ENVIRONMENTAL MANAGEMENT PLAN

Prepared on behalf of

Main Roads Western Australia
Great Southern Region

and

Department of Environment and Conservation
South Coast Region

for

Hamersley Drive Upgrade Section 3
(Hopetoun to Bremer Bay Road Stage 1A)

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1.0 BACKGROUND

1.1 Project Overview

Main Roads WA Great Southern Region has been requested by the Department of Premier and Cabinet to undertake significant improvement works to Hamersley Drive in the Fitzgerald River National Park. This proposal is to be undertaken in conjunction with the Department of Environment and Conservation. The work forms part of an economic boost for the Shire of Ravensthorpe after the closure of the BHP Billiton Ravensthorpe Nickel Mine. It is intended to provide improved access to the National Park for tourists and also to reduce the risk of spreading *Phytophthora* disease by sealing the road.

The proposal, known as Hamersley Drive Upgrade, forms Stage 1A of the Hopetoun to Bremer Bay road project (see Figure 1 below) and comprises of widening and sealing the existing unsealed road from Culham Inlet in the east to Hamersley Inlet in the west. This section of work has been broken down into three sections, with Section 3 (from west of Culham Inlet to the East Mount Barren car park) the subject of this Environmental Management Plan. Main Roads will use a “direct management” approach to deliver these works in close consultation with the Department of Environment and Conservation.

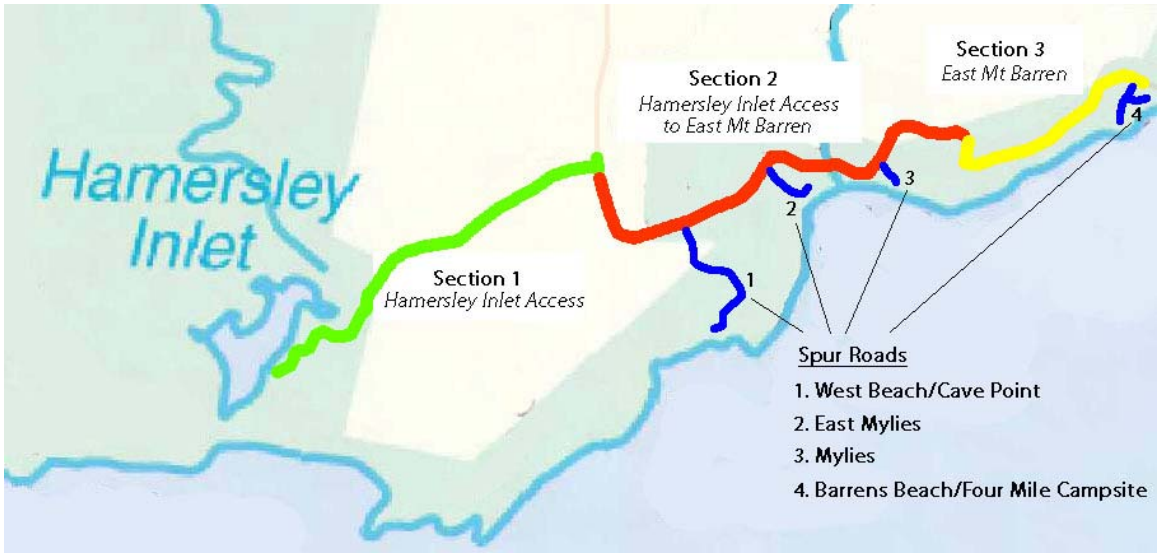

Figure 1 – Map showing Stage 1A, Section 3 of Hopetoun – Bremer Bay Road

This proposal is provided for under the *Conservation and Land Management Act* 1984 through the Fitzgerald River National Park Management Plan 1991-2001.

1.2 Scope of the Environmental Management Plan

This Environmental Management Plan has been developed to address the potential environmental impacts from construction activities relating to Section 3, Stage 1A of Hamersley Drive upgrade, from chainage 46400 to 49930. The extent of the supporting biological documentation within these chainages covers 25m on either side of the

existing road. It does not cover the Barrens Beach Lookout car park as this was outside the scope of the biological surveys.

This document aims to:

- Provide environmental management plans that minimise the environmental impact of the works and identify those responsible for it's implementation; and

- Define the monitoring program which assesses the implementation

in accordance with Main Roads corporate procedures, Environmental Management System (ISO 14001:2004) and referral documentation under the *Environment Protection and Biodiversity Conservation Act* 1999.

This Environmental Management Plan focuses specifically on the required environmental management measures to be undertaken during the construction and post-construction phases of the project. It forms part of the Main Roads Project Management Plan.

1.3 Existing Environment

1.3.1 Climate

The proposal is located within a region of warm to hot summers and cool, wet winters. The nearest weather station is Hopetoun North. Mean maximum temperature recorded at Hopetoun in the hottest month (February) is 26 degrees Celsius. Mean minimum temperature recorded in the coldest months is 8 degrees Celsius. The highest recorded temperature of 46 degrees was recorded in January 1997 while the lowest was -0.3 degrees Celsius in July 2000. Frosts have been recorded by farmers in the catchment during winter and spring, but are usually rare near the coast.

The rainfall is typical of a Mediterranean climate with a pronounced winter maximum and a long, dry summer. The mean annual rainfall on the coast is about 500mm, but has been highly variable over the past ten years, with the maximum of 610mm in 2001, followed by a very dry year in 2002 when only 274mm fell. Sporadic heavy rainfall events can occur in summer as a result of cyclonic events in the north of the state – the highest monthly rainfall of 185mm was recorded in January 2000 (Taken from Craig and Hickman, 2009).

1.3.2 Geomorphology

The Barren Ranges group of hard massive Proterozoic quartzites rise into a small abrupt mountain at East Mt Barren (about 275 m) with a pediment 90 m above sea level that fronts onto the sea. Soils on the mountain and pediment are rocky and skeletal. The 90m platform at the base of East Mt Barren is a wave-cut bench formed during the Tertiary when sea levels were about 100 m higher than today. The ranges would have then been isolated islands at the time of the deposition of the Plantagenet sediments that form the coastal plains. The coastal sedimentary plain that formed during the Tertiary to the west of East Mt Barren rises gently inland from the coast to about 150m altitude. These Plantagenet Group of sediments consist of thin-bedded mudstones and siltstones which are overlain by Quarternary drift sands on the seaward margin of the plain. The surface has developed a clearly differentiated profile with a superficial layer of bleached sand overlying a band of ironstone nodules over a mottled loam. Numerous intermittent streams flow directly to the sea, which flood after heavy rain and usually dry

up in summer, with the exception of Mylies Creek which maintains pools of water either side of Hamersley Drive. Water runoff is generally brackish, becoming more saline as volumes decrease. A major fault line east of East Mt Barren provides the boundary of the Esperance plain developed by Tertiary Plantagenet sediments. Again Quaternary sands have overlain the pediments on the lower, eastern slopes of the mount (Craig and Hickman, 2009).

1.3.3 Hydrology/Wetlands

The proposal area is coastal with varying rainfall. Surface water features that occur in the proposal area include ephemeral micro-wetlands and creeklines. Drainage to the micro-wetlands is likely to be both surface and subsurface.

1.3.4 Vegetation

The proposal area traverses an area of significance for its biodiversity. It occurs within the Fitzgerald Biosphere Reserve**.** The national park is the core area of the Fitzgerald Biosphere which is a part-tenured management concept recognised by UNESCO's Man and the Biosphere program. The Fitzgerald Biosphere Reserve is recognised as being a 'hotspot' within one of Earth's 34 global biodiversity 'hotspots'. The FRNP has approximately 1,660 plant taxa, containing over one-quarter (29%) of the south-west's flora. (Craig and Hickman, 2009).

The proposal area lies in the South West Botanical Province and the Esperance Biogeographic Region (after Cresswell and Thackway 1995) and is in the Barren Ranges System described by Beard (1973, 1976). This system includes four types of pediments:

- the small mountains of the Barren Ranges group supporting Barren Ranges thicket – the most consistent species being *Eucalyptus preissiana* and *Dryandra quercifolia*;
- small adjacent portions of coastal plain on sandy lateritic soil supports *Eucalyptus pleurocarpa* mallee-heath;
- river trenches with mallee, including *Eucalyptus redunca, E. uncinata* and *E. conglobata*;
- areas of coastal drift sand with coastal scrub – *Eucalyptus angulosa* and *Melaleuca pentagona* being typical.

Most of the Barren Ranges System of vegetation comprises five units of 'Barren Ranges thicket' – one characterized by *Adenanthos venosus* on shallow soils over outcropping quartzite at the base of East Mt Barren and wave-cut bench, three predominantly on lateritic soils, *Dryandra quercifolia*, *Eucalyptus preissiana* and *Eucalyptus falcata;* and *Melaleuca papillosa* on valley slopes where schist is exposed. Deeper, sandy soils have typical coastal plain vegetation characterized by *Eucalyptus pleurocarpa.* Four units were recognized that were characterized by *Banksia repens, Banksia speciosa, Calothamnus quadrifidus* or *Melaleuca pulchella.* Five coastal scrub communities lie inland of the beaches, dominated by *Acacia rostellifera, Eucalyptus angulosa, Melaleuca lanceolata, M. nesophila* or *M. pentagona.* Adjacent to Culham Inlet a wetland community of *M. cuticularis* grows. Inland drainage lines support *Eucalyptus occidentalis* dominated plant associations (Craig and Hickman, 2009).

1.3.5 Threatened Flora

Six species of Declared Rare flora were found adjacent to Hamersley Drive, principally on the wave-cut bench south of East Mt Barren or on the western flanks of the mountain.

Adenanthos ellipticus - Oval-leaf Adenanthos. No plants will be impacted by the proposal.

Eucalyptus burdettiana - Burdett Gum. Sixteen plants will be impacted by the proposal.

Eucalyptus coronata - Crowned Mallee. One plant will be impacted by the proposal.

Kunzea similis subsp. *similis*. Fourteen plants will be impacted by the proposal.

Stylidium galioides – Yellow Mountain Triggerplant. No plants will be affected by the proposal.

Verticordia pityrhops. Three plants will be impacted by the proposal.

1.3.6 Weeds

The vegetation was generally in excellent health with no weeds observed (Craig and Hickman, 2009).

1.3.7 Plant Pathogens

Numerous surveys have been conducted to determine the presence or absence of dieback disease in the eastern end of the Fitzgerald River National Park. These have generally been conducted by the Department of Conservation and Land Management/Department of Environment and Conservation prior to works occurring in the national park (Grant, 2010).

As of the Spring Survey 2009 conducted by Mr Malcom Grant, there have been no positive recoveries of *Phytophthora cinnamomi* from the eastern end of the Fitzgerald River National Park. However, "It must be recognised that there is still a considerable element of uncertainty with the disease status of this section of Hamersley Drive." (Grant, 2010).The survey conducted by Mr Grant does not exclude the possibility that the disease is present but has not expressed yet within the area surveyed.

There is, however, historical knowledge of *Phytophthora megasperma* (a native *Phytophthora* species) outbreaks occurring in 1988, 1992 and 1995 given appropriate climatic conditions. There is no methodology available to map the current extents of this species as plants killed by the disease have collapsed and infested sites have returned to a relatively "healthy" situation (Grant, 2010).

The historical knowledge shows that *Phytophthora megasperma* has occurred throughout the proposal area. The risk of the spread of *P. megasperma* will be managed by ensuring that any cut to fill material will remain within the micro catchment it came from, thereby preventing the spread of propagules from one micro catchment to another. Micro catchment mapping is shown at Appendix D.

Phytophthora multivora occurs within the project area from CH46420 to CH46440 and from CH48980 to CH49250. These areas have been mapped and are shown at Appendix D. No material is to be removed from within these chainages, and extra hygiene must apply to all vehicles on working in this area to ensure that this *Phytophthora* species is not spread from its current extent.

Additionally, an unknown *Phytophthora* species was returned from a sample taken within the proposal area between CH47373 and CH47425. The area has been mapped and chainages are shown at Appendix D. No material is to be removed from within these chainages, and extra hygiene must apply to all vehicles on working in this area to ensure that this unknown species is not spread from its current extent.

1.3.8 Threatened Ecological Communities

No listed Threatened or Priority Ecological Communities were found during the field survey, although a community of ecological significance is located on the wave-cut bench that extends south of East Mt Barren.

1.3.9 Significant Ecological Community

The perched micro-wetlands on the wave-cut bench are considered to be a rare community on the south coast (A. Chapman 2009; S.Comer, pers.comm.). These sedge-dominated communities occur within the *Banksia speciosa* vegetation unit and have permanently wet soil fed by freshwater from further upslope - they were too subtle to map individually. A number of small, freshwater pools were present. According to Chapman (2009) they are significant because "they maintain small patches of mesic environment in an otherwise very fire prone and possibly drying environment". (Taken from Craig and Hickman, 2009).

The micro wetlands are found between chainages 47360 – 47450 and 47680 – 47845 (RHS) (see Appendix D).

1.3.10 Fauna

Eleven species of vertebrate fauna of particular significance have been recorded in the vicinity of the proposal area. These include:

- *Macropus irma*, Western Brush Wallaby (Conservation Status: Priority 4)
- *Dasyurus geofrii*, Chuditch (Conservation Status: Vulnerable)
- *Parantechinus apicalis*, Dibbler (Conservation Status: Endangered)
- *Isodon obesulus fusciventer*, Southern Brown Bandicoot (Conservation Status: Priority 5)
- *Calyptorhychus latirostris*, Carnaby's Black Cockatoo (Conservation Status: Endangered)
- *Phospodes nigrogulairs oberon*, Western Whipbird (Conservation Status: Priority 4)
- *Dasyornis longirostris*, Western Bristlebird (Conservation Status: Vulnerable)
- *Pezoporus wallicus flaviventris*, Western Ground Parrot (Conservation Status: Critically Endangered)
- *Cereopsis novaehollandiae grisea*, Recherche Cape Barron Goose (Conservation Status: Vulnerable)
- *Leiopa ocellata*, Malleefowl (Conservation Status: N/A)
- *Morelia spilota imbricata*, Carpet Python (Conservation Status: Priority 4)

In addition, feral species include:

- Foxes
- Rabbits
- Cats
- Kookaburras
- Feral bees

However, it is unlikely that the road upgrade will impact on any critical habitat for vertebrate fauna (Chapman, 2009).

1.3.11 Land Use

The proposal area occurs within the Fitzgerald River National Park.

1.3.12 Aboriginal Heritage

Ethnographic and archaeological surveys were carried out by Brad Goode and Associates and Applied Archaeology Australia. No issues were noted of ethnographic or archaeological significance within Section 3 (from chainage 46400 to 49930). Some minor artefacts were found but were not considered significant. Due to the dense vegetation during the surveys, monitors will be required during clearing and ground-breaking works. (Goode, 2010, Guilfoyle, 2010).

1.4 Key Environmental Issues

The proposed upgrade to Hamersley Drive in the Fitzgerald River National Park has the potential to impact on the existing environmental features of the area. Environmental factors relevant to the Hamersley Drive upgrade include:

- Weed and disease hygiene control
- Threatened flora
- Vegetation and conservation of biodiversity
- Drainage and wetlands
- Aboriginal Heritage
- Fire control
- Visual amenity
- Waste management
- Rehabilitation success

1.5 Environmental Management Plan Objectives

This Environmental Management Plan has been developed with the overall objective of minimising the impact to the environment. It is designed to meet the following aims:

- Comply with environmental commitments made by Main Roads WA and DEC in accordance with the referral documentation under the *Environmental Protection and Biodiversity Conservation Act* 1999;
- Prevent the introduction of weeds and new *Phytophthora* disease infestations to the Fitzgerald River National Park;
- To ensure that environmental impacts are prevented or minimised in the design and construction of the road
- To ensure that changes to ground and surface water hydrology are prevented and/or adequately managed;
- Maintain the integrity, species diversity, geographic distribution and productivity of vegetation communities;

- Minimise the extent and impact of vegetation clearing required for the project;
- Protect “at risk” species of flora and fauna; and
- Minimise disruption to public access and amenities.

2.0 ENVIRONMENTAL MANAGEMENT AND IMPLEMENTATION STRATEGIES

2.1 Environmental Aspects and Impacts Register

The aspects and impacts register associated with this project was developed by Main Roads WA in consultation with DEC in September 2009. The below information is an excerpt from the full document Hamersley Drive Risk Management Plan (document number D09#232811). The risks associated with each aspect and impact were assessed according to Main Roads WA standard risk assessment methodology. For more information see full document.

Environmental Aspect	Potential Impacts	Treatment
Dieback	Spread of dieback	• Awareness workshop • Inductions to all project personnel • Implementation of Environmental Management Plan
Aboriginal Heritage	Delay due to Aboriginal Heritage issues	• Fast track planning approvals (where possible) • Implementation of Project Management Plan
	Disturbance of an Aboriginal Heritage Site	• Heritage Survey • Inductions to all project personnel • Implementation of Environmental Management Plan
Environmental Approvals	Delay due to Environmental Approvals issues	• Fast track planning approvals (where possible) • Implementation of Project Management Plan
Vegetation	Spread of weeds	• Implementation of Environmental Management Plan • Inductions to all project personnel
	Over-clearing beyond extent shown on drawings	• Clearly mark clearing limits prior to works commencing • Implementation of Environmental Management Plan and Construction Management Plan

		• Inductions to all project personnel
Vegetation	Damage to Declared Rare Flora	• Clearly mark clearing limits prior to works commencing • Clearly delineate DRF areas • Implementation of Environmental Management Plan and Construction Management Plan • Inductions to all project personnel
Visual Amenity	Littering in National Park	• Implementation of Environmental Management Plan • Inductions to all project personnel
	Poor rehabilitation success	• Implementation of Environmental Management Plan • Post-construction monitoring
Employee Awareness	Lack of employee awareness	• Implementation of Environmental Management Plan • Inductions to all project personnel

2.2 Statutory Requirements and Legislation

Key environmental legislation and standards relevant to the works are listed below.

