River NP, Ravensthorpe, Broomehill
<i>Spyridium glaucum</i>	Ravensthorpe Range, Mt Short, Bandalup Hill
<i>Spyridium mucronatum</i> subsp. <i>recurvum</i>	Borden, Lake Magenta, Ravensthorpe

Priority Four – Rare Taxa

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

<i>Acacia argutifolia</i>	S of Ravensthorpe
<i>Acacia dictyoneura</i>	Kundip
<i>Acacia grisea</i>	Nyabing, Peringillup, Kukerin, Kojonup, Woodanilling, Wagin, Ravensthorpe
<i>Acacia pinguiculosa</i> subsp. <i>pinguiculosa</i>	Ravensthorpe Range
<i>Banksia laevigata</i> subsp. <i>laevigata</i>	Fitzgerald River N.P., Ravensthorpe
<i>Chorizema ulotropis</i>	Jerramungup, Ongerup, Ravensthorpe, Young River, Dwellingup, Wandering, <i>North Bannister</i>
<i>Dampiera deltoidea</i>	Thumb Pk, Mt Desmond, Fitzgerald River, Ravensthorpe, Bandalup Hill
<i>Dryandra porrecta</i>	Ravensthorpe
<i>Eremophila serpens</i>	Hyden-Newdegate, Esperance, Lake Magenta, Ravensthorpe, Lake Milarup
<i>Eucalyptus bennettiae</i> x	Ravensthorpe Range, Fitzgerald River NP
<i>Eucalyptus desmondensis</i>	Mt Desmond, Ravensthorpe
<i>Eucalyptus stoatei</i>	Bandalup Creek, Kundip
<i>Eucalyptus x erythrandra</i>	Kundip, Jerdacuttup, Ravensthorpe
<i>Goodenia stenophylla</i>	Ravensthorpe
<i>Grevillea prostrata</i>	Newdegate-Lake King, Ravensthorpe, Marvel Loch, Forrestania
<i>Gyrostemon ditrigynus</i>	Lake King, Cascades North, Forrestania, Ravensthorpe, Pingaring, Mt Ridley, Bandalup Hill
<i>Leucopogon compactus</i>	Ravensthorpe-Hamersley River
<i>Pimelea physodes</i>	Ravensthorpe, Fitzgerald River NP, Bremer Bay
<i>Pterostylis</i> sp. Ongerup (KR Newbey 4874) [aff. <i>pusilla</i>]	Cape Arid, Stirling Range N.P., Ravensthorpe, Ongerup
<i>Rinzia affinis</i>	Lake King, Kukerin, Tarin Rock, Ravensthorpe
<i>Siegfriedia darwinoides</i>	Ravensthorpe

Verticordia integra

Newdegate - Lake King - Ravensthorpe,
Dragon Rocks

Declared Rare and Priority species potentially occurring on the Ravensthorpe Hopetoun Road

The following Declared Rare and Priority Flora were identified by CALM through a search of their Declared rare and priority flora database as potentially occurring in the vicinity of the project area.

Declared Rare – 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.

<i>Acacia rhamnophylla</i>	Ravensthorpe Range
<i>Anigozanthos bicolor</i> subsp. <i>minor</i>	Ravensthorpe-Esperance, Newdegate, Mount Baring
<i>Conostylis lepidospermoides</i>	E, NE and NW of Ravensthorpe
<i>Darwinia acerosa</i>	Mogumber, Ravensthorpe, Ongerup, Pine Hill
<i>Daviesia megacalyx</i>	Ravensthorpe Range
<i>Eremophila denticulata</i> subsp. <i>denticulata</i>	W of Ravensthorpe
<i>Eremophila verticillata</i>	NW of Ravensthorpe
<i>Eucalyptus steedmanii</i>	Ravensthorpe
<i>Marianthus villosus</i>	Ravensthorpe
<i>Thelymitra psammophila</i>	Stirling Range-Ravensthorpe, Kamballup, Nalyerlup

Priority One – Poorly Known Taxa

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

<i>Astartea</i> sp. <i>Jerdacuttup</i> (A Strid 21898)	Ravensthorpe, Jerdacuttup
<i>Beyeria</i> sp. A Ravensthorpe (AS George 9474)	Ravensthorpe Range, Bandalup Hill
<i>Dryandra corvijuga</i>	Mt Short, Ravensthorpe Range, Mt Desmond
<i>Eucalyptus purpurata</i>	Ravensthorpe Range
<i>Goodenia phillipsiae</i>	Ravensthorpe, Bandalup Hill, Kundip
<i>Guichenotia apetala</i>	Mt Desmond, Ravensthorpe Range
<i>Kunzea acicularis</i> ms	Ravensthorpe
<i>Melaleuca similis</i>	Young River, Ravensthorpe
<i>Melaleuca stramentosa</i>	Ravensthorpe

