

**Main Roads Western
Australia**

Monoghan's Roundabout
Project, Caves Road, Busselton

Environmental Impact
Assessment and
Environmental Management
Plan

March 2007



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1. Introduction

GHD Pty Ltd (GHD) were commissioned by Main Roads Western Australia (Main Roads), South West Region, to prepare a combined Environmental Impact Assessment and Environmental Management Plan (EIA and EMP) for the proposed construction of a roundabout (Monoghan's roundabout) in the Shire of Busselton. Monoghan's roundabout is to be located at the intersection of the Old Bussell Highway (H943) and Caves Road (M043) and includes upgrading the connecting roads. The location of the project study area is shown at Figure 1.

A Preliminary Environmental Impact Assessment (PEIA) was not completed for this project, as it is known that a fauna survey would be required to establish the number and density of Western Ringtail Possum (WRP) that may inhabit the vegetation present in the study area. The WRP (*Pseudocheirus occidentalis*) is known to occur in the Busselton area and is listed under the *Wildlife Conservation Act 1950* as a Schedule 1 species and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) as Vulnerable.

1.1 Scope of Report

This EIA and EMP has been prepared according to Main Roads brief for the project that included the following items:

- » determine the key environmental aspects to be considered and the scope of investigations required;
- » assessment to confirm if significant environmental impacts will occur and that referral to either the EPA or DEWR is required or not;
- » description and assessment of the existing environment, including physical, biological, social aesthetic, heritage, noise, and site contamination;
- » field investigations involving a pre-development survey for WRP as per the *Development Planning Guidelines for Western Ringtail Possums* by CALM (2003);
- » impact assessment that describes the proposed works and their potential impact on the existing environment;
- » assess the project against the Environmental Protection Act's 10 Clearing Principles (Schedule 5);
- » consultation with regulatory stakeholders to determine requirements;
- » provide all necessary information to obtain, and assist the Project Manager in applying for clearances required under legislative provisions, including (but not limited to) those required under the following Acts and regulations:
 - - *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*;
 - - *Rights in Water and Irrigation Act 1914*;
 - - *Conservation and Land Management Act 1984*;
 - - *Wildlife Conservation Act 1950*;
 - - *Heritage of Western Australia Act 1990*; and
- » provide environmental management actions suitable for inclusion in the tender documentation for project implementation;
- » provide a concise report on the results of environmental investigations and clearances obtained; and
- » provide complete and sufficient information to prepare the EMP for construction.

This EIA and EMP has been prepared based on:

- » A site visit with Main Roads Project Manager and Environment Officer



- » A review of relevant design documents prepared for the project
- » Discussions with Main Roads Project Manager and Environment Officer
- » A search of the Department of Environment and Conservation (DEC) Declared Rare and Priority Flora database
- » A search of DEC's Threatened Fauna database;
- » A pre-development survey for WRP; and
- » A relevant literature and database review.


Environmental and social impacts identified as requiring consideration during the proposed works and therefore addressed in this report include:

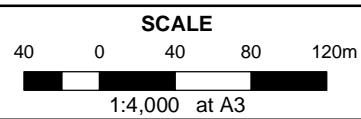
- » Wetlands and drainage
- » Acid sulphate soils
- » Reserves and conservation areas
- » Vegetation – Rare Flora, Priority Flora and Threatened Ecological Communities
- » Vegetation – clearing
- » Vegetation – weeds
- » Vegetation – Dieback and other diseases or pathogens
- » Revegetation and rehabilitation
- » Topsoil management
- » Fauna
- » European heritage
- » Aboriginal heritage
- » Landuse
- » Visual amenity
- » Contaminated sites
- » Pre-construction work; and
- » Construction phase impacts – noise and vibration, local community consultation and complaints management, dust, traffic safety and access, fire management, fuel and chemical storage and rubbish disposal.

Given the nature and location of the proposed project, impacts on air quality and groundwater were not considered issues of the project; nor were impacts to Public Drinking Water Source Areas as none are present within the study area. Therefore, these aspects have not been discussed within this EIA and EMP.



LEGEND

 Limit of Study Area



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CREATED BY ML	CHECKED	APPROVED
HORIZONTAL DATUM: GDA 94		PROJECTION: MGA ZONE 50
HEIGHT DATUM: NA		METADATA RECORDED: 100%
DATE 18.12.2006	FILE LOCATION N:\61\18225\GIS\MXD\S6118225-G4_locality_rev1.mxd	
REVISION 1	DRAWING NO 6118225-G4	



Busseton Highway (Monaghan's Roundabout)

**Location Map
Figure 1**

MAP UNITS PROJECTED IN MGA ZONE 50
 NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
 AERIAL PHOTOGRAPHY SOURCED FROM DLI - 2004 BUSSETON MOSAIC REPRODUCED
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2. Project Description and Justification

Main Roads proposes to construct a roundabout (Monaghan's roundabout) at the intersection of the Old Bussell Highway (H943) and Caves Road (M043) in Abbey, Shire of Busselton. Traffic volumes at the intersection of the Old Bussell Highway (H943) and Caves Road (M043) are forecast to grow substantially over the next 25 years. Therefore, the design for the roundabout needs to allow for future works to incorporate connection of the proposed second carriageway on Old Bussell Highway. The roundabout will be sized to cater for a range of vehicles including B-double trucks.

The project also includes upgrading the following connecting road sections:

- a) the Old Bussell Highway east from the intersection to Cambridge Boulevard;
- b) approximately 700 metres of the Old Bussell Highway south from the intersection to connect to the section improved as part of the Busselton Bypass project (150 m south of Cookworthy Road); and
- c) Caves Road west from the intersection for approximately 100 metres.

The maximum total area of vegetation clearing required is approximately 0.25 ha. All vegetation clearing will be confined to areas within the road reserve. Clearing will be required to develop the roundabout and road sections a) and b) noted above as follows:

No vegetation clearing is required along Caves Road west from the intersection.

A concept design for the roundabout was prepared some time ago as part of the overall concept design project for the duplication of the Old Bussell Highway from Dolphin Road to Caves Road. This was reviewed in 2006.

Funding for construction of the roundabout has been programmed for the 2006/07 and 2007/08 financial years. It is planned that service relocation work will commence in February 2007 to enable roadwork to be undertaken between September and November 2007.



3. Environmental Impacts and Management

3.1 Existing Environment

The following section describes the existing environmental and social aspects considered relevant to the project and discusses actions necessary to adequately manage the impacts of the project. An Environmental Aspects Table detailing potential environmental impacts of the works is included in Appendix A. Relevant environmental management measures and responsibilities are summarised in an Environmental Management Responsibilities Table (Appendix B). Appendix B is designed to be used as a 'stand alone' EMP during the design and implementation of the project. Environmental constraints mapping is shown at Appendix C.

3.1.1 Climate of area

The study area has a Mediterranean-type climate, with warm, dry summers and cool wet winters. The closest Bureau of Meteorology weather-recording station to the project site is located at the Shire of Busselton Weather Station. The recorded climate data at the Busselton Weather Station is summarised below.

Shire of Busselton Weather Station

Mean Daily Maximum Temperature Range: 28.5 °C (January) to 16.3 °C (July)

Mean Daily Minimum Temperature Range: 14.0 °C (February) to 7.5 °C (Jul/Aug)

Mean Annual Rainfall: 817.2 mm

Mean No. Rain days per year: 129.7

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

3.1.2 Geomorphology, Landform and Soils

The project area occurs on the Quindalup Dune System that contains relic fore dune plain, estuarine terraces and degraded surfaces of eolian origin. Three main soil types have been identified in the project area. Belford (1987) describes these as:

- » **Calcareous sand** – white, medium grained, rounded quartz and shell debris, well sorted, of eolian origin. This soil type occurs north of Cookworthy Road and covers the largest portion of the project area.
- » **Clayey Peaty Sand** – grey to black quartz sand with variable organic content, minor clays of lacustrine origin. This soil type occurs as a thin east-west strip that crosses the Bussell Highway approximately 30 m south of the intersection.
- » **Silt** – brownish grey, calcareous in part, soft, some fine sand and shell debris in places, minor clay content of estuarine origin. This soil type is present south of Cookworthy Road and extends for approximately 150 m.

3.1.3 Wetlands and Drainage

One dampland area (approximately 60 m wide) crosses the Bussell Highway from west to east at approximately 30 m south of the Bussell Highway / Caves Road intersection. The dampland has been classed as "multiple use" and its location coincides with the "clayey peaty sand" soil type described above. During a site inspection on 28 August 2006, the area was observed to be in degraded condition with various common pastoral and grass weed species present with evidence of human disturbance



associated with its proximity to public access. As the proposed project consists primarily of surface roadwork on existing road infrastructure and no dewatering is required, it is not expected that the proposed project will impact on the dampland or significantly change existing surface water drainage.

The road drainage will be designed and implemented to maintain existing surface water flows in the project area.

3.1.4 Acid Sulphate Soils

The Western Australian Planning Commission Bulletin No. 64 (WAPC, 2003) depicts two separate areas as having a “*High risk of Actual Acid Sulfate Soil (AASS) and Potential Acid Sulphate Soil (PASS) < 3 m from the surface*”. One strip is associated with the dampland area described above in section 3.1.3. The second (broader area) is present below approximately 160 m of the Bussell Highway south of Cookworthy Road. The remaining parts of the project area have been classed as having a “*Low to no risk of AASS and PASS occurring at depths of > 3 m*”. The locations and extents of these areas are mapped on Figure 2 (Appendix C).

During a discussion on 24 August 2006, Mr Bruce Walker (Main Roads Project-Contract Manager South West) advised that it is unlikely any significant depth of excavation would be required during the development of the project and confirmed that dewatering would not be necessary.

The risk of disturbing Acid Sulphate Soil is greatest in the two areas noted above during any significant excavation activities. Given the nature of the proposed project (primarily surface roadwork) on existing infrastructure that is underlain by imported materials there is a low potential for the work described by Main Roads to disturb Acid Sulphate Soils in the area.

Should any excavation be necessary in the high risk areas shown at Appendix C, further Acid Sulphate Soil Investigations should be conducted and a management plan developed, if necessary. This investigation could be incorporated into any geo-technical investigation proposed.

3.1.5 Reserves and Conservation Areas

The entire proposed project falls within Main Roads gazetted road reserve. An area identified as “other reserves (conservation and recreation)” is located south of Cookworthy Road but this will not be disturbed or impacted by the proposed project work in that section. The proposed project is not anticipated to directly impact upon any reserves or conservation areas.

3.1.6 Vegetation

The vegetation in the greater study area has been described as “Low Woodland-Open Low Woodland” in the south with “Low Forest and Woodland” to the north (Department of Agriculture WA, 2003). Mature Peppermint trees (*Agonis flexuosa*) dominate the upperstorey adjacent to the road corridor where many have been heavily pruned to accommodate overhead power cables. Occasional Flooded Gum (*Eucalyptus rudis*) and Paperbark (*Melaleuca raphiophylla*) are also present adjacent to the Bussell Highway in the projects southern section.

In Western Australia (WA), the Environmental Protection Authority (EPA), has established through Position Statement No. 2. (Environmental Protection of Native Vegetation in Western Australia), the “threshold level” below which species loss appears to accelerate exponentially at an ecosystem level as being at 30% of the pre-clearing extent of the vegetation type (EPA, 2000). In the case of the vegetation present in the immediate project area, consultation with the DEC (Native Vegetation & Wetlands Branch, Bunbury) confirmed that it does not represent a functioning vegetation community (pers. comm. Kym



Lewis, 11 January, 2007). Consideration was given to the field assessment and aerial photography analysis. Therefore, determining the percentages of this vegetation complex remaining does not apply and the proposed clearing within the road reserve can be considered as not contradictory to the EPA's recommendations stated in Position Statement No. 2.

Overall, the native vegetation within the proposed project clearing area is either:

1. Cleared with no or few sparse native species and weeds present; or
2. Fragmented, significantly disturbed, has no canopy connectivity, low species diversity and weeds present.

During a site assessment on the 28th August 2006, it was noted that the original vegetation structure was no longer present. The narrow (one tree wide) segments of vegetation aligning the road reserve have low species abundance and low diversity. The condition of understorey species varied from degraded to good (in parts), but remains susceptible to ongoing weed infestation and degradation. The vegetation within the immediate project area has low potential to provide any ecological linkage to the Broadwater Conservation Reserve System (approximately 1 km to the southeast).

One small (approximately 0.2 ha) stand of re-growth native vegetation is located southeast of the Bussell Highway and Caves Road intersection within the road reserve. It is surrounded by cleared land and a track on its south and western sides. Its overstorey is dominated by Wattle (*Acacia saligna* and *A. littorea*) with occasional Peppermint of approximately 2-3 m height. The understorey in this part is dominated by weeds. A Pre-development survey for Western Ringtail Possum (WRP) identified a number of WRP dreys within this vegetation and in parts of the road reserve upperstorey (Appendix D).

There is a larger block of vegetation (5+ ha) with habitat suitable for WRP's located directly southeast of the road reserve and outside of the project clearing area. This vegetated block has less edge ratio compared to that along the highway, a greater distance from highway traffic and greater potential as habitat for the WRP. However the future of this area is uncertain as it occurs on freehold land.

The vegetation condition has been assessed according to the Bush Forever Vegetation Condition Ratings shown in Table 1. This assessment considered the vegetations structure (height and density) as a whole unit. The vegetation present ranged from Condition Rating 4 "Good" to predominantly 5 "Degraded" (Government of Western Australia, 2000). However, it does have some potential for regeneration that will be of benefit during the projects rehabilitation / revegetation activities.