Legislation/Standard	**Source**	**Associated Regulations/ Documentation**
Environment Protection and Biodiversity Conservation Act 1999	Commonwealth	• Ten conditions as listed in project referral documentation
Native Title Act 1993	Commonwealth	• None relevant

Environmental Protection Act 1986	WA	• Environmental Protection (Clearing Native Vegetation) Regulations 2004 • Environmental Protection (Diesel and Petrol) Regulations 1999 • Environmental Protection (Controlled Waste) Regulations 2004 • Environmental Protection (Unauthorised Discharges) Regulations 2004
Aboriginal Heritage Act 1972	WA	• Aboriginal Heritage Regulations 1974
Conservation and Land Management Act 1984	WA	• Conservation and Land Management Regulations 2004
Wildlife Conservation Act 1950	WA	• Wildlife Conservation (Reptiles and Amphibians) Regulations 2002 • Wildlife Conservation Regulations 1970
Contaminated Sites Act 2003	WA	• Contaminated Sites Regulations 2006
Main Roads Act 1930	WA	• None listed
Rights in Water and Irrigation Act 1914	WA	• Rights in Water and Irrigation Regulations 2000
Waterways Conservation Act 1976	WA	• Waterways and Conservation Regulations 1981
AS/NZS ISO 14001:2004 – Environmental Management Systems	International	• None
AS 1940:1993 – The Storage and Handling of Flammable and Combustible Materials	Australian Standard	• None

AS 1851: 2005 – Maintenance of fire protection systems and equipment	Australian Standard	• None

2.3 Roles and Responsibility

The following roles and responsibilities have been defined for this stage of the project.

Main Roads Corporate Responsibility

Main Roads is responsible for ensuring that works meet regulatory requirements and that the environmental objectives contained in this document are met.

Main Roads is also responsible for the environmental performance of their staff and sub-contractors, training and toolbox talks, and maintenance and implementation of the EMP.

Department of Environment and Conservation Corporate Responsibility

The Department of Environment and Conservation maintains ongoing care and control of the Fitzgerald River National Park, and is responsible for advice regarding and approval of project documentation, as well as monitoring the implementation of the EMP.

Project Manager

The Project Manager (PM) is responsible for the overall environmental performance of the project through the implementation and maintenance of the EMP.

Environment Officer

The Environment Officer (EO) is responsible for overseeing implementation of the EMP and monitoring the activities of work contractors. This person also assesses and audits compliance with the EMP and co-ordinates Main Roads' environmental supervision of key activities.

The EO is to be appropriately experienced and qualified to undertake environmental management and conduct environmental audits.

The EO is responsible for liaising with the Department of Environment and Conservation directly on at least a cyclical basis. In the event of a significant incident, the EO is to report to DEC as soon as practicable after the event, or directly twith DEC if advice regarding the incident is required.

The EO may delegate tasks to other personnel, but the responsibility for the implementation of the EMP remains with the EO.

Construction Manager

The Construction Manager responsible for ensuring any work being conducted under their supervision is done in accordance with this EMP, Main Roads' specifications and is compliant with legislative requirements. The Works Supervisors are to pass on relevant environmental information from the Works Manager, Environment Officer or the Project Manager to their staff at start up and toolbox meetings.

Works Supervisors will generally be the first point of contact for a worker reporting an environmental incident. As such they will be responsible for completing Part A of the Environmental Incident Form (Main Roads' Form 6707/042/01). (See Appendix I).

The Construction Manager is responsible for ensuring that plant servicing, maintenance, refuelling and operation is carried out in accordance with accepted environmental practice and this EMP.

Construction Subcontractors

Any subcontractors employed by Main Roads for daily operations and construction activities on site are responsible for compliance with all the environmental provisions of any design drawings, specifications, this EMP and specific work instructions.

All Staff

All persons associated with the project have a general environmental duty under the Environmental Protection Act 1986. Specifically, personnel must not carry out any activity that causes, or is likely to cause, environmental harm, unless that person takes all reasonable care to prevent and minimise the harm.

2.4 Environmental Incident Reporting and Investigation

Main Roads' Corporate Procedure 6707/042 Environmental Guideline – Environmental Incident Reporting and Investigation shall be used to report and investigate environmental incidents. Environmental incident reports are to be filed by Project Manager.

The following is a summary of Main Roads' Environmental Incident Reporting and Investigation Procedure:

- Environmental incident occurs
- Immediate remedial action: the observer of an incident should undertake any immediate actions to stop, control or contain the incident to prevent further damage
- Determine Environmental Incident Category (Minor/Significant/Major)
- Notify Management
- Assessment and Investigation
- Incident Report
- Corrective and Preventative Actions – the EO shall track the progress of agreed corrective and preventative actions.

2.5 Environmental Inspections

Cyclical environmental checklists are to be undertaken by the Environment Officer, in accordance with the Cyclical Environmental Checklist located in Appendix E. Completed checklists are to be given to the Project Manager, with a copy to nominated DEC Officer.

2.6 Monitoring

Monitoring is to be conducted on a daily basis with Cyclical Environmental Checklists completed**.**

2.7 Review and Reporting

A monthly environmental report is to be compiled by the Environment Officer by the end of each month, including a summary of all environmental inspections, auditing and monitoring completed. A copy of the report is to be provided to the nominated DEC Officer also. Incidents to be reported by the Environment Officer at fortnightly meetings.

3.0 ENVIRONMENTAL MANAGEMENT PLANS

3.1 Overview

This section contains the individual Environmental Management Plans (EMPs) and provides details of mitigation measures and management developed for environmental issues relevant to the works. The aim of these plans is to assess the environmental performance of the project during the construction phase, as well as containing mitigation measures to minimise potential impacts.

3.2 Format

The standard format of these EMPs is:

- Title of EMP;
- Existing Environment;
- Potential Impacts;
- Objectives;
- Management;
- Reporting/Monitoring;
- Location;
- Timing; and
- Responsibilities

3.3 Environmental Management Plans

3.3.1 Drainage Management Plan

Existing Environment	• Hamersley Drive is an unsealed gravel road through FRNP • Seasonal micro wetlands occur from chainages 47360 – 47450 and 47680 – 47845 (RHS), fed from surface and sub-surface drainage • Currently there is evidence of erosion in off road drainage and table drains • Current drainage structures consist of corrugated steel and aluminium culverts
Potential Impacts	• Pollution and/or drainage changes to micro-wetlands • Disruption of natural flows • Erosion and sedimentation of areas adjacent to the road • Pollution of groundwater • Death of groundwater dependant vegetation
Objectives	• To ensure that changes to surface hydrology and groundwater quality are prevented or adequately managed • To protect groundwater dependant vegetation • Prevent pollution of underlying groundwater sources
Management	• Ensure drainage structures, including geotextile and aggregate, are correctly installed and working properly • Scour protection to batters and drains as per design • Revegetation of batters and drains as far as practicable
Reporting, Monitoring	Monitoring during construction shall consist of: • Visual inspections (once per cycle) of the micro wetlands for changes to vegetation • Visual inspection once per cycle for evidence of erosion, scours or sediment deposition
Location	• Drainage structures occur throughout the project area • Micro wetlands occur at chainages 47360 – 47450 and 47680 – 47845 (RHS)
Timing	• During construction
Responsibilities	Project Manager: • Drainage design • Construction of drainage structures Environment Officer: • Cyclical Environmental Checklist Construction Manager: • Identify potential erosion issues arising from construction activities

3.3.2 Rehabilitation and Topsoil Plan

Existing Environment	• Undisturbed vegetation and topsoil adjacent to existing road
Potential Impacts	• Loss of topsoil through poor management • Poor rehabilitation success
Objectives	• Maximise rehabilitation success • Utilise best practice topsoil management techniques • Stabilise road batters • Minimise the risk of introducing weeds and disease
Topsoil Management	Topsoil Stripping • Topsoil and mulch shall be stripped together using appropriate plant and equipment to a depth of 150mm where possible • Topsoil is to be stockpiled in windrows inside the marked clearing line where it was cleared – topsoil and vegetative matter is not to be transported along the alignment • Windrows are not to be higher than 1.5m or wider than 3m at the base Topsoil Respread • Topsoil/mulch is to be respread to all disturbed areas immediately following completion of earthworks to sub-grade level • Topsoil/mulch is to be spread evenly, preferably to a depth of 70mm where amount is sufficient • Topsoil/mulch shall be tracked in using a machine
Reporting, Monitoring	• Cyclical environmental checklist • Daily visual inspections • Visual inspections post-construction to monitor regrowth
Location	• Clearing area as per road plan (Appendix D)
Timing	• During construction
Responsibilities	Project Manager • Stripping, stockpiling and respread of topsoil/mulch Environment Officer • Visual inspection of windrows to ensure they remain intact and weed free • Monitoring topsoil respread

3.3.3 Materials and Water Extraction Management Plan

Existing Environment	• Gravel extraction: Rural, privately owned, vegetated property • Sand extraction: Rural privately owned property with no vegetation cover • Water extraction: WaterCorp bore, water slightly saline (~3900ppm)
Potential Impacts	• Spread of weeds and disease from contaminated gravel, sand or haulage arrangements • Clearing of 1ha of native vegetation to extract road building materials • Poor rehabilitation success of pit following closure • Increasing salinity of bore
Objectives	• Prevent the introduction of weeds and disease • Minimise the impact of pit operations • Minimise impacts to vegetation from spray drift
Management	• All pits, haulage tracks and stockpile areas are to be inspected once per cycle for signs of weeds and disease • Haulage tracks to be in sand and controlled for weeds • Vehicles entering pits and stockpile areas to be cleaned of soil and vegetative matter as per Weed and Disease Hygiene Management Plan • Spray drift to be restricted to the road alignment as far as practicable
Reporting, Monitoring	• Cyclical Environmental Checklist • Daily inspections during pit operations • Monitor salinity levels of water from bore once a cycle
Location	• Fisher's Pit, Location 638 Steeredale Road, Hopetoun • Sand Pit, Location 95, Hamersley Drive, Hopetoun • Haulage tracks and stockpile areas to be determined
Timing	• Pre-Construction and during construction
Responsibilities	Construction Manager • Responsible for the overall operation of the pits, haulage tracks, stockpile areas and bore Environment Officer • Responsible for monitoring environmental aspects of the pit operation, haulage tracks and stockpile areas • Monitoring of bore water once a cycle

3.3.4 Weed and Disease Management Plan

Existing Environment	• Vegetation within in Section 3 of Hamersley Drive is in excellent condition and is considered currently weed- and *Phytophthora cinnamomi* disease-free • *P. megasperma, multivora* and an unknown species have been recorded in the area
Potential Impacts	• Introduction and spread of weeds and disease (Phytophthora spp) • Ecosystem collapse due to introduction and/or spread of disease and weeds
Objectives	• Minimise risk of introduction and spread of weeds and disease
Management	GENERAL HYGIENE PROCEDURES • All equipment used shall be cleaned of soil and vegetative matter, including hand tools and other equipment, with 100% methylated spirits • Boots shall be sprayed with 100% methylated spirits prior to and after working in the Park • All project staff to be inducted prior to commencing works on site VEHICLE HYGIENE • All machinery, such as light vehicles, bob cats, trucks, bucket loaders, graders, graders, dozers and post-hole boring equipment will be required to be washed down prior to entry into the National Park so as to be free of **all** adhering soil and vegetative matter • Vehicle inspections are to include known areas where soil and vegetative matter can adhere such as undercarriage spare tyres and inside front bumpers • Infestation of *P. mulitvora* and *P.* sp unknown occur on this site. For details refer to maps at Appendix D. • Machinery working within these chainages is to be air cleaned in situ before exiting these chainages and then removed to the Hopetoun Car Wash facility for full wash down • No soil or vegetative matter is to be removed from these chainages • No soil or vegetative matter is to be moved from one micro catchment to another WEATHER CONDITIONS • WORKS WILL BE STOPPED when there is a single rainfall event of 7.5mm or when combined events over two days total 10mm or more • Light vehicles are to be removed from site, and heavy plant to be removed or left depending on rainfall forecasts • Shutdown is required until the road surface has dried to the

	extent that surface soils are not adhering to the undercarriages of vehicles • Works can only recommence with the approval of the Environment Officer
Reporting, Monitoring	• Cyclical environmental checklist • Daily visual inspections and checklist with signatures to ensure plant and vehicles are free of adhering soil and vegetative matter • Monitor rainfall and weather conditions for events which may cause work to stop
Location	• Project area
Timing	• During construction
Responsibilities	Environment Officer • Monitoring and control of weeds • Monitoring of vehicle hygiene and vehicle hygiene checklist • Cyclical checklist • Monitoring of rain gauges and weather conditions in case of stop work conditions

3.3.5 Fauna Management Plan

Existing Environment	• Native fauna will be encountered during upgrade and road construction • See Section 1.3.10 for detail
Potential Impacts	• Loss of fauna habitat • Death or injury from loss of fauna habitat • Death or injury to fauna from upgrade construction activities • Death or injury to fauna from road operation
Objectives	• To protect native fauna
Management	• Site induction is to include management of native fauna • No animals are to be intentionally harmed or killed by project personnel, unless there is a real and immediate threat to human health. THIS INCLUDES SNAKES • Animals (in particular snakes) should be allowed to move on if there is no threat to human safety in doing so • If a snake will not move on a suitably qualified reptile handler shall be called to remove the animal if possible • If a sick or injured animal is encountered contact the Environment Officer and the Fitzgerald River National Park Ranger • No pets, traps or firearms will be allowed on site • Any incident involving death or injury to an animal is to be reported to a Supervisor as an environmental incident
Reporting, Monitoring	• Cyclical environmental inspection • Environmental incidents involving fauna encounters
Location	• Project area
Timing	• During construction
Responsibilities	Project Manager • Updating register of required fauna handling personnel Project Environment Officer • Monitoring and reporting of fauna encounters

3.3.6 Declared Rare Flora and Priority Species Management Plan

Existing Environment	• 4 species of Declared Rare Flora will be impacted by the project. *Eucalyptus burdettiana, E. coronata, Kunzea similis* subsp*. similis, Verticordia pityrhops*.
Potential Impacts	• Loss of DRF not covered by Permit • Significant impacts to populations of Priority Flora
Objectives	• Protect DRF outside of clearing area
Management	• Five areas of DRF will be protected during clearing and earthworks, located at chainages o 46790 – 46820 (RHS) o 47475 – 47485 (LHS) o 47865 – 47875 (LHS) o 48110 – 48120 (LHS) o 48360 - 48370 (LHS) • Permit to Take Declared Rare Flora received • Comply with conditions of approved Permit to Take DRF • Any populations within the road reserve will be clearly marked and fenced to prevent disturbance • Identified populations of DRF will be monitored regularly for disturbance, disease or weeds • Site induction is to include management of DRF and locations of sites
Reporting, Monitoring	• All DRF populations identified within the road reserve are recorded and marked on appropriate drawings • Environmental checklist once per cycle
Location	• See map at Appendix D
Timing	• During construction
Responsibilities	Project Manager • Avoid impacts to DRF not included in permit during construction Environment Officer • Mark and monitor known populations of DRF • Comply with conditions of Permit to Take DRF

3.3.7 Visual Amenity Management Plan

Existing Environment	• Project area is uninhabited and maintains a sense of wilderness. • Refer to Visual Assessment Report prepared by DEC.
Potential Impacts	• Loss of visual amenity • Loss of landscape values
Objectives	• Ensure that the upgrade blends in with the surrounding environment • Minimise impact on local landscape character • Maximise visual amenity at roadside stopping bays and coastal access points
Management	• Maintain good housekeeping practices during construction to prevent litter • DEC input regarding visual amenity • Adherence to Disease and Weed Management Plan (Section 3.3.4) • Removal of all unnecessary construction markers etc
Reporting, Monitoring	• Monthly environmental inspection (for litter)
Location	• Project area
Timing	• During construction
Responsibilities	Project Manager • Ensure disruption to visual amenity minimised by design features and on site activities

3.3.8 Aboriginal Cultural and Heritage Sites Management Plan

Existing Environment	• No known sites of Aboriginal Heritage were identified in the surveys, but the area is likely to contain scattered artefacts
Potential Impacts	• Disturbance to Aboriginal Heritage site
Objectives	• Protect known sites and artefacts of Aboriginal Heritage • Comply with *Aboriginal Heritage Act* 1972 • Minimise impacts to unknown sites
Management	• Aboriginal survey found no sites within the project area • Works are to cease if skeletal material or Aboriginal artefacts are discovered • Skeletal material: • All works through out the project area are to cease until given the all clear by Police • Police are to be called to establish if the remains are a potential crime scene • Remains are to be protected from further disturbance • If the remains are determined to be of Aboriginal origin, Native Title claimants are to be consulted on the management of the remains • Work at the immediate location (plus 50m buffer) of the skeletal remains is not to recommence until all parties have been consulted and agreement has been reached • Other Aboriginal artefacts: • Works shall cease in the immediate vicinity of the discovery. (Boundary of discovery plus 20m buffer) • No unauthorised people are to enter the exclusion zone until advised accordingly • A qualified archaeologist shall examine the material • If the material is deemed to be of Aboriginal origin, DIA and Native Title claimants are to be informed • Treatment of the archaeological material shall be decided in consultation with DIA and Native Title claimants
Disputes Resolution	• Should an issue arise where there is conflict or the potential for conflict, then a discussion will be arranged, or the resolution of the issue will be addressed at a specially called team meeting between the Cultural Heritage Monitors, Main Roads WA and Brad Goode, Aboriginal Heritage Consultant. This team is to be known as the Disputes Resolution Team. • The Disputes Resolution Team will consult with each other to resolve the dispute. If the parties cannot resolve the dispute within 14 days then mediation may be required using a mutually agreed mediator.
Reporting, Monitoring	• All consultation with Aboriginal groups is to be recorded • Any new sites discovered are to be recorded
Location	• Throughout the project area