<i>Melaleuca</i> sp. Kundip (G.F. Craig 6020)	Kundip
<i>Microcorys pimeleoides</i>	Ravensthorpe Range, Bandalup Hill
<i>Neofuscelia subimitatrix</i>	Bandalup Creek
<i>Pultaneae calycina</i> subsp. <i>proxena</i>	Bandalup Creek

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>Acacia disticha</i>	Kundip
<i>Acacia laricina</i> var. <i>crassifolia</i>	Mt Desmond, Mt Short, Ravensthorpe Range, Kundip
<i>Acacia papulosa</i>	Ravensthorpe
<i>Austrostipa exilis</i>	Cocklebidy, Marra Bridge-Pallinup River, Ravensthorpe, Fitzgerald River NP, Needilup, SE of Lake Grace, Wickepin, Coyrecup Lake, Wandina
<i>Dampiera orchardii</i>	Tone R., Oldfield R., Ravensthorpe, Lake King, Lake Johnston
<i>Daviesia newbeyi</i>	near Barker Lake, Fitzgerald River NP, Ravensthorpe, Near Mt Buraminya
<i>Daviesia pauciflora</i>	Cascades, Ravensthorpe, Esperance, Scaddan
<i>Dryandra foliosissima</i>	Tarin Rock, Ravensthorpe
<i>Eucalyptus petila</i>	Ravensthorpe
<i>Gyrostemon sessilis</i>	Ravensthorpe
<i>Hakea accuminata</i>	Ravensthorpe
<i>Levenhookia pulcherrima</i>	Mt Gibbs, Ravensthorpe
<i>Melaleuca penicula</i>	Fitzgerald River N.P., Ravensthorpe
<i>Opercularia hirsuta</i>	Ravensthorpe, Peak Charles, Esperance
<i>Thysanotus brachiatus</i>	Munglinup, Ravensthorpe, Hopetoun, Dalyup
<i>Thysanotus parviflorus</i>	Ravensthorpe Range

Priority Three: Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat.

<i>Acacia bifaria</i>	Ravensthorpe, Fitzgerald
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<i>Acacia durabilis</i>	Ravensthorpe Range, Jerdacuttup
<i>Acacia errabunda</i>	Ravensthorpe, Jerramungup, Broomehill
<i>Acacia improcera</i>	Ravensthorpe, Frank Hann N.P., Lake King, Mount Glasse, Grass Patch, Sheoak Hill
<i>Acacia newbeyi</i>	Nyabing, Boxwood Hills, Ravensthorpe, Ongerup, Dragon Rocks
<i>Acacia ophiolithica</i>	Ravensthorpe Range, Oldfield River, Bandalup Hill
<i>Acacia sp.</i> Ravensthorpe Range (BR Maslin 5463)	Ravensthorpe Range
<i>Adenanthos glabrescens</i> subsp. <i>exasperatus</i>	Ravensthorpe
<i>Boronia oxyantha</i> var. <i>brevicalyx</i>	Ravensthorpe, Ongerup, Boxwood Hill, Fitzgerald River N.P., Bandalup Hill
<i>Dryandra ferruginea</i> subsp. <i>chelomacarpa</i>	Newdegate, Ravensthorpe
<i>Dryandra ferruginea</i> subsp. <i>flavescens</i>	Ravensthorpe, Lake King, Frank Hann, Forrestania, Hatters Hill, Bodallin
<i>Dryandra meganotia</i>	Kulin-Pingrup, Yilliminning, Ravensthorpe, Nyabing, Harrismith, Badgebup, Wandering
<i>Dodonaea trifida</i>	Ravensthorpe
<i>Eucalyptus angustissima</i> subsp. <i>quaerenda</i>	Lake Chinokup, Ravensthorpe, Hatters Hill, Pallarup, Pingrup, Phillips River
<i>Eucalyptus depauperata</i>	Lake Ace, Lake King, Ravensthorpe, Lort River, Lake Magenta NR, Lort River
<i>Eucalyptus famelica</i>	Hopetoun
<i>Eucalyptus ovularis</i>	Ravensthorpe
<i>Grevillea fulgens</i>	Mt Desmond, Ravensthorpe Range
<i>Hakea brachyptera</i>	Lake Magenta, Lake Cairlocup, Ravensthorpe, ?Tambellup, ?Ongerup
<i>Lechenaultia acutiloba</i>	Jerramungup, Ravensthorpe, Cairlocup, Lake Magenta, Hopetoun, West River
<i>Levenhookia octomaculata</i>	Kalbarri, Northampton, Bolgart, Canna, Lesueur, Ravensthorpe, Wicherina, Dinninup, Perenjori
<i>Melaleuca sculponeata</i>	W of Ravensthorpe, Lake King
<i>Micromyrtus triptycha</i> subsp. <i>carinata</i> ms	Ravensthorpe
<i>Persoonia brevirhachis</i>	Lake Grace, Ravensthorpe