Table 1 Bush Forever Condition Rating (Government of Western Australia, 2000)

Rating	Description	
1	Pristine	Pristine or nearly so.
2	Excellent	Vegetation structure intact, disturbance affecting individual species, and weed are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances, retains basic vegetation structure or ability to regenerate it.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good



Rating Description

		condition without intensive management.
6	Severely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost without native species.

3.1.7 Declared Rare and Priority Flora

The DEC’s *Threatened (Declared Rare) Flora* database and the *Western Australian Herbarium Specimen* database were consulted to determine the presence of any Declared Rare or Priority Flora species that may exist in, or near, the project area. Table 2 describes the DEC’s Flora Conservation Codes and Table 3 lists the database search results. GIS mapping of the listed species locations showed that no Declared Rare or Priority Flora species have been previously identified in the immediate project area.

Table 2 Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora

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



Table 3 Declared Rare and Priority Flora Species

Species / Taxon	Conservation Code (DEC)
<i>Acacia flagelliformis</i>	4
<i>Acacia lateriticola glabrous variant</i> (BR Maslin 6765)	3
<i>Amperea micrantha</i>	2
<i>Angianthus drummondii</i>	3
<i>Anthotium junciforme</i>	4
<i>Aotus cordifolia</i>	3
<i>Astartea sp.</i> Scott River	4
<i>Blennospora doliiformis</i>	3
<i>Boronia capitata subsp. gracilis</i>	2
<i>Boronia tenuis</i>	4
<i>Boronia tetragona</i>	3
<i>Brachyscias verecundus</i>	R
<i>Caladenia busselliana</i>	R
<i>Caladenia caesarea subsp. maritima</i>	R
<i>Caladenia longicauda subsp. clivicola</i>	4
<i>Caladenia procera</i>	R
<i>Caladenia viridescens</i>	R
<i>Caustis sp.</i> Boyanup	1
<i>Chamelaucium erythrochlorum ms</i>	4
<i>Chordifex gracilior</i>	3



Species / Taxon	Conservation Code (DEC)
<i>Diuris purdiei</i>	R
<i>Drakaea elastica</i>	R
<i>Eryngium subdecumbens ms</i>	3
<i>Eucalyptus phylacis x</i>	R
<i>Eucalyptus relicta</i>	2
<i>Eucalyptus rudis subsp. cratyantha</i>	4
<i>Gastrolobium modestum</i>	R
<i>Gastrolobium papilio</i>	R
<i>Grevillea brachystylis subsp. brachystylis</i>	3
<i>Grevillea brachystylis subsp. Busselton</i>	R
<i>Hakea oldfieldii</i>	3
<i>Isopogon formosus subsp. dasylepis</i>	3
<i>Lambertia echinata subsp. occidentalis</i>	R
<i>Laxmannia jamesii</i>	4
<i>Leptomeria furtiva ms</i>	2
<i>Meeboldina thysanantha ms</i>	3
<i>Millotia tenuifolia var. laevis</i>	2
<i>Myriophyllum echinatum</i>	3
<i>Pultenaea pinifolia</i>	3
<i>Schoenus benthamii</i>	3
<i>Schoenus natans</i>	4



Species / Taxon	Conservation Code (DEC)
<i>Stylidium barleei</i>	3
<i>Stylidium longitubum</i>	3
<i>Synaphea hians</i>	3
<i>Synaphea petiolaris subsp. simplex</i>	2
<i>Tetraria australiensis</i>	R
<i>Thysanotus glaucus</i>	4
<i>Tripterococcus paniculatus ms</i>	1
<i>Verticordia attenuata</i>	3
<i>Verticordia densiflora var. pedunculata</i>	R
<i>Verticordia lehmannii</i>	4
<i>Verticordia plumosa var. ananeotes</i>	R

3.1.8 Threatened Ecological Communities

Threatened Ecological Communities (TEC's) are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe, 1997). TEC's are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered, and Vulnerable.

Some TECs are protected under the Commonwealth *EPBC Act* and the loss of, or disturbance to, some TECs triggers this legislation. Although TEC's are not specifically protected under the Western Australian *Wildlife Conservation Act, 1950* this act protects all native vegetation in Western Australia. The Environmental Protection Authority's (EPA's) position on TEC's states that proposals that result in the direct loss of TECs are likely to require formal assessment.

Searches using the *EPBC Act* Protected Matters Search Tool and of the DEC's TEC database indicated no TEC's are listed or known to occur within the study area. Therefore, no impacts to TEC's are expected.

3.1.9 Vegetation Clearing - Assessment Against Clearing Principles

Any clearing of native vegetation will require a permit under Part V of the *Environmental Protection Act 1986*, except where an exemption applies under Schedule 6 of the Act or is prescribed by regulation in the *Environmental Protection (Clearing of Native Vegetation) Regulations (2004)*, and not in an



Environmentally Sensitive Area (ESA). Consultation of the DEC's web based Native Vegetation Map Viewer showed that the proposed project does not occur within an ESA.

Clearing applications are assessed against ten principles outlined in Schedule 5 of the *Environmental Protection Amendment Act (2003)*. These principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

Main Roads have been granted a statewide project 'Clearing Permit' (CPS 818/3) under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Under Main Roads 'Clearing Permit', clearing of native vegetation is permitted where the clearing is unlikely to be in conflict with the clearing principles.

Table 4 provides an examination of the Ten Clearing Principles applied against the findings of this assessment.

Table 4 Assessment of Project against Ten Clearing Principles

Principle Number	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity	The remnant native vegetation in the project area does not contain a high level of biological diversity. The floristics in the project area have been significantly reduced by historic clearing activities, existing disturbances and the invasion of exotic weeds.	Clearing is not at variance to this Principle
(b)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia	The survey for the presence of Western Ringtail Possum (WRP) showed that they utilise the area for habitat. The survey The survey located a total of 20 WRP dreys across the study area with an estimated population of seven (7) WRP's using the site (Elscot, 2007).	Proposal is at variance to this Principle.
(c)	Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora	No DRF have been identified in the project area.	Clearing is not at variance to this Principle
(d)	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community	No TECs occur within or in proximity to the project area.	Clearing is not at variance to this Principle



Principle Number	Principle	Assessment	Outcome
(e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared	The overall vegetation structure is no longer intact. Field assessment and consultation with the DEC confirmed that the native vegetation present does not represent a functioning vegetation community. This can be attributed to its low diversity and abundance of native flora, low scoring condition ratings, fragmentation, abundance of weeds, disturbance and overall lack of connectivity.	Clearing is not at variance to this Principle
(f)	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland	The native vegetation is not associated with wetlands or riparian zones. The vegetation to be cleared is not growing directly in association with a watercourse.	Clearing is not at variance to this Principle
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	The clearing of native vegetation is unlikely to cause alteration in the health or capability of adjacent lands. The adjacent areas primarily contain cleared and built-up land. Therefore, no land degradation or impact upon the present or future land use is likely.	Clearing is not at variance to this Principle
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area	Given the nature and location of the proposed work, there will be no impact on any conservation areas.	Clearing is not at variance to this Principle
(i)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water	Due to the nature of the proposed work and nominal amount of clearing required there is unlikely to be any deterioration in the quality of surface or underground waters.	Clearing is not at variance to this Principle
(j)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding	Given the nature of the proposed work and nominal amount of clearing required it is unlikely to cause or exacerbate localised flooding or result in unacceptable changes in water regimes or environmental water provisions.	Clearing is not at variance to this Principle

Although the project does not occur within an ESA, the *Guide to Assessment of Native Vegetation* under the EP Act indicates that clearing is at variance to Principle (b) that is: *Native vegetation should not be*



cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

The WRP is listed under the *Environmental Protection and Biodiversity Act 1999* (EPBC Act) as Vulnerable and the *Wildlife Conservation Act 1950* as a Schedule 1 native fauna species. The proposed clearing has the potential to impact upon the WRP's habitat identified within the project area.

It is recommended that a Possum Management Plan should be developed for the project and approved by the DEC to support EPA and DEWR referrals. Submissions should be invited from parties that may have an interest in the proposed clearing as it is at variance to Principle (b).

Main Roads have been granted a statewide project 'Clearing Permit' (CPS 818/3) under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. As the proposed clearing is at variance with the clearing principles, referral to the EPA should be undertaken for the proposed clearing and an area permit applied for.

On-ground works will be conducted to minimise clearing and avoid clearing of mature trees within the project area. WRP's and their habitat provisions will be managed according to a DEC approved WRP management plan.

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

Clearing for works will be conducted as detailed below.

During road works, damage to existing remnant vegetation will be avoided as far as practicable. Clearing should be restricted to 1 m from the edge of works.

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 that are to be conserved will 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 and any WRP's are re-located by a licenced fauna specialist.

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 and vegetation to be retained.

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 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

Priority will be given to recycling any vegetation cleared for rehabilitation purposes before disposal off-site at an approved landfill site. No burning of cleared vegetation will be permitted within the project area.

Action: Main Roads Construction Manager / Construction Contractor

3.1.10 Rehabilitation and Revegetation

There is an opportunity for the Main Roads to provide environmental and social benefits through rehabilitation and revegetation in the project area. Rehabilitation of the road verge and adjacent areas will enhance native species abundance and diversity, increase fauna habitat and enhance roadside visual amenity.

After completion of the project, rehabilitation of the area will be carried according to Main Roads standard specifications. Areas to be revegetated should be pre-treated with herbicide to reduce the existing abundance of weeds. Priority will be given to planting local species suitable to increase the area available for WRP habitat as recommended in the projects WRP survey (Appendix D). This includes the following flora species:

- » Peppermint trees (*Agonis flexuosa*)
- » Cutleaf Hibbertia (*Hibbertia cuneiformis*)
- » Basket Bush (*Spyridium globulosum*)
- » Shark-toothed Wattle (*Acacia littorea*)
- » Orange Wattle (*Acacia saligna*)
- » Rigid Wattle (*Acacia cochlearis*)
- » Spiked-beard Heath (*Leucopogon parviflorus*)
- » Australian Bluebells (*Sollya heterophylla*)
- » Native Wisteria (*Hardenbergia comptoniana*)

Preference should be given to planting native species not susceptible to *Phytophthora cinnamomi* in any areas where imported topsoil has not been classed as Dieback-free.

Action: Main Roads Project Manager

3.1.11 Weed management

Common pastoral and grass weeds are present throughout the project area. During the field investigation two Declared plants were also identified within and adjacent to the project area. The Declared plants were Arum Lilly (*Zantedeschia aethiopica*) and Apple of Sodom (*Solanum linnaeanum*). Arum Lilly were scattered throughout the general area and one single isolated Apple of Sodom plant was located at GDA 94 (E:338660; N:6273970).

Under the *Agriculture and Related Resources Protection Act 1976*, the Declared plants identified are assigned the Statewide control codes of P1 (*prohibits movement*); and within the Shire of Busselton: P4 (*Aim to prevent infestation spreading beyond existing boundaries of infestation*).

The movement of vehicles and personnel across the project area is the most likely means by which weeds could be spread during construction. Weeds can readily become established in disturbed areas,



so pre-treating existing weeds and any areas to be revegetated will minimise their potential to exploit cleared areas.

Raising awareness amongst site personnel and implementation the following actions and hygiene measures during the project work will minimise the risk of introducing or spreading existing weeds within or from the area. All site employees should be advised of the following hygiene measures prior to commencement on site:

- » Main Roads should also advise its Term Network Contractor on the presence of these weeds to ensure they are eradicated in line with Main Roads responsibilities under the *Agriculture and Related Resources Protection Act 1976*.
- » Any Declared plants identified in the project area should be treated 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 prior to construction in accordance with methods recommended by the Department of Agriculture and Food.
- » Inductions of the workforce should raise awareness about the issue of spreading weeds and requirements for weed hygiene in the work area.
- » All road construction plant and machinery should be cleaned free of all soil and vegetative material:
 - prior to arrival within the project area; and
 - prior to departing the project area.
- » Clean down may comprise of the use of a brush and/or compressed air to remove clods of soil, vegetative matter and/or soil water slurry. A metal bar or spade may be used to remove compacted soil if necessary.

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

3.1.12 *Phytophthora cinnamomi* (Dieback) management

The occurrence of *Phytophthora cinnamomi* (Dieback) is extensive in the south west of Western Australia where the mean annual rainfall exceeds 800 mm. As the mean annual rainfall in the study area is 817 mm, there is the potential for Dieback to develop in the area. However, with the absence of Dieback susceptible host plants and presence of calcareous sand throughout the majority of the study area its potential for Dieback to develop is considered as low.

During the site inspection, DEC experienced Dieback Interpreter, Bruno Rikli, observed no evidence of *P. cinnamomi* in or adjacent to the project area. The area assessed can be described as “uninterpretable” for the presence of *P.cinnamomi*. The DEC (formerly CALM) defines the “uninterpretable” category as “Where susceptible plants are absent or too few to enable the interpretation of *Phytophthora cinnamomi* presence or absence” (CALM, 2003). No evidence of other plant diseases in the study area was noted.

Based on the site conditions, there is a low risk for Dieback to develop in the project area and no existing vegetation is considered to warrant protection. Applying the weed hygiene measures described above (see 3.1.11) will be adequate to avoid the introduction of Dieback during the construction of the proposed project.