Timing	• During construction
Responsibilities	Environment Officer • Ensure Cultural Heritage monitors and archaeologist are given work site inductions • Ensure legislative requirements are met by following instructions of monitors and archaeologist Cultural Heritage Monitors • Work in accordance with this EMP • Sign in and out as visitors on arrival and departure form the site • Wear appropriate PPE (provided by Main Roads) • Comply with safety instructions at all times • Be under the management of the Site Supervisor while on works site • Liaise with the Environment Officer and archaeologist (ie not directly with construction work teams) on issues of concern • Complete and sign the daily report

3.3.9 Waste Management Plan

Existing Environment	• All project activities have the potential to generate waste
Potential Impacts	• Contamination and pollution of the environment • Waste of resources
Objectives	• Encourage responsible removal of waste from site • Encourage recycling, reuse and reduction of waste • Minimise the risk of contamination from waste
Management	• All excess construction material to be spoiled to nominated dieback infested spoil sites • All waste generated by sub-contractors and other staff is to be removed by the individual/company involved • Licensed contractors will remove general rubbish from bins located at the site offices and crib room and skip bins located at the depot, site office and strategic locations along the alignment including stockpile and lay-down areas • Soil contaminated through chemical spills shall be managed in accordance with the provisions of the Contaminated Sites Act, 2003. Affected soil will be removed and disposed of at appropriate landfill site. • Segregate differing waste streams appropriately to ensure correct storage and disposal. o General wastes – office wastes, litter, food wastes o Inert wastes – construction rubble o Hazardous wastes – waste oils, fuels, chemicals, spill kits o Special wastes – e.g. asbestos, are to be reported to supervisor and only to be dealt with by licensed contractors • No liquid wastes shall be disposed of to drainage lines • All employees (including sub-contractors) whose activities include the storage and handling of wastes shall be appropriately trained and competent at undertaking required tasks • Wastes are to be stored in clearly labelled containers and in such a manner that they will not be released to open land, water courses or the atmosphere • Store liquid wastes in bunded areas away from drains and watercourses to contain any potential leaks or spills • Opportunities to minimise waste generation shall be maximised, including re-use and recycling options • Induction procedures to outline waste management guidelines • Regular inspections of work area by supervisors for litter • All oil filters to be removed from site • Human waste to be managed through temporary on site ablution facilities

Reporting, Monitoring	• Cyclical environmental inspection • Records of waste disposal actions to be kept
Location	• Project area • Nominated waste disposal sites
Timing	• During construction
Responsibilities	Project Manager • Responsible for overall site cleanliness and waste management Environment Officer • Monitoring of site through cyclical inspections

3.3.10 Vegetation Clearing Management Plan

Existing Environment	• Hamersley Drive is currently unsealed and runs through largely undisturbed Fitzgerald River National Park • Vegetation adjacent to road is in excellent condition • Unique vegetation occurs around East Mount Barren
Potential Impacts	• Clearing of 2.194ha of native vegetation • Clearing outside the clearing line • Poor rehabilitation success • Soil erosion and sedimentation
Objectives	• Minimise clearing area and disturbance to flora and fauna habitat • Prevent clearing outside the clearing line • Maximise success of revegetation on batters • Minimise soil erosion and sedimentation
Clearing Controls – General	• Induction – all site personnel are to be inducted on the clearing controls for this project • Areas of threatened flora are to be marked prior to clearing and are not to be disturbed • Maximum width of clearing is determined by design drawings • Actual clearing limits are to be determined by the amount of vegetation and topsoil required to be windrowed • The clearing line is to be marked by the surveyor with white flagging tape attached to either pegs or tied to vegetation with each peg/marker clearly visible from the last • No movement of vehicles or personnel outside of clearing line • No stockpiling of topsoil or other material is to occur outside of clearing line • Cleared vegetation is to be mulched in-situ and mixed with the topsoil for respread following earthworks • Clearing is only to occur immediately prior to construction commencing • Environment Officer to be on site during clearing operations
Special Clearing Controls – Chainages 47373 to 47425 – Dieback Infested with unknown dieback species And Chainages 46420 – 46440 48980 – 49250 Infested with *P. mulitvora*	• Cleared vegetation is to be mulched in situ and mixed with topsoil for respread following earthworks • Vegetative material from within these chainages is to remain within these chainages and is not to be removed from these chainages either by stockpiling outside chainages or by adhering to vehicles • All clearing equipment is to be cleaned of soil and vegetative matter as per Weed and Disease Hygiene Management Plan in situ

Special Clearing Controls DRF Sites – Chainages 46790 – 46820 (RHS) 47475 – 47485 (LHS) 47865 – 47875 (LHS) 48110 – 48120 (LHS) 48360 - 48370 (LHS)	• Mulched vegetation and topsoil is not to be stockpiled within these chainages as DRF needs to be protected • Any mulch and/or topsoil which needs to be stockpiled from within these chainages is to be halved and stored on each side • See Appendix D for detail
Reporting, Monitoring	• Cyclical environmental checklist • Daily visual inspections during clearing
Location	• All areas to be cleared for the road upgrade • See map at Appendix D for details
Timing	• During construction
Responsibilities	Project Manager • Installation and adherence to clearing controls Environment Officer • Daily inspection of clearing lines

3.3.11 Dust Management Plan

Existing Environment	• There are no residential areas likely to be impacted by dust from the upgrade works
Potential Impacts	• Damage to vegetation by excessive dust production
Objectives	• Minimise damage to vegetation caused by dust
Management	• Avoid earthmoving works in high winds • Water sprays to be used to prevent dust lift • Areas of temporary disturbance to be rapidly rehabilitated following construction
Reporting, Monitoring	• Cyclical environmental checklist
Location	• Project area
Timing	• During construction
Responsibilities	Environment Officer • Daily visual inspection for damage to vegetation caused by excessive dust

3.3.12 Handling, Storage and Disposal of Fuels, Oil and other Hazardous Substances Management Plan

Existing Environment	• The nominated depot area will contain waste products, fuel and any potentially hazardous substances
Potential Impacts	• Pollution of land and/or water from chemical or hazardous substance spill
Objectives	• Reduce the risk of contamination from fuels, oils and hazardous wastes • Respond effectively to incidents such as spills and leaks
Management	• No hazardous substances to be stored in the National Park • All storage and handling of fuels, oils and other hazardous materials in the project area is to be done in accordance with AS1940, legislative requirements and OSH procedures • Toxic and hazardous substances should be stored in secure chemical-resistant containers • All storage areas for fuel, oil or other hazardous substances are to be bunded so that toxic and hazardous substances can not escape to the environment under foreseeable conditions i.e. during normal operations, equipment malfunction or emergencies • Bunding shall contain sufficient volume to contain any spill plus 10% • All mobile plant is to be refuelled outside the Park • All heavy plant is to be refuelled on the road alignment only • All refuelling vehicles are to carry spill kits and fire extinguishers • If a fuel/chemical storage tank compound is to be left unattended at any time, locked security fencing should be in place to prevent unauthorised access to the compound and its facilities • Any spills are to be contained immediately and remediated within one week • In the event of a major spill that may contaminate water sources or ground water, DEC Emergency Pollution Response is to be called (1300784782) Emergency Response • Any hydrocarbon spill (or other chemical spill) will be dealt with according to the hierarchy of actions: o Stop the flow – if it is safe and practical to do so, the operator or other contractor should attempt to stop the flow of a spill. This could be as simple as shutting off a valve o Contain the spill – if it is safe and practical to do so, the spill should be contained. This can be done using spill kits or by building a “dam” to contain the spill. At this stage the spill should be reported to a supervisor o Remediate the spill – After the flow of chemical has stopped and the spill has been contained, an assessment will be made on how to remediate the

	spill. In the case of moderate spills (~100l) remediation may require only removing the contaminated soil and backfilling. Larger spills may require DEC's pollution response or FESA to assess the risk and remediate.
Reporting, Monitoring	• Cyclical environmental checklist • All spills shall be reported and documented immediately
Location	• Project area • Nominated depot for storage of fuel, oil or other hazardous material is to be uncontaminated
Timing	• During construction
Responsibilities	Project Manager • Ensure procedures are followed and incidents reported

3.3.13 Fire Control and Response Management Plan

Existing Environment	• Vegetation within project area is highly susceptible to fire in summer • Project works present possible ignition sources for wildfire • Project area is relatively remote
Potential Impacts	• Increased risk of ignition during periods of high or extreme fire danger during construction
Objectives	• Reduce the risk of ignition from construction activities
Management	NOTE: This plan covers the risk of fire from the project on the environment. Fire fighting and evacuation procedures are covered under emergency response in the Hamersley Drive Project Safety Plan. • In case of fire ring 000/Ravensthorpe Chief Bushfire Control Officer Rod Daw (9839 6010) • If a wildfire occurs inform DEC and Paul Corey, Park Ranger, (9838 3060) • Induction will include evacuation procedures, location of fire response equipment and emergency contacts • Works procedures for “hot works” to include; o Clear area around works (no flammable materials) o Fire trailer to be located at site of hot works • Visual inspection of project area for ignition sources and high fuel loads • All operations and machine activities must conform to the requirements of the Bush Fires Act • Make all staff aware of any fire bans and warnings
Reporting, Monitoring	• Cyclical environmental checklist
Location	• Project area
Timing	• During construction
Responsibilities	Project Manager • Responsible for fire control and response Environment Officer: • Responsible for checking daily fire danger warnings, Shire warnings and bans and providing this information to Construction Manager

4.0 REFERENCES

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Department of Environment and Conservation, Fitzgerald River Management Plan, 1991 – 2001.

5.0 APPENDICES

Appendix A - Vegetation and Flora Survey

Appendix B - Fauna Survey

Appendix C - Dieback Survey

Appendix D - Road Plan of Key Environmental Features

Appendix E - Cyclical Environmental Checklist

Appendix F - Permit to Take Declared Rare Flora

Appendix G - EPBC Act Referral Documentation

Appendix H - Aboriginal Heritage Monitor Daily Report

Appendix I - Environmental Incident Form

Appendix J – Aboriginal Heritage Surveys

Appendix K Visual Assessment Report (prepared by DEC)

Appendix A - Vegetation and Flora Survey

FITZGERALD RIVER NATIONAL PARK
HAMERSLEY DRIVE UPGRADE

VEGETATION & FLORA

Gillian F Craig

Ellen J Hickman

A report prepared for
Main Roads Western Australia
Great Southern Region
Chester Pass Road, PO Box 503, Albany WA 6331

October 2009

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Cover photos: [top left] *Eucalyptus burdettiana* (Burdett's Gum), [top centre] *Morelia imbricata* (Carpet Python), [top right] *Lechenaultia superba* (Barren Leschenaultia), [centre] East Mt Barren and wave-cut bench from east), [bottom left] Eucalyptus coronata (Crowned Mallee) bud and flowers, [bottom centre] *Adenanthos ellipticus* (Oval-leaf Adenanthos), [bottom right] *Stylidium galioides* (Yellow Mountain Triggerplant), (©E.J.Hickman 2009).

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Executive Summary

Main Roads Western Australia is undertaking upgrade works on Hamersley Drive in the Fitzgerald River National Park (Shire of Ravensthorpe) on behalf of the Department of Environment and Conservation. The works will involve widening and sealing of the existing road for tourism purposes, and will remain on its current horizontal alignment. It is likely that the works will require the clearing of up to 10 m of native vegetation on either side of the existing gravel road from the current centreline.

Vegetation and flora surveys are being carried out in a staged process. This report includes results from the first 10 km, ie Culham Inlet to Hamersley Inlet Road.

Vegetation

The survey area lies in the Barren Ranges system of Beard (1976). Most of the vegetation comprises five units of 'Barren Ranges thicket' – one characterized by *Adenanthos venosus* on shallow soils over outcropping quartzite at the base of East Mt Barren and wave-cut bench, three predominantly on lateritic soils, *Dryandra quercifolia*, *Eucalyptus preissiana* and *Eucalyptus falcata,* and *Melaleuca papillosa* on valley slopes where schist is exposed.

Deeper, sandy soils have typical coastal plain vegetation that includes *Eucalyptus pleurocarpa.* Four units were recognized that were characterized by *Banksia repens, Banksia speciosa, Calothamnus quadrifidus* or *Melaleuca pulchella.*

Five coastal scrub units lie inland of the beaches, dominated by *Acacia rostellifera, Eucalyptus angulosa, Melaleuca lanceolata, M. nesophila* or *M. pentagona.* Adjacent to Culham Inlet a wetland community of *M. cuticularis* grows. Inland drainage lines support *Eucalyptus occidentalis* dominated plant associations.

The vegetation is in excellent condition with no weeds or *Phytophthora cinnamomi* dieback disease evident. A fire in 2006 burnt parts of the survey area east of the West Beach spur road.

Declared Rare and Priority flora

Field surveys were carried out in spring 2009 and identified five Declared Rare flora (DRF) - *Adenanthos ellipticus, Eucalyptus burdettiana, Eucalyptus coronata, Kunzea similis* subsp. *similis* and *Stylidium galioides* - growing on the wave-cut bench on the south side of East Mt Barren, in the proposed area of disturbance. A sixth DRF species, *Verticordia pityrhops,* was not found but previous surveys suggest that some plants grow within 10 m of the current road verge.

Most Priority species occur between Mylies Creek and Culham Inlet, including four Priority Two species - *Calothamnus macrocarpus, Gonocarpus hispidus, Hibbertia papillata, Leptospermum confertum.* Five Priority Four species, *Acacia argutifolia, Anthocercis fasciculata, Dampiera deltoidea, Jacksonia compressa* and *Pimelea physodes* are present in this section. Two other P4s, *Lechenaultia superba* and *Hakea hookeriana* have been collected near the road in the past, but were not found in the proposed impact area during this survey.

West of Mylies Creek, the Priority Four species *Acacia moirii* subsp. *dasycarpa* and *Jacksonia compressa* are frequent and widespread. *Melaleuca papillosa* is abundant on schist on slopes of drainage lines. *Leucopogon compactus* was found west of the West Beach turnoff.

Threatened Ecological Communities

No listed Threatened or Priority Ecological Communities were found during the field survey, although a community of ecological significance is located on the wave-cut bench that extends

south of East Mt Barren. These micro-wetlands are sedge-dominated communities that are fed by freshwater from further upslope. They occur within the *Banksia speciosa* vegetation unit and were too subtle to map individually.

Recommendations

The wave-cut bench on the seaward side of East Mt Barren is the one of the most botanically significant areas in the Fitzgerald River National Park and the south coast. The following is recommended:

- keep road verges and spur drains to the absolute minimum width/size allowed by road design;
- survey DRF *Verticordia pityrhops* when flowering (February - June);
- consult an expert in freshwater habitats to assess the ecological value of the micro-wetlands;
- ensure that sub-surface drainage to and from the micro-wetlands is not impeded by the road base;
- have an on-site inspection of the wave-cut bench with biologists and surveyor/ road engineer present;
- design a high quality walk trail along the wave-cut bench, linking the carparks at the east and west ends of East Mt Barren;
- weed invasion and plant disease have the greatest potential to impact the high biological and conservation value of the FRNP. Road materials (including water) must come from weed- and disease-free areas, so that they are not imported by either the material itself or the machinery carting it.

1. Introduction

Purpose

Main Roads Western Australia (Main Roads) is undertaking upgrade works on Hamersley Drive in the Fitzgerald River National Park (FRNP) on behalf of the Department of Environment and Conservation (DEC). The works will involve widening and sealing of the existing road for tourism purposes, and will remain on its current horizontal alignment. It is likely that the works will require the clearing of up to 10 m of native vegetation on either side of the existing track from the current centreline.

Main Roads require biological surveys for the above project. The purpose of the surveys is to provide an appropriate examination and description of the receiving environment to ensure that all aspects of biological/ecological significance are identified and recorded. The results of the biological survey will assist in the preparation of an Environmental Impact Assessment and an Environmental Management Plan or other referral documents.

Background

The proposal to upgrade roads in the Fitzgerald River National Park was first announced on the 30 January 2009 by the Honorable Colin Barnett Premier; Minister for State Development with the intent to offset the economic effect of the closure of the Ravensthorpe nickel mine. The State Government committed to a long term measure of support to increase economic viability of the towns of Ravensthorpe and Hopetoun in the Shire of Ravensthorpe.

The road upgrade is intended to inject funds into the communities of Hopetoun and Ravensthorpe by providing opportunities for local sub-contractors to be employed through the construction process. Economic benefits will also flow to service providers in the local towns through the delivery of this project.

Study Area

Figure 1 details the location of the biological survey. The survey is restricted to an area 25 m either side of the existing road alignment, including all spur roads and car parks. Eventually, the survey area is to include borrow and gravel pits, basecourse and sub-base pits, spoil sites, proposed works camp and compound areas, stockpile sites and any other areas to be disturbed.

Stage 1
This interim report includes 10 km of Hamersley Drive, ie from Culham Inlet to the Hamersley Inlet Road intersection. Stage 2 will include Hamersley Inlet Road to Hamersley Inlet.

The spur roads and carparks will be surveyed during 2010.

Concurrent biological studies
Separate reports have been prepared by:

1. Ellen Hickman surveyed the vegetation and flora at the proposed gravel pits on Location 6382 Steeredale Road, Hopetoun;

2. Andrew Chapman has assessed the implications for fauna;

3. Malcom Grant surveyed for dieback *Phytophthora* and other plant pathogens.

Figure 1: Survey area in Fitzgerald River National Park – Hamersley Inlet to Culham Inlet

2. Methods

Desktop

A search was made of the Department of Environment and Conservation's (DEC) Threatened Flora Database (DEFL), WA Herbarium database (WAHerb) and the Declared Rare and Priority Flora Species List. The search co-ordinates requested were NW corner: 33°45'S 119°45'E SE corner: 33°57' 120°14'E. A search was undertaken of the DEC Threatened Ecological Communities database.