<i>Sphaerolobium validum</i> ms	Bremer Bay, Wellstead, Fitzgerald River NP, Ravensthorpe, Broomehill
<i>Spyridium glaucum</i>	Ravensthorpe Range, Mt Short, Bandalup Hill
<i>Spyridium mucronatum</i> subsp. <i>recurvum</i>	Borden, Lake Magenta, Ravensthorpe

Priority Four – Rare Taxa

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

<i>Acacia argutifolia</i>	S of Ravensthorpe
<i>Acacia dictyoneura</i>	Kundip
<i>Acacia grisea</i>	Nyabing, Peringillup, Kukerin, Kojonup, Woodanilling, Wagin, Ravensthorpe
<i>Acacia pinguiculosa</i> subsp. <i>pinguiculosa</i>	Ravensthorpe Range
<i>Banksia laevigata</i> subsp. <i>laevigata</i>	Fitzgerald River N.P., Ravensthorpe
<i>Chorizema ulotropis</i>	Jerramungup, Ongerup, Ravensthorpe, Young River, Dwellingup, Wandering, North Bannister
<i>Dampiera deltoidea</i>	Thumb Pk, Mt Desmond, Fitzgerald River, Ravensthorpe, Bandalup Hill
<i>Dryandra porrecta</i>	Ravensthorpe
<i>Eremophila serpens</i>	Hyden-Newdegate, Esperance, Lake Magenta, Ravensthorpe, Lake Milarup
<i>Eucalyptus bennettiae</i> x	Ravensthorpe Range, Fitzgerald River NP
<i>Eucalyptus desmondensis</i>	Mt Desmond, Ravensthorpe
<i>Eucalyptus stoatei</i>	Bandalup Creek, Kundip
<i>Eucalyptus x erythrandra</i>	Kundip, Jerdacuttup, Ravensthorpe
<i>Goodenia stenophylla</i>	Ravensthorpe
<i>Grevillea prostrata</i>	Newdegate-Lake King, Ravensthorpe, Marvel Loch, Forrestania
<i>Gyrostemon ditrigynus</i>	Lake King, Cascades North, Forrestania, Ravensthorpe, Pingaring, Mt Ridley, Bandalup Hill
<i>Leucopogon compactus</i>	Ravensthorpe-Hamersley River
<i>Pimelea physodes</i>	Ravensthorpe, Fitzgerald River NP, Bremer Bay
<i>Pterostylis</i> sp. Ongerup (KR Newbey 4874) [aff. <i>pusilla</i>]	Cape Arid, Stirling Range N.P., Ravensthorpe, Ongerup

Rinzia affinis

Lake King, Kukerin, Tarin Rock,
Ravensthorpe

Siegfriedia darwinoides

Ravensthorpe

Verticordia integra

Newdegate - Lake King - Ravensthorpe,
Dragon Rocks

Appendix G

GPS Locations of Declared Rare and Priority Flora and Declared Plants

South Coast Highway Treatment 1

Datum: WGS84 which is compatible with Geocentric Datum Australia 1994 (GDA94)