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

3.1.13 Topsoil Management

After the completion of clearing activities, any topsoil windrowed or stored beside the road will be utilised in adjacent areas and for rehabilitation purposes.

Action: Main Roads Construction Manager / Construction Contractor

Topsoil will be stored and respread within the section that it was stripped from to minimise the potential to spread weeds.

Action: Main Roads Construction Manager / Construction Contractor

Precautions need to be taken so as to not introduce weed species into the topsoil during construction and to maximise in-situ the use of the topsoil.

Action: Main Roads Construction Manager / Construction Contractor

Consideration will be given to importing Dieback-free topsoil soil in any areas where revegetation using *Phytophthora* susceptible species is planned.

Action: Main Roads Construction Manager / Construction Contractor

3.1.14 Fauna

The conservation status of fauna species is assessed under both State and Commonwealth Acts. This includes the Western Australian *Wildlife Conservation Act 1950* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). In Western Australia (WA), the DEC classifies fauna significance levels in a series of schedules. The DEC also produces a supplementary list of Priority Fauna, being species that are not considered threatened under the *Wildlife Conservation Act 1950*. However, the DEC considers Priority fauna are those in need of further survey and evaluation of conservation status before consideration can be given to their declaration as threatened fauna. The significance levels for fauna used in the *EPBC Act 1999* are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). This list includes a number of Migratory and Marine bird species known to forage on wetland habitats.

A desktop analysis of fauna species believed to occur in or within the vicinity of the project (plus ~ 5 km buffer) was conducted based on a search of DEC's Threatened Fauna database and a search of the *EPBC Act 1999* Matters of National Environmental Significance database. The searches identified one Schedule 1, one Schedule 2 and four Priority species as prescribed under the *Wildlife Conservation Act 1950*. A total of thirteen species as prescribed under the *EPBC Act 1999* were also identified. An explanation of significance levels for fauna is detailed in Table 5 followed by the fauna search results in Table 6.

Of the fauna believed to occur in or within the vicinity of the project, the only listed fauna species identified in the project area that may be impacted by the proposed clearing was the WRP (*Pseudocheirus occidentalis*). The WRP is listed under the *EPBC Act 1999* as Vulnerable and the *Wildlife Conservation Act 1950* as a Schedule 1 species. The majority of the other listed fauna are birds that may make only limited or occasional use of the area. Notwithstanding the listing of species under the aforementioned Acts, all native fauna are protected in WA under the *Wildlife Conservation Act 1950*.

Field assessment included opportunistic observations for fauna, habitat assessment and a Pre-development survey for Western Ringtail Possum (WRP). The WRP survey was completed by Sue



Elscot during December 3rd and 4th, 2006 as per the *Development Planning Guidelines for Western Ringtail Possums* by CALM (2003). The survey included spotlight surveys, site photographs and information about the WRP's distribution, abundance and habitat. Her report details the current legislation applicable to this fauna species and provides recommendations to mitigate any impacts to WRP's and their habitat. A summary of the WRP survey report findings and recommendations is given below with the full report included at Appendix D.

Summary of Western Ringtail Possum Survey

The site lies within an area known to contain populations of the specially protected Western Ringtail Possum (*Pseudocheirus occidentalis*), and the site contains Western Australian Peppermint trees (*Agonis flexuosa*), which are potential habitat for the Western Ringtail Possum.

All of the remnant vegetation within the study area occurs as discrete blocks without canopy connectivity between the stands, and the remainder of the study area is cleared paddock. Ringtail Possums would need to descend to the ground to travel between blocks of vegetation making them susceptible to predation by dogs, cats and foxes, and vulnerable to striking by cars should they attempt to cross the road.

During the daytime search, carried out on December 3rd, 2006, a total of 20 Western Ringtail Possum dreys were located across the study area. It is considered that the spotlighting-derived estimate of at least 7 WRP's using the site is a reasonably accurate estimate of the site's Ringtail Possum population size.

WRP Survey Recommendations

To reduce impacts of the proposed road upgrade on the existing Ringtail Possum population within the study area, a number of measures can be implemented:

- » The new roundabout and associated roads should be located within existing cleared areas, as much as is possible, to minimise loss of native vegetation within the site.
- » Areas of disturbance should be minimised through a process of workforce induction, and flagging limits of disturbance within existing remnants of vegetation.
- » Further fragmentation of habitat can be reduced by removing the edges of a remnant in preference to clearing a path through centre. While both approaches reduce the size of the remnant, the former approach maintains a single remnant of a size (relatively) similar to the original whereas the latter creates two much smaller, disconnected remnants. This is particularly applicable to the Shark-toothed Wattle thicket within the study area.
- » Following completion of the upgrade works, all areas not required to maintain a line-of-sight for safety should be rehabilitated with appropriate local native species, particularly Peppermint trees (*Agonis flexuosa*). Commercially available understorey species which are appropriate for this site are:
 - - Cutleaf Hibbertia (*Hibbertia cuneiformis*)
 - - Basket Bush (*Spyridium globulosum*)
 - - Shark-toothed Wattle (*Acacia littorea*)
 - - Orange Wattle (*Acacia saligna*)
 - - Rigid Wattle (*Acacia cochlearis*)
 - - Spiked-beard Heath (*Leucopogon parviflorus*)
 - - Australian Bluebells (*Sollya heterophylla*)
 - - Native Wisteria (*Hardenbergia comptoniana*)



- » Coastal Sword Sedge is an important understorey component of the local Peppermint woodland vegetation community and provides a dense understorey, which Ringtail Possums prefer. Coastal Sword Sedge is generally commercially unavailable so, where Coastal Sword Sedge needs to be removed, it should be carefully transplanted to another part of the site.
- » As a listed nationally threatened species, the Western Ringtail Possum is defined as a matter of National Environmental Significance (NES) or a 'trigger species' under the Commonwealth EPBC Act. As the site is used by at least seven Ringtail Possums, MRWA should refer the proposal to the Commonwealth Department of Environment and Water Resources (DEWR) for a determination on whether assessment is required under the Act. Information on referring a proposal can be found on the DEWR website at: <http://www.dewr.gov.au/epbc/publications/referral.html>
- » As Ringtail Possums are present within the site, any proposal to develop the site should also be referred to and assessed by the Department of Environment and Conservation (DEC) as part of the approvals process.

Further advice regarding the referrals required for the proposed project is given in Section 5 of this EIA and EMP report. The advice provided at Section 5 takes into consideration all matters assessed during the preparation of this EIA and EMP.

Table 5 Significance Levels for Fauna species – EPBC Act, DEC

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



Status	Significance Level	Definition
EPBC Act	Migratory	<p>Taxa that are listed in</p> <p>appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;</p> <p>the Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA); and</p> <p>the Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).</p> <p>Listed migratory species also include any native species identified in an international agreement approved by the Commonwealth Environment Minister. The Minister may approve an international agreement for this purpose if satisfied that it is an agreement relevant to the conservation of migratory species.</p>
	Marine	species is the list established under s248 of the EPBC Act.
DEC	Schedule 1	"...fauna that is rare or likely to become extinct, are declared to be fauna that is in need of special protection."
	Schedule 2	"...fauna that is presumed to be extinct, are declared to be fauna that is in need of special protection."
	Schedule 3	"...birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection."
	Schedule 4	"...fauna that is in need of special protection, otherwise than for the reasons mentioned [in Schedule 1 – 3]"
DEC	Priority 1	Taxa with few, poorly known populations on threatened lands.
	Priority 2	Taxa with few, poorly known populations on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc.
	Priority 3	Taxa which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation.
	Priority 4	Rare taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.



Status	Significance Level	Definition
	Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Table 6 Significant Fauna occurring, or likely to occur within the vicinity of the project area.

Genus	Species	Common Name	EPBC Act Status	DEC Status
<i>Calyptorhynchus</i>	<i>baudinii</i>	Baudin's Black-Cockatoo	Vulnerable	
<i>Dasyurus</i>	<i>geoffroi</i>	Chuditch	Vulnerable	
<i>Pseudocheirus</i>	<i>occidentalis</i>	Western Ringtail Possum	Vulnerable	Schedule 1
<i>Helicarion</i>	<i>castanea</i>	Helicarion castanea		Schedule 2
<i>Haliaeetus</i>	<i>leucogaster</i>	White-bellied Sea-eagle	Migratory, Marine	
<i>Apus</i>	<i>pacificus</i>	Fork-tailed Swift	Overfly marine area	
<i>Ardea</i>	<i>alba</i>	Great Egret, White Egret	Overfly marine area	
<i>Ardea</i>	<i>ibis</i>	Cattle Egret	Overfly marine area	
<i>Merops</i>	<i>ornatus</i>	Rainbow Bee-eater	Overfly marine area	
<i>Diomedea</i>	<i>gibsoni</i>	Gibson's Albatross	Vulnerable	
<i>Macronectus</i>	<i>giganteus</i>	Southern Giant-Petrel	Endangered	
<i>Pachysaga</i>	<i>strobila</i>	Pachysaga strobila	Endangered	Priority 1
<i>Macronectus</i>	<i>halli</i>	Northern Giant-Petrel	Endangered	
<i>Thalasarche</i>	<i>cauta</i>	Shy Albatross	Vulnerable	
<i>Hydromys</i>	<i>chrysogaster</i>	Water-rat (Rakali)		Priority 4
<i>Westralunio</i>	<i>carteri</i>	Westralunio carteri		Priority 4
<i>Isoodon</i>	<i>obesulus fusciventer</i>	Quenda		Priority 5



3.2 Social Environment

3.2.1 European Heritage

No heritage places with potential heritage significance are present within proximity to the project area. This was confirmed through searches of the Australian Heritage Places Inventory and Heritage Council of Western Australia-Places Database. A search using the EPBC Act on-line Protected Matters Search Tool showed that no World Heritage Properties of National Heritage Places occur in the project area. There are no heritage listed sites on the Shire of Busselton's Municipal Heritage Inventory. Therefore, no impacts to European cultural heritage sites are anticipated from developing the proposed project.

3.2.2 Aboriginal Heritage

Aboriginal Heritage surveys have been completed over the proposed project area. This included an ethnographic survey by Goode (2002) and an archaeological survey by Greenfeld and Webb (2002). The surveys covered a 100 m corridor along Caves Road and the Bussell Highway in the project area. The Aboriginal representatives consulted were satisfied that the proposed roundabout project will not impact upon any registered or yet to be registered Aboriginal heritage sites.

A search of the Department of Indigenous Affairs (DIA) Heritage Enquiry System in November 2006 revealed there is one registered Aboriginal site covering the greater project area. The site (Site ID 21551) is described as "Abbey Waters Isolated Find". The detailed results for this site are given in Appendix E. Given the location of the proposed project and previous survey results no impact to Site 21551 or any other site is anticipated.

If material likely to be of interest to the Aboriginal community is uncovered during construction work it should immediately cease within 50 m of the material and the Department of Indigenous Affairs (DIA) advised immediately. If skeletal material is uncovered during works then the WA Police Service should also be advised immediately.

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

3.2.3 Land Use

The land to the north of the project contains established residential developments and a small shopping complex. Undeveloped, rural freehold land and a number of residential properties adjoin the east and western sides of the Bussell Highway along the section located south from its intersection with Caves Road.

3.2.4 Traffic noise and vibration

The project includes upgrading the road and highway approaches to the proposed Monoghan's roundabout. Noise and vibration levels may increase during construction, however these are not considered significant. Dilapidation of buildings is not considered an issue given the distance of structural developments from the proposed work area and type of equipment used with no requirement for blasting rock. Some consultation with adjacent property owners may be required to discuss the issue.

These aspects can be managed by standard noise and vibration management techniques employed by the construction contractor.



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

3.2.5 Land Acquisition and Fencing

The entire proposed project is to be developed within Main Roads road reserve. Therefore, no land will be required to develop the project. Should the scope of work change and additional land is necessary for completion of the project, it will be acquired by Main Roads.

Action: Main Roads Land Acquisition Manager

3.2.6 Visual Amenity

Rehabilitation of the road verges will be required to enhance visual amenity with the additional benefit of increasing fauna habitat (particularly for the WRP's). The existing view-shed will not be significantly impacted by the proposed roadwork as only a small amount of clearing is proposed.

Minimising and avoiding clearing of native vegetation to that which is practicable for the safe construction and operation of the alignment will reduce impacts on the current view-shed and potential WRP habitat.

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

3.2.7 Contaminated Sites

A search was completed by the Department of Water (DoW) for contaminated sites using the Legaci Contaminated Sites Database. No evidence of potential contaminated sites was observed during the site inspection. The database search results indicate that no known potential contaminated sites occur within the project area, which is consistent with field observations.

3.3 Pre-construction Work

There are existing service lines in the project area. It is planned that service relocation works will commence in February 2007 to enable roadwork to be undertaken in September and November 2007.

Action: Main Roads Project Manager / Service Authorities

3.4 Construction Phase

Consideration and management of temporary nuisance issues that may impact residents and properties (all greater than 50 m from the work area) will be necessary during the construction phase. The additional environmental and social impacts identified that are likely to occur during construction of the project include:

- » Environmental management;
- » Construction noise;
- » Vibration;
- » Dust;
- » Traffic safety and access;
- » Fire management;
- » Fuel and chemical storage; and



- » Rubbish disposal.