The Commonwealth's Threatened Flora database was searched to determine the category under the Environmental Protection and Biodiversity Conservation(EPBC) Act for listed Threatened flora.

The flora database information was imported into OziExplorer® software to determine those species likely to occur in the impact area. Orthophotos of the Whoogerup (2003- pre-burn) and Ravensthorpe (2007 – post-burn) map sheets were provided by DEC to use as base imagery.

Scientific licences and a Regulation 4 Authority permit were obtained from DEC to take flora within the Fitzgerald River National Park. Permission to use digital information was obtained from DEC's Species and Community Branch, Kensington.

Previous reports and publications relevant to the region were reviewed.

Eucalypts on East Mt Barren

DEC Albany's threatened flora files for *Eucalyptus coronata* and *Eucalyptus burdettiana* were reviewed, specific locations of all known population on and around East Mt Barren were identified and plant numbers were summarised to get an overview of each species.

Orthophotos from the Ravensthorpe sheet (2003 – pre-burn and 2007 – post-burn) were provided by DEC for use in the field.

Field survey

Hamersley Drive

The survey was carried out according to the Environmental Protection Authority's Draft Guidance No.51 (EPA 2003). Each side of the road was traversed on foot by Gillian Craig, between the verge and up to 25 m into the undisturbed vegetation. Along each traverse, boundaries of vegetation units (based on changes in species composition) and threatened flora were marked as waypoints on the GPS using the GDA94 datum.

Relevés were recorded and a digital photo taken of representative vegetation units. Common species were recorded, ie more than five plants were observed in the general vicinity, in a plotless 10 m x 10 m quadrat for shrubs (< 2 m tall), sedges and herbs, and 20 m x 20 m for tall shrubs (> 2 m tall) and eucalypts. Vegetation structure, based on a modified Muir classification (Appendix 2), was recorded.

Surveys were carried out on 22nd, 25th and 29th September, 1st, 12th, 16th and 23rd October 2009. The weather was cool to warm (16°C – 21°C max) and sunny or intermittently overcast with a slight to moderate winds.

Plant specimens were verified using the author's private herbarium (previously verified in the Perth Herbarium), Albany and Ravensthorpe Regional Herbaria, and the Perth Herbarium; nomenclature follows that of WAHERB, except for *Dryandra.* Voucher specimens will be lodged in the Perth and Ravensthorpe herbaria.

Waypoints were downloaded from the GPS to OziExplorer®, then divided into individual files for each species of declared rare or priority flora. Vegetation units were mapped using combination of field data and interpretation of orthophotos.

Eucalypts on East Mt Barren

Foot traverses of all the populations identified from the Threatened Flora file review of *Eucalyptus coronata* and *E.burdettiana* on and around East Mt Barren were carried out on 29th and 30th September, 1st, 2nd, 21st, 22nd, 23rd and 24th October 2009 by Ellen Hickman. The weather was cool to warm (15°C – 28°C max) and sunny or overcast with slight to moderate winds.

Most plants were marked as waypoints on a Garmin GPS 60 using the GDA94 datum. A proportion of each species was also tagged using sheep tags. The tags were of two shades of green to distinguish the two species and scribed with the species initials and a number in sequence (ie EC001, EC002 to EC500 for *E.coronata*, and EB001, EB002 to EB500 for *E.burdettiana*). When the tags ran out the plants were simply marked with a waypoint.

Plants of each species identified as growing within 25 m on either side of the Hamersley Drive road were waypointed and flagged with blue flagging tape, but not tagged.

Areas of vegetation known to have plants of either species that were not burnt in the 2006 fire proved to be too thick to traverse by foot so estimations of plant numbers were made by interpreting aerial photography.

Waypoints and tracks were downloaded from the GPS using DNR Garmin software. The waypoints were exported as text files to be imported into Excel to allow for sorting the data into individual files for each species. These were then imported into Arcview to provide shape files of each species location on and around East Mt Barren. The tracks were saved as shape files for direct import into Arcview.

Digitising

Digital files including waypoints of each species of threatened flora encountered during the survey and line work of the vegetation map (1:10 000 scale) were sent to Meredith Spencer (DEC Albany) for digitising. Final maps were provided as shapefiles for compatibility with ArcMap.

3. Desktop Assessment

Physical Environment

Climate

A Mediterranean climate of warm to hot summers and cool, wet winters is generally experienced. The nearest weather station is Hopetoun North, for which the last 13 years of data is available (Table 1). Mean maximum temperature recorded at Hopetoun in the hottest month (February) is 26^{o}C. Mean minimum temperature in the coldest months (July-August) is 8^{o}C. The highest recorded temperature of 46 ^{o}C was recorded in January 1997, while the lowest of -0.3 ^{o}C was in July 2000. Frosts have been recorded by farmers in the catchment during winter and spring, but are usually rare on the coast.

The rainfall is typical of a Mediterranean climate with a pronounced winter maximum and a long dry summer. The mean annual rainfall on the coast is about 500 mm, but has been highly variable over the past 10 years with the maximum of 610 mm in 2001, followed by a very dry year in 2002 when only 274 mm fell. Sporadic heavy rainfall events can occur in summer as a result of cyclonic events in the north of the State - the highest monthly rainfall of 185 mm was recorded in January 2000.

Annual evaporation is generally 1500 mm.

Morning wind speeds are typically 17-22 km/h and increase in the afternoon to average 20-29 km/h.

Climate Change is predicted to impact the south coast of Western Australia. Changes in temperature and rainfall patterns may lead to changes in the physical condition of the region and to the growing season, incidence of frost and flood events etc.

Table 1: Climate data for Hopetoun North (BOM 2009)

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	
Temperature															
Maximum temperature															
Mean maximum temperature (℃)	25.2	25.8	25	23.3	21.6	19.2	18.2	18.9	20.5	21.4	23.1	24.4	**22.2**	14	1996 2009
Minimum temperature															
Mean minimum temperature (℃)	15.2	15.7	14.3	12.6	10.5	8.5	7.7	7.9	8.7	10	12.2	13.9	**11.4**	14	1996 2009
Rainfall															
Mean rainfall (mm)	48.6	18.1	29.3	44.5	36.8	49.5	66.3	54.1	49.1	39.5	37.4	24	**496.4**	13	1996 2009
Highest rainfall (mm)	185	72.4	69.4	138	78.4	106	126	127	109	70.4	97.2	54.6	**609.8**	13	1996 2009
Date	2000	1997	2006	2007	1999	2005	2001	2001	1996	2008	2008	2008	2001		
Lowest rainfall (mm)	0	0.2	0	0	8.2	14.4	30	19.6	5.2	14.4	1.4	3.2	**274**	13	1996 2009
Date	1998	2008	2008	2008	2002	2002	1996	1996	2000	2006	2007	2006	2002		
Mean number of days of rain	6.5	5.4	7.8	11.5	12.5	13.8	15	14.8	13.9	10.9	8.1	6.7	**126.9**	13	1996 2009

Geology and Soils

The Barren Ranges group of hard massive Proterozoic quartzites rise into a small abrupt mountain at East Mt Barren (about 275 m) with a pediment 90 m above sea level that fronts onto the sea, creating one of the most striking coastlines of the south coast. Soils on the mountain and pediment are rocky and skeletal. The 90 m platform at the base of East Mt Barren is a wave-cut bench formed during the Tertiary when sea levels were about 100 m higher than today. The ranges at that time would have been isolated islands at the time of deposition of the Plantagenet sediments that form the coastal plains.

The coastal plain that formed during the Tertiary to the west of East Mt Barren rises gently inland from the coast to about 150 m altitude. These Plantagenet Group of sediments consist of thin-bedded mudstones and siltstones which are overlain by Quarternary drift sands on the seaward margin of the plain. The surface has developed a clearly differentiated profile with a superficial layer of bleached sand overlying a band of ironstone nodules over a mottled loam.

Numerous intermittent streams flow directly to the sea, flooding after heavy rain and usually dry up in summer, except Mylies Creek which maintains pools of water either side of Hamersley Drive. Water runoff is generally brackish, becoming more saline as volumes decrease.

A major fault east of East Mt Barren provides the boundary of the Esperance plain developed by Tertiary Plantagenet sediments. Again Quaternary sands have overlain the pediments on the lower, eastern slopes of the mount.

Previous biological surveys

Vegetation and flora surveys have been carried out by:

- Beard (1976, 1979) mapped the vegetation at 1:250 000 scale;
- Aplin and Newbey (1990 a & b) described the vegetation and flora of the FRNP;
- Chapman and Newbey (1995) established a series of monitoring quadrats for flora and trap lines for fauna across the FRNP (Appendix 6);
- Lamont and Witkowski (1995 and 1999) have measured the response to fire of *Banksia* species growing near Hopetoun;
- in 2007, DEC Albany established monitoring plots north of Hamersley Drive, to determine vegetation response to the October 2006 fire. The fire followed from a prescribed burn between Eyre Range and East Mt Barren to achieve some 'break up' of the 1989 wildfire.

Assessment of the state of biological knowledge and its relevance to the FRNP can be found in:

- Hopper and Gioia (2004) discuss the evolution and conservation of the south-west's flora in the context of the area being an International biodiversity hotspot. The FRNP is recognized as an area of particularly high diversity within the south-west;
- Deegan (2005 and 2006) prepared a bibliography and review of the state of knowledge of the Fitzgerald Biosphere;
- a list of the 1,665 plant taxa known from the Park is given in Newbey and Hickman (2008) .

Fitzgerald Biosphere Reserve

The national park is the core area of the Fitzgerald Biosphere which is a part-tenured management concept recognised by UNESCO's Man and the Biosphere program. The Fitzgerald Biosphere Reserve is recognised as being a 'hotspot' within one of Earth's 34 global biodiversity 'hotspots'. The FRNP has approximately 1,660 plant taxa, containing over one-quarter (29%) of the south-west's flora.

The protection of biodiversity is increasingly seen as a global concern. This change in perspective has been associated with an increasing number of international instruments addressing biodiversity conservation issues. Some of these instruments, such as those relating to Biosphere Reserves, have been given some recognition in the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999.* Moreover, the Environmental Protection Authority has recognised the importance of maintaining ecosystem/ecological processes for ecologically sustainable management (EPA 1999).

The government of Western Australia occasionally discusses the *Biodiversity Conservation Act* in Parliament. This Act proposes to enhance legislation for the protection, restoration and sustainable use of our native plants, animals and other native organisms. The government recognises that "all of our natural biodiversity is important and it is our responsibility to ensure that our biodiversity is conserved" (Government of WA 2002).

Vegetation Classification

The survey area lies in the South West Botanical Province and the Esperance Biogeographic Region (after Cresswell and Thackway 1995) and is in the Barren Ranges System described by Beard (1973, 1976). This system includes four types of pediments:

- the small mountains of the Barren Ranges group supporting Barren Ranges thicket – the most consistent species being *Eucalyptus preissiana* and *Dryandra quercifolia*;
- small adjacent portions of coastal plain on sandy lateritic soil supports *Eucalyptus pleurocarpa* mallee-heath;
- river trenches with mallee, including *Eucalyptus redunca, E. uncinata* and *E. conglobata;*
- areas of coastal drift sand with coastal scrub – *Eucalyptus angulosa* and *Melaleuca pentagona* being typical.

Threatened Ecological Communities

The search of DEC's Threatened Ecological Communities database found no known occurrences of threatened ecological communities in the study area (M. Hunter, pers.comm.). However, there are occurrences of the following ecological communities within approximately 5 km of the survey area:

- The 'Vulnerable' threatened ecological community – 'Thumb Peak - Mid-Mount Barren - Woolburnup Hill (Central Barren Ranges) *Eucalyptus acies* mallee heath' ;

- The 'Priority 1' ecological community – 'Very open mallee over *Melaleuca* sp. Kundip (GF Craig 6020) dense heath'.

Declared Rare and Priority Flora

The WAHERB and DEFL searches found 40 species in the vicinity of the survey area, including eight Declared Rare flora. After ovelaying their locations on an orthophoto, this number was reduced to twenty species being recorded near Hamersley Drive (Appendix 1.2). Six Declared Rare flora were located on or near East Mt Barren (Table 2).

Table 2: Declared Rare flora near Hamersley Drive

Species Name	DEC Conservation Code	EPBC Act
Adenanthos ellipticus	R	Vulnerable
Eucalyptus burdettiana	R	Endangered
Eucalyptus coronata	R	Vulnerable
Kunzea similis subsp. *similis*	R	-
Stylidium galioides	R	Vulnerable
Verticordia pityrhops	R	Endangered

4. Field Investigation

Vegetation

The survey area lies in the Barren Ranges system of Beard (1976). Most of the vegetation comprises five units of 'Barren Ranges thicket' – one characterized by *Adenanthos venosus* on shallow soils over outcropping quartzite at the base of East Mt Barren and wave-cut bench, three predominantly on lateritic soils, *Dryandra quercifolia*, *Eucalyptus preissiana* and *Eucalyptus falcata;* and *Melaleuca papillosa* on valley slopes where schist is exposed (Table 3).

Deeper, sandy soils have typical coastal plain vegetation characterized by *Eucalyptus pleurocarpa.* Four units were recognized that were characterized by *Banksia repens, Banksia speciosa, Calothamnus quadrifidus* or *Melaleuca pulchella.*

Five coastal scrub communities lie inland of the beaches, dominated by *Acacia rostellifera, Eucalyptus angulosa, Melaleuca lanceolata, M. nesophila* or *M. pentagona.* Adjacent to Culham Inlet a wetland community of *M. cuticularis* grows. Inland drainage lines support *Eucalyptus occidentalis* dominated plant associations.

Seven A4 maps at 1:10 000 scale will cover the whole project area. Stage 1 of the project covers Maps 2, 3A, 4 and 5 (Appendix 3).

Table 3: Vegetation units in the Fitzgerald River National Park

Map Code	Vegetation structure	Typical species
1. Quartzite & schist:		
Adven	Heath	*Adenanthos venosus, Taxandria conspicua ssp. abrupta, Regelia velutina*
Dque	Open mallee-thicket/heath	*Dryandra quercifolia, Eucalyptus pleurocarpa, Banksia lemanniana*
Efal	Mallee scrub	*Eucalyptus falcata, Templetonia retusa*
Epre	Mallee shrub	*Eucalyptus preissiana, Dryandra quercifolia*
Mpap	Shrub heath	*Melaleuca papillosa*
2. Coastal plain		
Brep	Open mallee-heath	*Eucalyptus pleurocarpa, Banksia repens, Adenanthos cuneatus,*
Bspe	Scrub thicket - sedge	*Banksia speciosa, Anarthria laevis*
Eple/Cqua	Open mallee-heath	*Eucalyptus pleurocarpa, Calothamnus quadrifidus, Anarthria laevis*
Mpul	Heath	*Melaleuca pulchella*
3. Coastal dunes:		
Aros	Thicket	*Acacia rostellifera*
Eang	Open mallee-heath	*Eucalyptus angulosa*
Mlan	Scrub thicket	*Melaleuca lanceolata, Scaevola crassifolia, Acacia rostellifera*
Mnes	Shrub heath	*Melaleuca nesophila*
Mpen	Shrub heath	*Melaleuca pentagona*
4. Creeklines & wetlands:		
Eocc	Woodland	*Eucalyptus occidentalis, Rhagodia baccata*
Mcut	Shrubland	*Melaleuca cuticularis*

These vegetation units will be described in greater detail when all surveys for the project area have been completed in 2010.

Declared Rare and Priority Flora

Five species of Declared Rare flora were found adjacent to Hamersley Drive, principally on the wave-cut bench south of East Mt Barren or on the western flanks of the mountain. A sixth DRF *Verticordia pityrhops* was expected to be found, however no plants were seen (see notes below). A summary of each species is given below and full details of GPS locations and population numbers given in Appendix 4.

Declared Rare flora **(Figure 2)**

***Adenanthos ellipticus* Oval-leaf Adenanthos (Vulnerable)**

Endemic to the Fitzgerald River National Park, this species grows on the summit and south-west slopes of East Mt Barren, extending onto the wave-cut bench south of the mountain. It is a relatively slow growing plant that is killed by fire, but regenerates readily from seed. Field observations (Robinson and Coates 1995) suggest a high susceptibility to *Phytophthora* dieback.

This population was surveyed by DEC Albany in 2008 and estimated to be 30,000+ mature plants and approximately 10,000 seedlings in the burnt area (2006 prescribed burn). In addition, *Adenanthos ellipticus* is known to occur on Thumb Peak and West Mt Barren. Less than 1% of the East Mt Barren population will be impacted by the Hamersley Drive upgrade.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	350	0.9	0.7
[1] East Mt Barren	40,000+		
[2] Thumb Peak	10,000+		
[2] West Mt Barren	1,000+		

[1] DEC Albany 2008
[2] Robinson & Coates 1995

***Eucalyptus burdettiana* Burdett Gum (Endangered)**

Burdett gum is a multi-stemmed mallee, up to 4m high. It has smooth bark and glossy green leaves 9 cm long and 1.7 cm wide. It has stalkless clusters of 7 to 11 flowers on a flattened flower stalk. The floral tubes are not fused and they have very long, horn-shaped bud caps that are slightly warty. This species only grows on and around East Mt Barren.

Prior to this survey *E.burdettiana* was recognised to occur in 2 populations, with population 1 divided into 5 sub-populations (1A, 1B, 1C, 1D & 1E). The total number of plants was believed to be 239, however these numbers fluctuated across visitation from the 1980's to 2000's particularly in populations 1A and 1B. This survey estimates the population to consist of 3500 – 4000 plants, with 1571 plants actually waypointed. 42 plants were identified within the 25 m road buffer. Therefore the plants deemed to be under threat from the proposed road works constitutes 1.2% of the entire population on East Mt Barren.