Priority Species	Wpt#	Zone	Easting	Northing	No. plants*
West limit of survey	26	51H	226872	6280703	
Priority Three					
<i>Acacia bifaria</i>	25	51H	227077	6280887	common NS to wpt 26
<i>Acacia bifaria</i>	24	51H	227123	6280901	1
<i>Acacia bifaria</i>	22	51H	227356	6281009	frequent, scattered to wpt 23
<i>Acacia bifaria</i>	23	51H	227435	6281010	frequent, scattered to wpt 22
<i>Acacia bifaria</i>	21	51H	227443	6281060	3 N
<i>Acacia bifaria</i>	13	51H	228067	628149	2 S, unhealthy
Declared Plant					
Saffron thistle	16	51H	228563	6281691	few
Site of Interest					
heritage signs	17	51H	228261	6281667	

Ravensthorpe Hopetoun Road

Datum: WGS84 which is compatible with Geocentric Datum Australia 1994 (GDA94)

Priority Species	Wpt#	Zone	Easting	Northing	No. plants*	Community
Priority One						
<i>Goodenia phillipsiae</i>	97	51H	234214	6276677	1 W	I
Priority Two						
<i>Daviesia newbeyi</i>	93	51H	229027	6279463	1 W	B/C
Priority Three						
<i>Acacia bifaria</i>	29	51H	228449	6280038	3 W	B
<i>Acacia bifaria</i>	30	51H	228830	6279593	2 W, 3 E	B
<i>Acacia bifaria</i>	33	51H	229178	6279354	EW 20+	C
Community A: <i>Acacia bifaria</i>					occasional, scattered	A
Community H: <i>Acacia bifaria</i>					frequent, scattered	H

Priority Species	Wpt#	Zone	Easting	Northing	No. plants*	Community
Community I: Acacia bifaria extends S to near Elverdton Rd					occasional, scattered	I
Acacia errabunda	34	51H	229585	6279108	numerous	C
Acacia errabunda	36	51H	229501	6279191	numerous	C
Acacia errabunda	38	51H	229543	6279152	1 W	C
Acacia errabunda	37	51H	229422	6279231	2 E	C
Acacia errabunda	39	51H	229625	6279108	c. 40 E W	C
Acacia errabunda	49	51H	232384	6277945	2 W	G
Acacia errabunda	47	51H	232232	6278046	5 E	G
Community I: Acacia errabunda					frequent, 100s E W	H
Priority Four						
Eucalyptus desmondensis	99	51H	233704	6277118	10+ W	I
Eucalyptus desmondensis	100	51H	233808	6277073	6 W E	I
Eucalyptus desmondensis	91	51H	234912	6276063	c.30 E + 10 NE of intersection	I
Eucalyptus desmondensis	92	51H	234900	6276181	N limit on W side	I
Eucalyptus desmondensis	99	51H	233704	6277118	10+ W	I
Eucalyptus desmondensis	100	51H	233808	6277073	6 WE	I
Eucalyptus desmondensis	91	51H	234912	6276063	C. 30 E + 10 NE of intersection	I
Eucalyptus desmondensis	92	51H	234900	6276181	N limit on W side	I
Significant Species						
Cryptandra sp. Ravensthorpe (GF Craig 6309)		51H	228526	6279934	frequent, scattered W	B
Microcorys sp. GFC 6364	100	51H	233808	6277073	6 E	I
Declared Plant						
Saffron thistle	33	51H	229178	6279354	15 W	C

***Cryptandra* sp. Ravensthorpe (GF Craig 6309)**

Location (wpt)	West road reserve	Vegetation Community	Distance from road verge edge	No. of plants
5-7-8	Opposite parking bay	Salmon gum - Yate	0 – 10 m	29
8-3-9-6-7	Opposite parking bay	Salmon gum - Yate	10-25 m	41
1	Towards dam	Salmon gum - Yate	200 m	1 (grazed)
10	200 m N or parking bay	Sheoak scrub	30 m	6
11	200 m N or parking bay	Sheoak scrub	> 12 m	13
13	Near power lines	Sheoak scrub	160 m	2
Total				92

Appendix H
Threatened Fauna Species
Potentially Occurring Within or
Adjacent to the Project Area

Schedule 1 (Fauna that is rarer or likely to become extinct):

Chuditch (*Dasyurus geoffroi*)

The Chuditch is also listed on the Environment Australia database and the Museum of Western Australia's 'Faunabase' as potentially occurring within the project area. This carnivorous marsupial occupies a wide variety of habitats such as Jarrah-Marri and Wandoo forests, provided that sufficient den sites, usually log hollows, are located within the area. It is a highly mobile animal with large home ranges, primarily due to its carnivorous diet and thus requirement for prey species that are typically widely dispersed throughout its habitat. It has become threatened through a wide variety of factors associated with European colonisation, including loss of habitat and predation by / competition with introduced species. Chuditch were sighted in 1992 in Kundip and as recently as 2002 in Boaiup.