3.4.1 Environmental Management and Quality Plan

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

Action: Construction Contractor

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

Action: Construction Contractor

3.4.2 Construction Noise

The Construction Contractor will observe their obligations under the *Environmental Protection Act* (1986), the *Environmental Protection Noise Regulations* (1997) and section 6 of AS 2436 – 1981: Guide to Noise Control on Construction, Maintenance and Demolition Sites.

Action: Main Roads Construction Manager / Construction Contractor

For construction work between 7:00 am and 7:00 pm (excluding Sunday and public holidays), the construction contractor will minimise the effects of noise on the occupants of adjacent properties. This may include using silenced plant, operating plant as far away as practicable from occupied properties, or by limiting working hours on those construction activities which generate significant noise.

Action: Main Roads Construction Manager / Construction Contractor

At least seven days prior to after-hours construction work commencing, the Construction Contractor will submit an approved Noise Management Plan to Main Roads Superintendent for approval. The Noise Management Plan will be approved by the Chief Executive Officer (CEO) of the Shire of Busselton and will include, but not be limited to, the following requirements:

- » Details of and reasons for construction work which is outside the normal daytime operating hours;
- » Details of activities likely to result in noise emissions above the assigned noise levels;
- » Predictions of construction noise levels;
- » Details of noise control measures to be implemented;
- » Procedures for on-site monitoring;
- » Plans for notifying the occupiers of adjacent properties; and
- » Plans for complaint response.

Action: Main Roads Construction Manager / Construction Contractor

3.4.3 Vibration

The Construction Contractor will take all necessary precautions during its operations to limit ground particle velocities from vibratory compaction or percussion equipment so that they do not become a public nuisance or result in property damage.



Action: Main Roads Construction Manager / Construction Contractor

Prior to the start of any operation that may cause vibration or result in damage, the Construction Contractor will conduct property inspections to establish their pre-works condition.

Action: Main Roads Construction Manager / Construction Contractor

The Construction Contractor is liable for any vibration damage caused to buildings and property adjacent to the works, and will take all necessary precautions to prevent such damage. If damage is caused due to the Construction Contractor's operations, they are responsible to take all necessary action to rectify the damage.

Action: Main Roads Construction Manager / Construction Contractor

3.4.4 Dust

There is likely to be some dust lift generated during the construction work 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 road sections in the project area, these will be swept to reduce the potential for dust generation and maintain traffic safety.

Action: Main Roads Construction Manager / Construction Contractor

3.4.5 Traffic Access and Safety

To ensure the safe access of traffic through the construction site 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* (2002). The TMP should be submitted to the Construction Manager for approval within twenty-eight days of Award of Contract or within ten days of Possession of Site being granted or prior to the commencement of works, whichever is earlier.

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* (2002).

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.

3.4.6 Fire Management

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



Machines and vehicles will be restricted to designated cleared areas and no burning of site rubbish or waste materials is not allowed on site.

Action: Main Roads Construction Manager / Construction Contractor

The Construction Contractor will conform to any specific requirements for fire prevention requested by the Shire of Busselton, DEC and/or the Fire and Emergency Services Authority (FESA) of Western Australia.

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 will have exhaust systems in good working order;
- » All machinery will be shut down during periods of extreme fire hazard as advised by DEC or the Shire of Busselton; and
- » All machinery will be fitted with fire extinguishers.

Action: Main Roads Construction Manager / Construction Contractor

3.4.7 Fuel and Chemical Storage

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

Action: Main Roads Construction Manager / Construction Contractor

No major vehicle and plant servicing will be conducted within the project area.

Action: Main Roads Construction Manager / Construction Contractor

3.4.8 Rubbish Disposal

All domestic rubbish and other waste associated with the upgrade works shall be disposed of at an authorised waste disposal site, or a site agreed with the Shire of Busselton.

Action: Main Roads Construction Manager / Construction Contractor

3.5 Environmental Compliance and Monitoring

Main Roads is responsible for the proposed project in line with the environmental management measures detailed in this EIA and EMP. Environmental management measures detailed in this EIA and EMP will be included in the technical specifications 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

The preparation and implementation of the Rehabilitation and Revegetation (Landscape Plan) for the project is the responsibility of the Main Roads Project Manager and the Main Roads Regional Manager.



Details on the progress of these activities will be provided to the relevant authorities and Main Roads Environment Manager on request.

Action: Main Roads Regional Manager / Main Roads Project Manager

Monitoring the success of the Revegetated areas will be conducted for a minimum period of three years from the time of implementation. Additional work and/or remedial action will be taken to ensure its success.

Action: Main Roads Regional Manager / Main Roads Project Manager



4. Consultation

The DEC and DoW were contacted to complete a number of database searches within the study area during the preparation of this EIA and EMP. The results of these are noted within this EIA report. The DEC's Native Vegetation and Wetlands Branch in Bunbury was also contacted to discuss the projects assessment against the Environmental Protection Act's 10 Clearing Principles. The agencies contacted and the information provided / discussed included the following:

- » DEC-Declared Rare and Priority Flora database search;
- » DEC-WA Herbarium Specimens database search;
- » DEC-Threatened and Priority Fauna database search;
- » DEC-TECs database search;
- » DEC Native Vegetation and Wetlands Branch, Bunbury - Ms Kym Lewis was contacted by telephone on 11 January, 2006. She agreed that the native vegetation present in the project area is not considered as representing a functioning native vegetation community. Also that determining the percentage of the vegetation complex remaining does not apply and the proposed clearing within the road reserve can be sought through Main Roads Statewide project 'Clearing Permit' (CPS 818/3). Ms Lewis noted that a similar project by the Shire of Busselton also contained WRP's and was managed according to a project specific WRP Management Plan developed in consultation with the DEC.
- » DoW-Contaminated sites LEGACI database search; and
- » Shire of Busselton – Mr Aaron Bell (Senior Planner) advised there are no heritage listed sites within the project area on the Municipal Heritage Inventory.



5. Environmental Approvals

5.1 Commonwealth Government

The “Pre-development Survey” for Western Ringtail Possum (WRP) estimated a population of seven (7) within the study area. The WRP is listed as “Vulnerable” under the EPBC Act. As such determination as to whether the Department of Environment and Water Resources (DEWR) assessment is required for the proposed project should be sought. To support a DEWR referral and minimize any delays in the process, it is recommended that prior clearance be obtained from DEC (i.e. develop a WRP management plan in consultation with, and approved by, the DEC).

5.2 Government of Western Australia

5.2.1 Department of Environmental Protection

The WRP is listed under the *Wildlife Conservation Act 1950* as a Schedule 1 species. Based on the projects assessment against the ten clearing Principles, referral to the EPA is also warranted as the proposed clearing is at variance to Principle (b), that is: *Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.*

Submissions should be invited from parties that may have an interest in the proposed clearing and where possible, incorporated into the Possum Management Plan developed for the project.

5.2.2 Department of Environment and Conservation

The WRP is listed under the *Wildlife Conservation Act 1950* as a Schedule 1 species. Based on the findings of this EIA and the “Pre-development Survey” for WRP’s, the development of a WRP management plan should discussed with the local DEC’s Busselton Work Centre, Nature Conservation Officer (Ms Caitlin Prowse) and approved by the DEC to support the DEWR and EPA referral submissions.



6. References

- Australian Standard (1981). Guide to Noise Control on Construction, Maintenance and Demolition Sites, Standards Australia, NSW, AS 2436.
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Appendix A
Environmental Aspects Table



Environmental Aspect	Potential Impact	Management Measure	Phase
Air quality	No identified impacts.	N/A	N/A
Dust	Minor temporary dust lift generated during the construction work may fall on adjacent vegetation and properties.	Construction Contractor to employ construction methods to reduce dust generation such as by watering of the works area and of roads, streets and other areas immediately adjacent to the works.	Construction
Fauna	The field survey confirmed the presence of the specially protected WRP (<i>Pseudocheirus occidentalis</i>) in and adjacent to the project areas to be cleared.	Develop a WRP Management Plan in liaison with the DEC. Minimise clearing and rehabilitate cleared/disturbed areas. Revegetate areas adjacent to the project with native species suitable for WRP habitat.	Pre-Construction Construction Post-Construction
Vegetation - Threatened Species and Threatened Ecological Communities (TECs)	No threatened flora or TEC's identified to occur in the project area. The vegetation in the project area is not considered a functioning floral community and has been significantly degraded over time.	N/A	N/A
Vegetation - Clearing	Clearing of 0.6 ha of vegetation is required for implementation of the project.	Seek approval for clearing under Main Roads Statewide purpose clearing permit (CPS 818/2). Minimise and manage clearing.	Design Construction



Environmental Aspect	Potential Impact	Management Measure	Phase
Vegetation – Dieback and other disease and pathogens	Reduction in biodiversity in revegetated areas / flora condition may be reduced.	Select revegetation species not susceptible to <i>P. cinnamomi</i> in area where revegetation is planned on imported soil that is not from a Dieback-free source.	Post-Construction
Vegetation - Weeds	Introduction and spread of existing weeds within and outside of the project area.	Treat Declared weeds.	Pre-Construction
		Inform site personnel of weed hygiene requirements.	
		Implement machine and vehicle hygiene measures. Manage topsoil movement.	Construction
European Heritage	No identified European Heritage sites within or adjacent to the project area.	N/A	N/A
Aboriginal Heritage	No impacts anticipated based on previous heritage surveys and DIA database search results over the project area. Section 18 not warranted by the DIA for this project.	N/A	N/A
Surface waters / drainage	The proposed work will not cause significant change to existing natural drainage and surface run-off patterns.	Design drainage to maintain existing surface water flows in the project area.	Design
Public Drinking Water Supplies	None are present in the project area.	N/A	N/A
Groundwater	Not in a groundwater protection area.	N/A	N/A



Environmental Aspect	Potential Impact	Management Measure	Phase
Wetlands	One "Multiple use" dampland is present at the southern end of the project area. The work proposed in this section will be confined to the existing road clearance area. Thus, no impact is anticipated.	Establish limits of clearing prior to commencing work. Spill kits should be available on-site to mop-up any accidental spills.	Construction
Noise and Vibration	No major sensitive receivers. Temporary noise will occur during construction. Vibration impacts to adjacent properties is unlikely given their distance from the proposed work and site conditions.	Construction Contractor to observe obligations under the EP Noise Regulations (1997) and conduct property inspections to establish their pre-works condition. Limit work to normal working hours.	Construction
Visual Amenity	Opportunity to enhance the existing visual viewshed.	Undertake revegetation with consideration of visual amenity.	Design and Construction
Public Safety and Risk	Provided traffic management and signage is employed according to current standards, the works will not present a significant risk hazard or risk to public safety.	Develop and apply a traffic management plan to current standards.	Design and Construction
Contaminated Sites	The relatively superficial works are within the road where no known previous land use activities have had the potential to create pollution.	N/A	N/A



Environmental Aspect	Potential Impact	Management Measure	Phase
Acid Sulphate Soil (ASS)	The proposed works are relatively superficial. However, two areas have been identified to with a “ <i>High risk of Actual Acid Sulfate Soil (AASS) and Potential Acid Sulphate Soil (PASS) < 3 m from the surface</i> ”.	Should excavation be required below the existing sub-base road material in the high risk area, and ASS investigation should be completed and management plan developed for the construction phase if necessary.	Design and Construction
Use of Hazardous Substances	N/A	N/A	N/A
Reserve Areas	No reserves will be impacted by the proposed work that will be confined to the existing road reserve.	N/A	N/A
Rehabilitation and Revegetation	Revegetate areas adjacent to the work to enhance visual amenity and increase potential fauna habitat suitable for the WRP.	Develop and Implement a Revegetation/Landscape Plan. Species used in revegetation will be locally occurring plant species. Monitor success of revegetation and take corrective action if necessary.	Design and Post-construction Post-construction
Topsoil Management	Strip topsoil as a component of road works.	Manage topsoil stripping and re-spreading.	Construction
Landuse	Potential impact on adjacent landuse during road works.	Manage works to minimise impact and maintain adjacent landuse.	Construction



Environmental Aspect	Potential Impact	Management Measure	Phase
Pre-Construction	Service relocations will be required throughout the road works.	Comply with environmental management measures during pre-construction activities and at any time a service provider is involved in works within the project area.	Design, Construction and Post-construction
Construction	Various impacts as a result of road works.	Manage impacts of road works according to the EMP.	Construction
Monitoring	Monitor compliance with management measures.	Main Roads will regularly monitor compliances with environmental management measures outlined in the EMP. Monitoring of the Revegetated areas will be conducted for a minimum period of 3 years from the time of implementation.	Construction Post Construction



Appendix B

Environmental Management Responsibilities and Actions Table (EMP)



Management Measure	Expected Outcome	Responsibility
1.0 Overall Project		
Project Environmental Management		
1.1 Main Roads South West Region is responsible for the construction of the Monaghan's Roundabout Project and associated highway upgrades in line with the environmental management measures detailed in this EIA and EMP.	Implement the construction of the project as detailed in this EIA and EMP.	Main Roads Project Manager
1.2 Environmental management measures detailed in this EIA and EMP will be included in the technical specifications prepared for the project.	Document in contract documentation / specification environmental management measures.	Main Roads Project Manager
2.0 Pre-construction \ Design Phase		
Approvals		
2.1 If the project is not formally assessed by the EPA, Main Roads should seek to have the project clearing approved under Main Roads Statewide project 'Clearing Permit' (CPS 818/1).	Obtain approval to clear native vegetation clearing.	Main Roads Project Manager
Land Acquisition and Fencing		
2.2 Any land that is to be acquired from private property will be acquired under the provisions of the <i>WA Land Administration Act 1997</i> .	Land acquired from private property will be done so in accordance with the relevant Act.	Main Roads Land Acquisition Manager
2.3 Where land is acquired from private property existing fences will be replaced by Main Roads, with the type of fence to be determined in consultation with the individual landowners.	Replace existing fences.	Main Roads Project Manager