Population 1E was visited but no plants located and after review of notes on this population it is believed to be equivalent to population 1C. *E.burdettiana* plants were found on all slopes of East Mt Barren with the exception of the extreme eastern slopes, populations 1A, 1B, 1C and 1D all merge and as such the subdivision of these populations is irrelevant. Specific comments on each population are presented in Appendix 4.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	42	1.2	1.2
East Mt Barren	3580		

***Eucalyptus coronata* Crowned Mallee (Vulnerable)**

The Crowned Mallee is a small multi-stemmed, smooth-barked mallee up to 2.5 m high, with bluish-green leaves 12 cm long and 3 cm wide. Strongly ribbed buds occur in threes on a broad flattened stalk. The large fruits have a broad disc and domed, protruding valves that look like a crown.

Prior to this survey *E.coronata* was recognised to occur in 4 populations, from East Mt Barren, Eyre Range, Whoogarup Range and Mid Mt Barren. The total plant numbers was estimated at 215, with 150 of these plants known from East Mt Barren, within 2 sub-populations 1A on the eastern slopes consisting of 100 plants and 1B the summit consisting of 50 plants. This survey amended the population number on East Mt Barren to approximately 2000 plants, with 461 plants actually waypointed. Nine plants identified within the 25 m road buffer. Therefore the plants deemed to be under threat from the proposed road works constitutes 0.5% of the entire population on East Mt Barren.

Since populations 1A and 1B merge on the southern slopes of East Mt Barren the division into sub-populations is irrelevant. Specific comments on each population are presented in Appendix 4. *E.burdettiana* and *E.coronata* population overlap near the summit and on the south-eastern slopes of East Mt Barren.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	9	0.45%	<0.45%
East Mt Barren	2,000		
Annie Peak	unknown		
Whoogerup Range	unknown		
Mid Mt Barren	unknown		

***Kunzea similis* subsp. *similis* (EPBC - not listed)**

Endemic to East Mt Barren, the only known population is on the wave-cut bench, south-west of the mountain. The closely related subsp. *mediterranea* is only known from Bandalup Hill. A survey by Craig (2000) found the population extends for approximately 300 m x 450 m (= 13.5 ha) and was restricted to areas of shallow sand over outcropping quartzite. At that time the population was estimated to be approximately 1,000 plants which were unevenly distributed. This population was surveyed again by DEC Albany in 2009 and estimated to be 3,600 plants in 10 ha. No seedling recruitment was found where the 2006 prescribed burn had escaped into the population.

The densest areas of plants grow in shallow depressions on the bench and in the gullies which drop-off the bench towards the ocean. Here, *Kunzea similis* grows to 1.2 m tall, in an *Adenanthos venosus* vegetation unit.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	100	2.8	2.8
[1] East Mt Barren	3,600		

[1] DEC Albany 2009

***Stylidium galioides* – Yellow Mountain Triggerplant (Vulnerable)**
Endemic to the Eyre Range, a plant with trailing stems that apparently roots at the nodes, which makes it difficult to count the number of plants in a population/area. It is common on East Mt Barren and during the eucalypt survey Ellen Hickman observed *S. galioides* along the walk trail to the summit, all over summit, on the south-eastern face above Hamersley Drive, on the north-eastern face up into the gully directly below the summit and in the gully on west side of East Mt Barren.

Along Hamersley Drive, *S. galioides* occurs from the western slopes of East Mt Barren to the eastern carpark on the wave-cut bench, preferring shallow soil amongst outcropping quartzite. Although the table below indicates a significant percentage of plants would be impacted, the widespread occurrence of *S. galioides* on East Mt Barren suggests that in reality only a very small percentage of plants will be affected by the road upgrade.

		% EMB population	% all populations
Hamersley Drive upgrade	500+	<16%	unknown
[1] East Mt Barren	3,000+		
[2] Fortification Hill	scattered		
[2] Annie Peak	common		

[1] E.Hickman pers.comm.
[2] Robinson & Coates 1995

***Verticordia pityrhops* (Endangered)**
Endemic to East Mt Barren, the only known population is on the wave-cut bench, south-west of the mountain, in the same area as *Kunzea similis*. *Verticordia pityrhops* was surveyed by DEC Albany in 2009 and the population estimated to be approximately 2,000 plants in 10 ha. *Verticordia pityrhops* is killed by fire and no seedling recruitment was found where the 2006 prescribed burn escaped into the population. It is very slow to regenerate from seed (Robinson and Coates 1995).

This species was not found during the current survey, probably because it was vegetative in spring and difficult to discern amongst the relatively mid-dense to dense vegetation in its known area of occurence. *V. pityrhops* usually flowers between February and June, and a survey adjacent to Hamersley Drive during this period is recommended.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	nil seen	few(?)	
[1] East Mt Barren	+/- 2000		

[1] DEC Albany 2009

Priority Two flora (Figure 3)

Calothamnus macrocarpus

Endemic to the East Mt Barren and immediate environs. A robust shrub that grows in sandy soils between Mylies Creek and Culham Inlet, often in association with the very similar *Calothamnus validus*. A large population (100+) occurs on the east bank of Mylies Creek in coastal scrub. A scattered population (estimated 1,000) occurs on the wave-cut bench south and south-east of East Mt Barren growing in shallow soil over rocky quartzite and extends downslope to the park entrance – the north-south extent of this population is unknown.

C. macrocarpus readily resprouts from rootstock following disturbance - some of the largest plants occur on the road verge where plant competition is reduced and there is increased water runoff. A significant number of plants will be affected by the road upgrade.

		% EMB population	% all populations
Hamersley Drive upgrade:			
A. Mylies Beach	233	unknown	unknown
B. Wave-cut bench - inlet	157	est. 15%	unknown
[1] East Mt Barren	200+		
[2] Wave-cut bench	est. 1,000		

[1] Robinson & Coates 1995

[2] S.Barrett DEC Albany 2008

Gonocarpus hispidus

Endemic to the Eyre Range, an unobtrusive, weak shrub that is known only from the summit and slopes of East Mt Barren and immediate surrounding hills (Robinson and Coates 1995), growing amongst outcropping quartzite. The species shows massive germination when stimulated by fire and on the lower, east slope of East Mt Barren a large population (1,000+) plants occurs upslope of Hamersley Drive in an area burnt in October 2006. This sub-population starts 15 m from the verge, extending north and north-east, and is not likely to be impacted by the road upgrade.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	50	0.05	0.05
[1] East Mt Barren	100,000+		

[1] Robinson & Coates 1995

Hibbertia papillata

Endemic to the Eyre Range, being recorded from East Mt Barren and the Eyre Range only (Wheeler 2004) - the size and extent of the population has not been surveyed. It is apparently frequent on mid- and upper-elevations of the mountain (Horn & Butcher, 1999 voucher collection). *H. papillata* is a common component of the *Adenanthos venosus* vegetation unit on the wave-cut bench and extends for nearly 4 km along Hamersley Drive, around the base of East Mt Barren.

A significant number of plants will be affected by the road upgrade.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	est. 500+	unknown	unknown
East Mt Barren	not surveyed		

Leptospermum confertum

Endemic to the Fitzgerald River National Park, known mainly from the summit of East Mt Barren and Thumb Peak. The population on East Mt Barren has not been fully surveyed, although Sarah Barrett (DEC Albany 2005) counted approximately 100 plants adjacent to the walk trail to the summit. A dense thicket of ten plants occurs on the north side of Hamersley Drive, within 10 m of the verge and is likely to be impacted by the road. They are in the same vicinity as *Eucalyptus burdettiana* and *E. coronata.*

		% EMB population	% all populations
Hamersley Drive upgrade	10	?10%	unknown
[1] East Mt Barren	+/-100		
[2] Thumb Peak	500+		

[1] S.Barret, DEC Albany 2005
[2] Robinson & Coates 1995

Priority Four flora (Figure 4)

Acacia argutifolia East Barrens Wattle

This species is known from a number of ranges in the Fitzgerald River National Park, including Whoogerup Range, Thumb Peak and Sepulcralis Hill. It extends northward from East Mt Barren through the Eyre Range, occurring at No Tree Hill and eastwards at Kundip (Robinson and Coates 1995). Along Hamersley Drive it is a frequent component of the *Adenanthos venosus* vegetation unit on wave-cut bench.

Although 100+ plants will be affected by the road upgrade, the impact on this species will relatively low.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	est. 100	est. <5%	est. <3%
[1] East Mt Barren	2,000+		
[1] FRNP	830+		
[1] Kundip	3+		

[1] Robinson & Coates 1995

Acacia moirii subsp. *dasycarpa*

This species is widespread on sandplain from Hamersley Inlet to Munglinup. It is most common on yellow sands after disturbance such as fire. It was frequent in nearly all vegetation units of the study area.

It is recommended that this species be deleted from the Priority flora list.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	est. 1,000+	est. <1%	est. <0.5%
[1] Hamersley Drive	occasional		
[1] Hamersley Inlet	common		
[1] Mt Desmond	100+		
[1] Jerdacuttup	10+		

[1] Robinson & Coates 1995

Anthocercis fasciculata

Endemic to the FRNP, found on quartzite peaks and hills from West Mt Barren to East Mt Barren growing in shallow rocky soils. A disturbance opportunist that appears in great numbers after fire and is relatively short-lived (about 5 years). A patch was found immediately east of Mylies Creek then small groups of plants from near the eastern carpark on the wave-cut bench downslope to the Ranger's residence – all areas which had been burnt in October 2006. In addition, Ellen Hickman observed many patches of *A. fasciculata* on East Mt Barren during the eucalypt survey.

About 100 plants may be affected by the road upgrade, although many of these are adjacent to the existing section of bitumen road that extends uphill from the Park entrance, so presumably won't be impacted.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	100	est. <2%	est. <1%
[1] East Mt Barren	1,000+		
[1] West Mt Barren	500+		

[1] Robinson & Coates 1995

Dampiera deltoidea

A widespread species that is known from Bandalup Hill and from a number of populations in the FRNP, including the Whoogerup Range. It prefers shallow soils over rock (lateritic caprock and quartzite). During this survey, two sub-populations were found on quartz outcrops east of East Mt Barren. These outcrops are near the existing bitumen road, extend beyond the 25 m survey zone and are not likely to be impacted by the upgrade.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	80	unknown	<0.7%
[1] FRNP	6,000		
[1] Bandalup Hill	6,000		

[1] Cockerton and Craig 2000

Hakea hookeriana

A robust shrub that grows to about 2 m high which grows on shallow sand over outcropping quartzite adjacent to the coast. It is endemic to the FRNP and is known from the platform west of West Beach, Thumb Peak and Two Bump Hill. It has previously been collected near Hamersley Drive on the east of East Mt Barren (WAHERB), close to the unburnt/ burnt 2006 boundary. *H. hookeriana* was not found in this survey – the known plant/s were probably burnt in 2006 thus only seedlings would be present. Seedlings would be difficult to identify from the similar *Hakea pandanicarpa* subsp. *crassifolia* which may also grow in the area.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	nil seen	unknown	unknown
East Mt Barren	?		
[1] Thumb Peak	100+		
[1] Two Bump Hill	50+		

[1] Robinson & Coates 1995

Jacksonia compressa

A species that is widespread in the FRNP, and known from West Mt Barren, Mid Mt Barren, Woolbernup Hill and East Mt Barren. It was frequent and widespread in the survey area, particularly on disturbed road verges. Hundreds of plants will be impacted by the road upgrade, but *J. compressa* appears to readily re-establish following disturbance, although areas burnt in 2006 may not have developed an adequate seed bank for regeneration.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	1,400	est. <5%	est. 2%
East Mt Barren	est. 10,000+		

Lechenaultia superba

A species that is usually found within a few years of fire. It has previously been collected near Hamersley Drive, west of East Mt Barren. In this survey it was not found along Hamersley Drive, although Ellen Hickman observed thousands of flowering plants on East Mt Barren, usually in association with *Eucalyptus burdettiana.*

This species is a disturbance opportunist and is not likely to be impacted by the road upgrade.

Leucopogon compactus

A low shrub, found growing in the *Eucalyptus falcata* vegetation unit. Not common in survey area, but is known to frequent coastal scrub heaths in the FRNP. A few plants were found on the south side of Hamersley Drive, west of the West Beach turnoff. It is not expected to be significantly impacted by the road upgrade.

Melaleuca papillosa

A species endemic to the FRNP which forms shrub thickets on schist on valley slopes. It covers large areas west of Mylies Creek, and huge patches of flowering plants could be seen extending for hundreds of metres north of Hamersley Drive plus on slopes behind West Beach.

Seedlings were regenerating in areas that had been burnt in 2006 and an earlier fire (?1989) – apparently a very slow growing species.

It is recommended that this species be deleted from the Priority Flora list.

	No. Plants	% FRNP population
Hamersley Drive upgrade	2,000+	est. <<2%
FRNP	est.100,000+	

Pimelea physodes

A widespread, attractive low shrub that is found throughout the FRNP, mostly on sandplain. It is also known from the Ravensthorpe Range. Localised patches occur along Hamersley Drive in coastal plain communities. The road upgrade will take a small number of plants.

	No. Plants	% all population
Hamersley Drive upgrade	50	est. <0.2%
FRNP	common	
Ravensthorpe Range	occasional	

Threatened Ecological Communities

No listed Threatened or Priority Ecological Communities were found during the field survey, although a community of ecological significance is located on the wave-cut bench that extends south of East Mt Barren.

Significant Ecological Community

The perched micro-wetlands on the wave-cut bench are considered to be a rare community on the south coast (A. Chapman 2009; S.Comer, pers.comm.). These sedge-dominated communities occur within the *Banksia speciosa* vegetation unit and have permanently wet soil fed by freshwater from further upslope - they were too subtle to map individually. A number of small, freshwater pools were present. According to Chapman (2009) they are significant because "they maintain small patches of mesic environment in an otherwise very fire prone and possibly drying environment".

Currently, Hamersley Drive cuts through these micro-wetlands, but the porosity of the road base does not appear to be impeding water flow. It is imperative that any upgrade does not prevent natural water flow downslope of the road, nor cause unnatural ponding of water on the upside.

Vegetation Condition Assessment

The vegetation was generally in excellent health with no weeds observed.

Plants are regenerating in an area between Mylies Beach Road and the western slopes of East Mt Barren, following an escaped prescribed burn in October 2006. Resuckering species are up to 1 m tall, with many having flowers and/or fruits, while obligate seeder species are still establishing. Sandier soils have some relatively bare patches, although overall the original pre-burn suite of plants appears to be establishing successfully. Notes were taken during the survey of the method of regeneration of plants, ie resuckering from rootstock or obligate seeders.

In 1989, much of the survey area was burnt during a wildfire started by lightning strikes. Now, twenty years later, most of the plant communities have re-established with the majority of plants being sexually mature (producing fruits and seeds).

Several aerially-dispersed, canker-causing fungi including species of *Botryosphaeria, Diplodina* and *Zythiostroma,* have been isolated from *Banksia* in the Hopetoun region. Aerial canker *Botryosphaeria ribis,* which kills from the top down, was observed in a few areas, eg in old gravel pits south of Hamersley Inlet Road. In addition, the native dieback *Phytophthora megasperma* is known to occur on East Mt Barren. Plant pathogens appear to be causing decline of a patch of *Banksia speciosa* on the wave-cut bench, north side of Hamersley Drive. A full report on plant diseases and pathogens is being prepared by Malcom Grant.

5. Requirement for Referral or Other Clearances

DEC has ranked plant taxa considered to be threatened under a series of conservation codes, depending on their apparent degree of threat (see Appendix 1). Taxa listed as Declared Rare Flora require permission from the Minister responsible for the Wildlife Conservation Act 1950, if any portion of the plant is to be, or likely to be, disturbed.

The Hamersley Drive upgrade will require permits to take *Adenanthos ellipticus, Eucalyptus burdettiana, Eucalyptus coronata, Kunzea similis* subsp. *similis, Stylidium galioides* and possibly *Verticordia pityrhops.*

Schedule 5 of the *Environmental Protection Act 1986* has 10 principles of clearing. The wave-cut bench at the base of East Mt Barren, is one of the most botanically important sites in the FRNP and along the south coast. It is highly diverse with a large number of short-range endemics, including six species of Declared Rare flora two of which (*K. similis* and *V. pityrhops*) grow nowhere else. Also, a number of micro-wetlands supporting sedge communities important to fauna occur here (see A. Chapman report).

According to Schedule 5, native vegetation should not be cleared if —

1. it comprises a high level of biological diversity;
2. it includes, or is necessary for the continued existence of, rare flora;
3. it is growing in, or in association with, an environment associated with a watercourse or wetland;
4. the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

According to the above criteria, none of the vegetation on the wave-cut bench should have any further disturbance.

The upgrade of Hamersley Drive should be considered a controlled action under the Commonwealth's *Environmental Protection and Biodiversity Conservation Act* and will need to be referred to the Commonwealth's Minister of Environment for approval.

6. Conclusions and Recommendations

Stage 1 of the biological survey included 10 km of Hamersley Drive, from Culham Inlet to the Hamersley Drive turnoff. The section of road from about 2 km west of the carpark at the western end of East Mt Barren, to the eastern carpark on the wave-cut bench, is the most critical for road design and engineering. A high number of short-range endemic species grow here, including six Declared Rare flora which will be impacted by the upgrade. Five of the DRF were adequately surveyed, however it is recommended that *Verticordia pityrhops* be surveyed when flowering (February - June) to determine the number of plants potentially impacted by the road upgrade.

Additionally, on the wave-cut bench there are some ecologically significant micro-wetlands that will require care to ensure that drainage is not impeded by the road (also see A. Chapman's report). It is recommended that an expert in freshwater wetlands be consulted to assess the ecological value of these communities.