The level of disturbance and lack of suitable den sites observed within South Coast Highway Treatment 1 project area during field visitation suggests that it is unlikely that any Chuditch populations occur within this project area. The level of clearing and the extent of vegetation adjacent to the Ravensthorpe Hopetoun Road Project area, suggest that any existing populations within the project area are unlikely to be adversely impacted by the proposed roadworks.

Numbat (*Myrmecobius fasciatus*)

This diurnal marsupial feeds almost exclusively on termites and is highly vulnerable to predation by foxes and cats. It occurs in a variety of habitats including woodlands / shrublands and requires suitable hollow logs, tree hollows and burrows to provide shelter. It is considered unlikely that a population of numbats still survives within the project areas as the last known observation was of one individual only, sighted in the Ravensthorpe area in 1972.

This fact combined with the level of disturbance and lack of suitable shelter observed within South Coast Highway Treatment 1 project area during field visitation, suggests that it is unlikely that any Numbat populations occur within the project area. It is also considered unlikely that any Numbat populations occur within the Ravensthorpe Hopetoun Road Project area. If any populations do exist within the project area, the level of clearing proposed and the amount of vegetation adjacent to the project area is such that it is unlikely that the proposed clearing will adversely impact any existing Numbat populations.

Dibbler (*Parantechinus apicalis*)

The Dibbler was last recorded in 1986 by CALM in the Kundip Nature Reserve 7.5 to 10 km south of Passing Lane 1. This species is also listed on the Environment Australia database and the Museum of Western Australia's 'Faunabase' as potentially occurring within the project area. This small rat-size dasyurid is known to inhabit, within nearby Fitzgerald National Park, dense, long unburnt vegetation with a thick litter layer and sandy soils. Dibblers typically occupy heath and mallee-heath vegetation communities, where they have been located on the south coast of Western Australia.

The lack of recent records and the level of disturbance suggest that it is unlikely that any Dibbler populations occur within the project areas and are thus unlikely to be adversely impacted by the proposed clearing. If any populations of Dibbler do occur within the Ravensthorpe Hopetoun Road project area, it is unlikely that the proposed clearing due to the level of clearing proposed and the amount of vegetation adjacent to the project area will adversely impact them.

Malleefowl (*Leipoa ocellata*)

Is also listed on the Environment Australia database and the Museum of Western Australia's 'Faunabase' as potentially occurring within the project area. This large ground dwelling bird is known to occur, within Western Australia, in Dryandra State Forest, Fitzgerald National Park, Kalbarri National Park and Cape Arid National Park. It has also been reported from many reserves within and around the wheat belt. This species is largely confined to arid and semi-arid woodland that is dominated by mallee eucalypts on sandy soils, with less than 430 mm of rainfall annually. They may also be found in coastal heath where shrubs produce sufficient leaf litter for use in mounds. There have been a number of records of this species within the Ravensthorpe area, including Desmond (south of the Ravensthorpe – Hopetoun Road Project area – SLK 10.6).

The level of disturbance and lack of suitable nesting sites observed within the South Coast Highway Treatment 1 project area during field visitation suggests that it is unlikely that any Malleefowl populations occur within the project area and are thus unlikely to be adversely impacted by the proposed clearing.

The level of clearing proposed and the amount of vegetation adjacent to the Ravensthorpe Hopetoun Road project area, any populations of Malleefowl existing within the project area are unlikely to be adversely impacted by the proposed clearing.

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

Is also listed on the Environment Australia database and the Museum of Western Australia's 'Faunabase' as potentially occurring within the project area. The species breeds primarily in the southern and eastern parts of the southwest and tends to move to the coastal belt when not breeding. It is threatened primarily through the loss of tree hollows for breeding sites, particularly in the wheatbelt. These birds frequent proteaceous shrubs and heaths, adjacent Eucalypt woodlands and pine plantations. This species is considered likely to be an occasional transitory visitor to both project areas and may utilise the remnant vegetation in passing. Carnaby's Black Cockatoo may also utilise the Salmon Gums (*Eucalyptus salmonophloia*) occurring adjacent to the existing seal, in both project areas, periodically. None of the Salmon Gum's observed in the project area appeared to have significant hollows that could be used for breeding by Carnaby's Cockatoo. In addition, this species is known to breed primarily in the eastern Wheatbelt and not as far south as the Southern Coast. Hence, the removal of these trees within the project area is unlikely to result in an adverse impact to the Carnaby's cockatoo. Hence, clearing required for the project is not expected to threaten the long-term survival of this species.