Management Measure	Expected Outcome	Responsibility
Revegetation and Rehabilitation		
2.4 Revegetation will include locally sourced seed and/or seedlings that are 'provenance true'. Revegetation will be completed as soon after road works as possible.	Rehabilitate and revegetate all cleared and adjacent areas associated with the project where possible. Increase habitat area suitable for native fauna.	Main Roads Project Manager
Fauna		
2.5 The project will be designed and implemented to minimise vegetation clearing and soil disturbance during construction. No pets, firearms or traps will be allowed on the construction site.	Minimise clearing impacts and disturbance on fauna and habitats within and adjacent to the project area.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor
Develop a WRP Management Plan in liaison with and approved by the DEC.	Gain specialist advice on the management procedures necessary to minimise impacts to WRP during construction phases..	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor
Revegetate areas adjacent to the project with native species suitable for WRP habitat.	Increase size of habitat area suitable for WRP in the area.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor
Visual Amenity		
2.6 Impacts on the current view shed will be minimised by adhering to clearing limits, rehabilitating and revegetating cleared areas to that which is practicable for the safe construction and operation of the roads.	Enhanced view shed. Increased local flora diversity and abundance in existing degraded areas. Provide visual amenity congruent with the local environment.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor



Management Measure	Expected Outcome	Responsibility
Service Relocations		
2.7 Environmental management measures detailed in this EIA and EMP that are applicable for the works relating to any service relocations will be complied with by the relevant service providers.	Implement environmental management measures during service relocations.	Main Roads Project Manager / Service Authorities
3.0 Construction Phase		
Vegetation Clearing		
3.1 On-ground works will be implemented to minimise / avoid clearing of mature trees within the project area. Trees of particular significance that are to be conserved will be clearly marked prior to the commencement of clearing.	Maximise retention of any significant trees.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor
3.2 During road works, damage to existing native vegetation will be avoided as far as practicable. Clearing should be restricted to 1 m from the edge of works.	Ensure clearing is kept to the minimum necessary for the safe and efficient construction and operation of the road.	Main Roads Construction Manager / Construction Contractor
3.3 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 limits are correctly defined.	Ensure clearing is kept within defined areas necessary for the safe and efficient construction and operation of the road.	Main Roads Construction Manager / Construction Contractor
3.4 Trees to be removed will be felled in a manner that ensures they fall within the approved clearing area and cleared vegetation will be recycled in revegetation areas.	Minimise clearing impact. Recycling of cleared vegetation for revegetation purposes.	Main Roads Construction Manager / Construction Contractor
3.5 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 or undisturbed native vegetation.	Minimise impacts to native vegetation during works.	Main Roads Construction Manager / Construction Contractor



Management Measure	Expected Outcome	Responsibility
<p>3.6 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:</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.	Minimise clearing impact.	Main Roads Construction Manager / Construction Contractor
<p>3.7 Where cleared timber or vegetation not suitable for recycling in revegetation areas shall be will be disposed of off-site at a Shire approved landfill site. No burning of cleared vegetation will be permitted within the project area.</p>	Minimise clearing impact.	Main Roads Construction Manager / Construction Contractor



Management Measure	Expected Outcome	Responsibility
Weed Management		
3.8 The implementation of the following vehicle and machinery hygiene measures during road works will ensure that no additional weed species are transported to, or from, the project area: <ul style="list-style-type: none">» Main Roads should also advise its Term Network Contractor on the presence of these weeds to ensure they are eradicated in line with Main Roads responsibilities under the <i>Agriculture and Related Resources Protection Act 1976</i>.» Any Declared plants identified in the project area should be treated 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 prior to construction in accordance with methods recommended by the Department of Agriculture and Food.» Inductions of the workforce should raise awareness about the issue of spreading weeds and requirements for weed hygiene in the work area.» All road construction plant and machinery should be cleaned free of all soil and vegetative material:<ul style="list-style-type: none">– prior to arrival within the project area; and– prior to departing the project area.» Clean down may comprise of the use of a brush and/or compressed air to remove clods of soil, vegetative matter and/or soil water slurry. A metal bar or spade may be used to remove compacted soil if necessary.	Minimise the introduction and spread of weeds.	Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor



Management Measure	Expected Outcome	Responsibility
Dieback Management		
<p>3.9 The following precautions should be undertaken during construction to minimise the introduction and spread of dieback:</p> <ul style="list-style-type: none"> » Machinery and vehicles will be clean of soil and vegetative material on entry each time they enter the project area; » No clean down points (hygiene boundaries) are required within the project area; » No new cut-off drains will be developed along the length of the project area; » Utilise existing drainage lines over the length of the project area; and <p>Topsoil will be stored and respread within the section that it was stripped from to minimise the potential to spread dieback and / or weeds.</p>	<p>Minimise the introduction and spread of dieback.</p>	<p>Main Roads Project Manager / Main Roads Project Designer / Main Roads Construction Manager / Construction Contractor / DEC</p>
Topsoil Management		
<p>3.10 After topsoil has been stripped, topsoil free of weeds will be reused and spread over the embankment section where it was stripped as soon as practical in the location it was removed from.</p> <p>In batters greater than 1.5 metres high topsoil will be reused or another method will be used to stabilise batters.</p>	<p>Manage topsoil during works to minimise the spread of weeds and dieback.</p>	<p>Main Roads Construction Manager / Construction Contractor</p>
Aboriginal Heritage		
<p>3.11 If material likely to be of interest to the Aboriginal community is uncovered during construction works then works should immediately cease within 50 m of the material and the DIA advised immediately. If skeletal material is uncovered during works then the WA Police Service should also be advised immediately.</p>	<p>Ensure any Aboriginal heritage materials identified during works are managed appropriately.</p>	<p>Main Roads Project Manager / Main Roads Construction Manager / Construction Contractor</p>



Management Measure	Expected Outcome	Responsibility
Landuse		
3.12 Impacts on existing landuses will be kept to a practicable minimum during road works.	Minimise impacts of works on adjacent private property owners.	Main Roads Construction Manager / Construction Contractor
Environmental Management and Quality Plan		
3.13 The Construction Contractor will prepare a Quality Plan for the project, which will address the Construction Contractor's management responsibility, authority and communication requirements and clearly detail the Contractor's 'Quality Management Representative (QMR)' role with respect to the Contract in accordance with AS/NZS ISO 9001.	Ensure adequate environmental management during construction works.	Construction Contractor
3.14 The Quality Plan will be submitted to Main Roads Superintendent for approval within twenty-eight days of award of the Contract or ten days of Possession of Site being granted whichever is the earlier.	Ensure adequate environmental management during construction works.	Construction Contractor
Damage to Public Property, Noise and Vibration		
3.15 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 of road works on property and the public.	Main Roads Construction Manager / Construction Contractor
3.16 The Construction Contractor will write to the owners/occupants of properties within 200 m of the limits of the work site, informing them of the nature and timing of the works and providing contact details for complaints. Main Roads Superintendent will approve a copy of the letter, mailing list and delivery dates prior to the commencement of road works.	Minimise impacts of road works on property and the public.	Main Roads Construction Manager / Construction Contractor



Management Measure	Expected Outcome	Responsibility
3.17 The Construction Contractor will also provide occupants of adjacent properties with at least 24 hours warning when construction work is planned outside the hours of 7:00 am and 7:00 pm or on Sundays or public holidays.	Minimise impacts of road works on property and the public.	Main Roads Construction Manager / Construction Contractor
3.18 The Construction Contractor will detail in the Quality Plan, procedures for dealing with complaints regarding public nuisance or property damage. These procedures must ensure that the Superintendent is informed in a timely manner of any such complaint, the progress made in dealing with it, and of the reinstatement or repairs to damage carried out.	Minimise impacts of road works on property and the public.	Main Roads Construction Manager / Construction Contractor
Construction Noise and Vibration		
3.19 The Construction Contractor will observe its obligations under the <i>Environmental Protection Act 1986</i> , the <i>Environmental Protection (Noise) Regulations 1997</i> and section 6 of AS 2436 – 1981: Guide to Noise Control on Construction, Maintenance and Demolition Sites.	Minimise and manage construction noise.	Main Roads Construction Manager / Construction Contractor
3.20 For construction work between 7:00 am and 7:00 pm (excluding Sunday and public holidays), the construction contractor will minimise the effects of noise on the occupants of adjacent properties. This may include using silenced plant, operating plant as far away as practicable from occupied properties, or by limiting working hours on those construction activities which generate significant noise.	Minimise and manage construction noise.	Main Roads Construction Manager / Construction Contractor



Management Measure	Expected Outcome	Responsibility
<p>3.21 At least seven days prior to any after-hours construction work commencing, the Construction Contractor will submit an approved Noise Management Plan to Main Roads Superintendent for approval. The Noise Management Plan will be approved by the Chief Executive Officer of the Shire of Donnybrook-Balingup and will include, but not be limited to, the following requirements:</p> <ul style="list-style-type: none">» Details of, and reasons for, construction work which is outside the normal daytime operating hours» Details of activities likely to result in noise emissions above the assigned noise levels» Predictions of construction noise levels» Details of noise control measures to be implemented» Procedures for on-site monitoring» Plans for notifying the occupiers of adjacent properties, and» Plans for complaint response.	Minimise and manage construction noise.	Main Roads Construction Manager / Construction Contractor
Vibration		
<p>3.22 The Construction Contractor will take all necessary precautions during its operations to limit ground particle velocities from vibratory compaction or percussion equipment so that they do not become a public nuisance or result in property damage.</p>	Minimise and manage vibration impacts.	Main Roads Construction Manager / Construction Contractor
<p>3.23 The use of vibrating rollers in vibratory mode will not be permitted within the nominated distances of any building as detailed below:</p> <ul style="list-style-type: none">» All residential buildings – 50 m» Old / historic buildings, or where residents show concern – 100 m	Minimise and manage vibration impacts.	Main Roads Construction Manager / Construction Contractor



	Management Measure	Expected Outcome	Responsibility
3.24	Prior to the start of any operation that may cause vibration or result in damage, the Construction Contractor will conduct property inspections to establish their pre-works condition.	Minimise and manage vibration impacts.	Main Roads Construction Manager / Construction Contractor
3.25	The Construction Contractor is liable for any vibration damage caused to buildings and property adjacent to the works, and will take all necessary precautions to prevent such damage. If damage is caused due to the Construction Contractor's operations, they are responsible to take all necessary action to rectify the damage.	Rectify vibration impacts caused by construction activities.	Main Roads Construction Manager / Construction Contractor
Dust			
3.26	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 and safety on the public.	Main Roads Construction Manager / Construction Contractor
3.27	Where it is found that vehicles leaving the site have dropped excessive soil material onto the road these sections will be swept on an as needs basis to reduce the potential for dust generation and maintain traffic safety.	Minimise dust lift and impacts of dust and safety on the public.	Main Roads Construction Manager / Construction Contractor
Traffic Access and Safety			
3.28	To maintain safe thoroughfare of local traffic during all bridge and road works, the Construction Contractor will develop and implement a Traffic Management Plan congruent with Australian Standard Manual 1742.3 of Uniform Traffic Control Devices: Part 3 Traffic Control Devices for Works On-Road (Standards Australia, 2002).	Maintain safe thoroughfare of local traffic in the project area.	Main Roads Construction Manager / Construction Contractor
3.29	The Traffic Management Plan will conform to the Main Roads Traffic Management Requirements for Works on Roads. The TMP will be submitted to Main Roads for approval within twenty-eight days of Award of Contract, ten days within Possession of Site being granted or prior to the commencement of works, whichever is the earlier.	Maintain safe access for through traffic and local traffic movements.	Main Roads Construction Manager / Construction Contractor