Further consultation will be required between DEC and Main Roads to determine the preferred biological trade-offs in the road upgrade, particularly on the wave-cut bench. Most of the DRF occur at each end of the bench where outcropping quartzite may limit road construction – it is imperative that the intervening section of sandy soils characterized by the *Banksia speciosa* vegetation unit (which includes many of the micro-wetlands), is not compromised in the upgrade.

As well as the wave-cut bench being one of the most important botanical sites in the FRNP, it is also one of the most scenic. Despite the "No Stopping/Parking" signs along this section of road, tourists regularly stop to admire the plants and views. Although a 'pull-off' area is desirable to appease the tourists, there is no obvious location to put one. An alternative suggestion is to have a high quality, walk trail along the wave-cut bench, linking the carparks at the east and west ends of East Mt Barren.

An on-site inspection with biologists and surveyor/ road engineer is recommended. For example, near the populations of DRF *Eucalyptus burdettiana, E. coronata* and Priority 2 *Leptospermum confertum* a few large boulders on each side of the road provide ideal habitat for King skinks *Egernia kingii.* In deciding the road alignment, this fauna habitat will need to be considered as well as the threatened flora. Also, the micro-wetlands are difficult to flag on the ground and would be easier to show to the surveyor/ road engineer.

Both weed invasion and plant disease have the greatest potential to impact the high biological and conservation value of the FRNP. Road materials (including water) must come from weed- and disease-free areas, so that they are not imported by either the material itself or the machinery carting it.

Acknowledgements

The assistance of Department of Environment and Conservation (Albany) staff in providing background information and maps for this report is appreciated, notably Deon Utber, Sarah Barrett, Meredith Spencer and Sarah Comer. Information on was provided on fauna by Andrew Chapman and plant disease by Malcom Grant.

Charmaine Hickman accompanied Ellen in her scrambles over East Mt Barren in search of eucalypts. Rosemary Jasper confirmed identification of plant specimens at the Perth herbarium.

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Appendix 1: Department of Environment and Conservation's declared rare and priority flora list

Rare flora legislation and guidelines for gazettal

The State Conservation Strategy, Wildlife Conservation Act, 1950, and Conservation and Land Management Act 1984 provide the guidelines and legislative basis for the conservation of the State's indigenous plant and animal species. Under the Wildlife Conservation Act, the Department of Environment and Conservation (DEC) is responsible for the protection of flora and fauna of all lands and waters throughout the State. Section 23F of the Act gives the Minister responsible for the Act statutory responsibility for the protection of those classes of flora declared to be rare.

The Wildlife Conservation Act (1950-1985) protects all classes of indigenous flora throughout the State. Protected flora includes:

Spermatophyta - flowering plants, conifers and cycads
Pteridophyta - ferns and fern allies
Bryophyta - mosses and liverworts
Thallophyta - algae, fungi and lichens

Section 23F of the Act provides special protection to those taxa (species, subspecies, varieties) considered by the Minister to be:

* in danger of extinction - the taxon is in serious risk of disappearing from the wild state within one or two decades if present land use and other factors continue to operate;
* rare - less than a few thousand adult plants of the taxon existing in the wild;
* in need of Special Protection - the taxon is not presently in danger of extinction but is at risk over a longer period through continued depletion, or occurs largely on sites likely to experience changes in land use which could threaten its survival in the wild;

  or

* presumed Extinct - taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently.

This is achieved by declaring them to be 'rare' by notice published in the Government Gazette. DEC's Policy Statement No.9 discusses the legislation relating to Declared Rare Flora and outlines the criteria for gazettal.

Under the provisions of Section 23F, the 'taking' of Declared Rare Flora is prohibited by any person on any category of land throughout the State without the written consent of the Minister. A breach of the Act is liable to a penalty of up to $10 000. The legislation refers only to wild growing populations and applies equally to Government officers and private citizens on Crown and private land.

To 'take' in relation to any flora includes 'to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause a permit the same to be done by any means'. This includes not only direct destruction or injury by human hand or machine but also such activities as allowing grazing by stock, introducing pathogens, altering water-tables so as to inundate or deprive the flora of adequate soil moisture, allowing air pollutants to harm foliage, and burning.

The schedule published in the Government Gazette is revised annually to accommodate additions and deletions to the Declared Rare Flora. To qualify for gazettal, plants must satisfy certain requirements as defined in Policy Statement No.9, namely:

* the taxon (species, subspecies, variety) must be well-defined, readily identifiable and represented by a voucher specimen in the State or National Herbarium. It need not be formally described under conventions in the International Code of Botanical Nomenclature, but such a

description is preferred and should be undertaken as soon as possible after listing on the schedule;

* the taxon must have been thoroughly searched for in most likely habitats in the wild by competent botanists during the past five years;

* the searches have established that the plant in the wild is either rare, endangered or deemed to be threatened and in need of special protection.

Plants may be deleted from the Rare Flora schedule where:

* recent botanical survey has shown that the taxon is no longer rare, endangered or in need of special protection;

* the taxon is shown to be a hybrid;

* the taxon is no longer in danger of extinction because it has been adequately protected by reservation of land on which it occurs or because population numbers have increased beyond the danger point.

DEC's Priority Species List

DEC maintains a priority species list to determine for survey of plants of uncertain conservation status. The list comprises some 1000+ taxa that are poorly known and in need of high priority survey or are adequately surveyed but in need of monitoring. The poorly known taxa are possibly at risk but do not meet the survey requirements for gazettal as Declared Rare Flora (DRF), as outlined in Policy Statement No.9. Only those plants considered to be threatened on the basis of thorough survey or presumed extinct can be included on the DRF schedule.

The priority flora list is divided into the following categories according to the degree of threat.

Priority One - Poorly known Taxa
: Taxa which are known form 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.

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.

Priority Three - Poorly known Taxa
: Taxa which are known from several 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 need of further survey.

Priority Four - Rare Taxa
: Taxa which are considered to have been adequately surveyed and which, while being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Declared Rare and Priority Flora recorded in Fitzgerald River National Park survey area

The following list includes all species that have been recorded by the Department of Environment and Conservation between Hamersley Inlet and Culham Inlet (column 1). Species recorded in the near vicinity of Hamersley Drive are ticked in column 3, and those found during the current spring survey, within 25 m of the road verge ticked in column 4.

DEC Codes: R – Declared Rare Flora (X – presumed extinct)
P1 – Priority One
P2 – Priority Two
P3 – Priority Three
P4 – Priority Four

Environmental Protection and Biodiversity Conservation Act:
Codes EN – endangered
VU - vulnerable

Species Name	DEC Conserv Code	EPBC Act	Hamersley Drive DEFL & WAHERB	Spring survey 2009
Adenanthos dobagii	R	EN		
Adenanthos ellipticus	R	VU	✓	✓
Coopernookia georgei	R	EN		
Eucalyptus burdettiana	R	EN	✓	✓
Eucalyptus coronata	R	VU	✓	✓
Kunzea similis subsp. *similis*	R	-	✓	✓
Stylidium galioides	R	VU	✓	✓
Verticordia pityrhops	R	EN	✓	
Astartea sp. Fitzgerald (K.R. Newbey 10844)	P2			
Calothamnus macrocarpus	P2		✓	✓
Eremophila chamaephila	P2			
Eucalyptus sinuosa	P2			
Gonocarpus hispidus	P2		✓	✓
Hibbertia papillata	P2		✓	✓
Leptospermum confertum	P2		✓	✓
Pimelea longiflora subsp. eyrei	P2			
Pultenaea brachyphylla	P2			
Stenanthemum cristatum	P2			
Thysanotus brachiatus	P2			
Calycopeplus marginatus	P3			
Eucalyptus arborella	P3			
Gastrolobium stenophyllum	P3			
Lasiopetalum monticola	P3			
Lissanthe pleurandroides	P3			
Thomasia pygmaea	P3			
Acacia argutifolia	P4		✓	✓
Acacia moirii subsp. *dasycarpa*	P4		✓	✓
Adenanthos labillardierei	P4			
Anthocercis fasciculata	P4		✓	✓
Corybas limpidus	P4			
Dampiera deltoidea	P4		✓	✓

Species Name	DEC Conserv Code	EPBC Act	Hamersley Drive DEFL & WAHERB	Spring survey 2009
Eucalyptus praetermissa	P4			
Eucalyptus x erythrandra	P4			
Hakea hookeriana	P4		✓	
Jacksonia compressa	P4		✓	✓
Lechenaultia superba	P4		✓	
Leucopogon compactus	P4		✓	✓
Melaleuca papillosa	P4		✓	✓
Pimelea physodes	P4		✓	✓
Pleurophascum occidentale	P4			
Total species	40		20	17

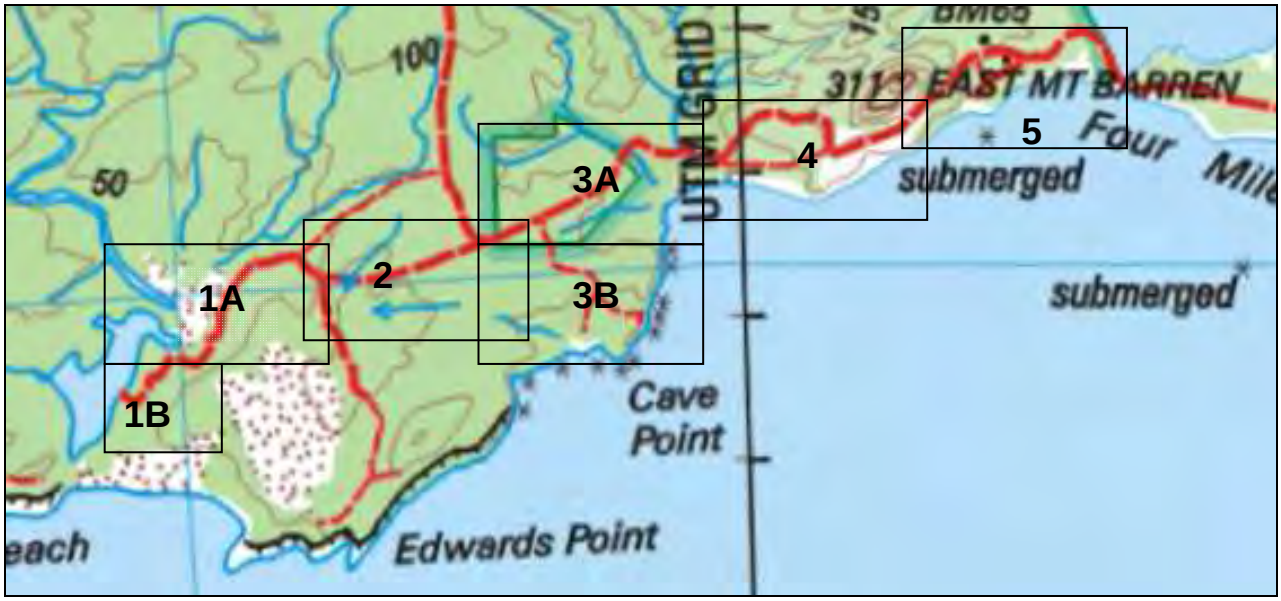
Appendix 2: Muir's (1977) Vegetation Classification

The classification was modified in this project by combining the 'Shrubs 1-1.5 m' and 'Shrubs 1.5 – 2 m' into a single layer, ie Shrubs 1-2 m.

LIFE FORM/ HEIGHT CLASS		CANOPY COVER			
		DENSE 70-100%	MID-DENSE 30-70%	SPARSE 10-30%	VERY SPARSE 2-10%
T	Trees >30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M	Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
LA	Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
LB	Trees <5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
KT	Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
KS	Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
S	Shrubs >2m	Dense Thicket	Thicket	Scrub	Open Scrub
SA	Shrubs 1.5-2m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB	Shrubs 1-1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
SC	Shrubs 0.5-1m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD	Shrubs <0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
P	Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
H	Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
GT	Bunch grass >0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
GL	Bunch grass <0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
J	Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
VT	Sedges >0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL	Sedges <0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
X	Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
	Mosses, liverwort	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