Schedule 4 (Other specially protected fauna)

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is considered a widespread though uncommon species occasionally observed throughout the southwest and other areas. The species was previously regarded as being under threat from egg shell thinning as a result of pesticide use, illegal hunting as a prey and capture for falconry and the caged bird trade (Garnett & Crowley, 2000). In WA, the species is considered as uncommon although secure and is gazetted mainly to protect it from illegal capture. It would make occasional use of the project area when hunting other birds. It prefers areas with rocky ledges, cliffs, watercourses and open woodlands (Johnstone & Storr,

1998). The Peregrine Falcon would not be threatened as a species by the loss of vegetation required for the project to proceed.

Priority One

Lerista viduata

This small skink is known from the Ravensthorpe Range and Kundip Reserve. This species shelters among leaf litter at bases of trees and shrubs in eucalypt woodlands on loam or loamy clay soil. It is unknown whether any *Lerista viduata* populations occur within the project areas.

It is assumed that due to the level of previously occurred disturbance within the South Coast Highway Treatment 1 project area, this species is unlikely to be adversely impacted by the proposed clearing. In addition, the level of clearing proposed and the amount of vegetation adjacent to the Ravensthorpe Hopetoun Road project area, if any populations of *Lerista viduata* do exist within this project area, it is unlikely that they will adversely impacted by the proposed clearing.

Priority Four

Western Brush Wallaby (*Macropus irma*)

Is also listed on Museum of Western Australia's 'Faunabase' as potentially occurring within the project area. This species of grazing kangaroo occurs in the open forests and woodlands of the southwest, typically in the grassy areas and open scrubby thickets of heath and mallee. It is believed to be secure but is highly vulnerable to predation by foxes. The Western Brush Wallaby was recorded within the Ravensthorpe area in 2000.

It is assumed that due to the level of disturbance within the South Coast Highway Treatment 1 project area, this species is unlikely to be adversely impacted by the proposed clearing.

During the Ravensthorpe Hopetoun Road botanical survey 2005, a Western Brush Wallaby was observed. However, the level of clearing proposed and the amount of vegetation adjacent to the Ravensthorpe Hopetoun Road project area, any populations of Western Brush Wallaby existing within the project area are unlikely to be adversely impacted by the proposed clearing.

Western Mouse (Walyadjì) (*Pseudomys occidentalis*)

Is also listed on Museum of Western Australia's 'Faunabase' as potentially occurring within the project area. This small mouse has been recorded from isolated conservation reserves within the southern wheatbelt and the south coast of Western Australia. The western mouse shows a preference for long unburnt habitat on clay loam or sandy loam. Vegetation in suitable habitats is variable and includes sparse low shrubland, tall dense shrubland, sparse to dense shrub mallee and mid-dense woodland. All sites where the western mouse has been collected have had patches of extremely dense vegetation. It is known to feed on the seeds of quandong (*Santalum acuminatum*) and various sedge species. This species has been recorded within the Ravensthorpe area and Bandalup Hill in 1995 and 2002.

However, the level of disturbance within the South Coast Highway Treatment 1 project area and the level of clearing proposed and the amount of vegetation adjacent to the Ravensthorpe Hopetoun Road project area, any populations of Western Mouse existing within either project areas are unlikely to be adversely impacted by the proposed clearing.

Western Whipbird (sthn WA subsp.) (*Psophodes nigrogularis oregon*)

Is also listed on the Environment Australia database and the Museum of Western Australia's 'Faunabase' as potentially occurring within the project area. This subspecies occurs from Stirling Range east to Munglinup and north to Lake Grace and inhabits mallee and heath, nesting in dense vegetation. It has been recorded once in 1966 and four times in 1984, within the vegetation of the Ravensthorpe Range.

The lack of recent records suggests that it is unlikely that any Western Whipbird populations occur within either project area. In addition, the level of clearing proposed and the amount of vegetation adjacent to the Ravensthorpe Hopetoun Road project area, if any populations of the Western Whipbird do exist within the project area, it is unlikely that they will adversely impacted by the proposed clearing.

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	J Wood	P Gunnell		R Pearson		