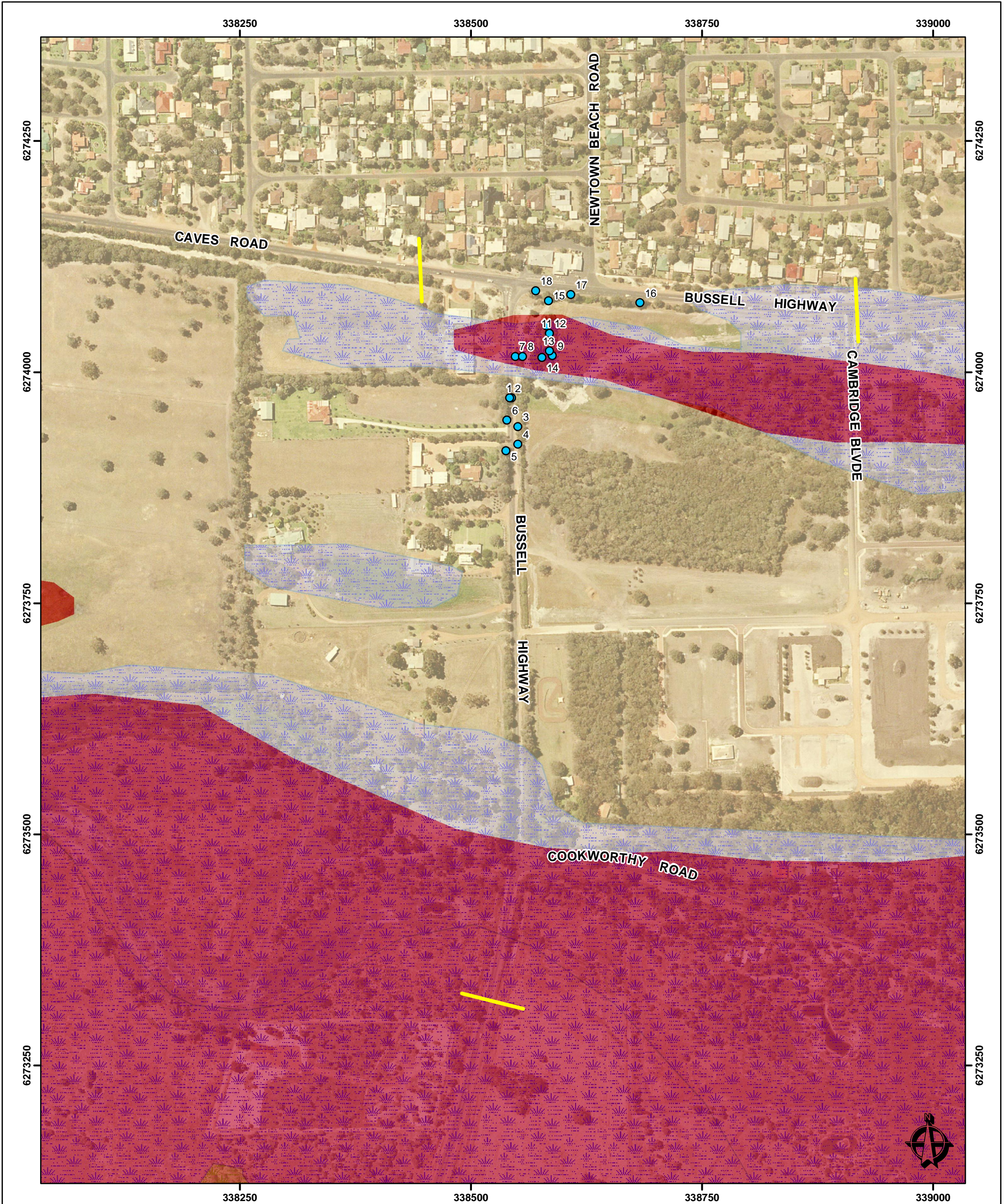
Management Measure	Expected Outcome	Responsibility
3.30 The Construction Contractor must submit with the Plan a Certificate of Compliance certifying that the Traffic Management Plan has been prepared and/or reviewed by an appropriately qualified person as defined in the Main Roads publication Traffic Management Requirements for Works on Roads (2002).	Maintain safe access for through traffic and local traffic movements.	Main Roads Construction Manager / Construction Contractor
3.31 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
Fire Management		
3.32 No burning will be permitted within the project area.	Reduce the fire risk as a result of construction works.	Main Roads Construction Manager / Construction Contractor
3.33 Machines and vehicles will be restricted to designated cleared areas.	Reduce the fire risk as a result of construction works.	Main Roads Construction Manager / Construction Contractor
3.34 The Construction Contractor will confirm with any specific requirements for fire prevention requested by the Shire of Donnybrook-Balingup, Department of Environment and Conservation and/or the Fire and Emergency Services Authority.	Comply with local fire management requirements.	Main Roads Construction Manager / Construction Contractor
Fuel and Chemical Storage		
3.35 No on-site storage of fuel, oils and other contaminant materials will be permitted during bridge and road construction. Chemicals required for the clean up of any accidental spillages will be maintained on-site.	Avoid hazardous chemical storage on the project site and maintain chemicals required for the clean up of any accidental spillages.	Main Roads Construction Manager / Construction Contractor
3.36 Major vehicle and plant servicing will not be conducted on the project site.	Avoid the occurrence of oil spillage from vehicle servicing on-site.	Main Roads Construction Manager / Construction Contractor



Management Measure	Expected Outcome	Responsibility
Rubbish Disposal		
3.37 Domestic site rubbish will not be disposed of by burning. All domestic rubbish, campsite effluent and other rubbish will be disposed of at an authorised waste disposal site, or a site agreed with the Shire of Busselton.	Ensure that rubbish is disposed of appropriately.	Main Roads Construction Manager / Construction Contractor.
Monitoring		
3.38 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.	Monitor compliance with environmental management measures.	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.	On-going weed management within the project area.	Main Roads Term Network Contractor
Monitoring		
4.2 The preparation and implementation of the Revegetation / Landscape Plan for the project is the responsibility of the Project Manager and the Main Roads Regional Manager. Details on the progress of the landscaping works will be provided to the EPA and Main Roads Manager Environment on request.	Monitor and report on the success of the revegetation works according to the Rehabilitation and Landscaping Plan.	Main Roads Regional Manager / Main Roads Project Manager
4.3 Monitoring the success of the revegetated areas will be conducted for a minimum period of three years from the time of implementation. Additional works and/or remedial action will be taken to ensure the success of the landscaping works.	Monitor and improve, if necessary, the success of the Rehabilitation and Landscape Plan.	Main Roads Regional Manager / Main Roads Project Manager



Appendix C
Environmental Constraints



LEGEND

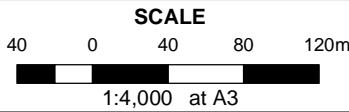
- Drey Locations
- Limit of Study Area

Acid Sulfate Soils Risk (ASS)

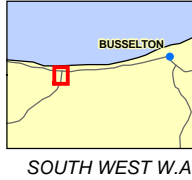
- Class 1 - High risk of ASS <3 m from soil surface
- Class 2 - Moderate to low risk of ASS occurring <3 m from soil
- Class 3 - Low to no risk of ASS occurring at depths of <3m

Geomorphic Wetlands (DEC)

- Multiple Use



LOCALITY MAP



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HORIZONTAL DATUM: GDA 94		PROJECTION: MGA ZONE 50
HEIGHT DATUM: NA		METADATA RECORDED: 100%
DATE 18.12.2006	FILE LOCATION N:\6118225\GIS\MXD\S6118225-G5.mxd	
REVISION 0	DRAWING NO 6118225-G5	



**Bussell Highway
(Monaghan's Roundabout Project)**

Figure 2 : Constraints Map

MAP UNITS PROJECTED IN MGA ZONE 50, NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
AERIAL PHOTOGRAPHY SOURCED FROM DLI - 2004 BUSSELTON MOSAIC REPRODUCED
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Appendix D
Western Ringtail Possum Survey

**Pre-development survey for the Western Ringtail
Possum *Pseudocheirus occidentalis* within the area of
the proposed Monaghan's Corner upgrade, corner of
Bussell Highway and Caves Road, Busselton, Western
Australia.**

Prepared for:

**GHD Consultants
10 Victoria Street
BUNBURY WA 6230**

Prepared by:

**Sue Elscot
GREEN IGUANA
PO Box 601
DUNSBOROUGH WA 6281
T/F: (08) 9755 2916
M: 041 935 4484
E: green_iguana@bigpond.com**

January 2007

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1 Introduction

1.1 Background

Main Roads Western Australia (MRWA) is planning to upgrade the corner of Bussell Highway and Caves Road, Busselton, which is locally known as 'Monoghan's Corner', to accommodate a new roundabout. The site lies within an area known to contain populations of the specially protected Western Ringtail Possum (WRP) (*Pseudocheirus occidentalis*), and the site contains Western Australian Peppermint trees (*Agonis flexuosa*), which are potential habitat for the WRP. As a result, in September 2006, GHD Consultants commissioned Green Iguana to undertake a survey for the WRP within the site. The survey aim was to provide detailed information on the distribution and abundance of the WRP within the site, to enable the species to be managed as required by the relevant State and Federal legislation. This report presents the results of the survey, carried out during December 3rd and 4th, 2006.

1.2 Western Ringtail Possum – Legislative Framework

The WRP is listed as a Schedule 1 species ('Fauna that is rare or likely to become extinct') under the Western Australian *Wildlife Conservation Act* (1950), and is a trigger species under the Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999) ('the EPBC Act'), where it is listed as 'Vulnerable'.

The EPBC Act provides protection for matters of National Environmental Significance (NES), and as a listed nationally threatened species, the WRP is defined as a matter of NES. Under the EPBC Act, any action that is likely to have a significant impact on a matter of NES requires assessment and approval by the Commonwealth Minister for the Environment. Guidelines for determining whether an action is likely to have a significant impact on a listed 'Vulnerable' species are provided in the '*EPBC Administrative Guidelines on Significance, July 2000*' (available online at the Federal Department of Environment and Heritage's (DEH) website at: <http://www.deh.gov.au/epbc/assessmentsapprovals/guidelines/administrative/index.html>).

Under these guidelines:

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

- *lead to a long-term decrease in the size of an important population of a species, or*
- *reduce the area of occupancy of an important population, or*
- *fragment an existing important population into two or more populations, or*
- *adversely affect habitat critical to the survival of a species, or*
- *disrupt the breeding cycle of an important population, or*
- *modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or*
- *result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat, or*
- *interferes substantially with the recovery of the species.*

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

- *key source populations either for breeding or dispersal,*
- *populations that are necessary for maintaining genetic diversity, and/or*
- *populations that are near the limit of the species range" (ibid).*

Under the EPBC Act, it is the responsibility of the proponent to refer any proposal that may have a significant impact on a matter of NES to the Commonwealth Department of Environment and Heritage (DEH) for determination of the level of assessment required, although other agencies may also refer a proposal to DEH.

Under the Western Australian *Wildlife Conservation Act* (1950) all native fauna that is declared as Specially Protected is wholly protected throughout the State at all times, except to the extent that the Minister declares otherwise by notice in the Government Gazette. Section 15 of the Act allows for the Minister to 'issue such licences as are prescribed', while Section 15(3a) of the Act allows the Minister to delegate any of the powers conferred upon them (with the exception of delegation) to the Executive Director of CALM or to any Wildlife Officer. Under Section 16 of the Act, the taking (killing or removal) of protected fauna is an offence under the Act, unless consent has been obtained under Section 15 of the Act.

1.3 Western Ringtail Possum - Biology

The WRP is a small, arboreal browsing mammal. WRPs are closely associated with the Peppermint tree (*Agonis flexuosa*) that occurs as the dominant overstorey species in woodland and also as a co-dominant in mixed woodland of Tuart (*Eucalyptus gomphocephala*), Jarrah (*E. marginata*), Marri (*Corymbia calophylla*) and *Banksia* spp. in the Busselton area. The WRP also lives within the suburbs of Busselton and travels via fences to individual Peppermint trees. WRPs are nocturnal and usually shelter by day in dreys (bird-like nests) or in tree hollows in the Busselton area. Dreys are typically located in the crown of Peppermint trees, but may be constructed in other species, such as *Melaleuca* and *Banksia* trees. WRPs are territorial and have defined, overlapping home ranges of 0.2 - 1.5 ha that extend to about 60m from the nearest drey or rest tree. There may be a number of dreys or rest sites within one home range. The leaves of Peppermint trees are the primary food source of the species, but individuals in residential areas may feed on garden plants, fruit and vegetables in compost heaps. Jones *et al.* (1994 a & b) present detailed information on aspects of the biology of the WRP.

2 Site Description

The study area encompasses the area proposed for the upgrade of Monoghan's corner which is shown bordered and hashed in yellow in figure twelve. The entire proposed project falls within the existing MRWA road reserve. The study area extends approximately 225 m along the Bussell Highway east of Monoghan's corner, and approximately 200m along Bussell Highway south of Monoghan's corner, and includes a triangle shaped area of mostly cleared paddock to the southeast of the current intersection. For the purposes of describing locations within the report, the remnant vegetation within the site was divided into five different areas, each of which is described separately below.

The vegetation along the Bussell Highway east of Monoghan's corner is comprised of an isolated, narrow (one tree width) corridor of large, mature Peppermint trees along the verge on the southern side of the road (northern part of the study area), with

varying condition understorey. There are several stands of good condition remnant Coastal Sword Sedge (*Lepidosperma gladiatum*) surrounding some of the Peppermint trees. Other locally-occurring native understorey shrubs present in this corridor include Cutleaf Hibbertia (*Hibbertia cuniefornis*), Spiked-beard Heath (*Leucopogon parviflorus*), *Acacia saligna*, Rigid Wattle (*A.cochlearis*), and Native Wisteria (*Hardenbergia comptoniana*). There are also several introduced Japanese Pepper trees and areas where the understorey is dominated by exotic weeds. This corridor has no direct canopy connectivity to other remnant vegetation within the study area. Figures one and two depict remnant vegetation within this part of the study area.

To the southeast of the current intersection, within the triangle-shaped area of paddock, there is one stand of highly disturbed, regenerated remnant vegetation. The stand is a dense thicket of Shark-toothed Wattle (*A. littorea*), with occasional Peppermint tree, *A.saligna* and an understorey dominated by weeds, predominantly Buffalo Grass, Dock, Grape Vines and one Pear tree. This stand of vegetation appears to be a regeneration cohort (i.e. trees all of the same age), possibly resulting from a past fire in this area. There are several isolated small Peppermint trees scattered around the thicket, which is also surrounded by regularly used vehicle tracks. Figures three, four and five depict the vegetation within this thicket.

To the south and south-east of the Shark-toothed Wattle thicket are a number of mature Peppermint trees with large open areas between the trees. The ground around these trees has been recently disturbed to install deep sewer pipes and the understorey in this area is comprised of large sandy patches and short, dry pasture grasses only. Figure six depicts the remnant vegetation within this area.