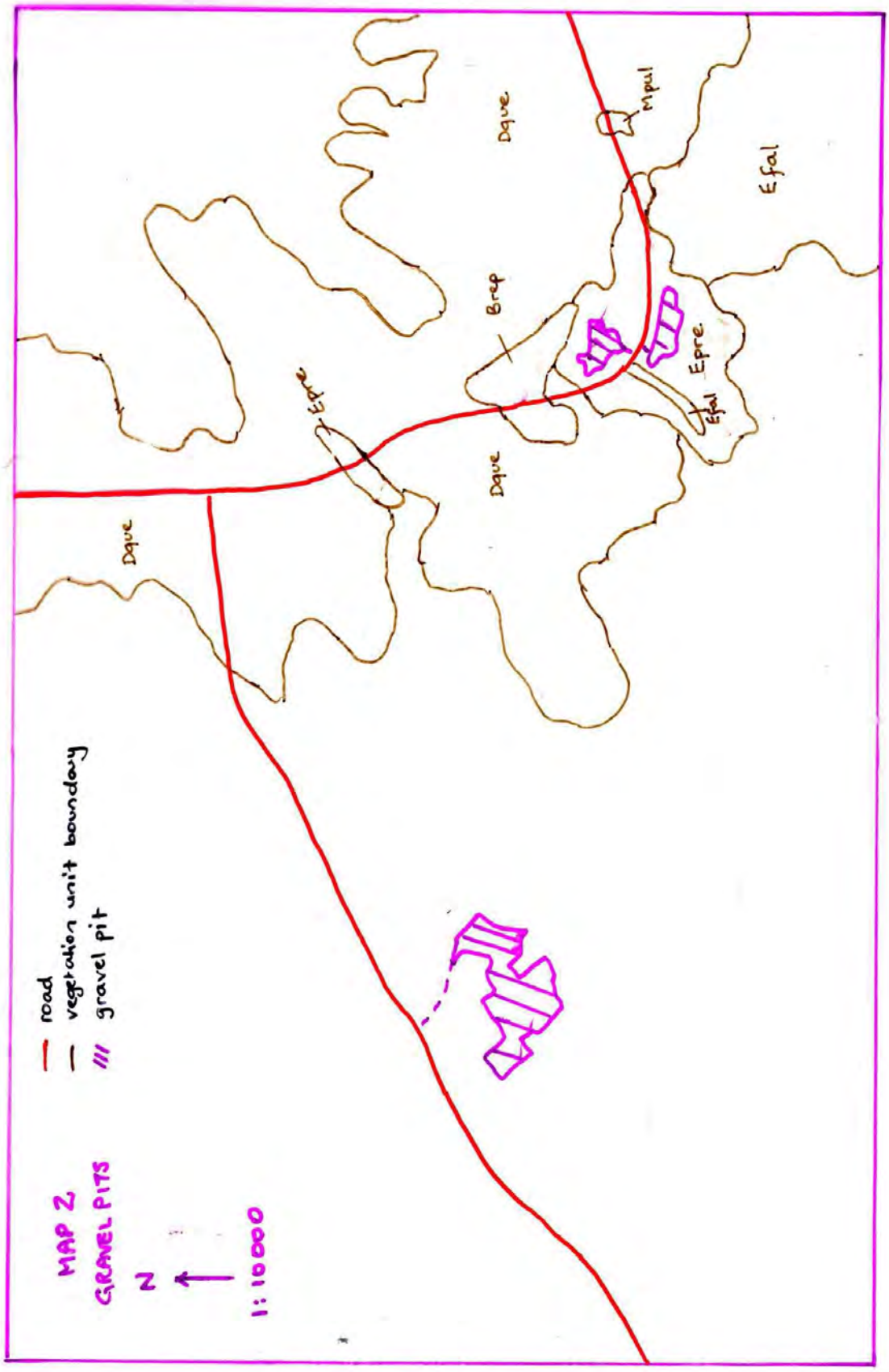
Appendix 3: Vegetation maps

Appendix 3.1: Coverage of vegetation maps

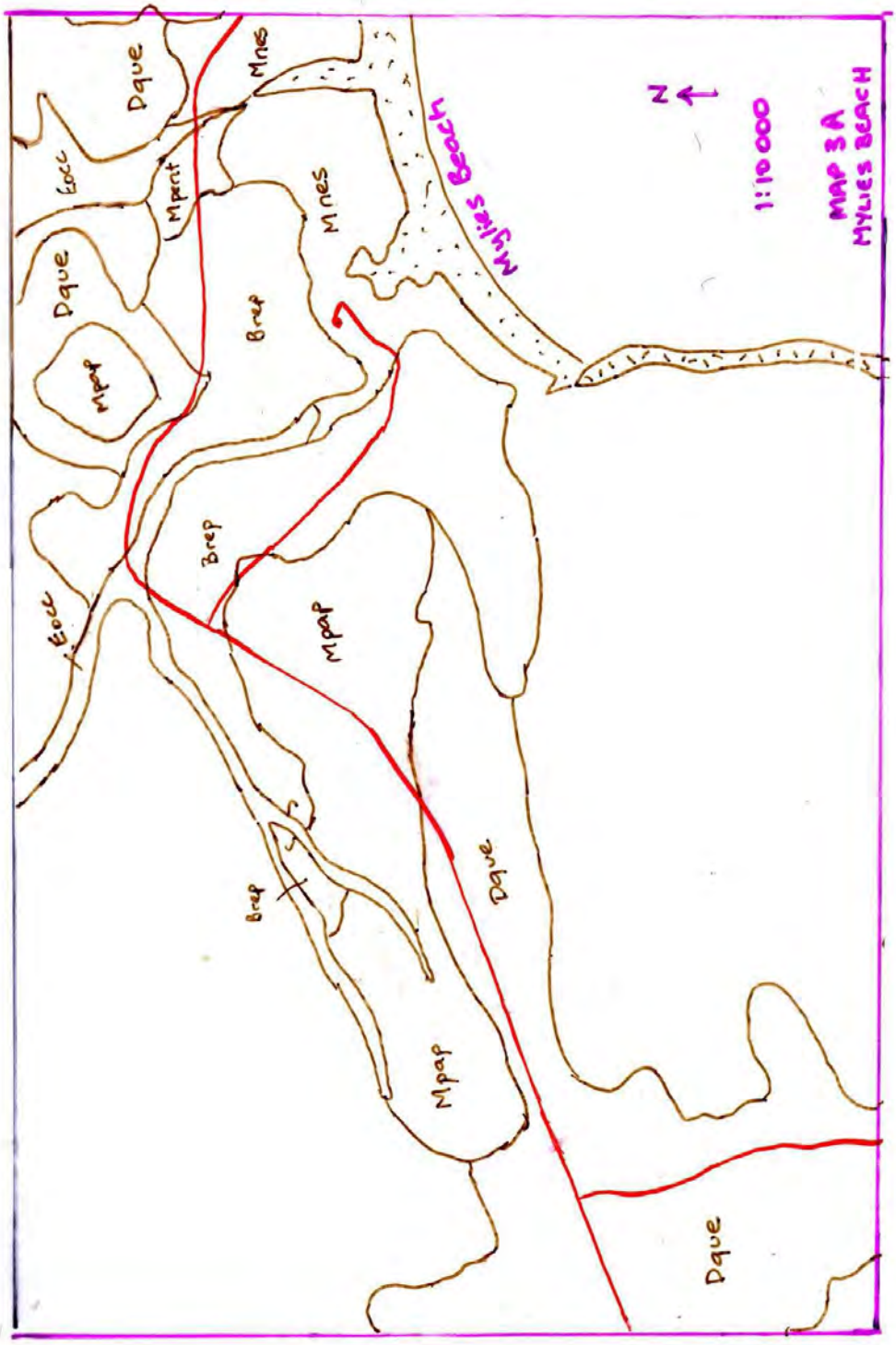


Appendix 3.2: Vegetation units adjacent to the Hamersley Drive upgrade

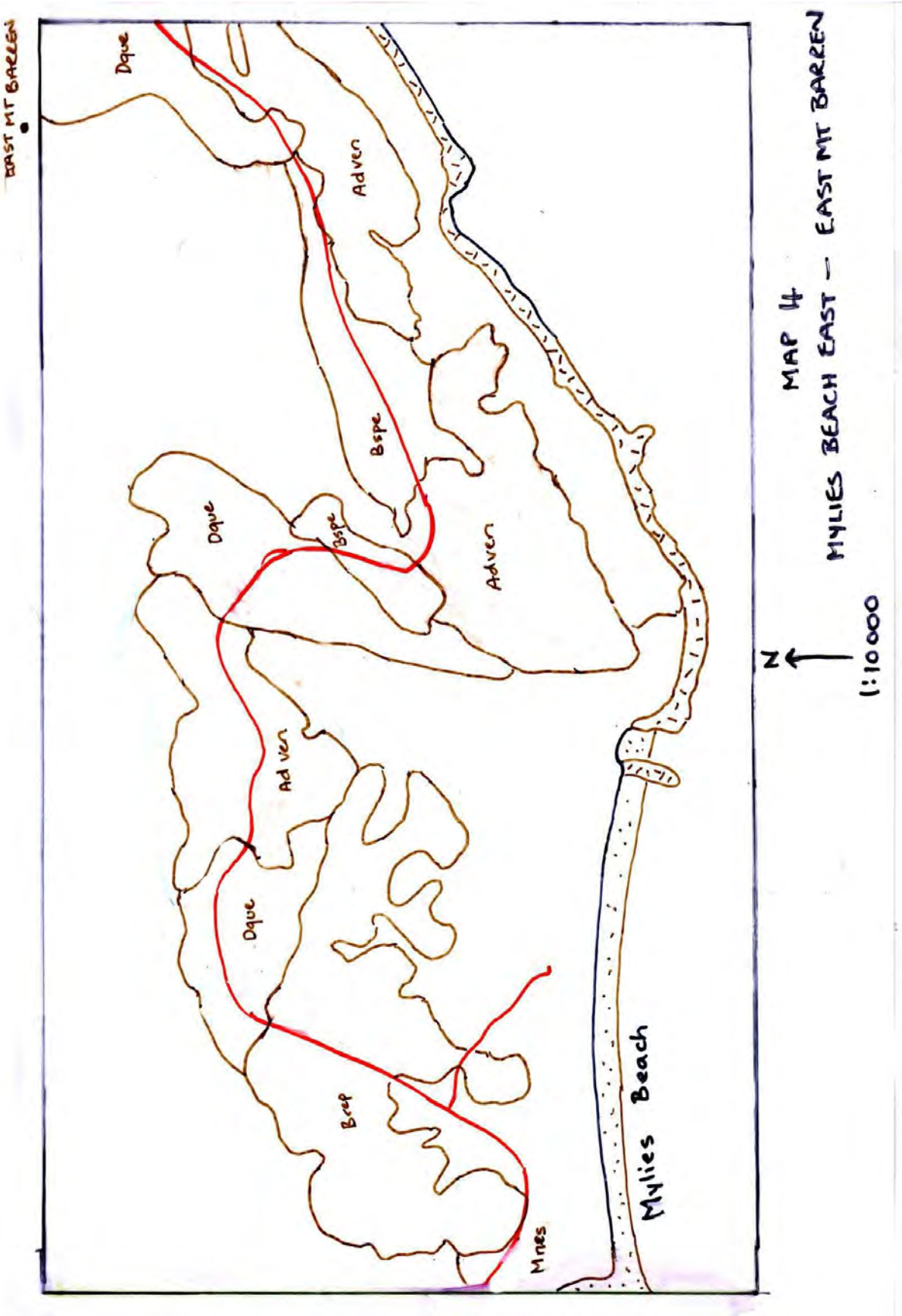
Map Code	Vegetation structure	Typical species
Quartzite & schist:		
Adven	Heath	*Adenanthos venosus, Taxandria conspicua ssp. abrupta, Regelia velutina*
Dque	Open mallee-thicket/heath	*Dryandra quercifolia, Eucalyptus pleurocarpa, Banksia lemanniana*
Efal	Mallee scrub	*Eucalyptus falcata, Templetonia retusa*
Epre	Mallee shrub	*Eucalyptus preissiana, Dryandra quercifolia*
Mpap	Shrub heath	*Melaleuca papillosa*
Coastal plain:		
Brep	Open mallee-heath	*Banksia repens, Adenanthos cuneatus, Eucalyptus pleurocarpa*
Bspe	Scrub thicket - sedge	*Banksia speciosa, Anarthria laevis*
Eple/Cqua	Open mallee-heath	*Eucalyptus pleurocarpa, Calothamnus quadrifidus, Anarthria laevis*
Mpul	Heath	*Melaleuca pulchella*
Coastal dunes:		
Aros	Thicket	*Acacia rostellifera*
Eang	Open mallee-heath	*Eucalyptus angulosa*
Mlan	Scrub thicket	*Melaleuca lanceolata, Scaevola crassifolia, Acacia rostellifera*
Mnes	Shrub heath	*Melaleuca nesophila*
Mpen	Shrub heath	*Melaleuca pentagona*
Creeklines & wetlands:		
Eocc	Woodland	*Eucalyptus occidentalis, Rhagodia baccata*
Mcut	Shrubland	*Melaleuca cuticularis*



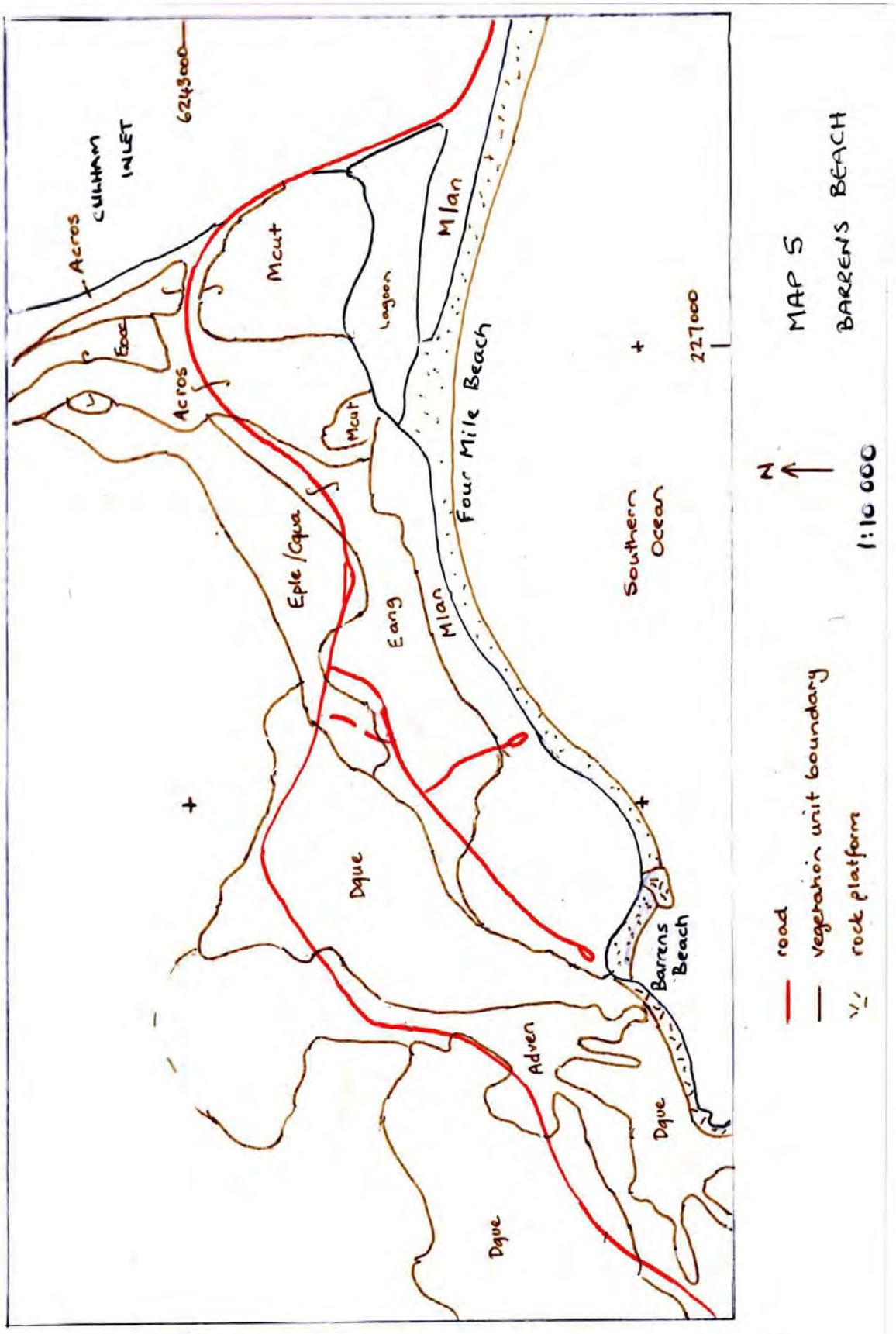
Map 2: Gravel Pits – Hamersley Drive/ Hamersley Inlet Road intersection



Map 3A: Mylies Beach Road



Map 4: Mylies Beach East – East Mt Barren



Map 5: Barrens Beach – Culham Inlet

Appendix 4: Declared Rare and Priority flora

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Appendix 4: Declared Rare and Priority flora

Adenanthos ellipticus (DRF)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Alt	Plant Count	Size	Notes	DigiPic
Hamersley Drive upgrade:								
59	-33.9267	120.01115	1-Oct-09	100.6	2			dscn6420-23
60	-33.92672	120.01123	1-Oct-09	98.5	20	<10m		
67	-33.92645	120.01106	1-Oct-09	98.8	1			
10	-33.93104	120.0128	12-Oct-09	90.5	30	patch	1.5 m	
14	-33.93115	120.01327	12-Oct-09	95.4	7			
15	-33.93113	120.01347	12-Oct-09	93.9	80			
16	-33.93108	120.01361	12-Oct-09	92.7	20	+		dscn6439
18	-33.93095	120.01411	12-Oct-09	90.2	20	+		dscn6442-5
26	-33.93072	120.01393	12-Oct-09	92.7	7			
27	-33.93079	120.01358	12-Oct-09	92	100	+ big patch	to wpt 30	
28	-33.93077	120.0133	12-Oct-09	95.7	30			
30	-33.93066	120.01283	12-Oct-09	97.5	10			
52	-33.92694	120.02457	16-Oct-09	101.2	4			
53	-33.92697	120.02443	16-Oct-09	101.2	3			
57	-33.92764	120.02373	16-Oct-09	96.3	4			
58	-33.92767	120.02369	16-Oct-09	91.1	1			
100	-33.9273	120.02446	16-Oct-09	88.4	11			
					350			
East Mt Barren (WAHERB & DEFL):								
17Ae	-33.93194	120.01361	28/02/2008					
18Ae	-33.91833	120.01333	26 11 1931					
19Ae	-33.91833	120.01333	02 11 1929					
20Ae	-33.91833	120.01333	21 04 1962					
21Ae	-33.91833	120.01333	26 11 1931					
22Ae	-33.91833	120.01333	07 05 1993					
23Ae	-33.91833	120.01333	25 10 1964					
24Ae	-33.91833	120.01333	02 11 1929					
25Ae	-33.91833	120.01333	31 01 1960					
26Ae	-33.91833	120.01333	14 04 1974					
27Ae	-33.91833	120.01333	25 10 1964					
28Ae	-33.91666	120.03333	09 11 1983					
29Ae	-33.91833	120.01333	29 12 1984					
30Ae	-33.91666	120.03333	12 01 1979					
31Ae	-33.92986	120.01456	26 04 2004					
32Ae	-33.92486	120.02678	10 04 1994					
33Ae	-33.92986	120.01539	30 11 1993					
34Ae	-33.91833	120.01333	07 09 1993					
35Ae	-33.91666	120.03333	19 11 1985					
36Ae	-33.91833	120.01333	25 05 1983					
37Ae	-33.91666	120	08 09 1992					
38Ae	-33.91666	120.03333	09 09 1971					
39Ae	-33.91666	120.03333	09 09 1971					
40Ae	-33.92861	120.0125	29 09 1999					

Adenanthos ellipticus – cont.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	350	0.9	0.7
[1] East Mt Barren	40,000+		
[2] Thumb Peak	10,000+		
[2] West Mt Barren	1,000+		

[1] DEC Albany 2008
[2] Robinson & Coates 1995

***Kunzea similis* subsp. *similis* (DRF)**

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	Size	DigiPic
Hamersley Drive upgrade								
11	-33.93104	120.01294	12-Oct-09	92	1			
14	-33.93115	120.01327	12-Oct-09	95.4	70	to wpt 15		dscn6433-8
15	-33.93113	120.01347	12-Oct-09	93.9				
16	-33.93108	120.01361	12-Oct-09	92.7	1			
19	-33.93083	120.01456	12-Oct-09	90.8	5			
21	-33.93043	120.01611	12-Oct-09	82.9	3			
23	-33.92956	120.01743	12-Oct-09	88.4	1			
25	-33.93064	120.01411	12-Oct-09	90.5	5			
26	-33.93072	120.01393	12-Oct-09	92.7	4			
28	-33.93077	120.0133	12-Oct-09	95.7	5			
84	-33.93057	120.0184	16-Oct-09	73.8	5			
					100			
East Mt Barren (WAHERB & DEFL):								
201Ks	-33.93153 -	120.01347	11/05/2005					
201Ks	33.932259	120.01262	07 09 1986					
203Ks	-33.93347	120.01206	04 01 2001				10 ha	

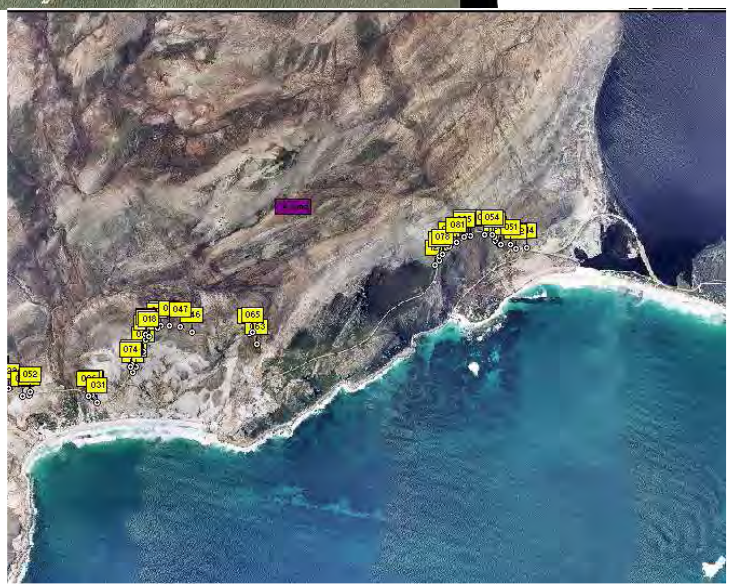
	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	100	2.8	2.8
1 East Mt Barren	3,600		

1 DEC Albany 2009

Acacia moirii subsp. *dasycarpa*

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	est. 1,000+	est. <1%	est. <0.5%
1 Hamersley Drive	occasional		
1 Hamersley Inlet	common		
1 Mt Desmond	100+		
1 Jerdacuttup	10+		