Remnant vegetation along the Bussell Highway south of Monoghan's corner is comprised of an overstorey of Peppermint trees with varying condition understorey. Along the western side of Bussell Highway south of Monoghan's corner, the vegetation comprises a single-tree width corridor of large, mature Peppermint trees with an understorey of dense Buffalo Grass with occasional *A.saligna* and Spiked-beard Heath in the northern section, or lawn along the southern section. Figure seven shows remnant vegetation along the western side of the Bussell Highway, south of Monoghan's corner.

Vegetation along the eastern side of Bussell Highway south of Monoghan's corner comprises a narrow corridor of small Peppermint trees which have dense canopies resulting from repeated pruning under the power lines. Much of the southern part of this corridor has an intact, good condition understorey of Coastal Sword Sedge with occasional *A.saligna* and Spiked-beard Heath, while the northern part has an understorey dominated by exotic weeds and crossed by several sandy vehicle tracks. Stout Paperbark (*Melaleuca raphiophylla*), Flooded Gum (*Eucalyptus rudis*) and dense Buffalo Grass are present in a low-lying area that occurs to the south of the triangle-shaped paddock (visible as a greener area on the figure 12). Figures eight to 11 depict remnant vegetation on the eastern side of Bussell Highway, south of Monoghan's corner.



Figure 1. Remnant vegetation along the Bussell Highway east of Monoghan's Corner (south side of the road, northern part of the study area).



Figure 2. Isolated Peppermint trees and weed understorey on the southeastern edge of Monoghan's Corner (north-west corner of the study area).



Figure 3. North-eastern corner of the Shark-toothed Wattle thicket (located within the paddock to the south-east of Monoghan's Corner) showing the invading Grape Vine.



Figure 4. Centre (west side) of the Shark-toothed Wattle thicket (located in the paddock to the south-east of Monoghan's Corner).



Figure 5. Southern end of the Shark-toothed Wattle thicket (located in the paddock to the south-east of Monoghan's Corner, showing weedy understorey and vehicle tracks.



Figure 6. Area of large Peppermint trees located to the south and south-east of the Shark-toothed Wattle thicket, showing disturbance from sewer pipe installation and vehicle tracks.



Figure 7. Remnant roadside vegetation along Bussell Highway south of Monoghan's Corner, western side of the road.



Figure 8. Remnant vegetation along the eastern side of Bussell Highway, south of Monoghan's Corner, showing dense canopy Peppermint trees resulting from pruning.



Figure 9. Remnant vegetation along the eastern side of Bussell Highway, south of Monoghan's Corner.



Figure 10. Dense canopy Peppermint trees resulting from pruning, on the eastern side of Bussell Highway, south of Monoghan's Corner.



Figure 11. Good condition Coastal Sword Sedge understorey on the eastern side of Bussell Highway, south of Monoghan's Corner.

All of the remnant vegetation within the study area occurs as discrete blocks without canopy connectivity between them, and the remainder of the study area is cleared paddock. WRPs would need to descend to the ground to travel between blocks of vegetation making them susceptible to predation by dogs, cats and foxes, and vulnerable to striking by cars should they attempt to cross the road. While there is currently a large area of Peppermint woodland which is suitable habitat for WRPs present on the lot adjoining the south-eastern side of the study area, this occurs on freehold land and the long-term status of the vegetation is uncertain. This vegetation currently provides an ecological link to the Broadwater Conservation Reserve system, located approximately 1km southeast of the study area however WRPs would need to descend to the ground to access this vegetation.

3 Survey Method

To identify whether WRPs are present within the site and to estimate the density at which they occur, the survey, undertaken by Sue Elscot and Floyd Irvine (Green Iguana – Dunsborough), had two components:

- 1) A daylight search to identify WRP dreys was focussed on the canopy of each Peppermint tree and all other potentially suitable tree and understorey plants within the site. The exact location of each drey within the site was recorded as a waypoint on the GPS and the tree or shrub species in which the drey occurred was also recorded. The ground around all trees within which dreys occurred was searched for WRP scat. The ground beneath any trees that appeared to have signs of browsing, including bare fine twigs and branches, and leaves with square ends, was also searched for scat. The daylight

search, undertaken on December 3rd, 2006, took a total of three hours to complete.

- 2) A night-time spotlighting survey was undertaken over two evenings to enable all of the vegetation within the site to be searched twice. The spotlighting survey was carried out on December 3rd and 4th, 2006, for two hours each evening. The canopy of each overstorey tree, particularly Peppermint trees, and each suitable understorey plant was thoroughly searched for possums using hand-held spotlights. The night-time surveys were undertaken in reasonable to good conditions, with a full moon and light winds on the first evening, and a full moon and fresh breeze the second evening. The night-time spotlighting survey took a total of six hours of field time to complete (three hours to cover the entire site each night).

4 Results and Discussion

4.1 Daytime search for Western Ringtail Possum dreys and scat

During the daytime search, carried out on December 3rd, 2006, a total of 20 WRP dreys were located across the study area. Of these, six dreys (30%) were located on the eastern side of Bussell Highway, south of Monoghan's corner; two dreys (10%) were found on the western side of Bussell Highway, south of Monoghan's corner; seven dreys (35%) were found within the Shark-toothed Wattle thicket in the paddock southeast of Monoghan's corner; and five dreys (25%) were found within the vegetation bordering the Bussell Highway east of Monoghan's corner (southern side of the road, northern part of the study area). Dreys were found within four different locally occurring native plant species: Peppermint trees (11 dreys, 55%), Shark-toothed Wattle (7 dreys, 35%), Stout Paperbark (1 drey, 10%), and Native Wisteria (1 drey, 1%). Nineteen of the dreys (90%) were found within trees or shrubs that had canopy connectivity to other Peppermint trees. Appendix one provides the locations details of all dreys found within the study area.

Jones *et al.* (1994a and b) provides the only published population study data for the WRP in the south-west of Western Australia, including eight sites within the Busselton area. At the 40 ha Locke Estate in Busselton (also known as 'the holy mile' area of church and community group campsites on the Siesta Park foreshore), which contains disturbed Peppermint woodland with areas where the native understorey is dense and intact, Jones *et al.* (1994a) recorded a ratio three dreys per WRP, based on the total number of occupied dreys to the total number checked. This suggests that the site's WRP population may be around six to seven individuals.

A recent study comparing survey methods for arboreal possums in Jarrah forest found that scat-detection rates for the WRP were strongly related to abundance derived by spotlighting when the surveys were carried out at the end of the summer drought period, when moisture-driven scat decay rates are lowest (Wayne *et al.*, 2005). Wayne *et al.* (2005) suggested that scat surveys may therefore be a useful alternative measure of relative abundance for the WRP. However, it was also noted that their use to compare data or calculate population estimates may be limited by variable defecation rates and scat decay rates which may also vary with habitat type.

No systematic scat surveys were carried out at this site however, WRP scat could readily be found on the ground beneath Peppermint trees where the understorey was open. It was not possible to find scat beneath trees where the understorey comprised dense Coastal Sword Sedge or Buffalo Grass.

4.2 Numbers of Western Ringtail Possums

Spotlighting surveys to locate WRPs were undertaken across the site on two separate evenings, December 3rd and 4th, 2006, for three hours each evening, to cover the entire site twice (i.e. one three hour night to cover the entire site once).

On the first evening's spotlighting, a total of seven WRPs were identified within the study area. Of these, one sighting was of an individual possum and three sightings were of pairs. All WRPs were found browsing Peppermint trees. One pair of WRPs was found at the western end of the narrow corridor of vegetation bordering the southern verge of Bussell Highway, east of Monoghan's Corner. One individual possum was found at the northern edge of the Shark-toothed Wattle thicket (located in the paddock to the south-east of Monoghan's Corner). One pair of WRPs were found within the area of open mature Peppermint trees to the south-east of the Shark-toothed Wattle thicket, and another pair were found within a dense thicket of Peppermint trees along the eastern side of Bussell Highway, south of Monoghan's Corner. No WRPs were seen on the western side of Bussell Highway south of Monoghan's corner. On the first evening, the WRPs could be heard frequently calling, and the majority of sightings were made after hearing the possums (either calling or moving through the canopy) first.

On the second evening, a total of four WRPs were identified within the study area. Of these, two sightings were of individual possums and one sighting was of a pair. All WRPs were found browsing the dense-canopied Peppermint trees on the eastern side of Bussell Highway, south of Monoghan's corner.

It is likely that the number of possums recorded on the second evening was less than the previous evening because the fresh breeze prevented possums from being heard moving through the tree canopies and, because of the density of the vegetation along the eastern side of Bussell Highway (from repeated pruning) and within the Shark-toothed Wattle thicket, it was difficult to spotlight to the centre of the tree canopies in these areas, so it is possible that more WRPs may have been present.

In a recent comparison of possum survey methods in Jarrah forest, Wayne *et al.* (2005) found that spotlighting with 50W or 100W spotlights detected significantly more WRPs than did trapping, and concluded that, in Jarrah forest, repeated spotlighting provides similar or better detection rates than extensive trapping but requires substantially less effort. Therefore, it is considered that the spotlighting-derived estimate of at least seven WRPs using the site is a reasonably accurate estimate of the site's WRP population size.

5 Summary and Recommendations

Main Roads Western Australia (MRWA) is planning to upgrade the corner of Bussell Highway and Caves Road, Busselton, which is locally known as 'Monoghan's Corner', to accommodate a new roundabout. The site lies within an area known to contain populations of the specially protected WRP (*Pseudocheirus occidentalis*), and the site contains Western Australian Peppermint trees (*Agonis flexuosa*), which are potential habitat for the WRP. As a result, in September 2006, GHD Consultants commissioned Green Iguana to undertake a survey for the WRP within the site. The survey aim was to provide detailed information on the distribution and abundance of the WRP within the site, to enable the species to be managed as required by the relevant State and Federal legislation during the upgrade of the intersection. The method agreed for the survey included a thorough daylight search of the site for

WRP dreys and two replicates of night-time spotlighting surveys to estimate the number of possums present within the site.

The site encompasses the area proposed for the upgrade of Monoghan's corner which is shown bordered and hashed in yellow in figure twelve. The study area extends approximately 225 m along the Bussell Highway east of Monoghan's corner, and approximately 200m along Bussell Highway south of Monoghan's corner, and includes a triangle shaped area of mostly cleared paddock to the southeast of the current intersection.

The vegetation along the Bussell Highway east of Monoghan's corner is comprised of an isolated, narrow (one tree width) corridor of large, mature Peppermint trees along the verge on the southern side of the road (northern part of the study area), with varying condition understorey. There are several stands of good condition remnant Coastal Sword Sedge with occasional native shrubs, and there are several introduced Japanese Pepper trees and areas dominated by exotic weeds.

To the southeast of the current intersection, within the triangle-shaped area of paddock, there is one stand of highly disturbed, regenerated remnant vegetation. The stand is a dense thicket of Shark-toothed Wattle (*A. littorea*), with occasional Peppermint tree, *A. saligna* and an understorey dominated by weeds. There are several isolated small Peppermint trees scattered around the thicket, which is also surrounded by regularly used vehicle tracks.

To the south and south-east of the Shark-toothed Wattle thicket are a number of mature Peppermint trees with large open areas between the trees. The ground around these trees has been recently disturbed to install deep sewer pipes and the understorey in this area is comprised of large sandy patches and short, dry pasture grasses only.

Remnant vegetation along the Bussell Highway to the south of Monoghan's corner is comprised of an overstorey of Peppermint trees with varying understorey condition. Along the western side of Bussell Highway south of Monoghan's corner, the vegetation comprises a single-tree width corridor of large, mature Peppermint trees with virtually no native understorey. Vegetation along the eastern side of Bussell Highway south of Monoghan's corner comprises a narrow corridor of small Peppermint trees which have dense canopies resulting from repeated pruning under the power lines. Much of the southern part of this corridor has an intact, good condition understorey of Coastal Sword Sedge with occasional native shrubs, while the northern part has an understorey dominated by exotic weeds and crossed by several sandy vehicle tracks.

All of the remnant vegetation within the study area occurs as discrete blocks without canopy connectivity between the stands, and the remainder of the study area is cleared paddock. WRPs would need to descend to the ground to travel between blocks of vegetation making them susceptible to predation by dogs, cats and foxes, and vulnerable to striking by cars should they attempt to cross the road. While there is currently a large area of Peppermint woodland which is suitable habitat for WRPs present on the lot adjoining the south-eastern side of the study area, this occurs on freehold land and the long-term status of the vegetation is uncertain. This vegetation currently provides an ecological link to the Broadwater Conservation Reserve system, located approximately 1km southeast of the study area however WRPs would need to descend to the ground to access this vegetation.

During the daytime search, carried out on December 3rd, 2006, a total of 20 WRP dreys were located across the study area. Of these, six dreys (30%) were located on the eastern side of Bussell Highway, south of Monoghan's corner; two dreys (10%) were found on the western side of Bussell Highway, south of Monoghan's corner; seven dreys (35%) were found within the Shark-toothed Wattle thicket in the paddock southeast of Monoghan's corner; and five dreys (25%) were found within the vegetation bordering the Bussell Highway east of Monoghan's corner (southern side of the road). Nineteen of the dreys (90%) were found within trees or shrubs that had canopy connectivity to other Peppermint trees. Appendix one provides the locations details of all dreys found within the study area.

Jones *et al.* (1994a and b) provides population study data for the WRP at the nearby 40 ha Locke Estate in Busselton (also known as 'the holy mile' area of church and community group campsites on the Siesta Park foreshore), which contains disturbed Peppermint woodland with areas where the native understorey is dense and intact. Jones *et al.* (1994a) recorded a ratio three dreys per WRP at the Locke Estate, based on the total number of occupied dreys to the total number checked. This suggests that the site's WRP population may be around six to seven individuals.

A recent study comparing survey methods for arboreal possums in Jarrah forest found that scat-detection rates for the WRP were strongly related to abundance derived by spotlighting when the surveys were carried out at the end of the summer drought period, when moisture-driven scat decay rates are lowest (Wayne *et al.*, 2005). Wayne *et al.* (2005) suggested that scat surveys may therefore be a useful alternative measure of relative abundance for the WRP. No systematic scat surveys were carried out at this site however, WRP scat could readily be found on the ground beneath Peppermint trees where the understorey was open.

Spotlighting surveys to locate WRPs were undertaken across the site on two separate evenings, December 3rd and 4th, 2006, for three hours each evening, to cover the entire site twice (i.e. one three hour night to cover the entire site once). On the first evening's spotlighting, a total of seven WRPs were identified within the study area, all browsing on Peppermint trees. Of these, one sighting was of an individual possum and three sightings were of pairs. One pair of WRPs was found at the western end of the narrow corridor of vegetation bordering the southern verge of Bussell Highway, east of Monoghan's Corner. One individual possum was found at the northern edge of the Shark-toothed Wattle thicket (located in the paddock to the south-east of Monoghan's Corner). One pair of WRPs were found within the area of open mature Peppermint trees to the south-east of the Shark-toothed Wattle thicket, and another pair were found within a dense thicket of Peppermint trees along the eastern side of Bussell Highway, south of Monoghan's Corner. On the second evening, a total of four WRPs were identified within the study area. Of these, two sightings were of individual possums and one sighting was of a pair. All WRPs were found browsing the dense-canopied Peppermint trees on the eastern side of Bussell Highway, south of Monoghan's corner. It is likely that the number of possums recorded on the second evening was less than the previous evening because the fresh breeze prevented possums from being heard moving through the tree canopies.

In a recent comparison of possum survey methods in Jarrah forest, Wayne *et al.* (2005) found that spotlighting with 50W or 100W spotlights detected significantly more WRPs than did trapping, and concluded that, in Jarrah forest, repeated spotlighting provides similar or better detection rates than extensive trapping but requires substantially less effort. Therefore, it is considered that the spotlighting-

derived estimate of at least seven WRPs using the site is a reasonably accurate estimate of the site's WRP population size.

To reduce impacts of the proposed project on the existing WRP population within the study area, a number of measures can be implemented:

- The new roundabout and associated roads should be located within existing cleared areas, as much as is possible, to minimise loss of native vegetation within the site.
- Areas of disturbance should be minimised through a process of workforce induction, and flagging limits of disturbance within existing remnants of vegetation.
- Further fragmentation of habitat can be reduced by removing the edges of a remnant in preference to clearing a path through the centre. While both approaches reduce the size of the remnant, the former approach maintains a single remnant of a size (relatively) similar to the original whereas the latter creates two much smaller, disconnected remnants. This is particularly applicable to the Shark-toothed Wattle thicket within the study area.
- Following completion of the upgrade works, all areas not required to maintain a line-of-sight for safety should be rehabilitated with appropriate local native species, particularly Peppermint trees (*Agonis flexuosa*). Commercially available understorey species which are appropriate for this site are:
 - Cutleaf Hibbertia (*Hibbertia cuneiformis*)
 - Basket Bush (*Spyridium globulosum*)
 - Shark-toothed Wattle (*Acacia littorea*)
 - *Acacia saligna*
 - Rigid Wattle (*Acacia cochlearis*)
 - Spiked-beard Heath (*Leucopogon parviflorus*)
 - Australian Bluebells (*Sollya heterophylla*)
 - Native Wisteria (*Hardenbergia comptoniana*)
- Coastal Sword Sedge is an important understorey component of the local Peppermint woodland vegetation community and provides a dense understorey which WRPs prefer. Coastal Sword Sedge is generally commercially unavailable so, where Coastal Sword Sedge needs to be removed, it should be carefully transplanted to another part of the site.

As a listed nationally threatened species, the WRP is defined as a matter of National Environmental Significance (NES) or a 'trigger species' under the Commonwealth EPBC Act. As the site is used by at least seven WRPs, MRWA should refer the proposal to the Commonwealth Department of Environment and Heritage (DEH) for a determination on whether assessment is required under the Act. Information on referring a proposal can be found on the DEH website at:

<http://www.deh.gov.au/epbc/publications/referral.html>

As WRPs are present within the site, any proposal to develop the site should also be referred to and assessed by the Department of Environment and Conservation (DEC), formerly the Department of Conservation and Land Management (CALM), as part of the approvals process.

6 References

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- Jones, B.A., How, R.A. and Kitchener, D.J. (1994b). A field study of *Pseudocheirus occidentalis* (Marsupialia: Petauridae). II. Population studies. *Wildlife Research* 21: 175-187.
- Wayne, A.F., Cowling, A., Ward, C.G., Rooney, J.F., Vellios, C.V., Lindenmayer, D.B. and Donnelly, C.F. (2005). A comparison of survey methods for arboreal possums in jarrah forest, Western Australia. *Wildlife Research* 32: 701-714.



Figure 12. Aerial photograph of Monoghan's corner showing the extent of remnant vegetation within and nearby the study area.

Appendix 1 Location of Western Ringtail Possum dreys within the area proposed for the upgrade of Monoghan’s Corner, corner of Bussell Highway and Caves Road, Busselton.

DREY	LOCATION (DATUM WGS84 UTM Zone 50)	COMMENTS
1	338544 E 6273972 N	One platform drey within a large Stout Paperbark <i>Melaleuca raphiophylla</i> , with an understorey of Peppermint trees, Buffalo Grass and Arum Lily. Drey tree has canopy connectivity to other Peppermint trees. Located on the eastern side of Bussell Highway, south of Monoghan’s corner.
2	338542 E 6273972 N	One platform drey within a Peppermint tree, with an understorey of <i>Acacia saligna</i> and Coastal Sword Sedge <i>Lepidosperma gladiatum</i> . Drey tree has canopy connectivity to other Peppermint trees. Located on the eastern side of Bussell Highway, south of Monoghan’s corner.
3	338551 E 6273941 N	One platform drey within a Peppermint tree, with an understorey of Coastal Sword Sedge. Drey tree has canopy connectivity to other Peppermint trees. Located on the eastern side of Bussell Highway, south of Monoghan’s corner.
4	338551 E 6273922 N	One platform drey in a small Peppermint tree, with an understorey of Coastal Sword Sedge. Drey tree has canopy connectivity to other Peppermint trees. Located on the eastern side of Bussell Highway, south of Monoghan’s corner.
5	338538 E 6273915 N	One basket drey in the upper canopy of a large Peppermint tree, lawn understorey. Drey tree has canopy connectivity to other Peppermint trees. Located on the western side of Bussell Highway, south of Monoghan’s corner, on the south side of the ice factory driveway.
6	338539 E 6273948 N	One basket drey within Native Wisteria <i>Hardenbergia comptoniana</i> , in a large Peppermint tree, weedy understorey. Drey tree has canopy connectivity to other Peppermint trees. Located on the western side of Bussell Highway, south of Monoghan’s corner.
7	338548 E 6274017 N	One basket drey within a Peppermint tree within a small thicket of Peppermint trees together with a large Japanese Pepper tree (introduced species). Drey tree has canopy connectivity to other Peppermint trees. Located on the eastern side of Bussell Highway, south of Monoghan’s corner.
8	338556 E 6274017 N	One platform drey within a Peppermint tree, on the other side of the Peppermint tree thicket where drey tree number seven occurs. Drey tree has canopy connectivity to other drey trees. Located on the eastern side of Bussell Highway, south of Monoghan’s corner.
9	338588 E 6274018 N	One platform drey within a Shark-toothed Wattle <i>Acacia littorea</i> with dense Buffalo Grass understorey. Drey tree has canopy connectivity to Peppermint trees. Located within the wattle thicket that lies in the paddock to the southeast of Monoghan’s corner.
10	338582 E 6274050 N	One WRP resting within a small platform drey in a Shark-toothed Wattle. Drey tree has canopy connectivity to Peppermint trees. Located within the wattle thicket that lies in the paddock to the southeast of Monoghan’s corner.

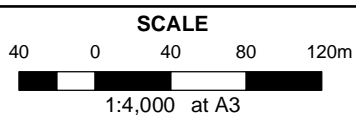
DREY	LOCATION (DATUM WGS84 UTM Zone 50)	COMMENTS
11 and 12	338585 E 6274042 N	Two dreys, one platform and one basket drey, within adjacent Shark-toothed Wattles in a dense thicket of Shark-toothed Wattle. Drey trees have canopy connectivity to Peppermint trees. Located within the wattle thicket that lies in the paddock to the southeast of Monoghan’s corner.
13	338585 E 6274023 N	Two basket dreys within within adjacent Shark-toothed Wattles in a dense thicket of Shark-toothed Wattle. Drey trees have canopy connectivity to Peppermint trees. Located within the wattle thicket that lies in the paddock to the southeast of Monoghan’s corner.
14	338577 E 6274016 N	One small platform drey within a Shark-toothed Wattle in a dense thicket of Shark-toothed Wattle. Drey trees have canopy connectivity to Peppermint trees. Located within the wattle thicket that lies in the paddock to the southeast of Monoghan’s corner.
15	338584 E 6274077 N	Two large platform dreys within adjacent large Peppermint trees, some Coastal Sword Sedge understorey. Drey trees have canopy connectivity to other Peppermint trees. Located within the vegetation that borders the Bussell Highway east of Monoghan’s corner (southern side of the road).
16	338683 E 6274075 N	One large basket drey within a large Peppermint tree, Coast Sword Sedge and Basket Bush (<i>Spyridium globulosum</i>) understorey. Drey tree has canopy connectivity to other Peppermint trees. Located within the vegetation that borders the Bussell Highway east of Monoghan’s corner (southern side of the road).
17	338608 E 6274084 N	One small platform drey within a large Peppermint tree with Coastal Sword Sedge understorey. Drey tree has canopy connectivity to other Peppermint trees. Located within the vegetation that borders the Bussell Highway east of Monoghan’s corner (southern side of the road).
18	338570 E 6274088 N	One platform drey within the upper canopy of an isolated Peppermint tree (no canopy connectivity to other trees) with Coastal Sword Sedge understorey. Located on the south-eastern side of Monoghan’s corner.
SUMMARY		Total of 20 WRP dreys located across the study area. Of these, six dreys (30%) were located on the eastern side of Bussell Highway, south of Monoghan’s corner; two dreys (10%) were found on the western side of Bussell Highway, south of Monoghan’s corner; seven dreys (35%) were found within the Shark-toothed Wattle thicket in the paddock southeast of Monoghan’s corner; and five dreys (25%) were found within the vegetation bordering the Bussell Highway east of Monoghan’s corner (southern side of the road). Dreys were found within four different locally occurring native plant species: Peppermint trees (11 dreys, 55%), Shark-toothed Wattle (7 dreys, 35%), Stout Paperbark (1 drey, 10%), and Native Wisteria (1 drey, 1%). Nineteen of the dreys (90%) were found within trees or shrubs that had canopy connectivity to other Peppermint trees.



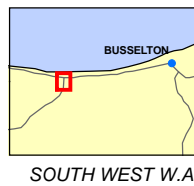
LEGEND

- Western Ringtail Possum (Drey Locations)

MAP UNITS PROJECTED IN MGA ZONE 50, NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
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LOCALITY MAP



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CREATED BY PN	CHECKED	APPROVED
HORIZONTAL DATUM: GDA 94		PROJECTION: MGA ZONE 50
HEIGHT DATUM: NA		METADATA RECORDED: 100%
DATE 04.01.2007	FILE LOCATION N:\61\18225\GIS\MXD\S6118225-G6.mxd	
REVISION 0	DRAWING NO 6118225-G6	

MAIN ROADS
Western Australia

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Bussell Highway
(Monaghan's Roundabout Project)

Appendix 1
Figure 13: Location of Dreys in the study area



Appendix E
DIA Aboriginal Sites Search



Search Criteria

1 sites in a search polygon. The polygon is formed by these points (in order):

MGA Zone 50	
Northing	Easting
6274310	337846
6274310	340100
6272820	340100
6272820	337846

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

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Legend

Restriction		Access		Status		Coordinate Accuracy	
N	No restriction	C	Closed	I	Interim register	Accuracy is shown as a code in brackets following the site coordinates.	
M	Male access only	O	Open	P	Permanent register	[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
F	Female access	V	Vulnerable	S	Stored data	[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.



Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
21551	I	O	N	Abbey Waters Isolated Find		[Other: Isolated find]	*Registered Informant names available from DIA.	339184mE 6273694mN Zone 50 [Unreliable]	



Legend

- Highlighted Area
- Town
- Map Area
- Search Area

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GHD Pty Ltd ABN 39 008 488 373

1st Floor 10 Victoria Street
Bunbury WA 6230

T: 08 9721 0700 F: 08 9721 0777 E: bunmail@ghd.com.au

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