1 Robinson & Coates 1995



Anthocercis fasiculata (Priority 4)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
6	-33.93141	119.99496	29-Sep-09	12.6	20		GFC8600	dscn6355-60
7	-33.93142	119.9951	29-Sep-09	11.3	20			
16	-33.93166	119.99464	29-Sep-09	6.1	2			
18	-33.93154	119.99472	29-Sep-09	8.8	+	W limit		
19	-33.93156	119.99484	29-Sep-09	9.8	+	E limit		
45	-33.92697	120.00646	1-Oct-09	84.7	1			
13	-33.92067	120.0401	23-Oct-09	10.1	1			
15	-33.92061	120.03979	23-Oct-09	7.3	13			
16	-33.92048	120.03958	23-Oct-09	11.9	5			
17	-33.92051	120.0393	23-Oct-09	14.3	7			
19	-33.92034	120.03876	23-Oct-09	17.4	3			
25	-33.9209	120.03957	23-Oct-09	11.9	2			
32	-33.92107	120.0407	23-Oct-09	7.6	1			
33	-33.92117	120.04071	23-Oct-09	7.6	12			
38	-33.91926	120.03498	23-Oct-09	47.9	5			
39	-33.91925	120.03508	23-Oct-09	48.8	4			
40	-33.91948	120.03553	23-Oct-09	46.6	200	+ large patch extends upslope		
55	-33.91939	120.0361	23-Oct-09	37.5	2			
59	-33.91891	120.03484	23-Oct-09	52.4	10			
65	-33.91961	120.03368	23-Oct-09	65.5	70			
66	-33.91979	120.03329	23-Oct-09	68.3	+			
67	-33.91998	120.03293	23-Oct-09	71.6	20			
81	-33.92008	120.03293	23-Oct-09	75	2			
					200			
East Mt Barren (WAHERB & DEFL):								
43Af	-33.91666	120.03333	05 08 1974					
44Af	-33.91833	120.01333	22 10 1961					
45Af	-33.91833	120.01333	25 10 1964					
46Af	-33.93305	119.98333	05 05 1991					
47Af	-33.91666	120.01667	13 04 1974					
48Af	-33.91833	120.01333	28 10 1963					
49Af	-33.91833	120.01333	26 11 1931					
50Af	-33.91833	120.01333	26 11 1931					
51Af	-33.91833	120.01333	26 11 1931					
52Af	-33.91833	120.01333	28 10 1963					
53Af	-33.925	120.05	14 09 1974					
54Af	-33.91666	120.01667	08 09 1992					

Anthocercis fasciculata

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	100	est. <2%	est. <1%
1 East Mt Barren	1,000+		
1 West Mt Barren	500+		

1 Robinson & Coates 1995

Dampiera deltoidea (Priority 4)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	DigiPic
Hamersley Drive upgrade:							
37	-33.91939	120.0348	23-Oct-09	56.7	25	+	dscn6547-9
41	-33.91945	120.03558	23-Oct-09	40.5	1		
54	-33.91954	120.03648	23-Oct-09	37.8	1		
71	-33.92016	120.03231	23-Oct-09	81.1	50	+	
East Mt Barren (WAHERB & DEFL):							
91Dd	-33.91986	120.03484	1/10/1998				
92Dd	-33.93333	120.03333	04 10 1966				

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	80	unknown	<0.7%
1 FRNP	6,000		
1 Bandalup Hill	6,000		

1 Cockerton and Craig 2000

***Hakea hookeriana* (Priority 4)**

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude
East Mt Barren (WAHERB & DEFL):				
168Hh	-33.91666	120.01667	31 01 1960	
169Hh	-33.92013	120.03289	16 11 2003	

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	nil found	-	-
East Mt Barren	?		
1 Thumb Peak	100+		
1 Two Bump Hill	50+		

1 Robinson & Coates 1995

Jacksonia compressa (Priority 4)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
9	-33.93489	119.96026	22-Sep-09	57.6	11			
10	-33.93519	119.9605	22-Sep-09	58.2	10			
12	-33.93541	119.96062	22-Sep-09	61	10			dscn6238-41
13	-33.93558	119.96038	22-Sep-09	62.2	30			
42	-33.93557	119.96094	22-Sep-09	61.9	45	50+ on E-W ridge		
43	-33.93516	119.96055	22-Sep-09	62.2	+			
44	-33.93504	119.96047	22-Sep-09	61.3	5			
42	-33.93653	119.97734	23-Sep-09	55.8	13			
43	-33.93705	119.97565	23-Sep-09	64	50	W limit		
44	-33.93709	119.97579	23-Sep-09	61.6	20	abundant on N verge		
45	-33.93665	119.97654	23-Sep-09	59.7	30			
46	-33.93672	119.97706	23-Sep-09	57.6	1			
47	-33.93593	119.97932	23-Sep-09	52.4	200			
48	-33.93576	119.97964	23-Sep-09	50	5	E limit		
52	-33.93576	119.97949	23-Sep-09	50	500			
53	-33.93655	119.97724	23-Sep-09	57.6	20			
1	-33.9026	119.9476	25-Sep-09	171	+			
10	-33.92643	120.00271	1-Oct-09	66.8	2			
11	-33.92658	120.00213	1-Oct-09	63.4	20	+		
12	-33.92668	120.00186	1-Oct-09	61.3	50			
13	-33.92682	120.00166	1-Oct-09	60.4	10	+		
15	-33.92698	120.00156	1-Oct-09	58.2	+			
18	-33.9271	120.00181	1-Oct-09	56.1	8			
19	-33.92667	120.00221	1-Oct-09	62.2	6			
20	-33.92649	120.00297	1-Oct-09	69.2	4			
22	-33.92637	120.00482	1-Oct-09	75	1			
23	-33.92688	120.00558	1-Oct-09	78.3	50			
26	-33.92724	120.00646	1-Oct-09	84.1	10			
28	-33.92715	120.00718	1-Oct-09	89.9	5			
29	-33.92715	120.0072	1-Oct-09	86	5			
30	-33.92739	120.00781	1-Oct-09	87.2	10	+		
37	-33.92746	120.0085	1-Oct-09	86.3	+			
39	-33.92745	120.00866	1-Oct-09	86.3	+			
41	-33.9272	120.00838	1-Oct-09	89.3	20	+		
43	-33.927	120.00736	1-Oct-09	89.3	+			
46	-33.92692	120.00617	1-Oct-09	82.9	+	common		
47	-33.92636	120.00497	1-Oct-09	79.9	+			
50	-33.92694	120.00878	1-Oct-09	88.4	+	frequent		
54	-33.92681	120.01008	1-Oct-09	89.9	+			
56	-33.9267	120.01029	1-Oct-09	92.7	+			
59	-33.9267	120.01115	1-Oct-09	100.6	+			
61	-33.92681	120.01149	1-Oct-09	100.3	50			
67	-33.92645	120.01106	1-Oct-09	98.8	+	E limit		
68	-33.92644	120.01069	1-Oct-09	95.4	10	+		
14	-33.93115	120.01327	12-Oct-09	95.4	3			
27	-33.93079	120.01358	12-Oct-09	92	3			
32	-33.92337	120.03024	16-Oct-09	91.1	50	+		
35	-33.92415	120.0293	16-Oct-09	87.8	+			
36	-33.92423	120.02927	16-Oct-09	86.9	+	frequent		
42	-33.92526	120.02648	16-Oct-09	94.2	+	frequent		
45	-33.92568	120.0257	16-Oct-09	100	+			
50	-33.92643	120.02499	16-Oct-09	99.7	+			
52	-33.92694	120.02457	16-Oct-09	101.2	+			
58	-33.92767	120.02369	16-Oct-09	91.1	+	occasional		
61	-33.92821	120.02257	16-Oct-09	89.3	+			
62	-33.92821	120.02234	16-Oct-09	89.9	+			

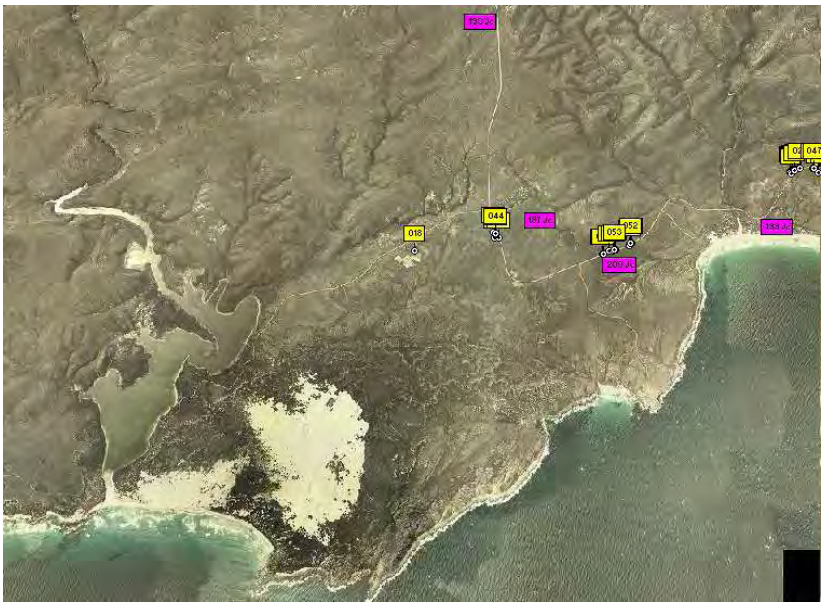
70	-33.92886	120.0203	16-Oct-09	96.3	+	frequent
72	-33.92889	120.01995	16-Oct-09	93	+	
96	-33.92821	120.02323	16-Oct-09	89.9	+	
97	-33.9281	120.0233	16-Oct-09	87.5	+	frequent
98	-33.92768	120.02399	16-Oct-09	93.3	+	
99	-33.9274	120.02434	16-Oct-09	96.6	+	
100	-33.9273	120.02446	16-Oct-09	95.4	+	
101	-33.9268	120.0248	16-Oct-09	96.3	+	
107	-33.92507	120.02699	16-Oct-09	95.1	10	+
110	-33.92449	120.0289	16-Oct-09	88.4	+	
112	-33.92434	120.02927	16-Oct-09	84.1	+	
114	-33.92342	120.03073	16-Oct-09	83.8	+	
117	-33.92188	120.03108	16-Oct-09	83.8	+	
119	-33.92153	120.0311	16-Oct-09	86.3	+	
120	-33.92123	120.03093	16-Oct-09	87.8	+	
122	-33.92216	120.03075	16-Oct-09	87.2	+	
18	-33.93732	119.94923	19-Oct-09	59.4	+	
34	-33.91957	120.0341	23-Oct-09	52.4	20	+
44	-33.91959	120.03598	23-Oct-09	38.4	5	+
45	-33.91994	120.03668	23-Oct-09	32.9	5	+
49	-33.92045	120.03804	23-Oct-09	19.2	8	
58	-33.91904	120.03484	23-Oct-09	53.3	5	
64	-33.91942	120.0338	23-Oct-09	68	+	
65	-33.91961	120.03368	23-Oct-09	65.5	+	
66	-33.91979	120.03329	23-Oct-09	68.3	+	
67	-33.91998	120.03293	23-Oct-09	71.6	+	
69	-33.92015	120.03262	23-Oct-09	76.2	+	
72	-33.92024	120.03219	23-Oct-09	85.3	+	
73	-33.92038	120.0321	23-Oct-09	79.6	+	
74	-33.92103	120.03108	23-Oct-09	87.5	+	
76	-33.92121	120.03117	23-Oct-09	88.7	+	
78	-33.92097	120.03143	23-Oct-09	87.5	+	
79	-33.92074	120.0317	23-Oct-09	85	+	
80	-33.92048	120.03223	23-Oct-09	82.9	+	
81	-33.92008	120.03293	23-Oct-09	75	+	
82	-33.91966	120.03378	23-Oct-09	66.8	+	
					1370	

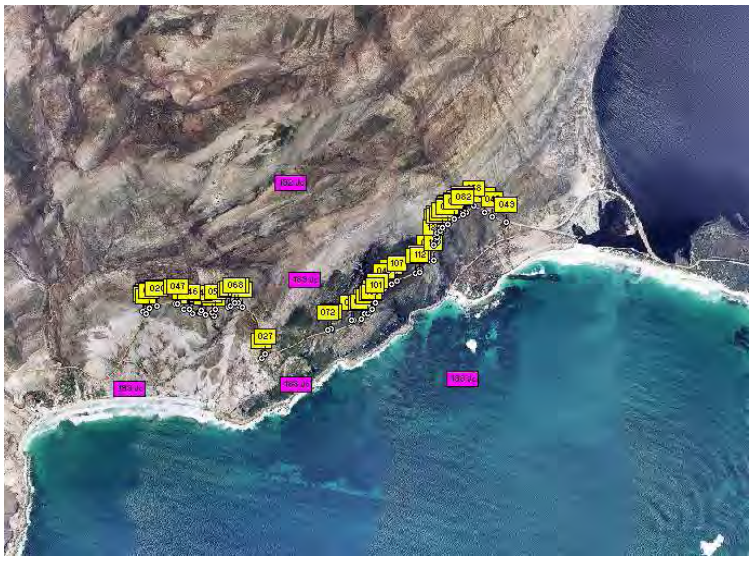
East Mt Barren (WAHERB & DEFL):

181Jc	-33.91666	120.01667	22 10 1985
182Jc	-33.91666	120.01667	10 01 1969
183Jc	-33.91666	120.01667	17 09 1965
184Jc	-33.91666	120.01667	01 10 1970
185Jc	-33.91666	120.01667	21 04 1962
186Jc	-33.91666	120.01667	31 01 1960
187Jc	-33.91666	120.01667	13 12 1964
188Jc	-33.93333	120.01667	02 01 1983
189Jc	-33.92472	120.01778	15 01 2002
190Jc	-33.91666	120.01667	14 07 1971
191Jc	-33.93333	120.03333	07 02 1986
192Jc	-33.91666	120.01667	25 05 1983
193Jc	-33.91055	119.9575	26 12 2006
194Jc	-33.93333	120.03333	28 11 1992
196Jc	-33.93333	120.03333	28 11 1991
197Jc	-33.93333	119.96667	29 11 1992
199Jc	-33.93333	120	28 11 1992
200Jc	-33.93833	119.97806	19 09 2005

Jacksonia compressa

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	1,400	est. <5%	est. 2%
East Mt Barren	est. 10,000+		





Leucopogon compactus (Priority 4)

Surveyed by Gillian Craig – October 2009

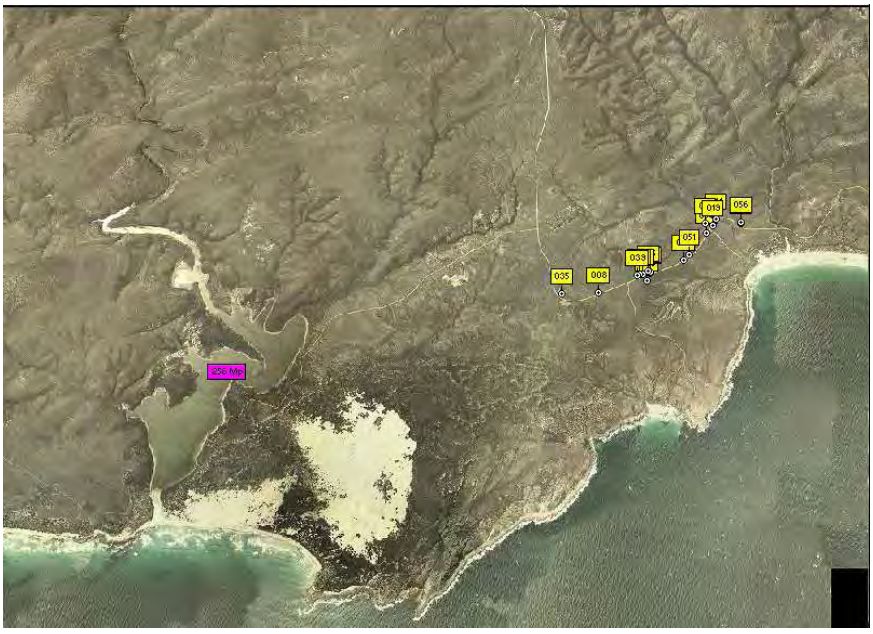
Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
29	-33.9404	119.96534	22-Sep-09	57.9	+		GFC8559-2	
East Mt Barren (WAHERB & DEFL):								
239Le	-33.93208	119.9515	14/07/1992					
242Le	-33.89875	119.93484	14/07/1982					
225Le	-33.91666	120.01667	03 09 1986					
226Le	-33.93333	119.95	14 07 1982					
227Le	-33.91833	120.01333	23 10 1985					
228Le	-33.91666	120.01667	03 09 1986					
229Le	-33.90833	119.93472	11 09 1986					
230Le	-33.89472	119.945	21 08 1991					
231Le	-33.9	119.93333	14 07 1982					

Melaleuca papillosa (Priority 4)

Surveyed by Gillian Craig – October 2009

c	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
35	-33.93974	119.96333	22-Sep-09	57.6	10	gravel pit regen	GFC8562	dscn6256-63
8	-33.93951	119.96844	23-Sep-09	59.7	1			
29	-33.93803	119.97523	23-Sep-09	58.2	200+	burnt 1989; nil in 2006 burn		
33	-33.93706	119.97556	23-Sep-09	63.4	2			
34	-33.93698	119.97555	23-Sep-09	62.2	2			
35	-33.93688	119.97534	23-Sep-09	61.9	1,000	+ N&S side		
37	-33.93727	119.97462	23-Sep-09	63.4	+	W limit at verge		
38	-33.93728	119.97416	23-Sep-09	64.9	+			
39	-33.93738	119.97384	23-Sep-09	65.8	+	SW limit - lge pop extends to N		
49	-33.93545	119.98023	23-Sep-09	44.5	20	unburnt		
					1,000	+ seedlings burnt 2006; extends S		
51	-33.93482	119.98101	23-Sep-09	38.1	+	extends N & E; burn mosaic		
54	-33.93221	119.98331	23-Sep-09	22.6	+	E limit on verge		
14	-33.93054	119.98457	25-Sep-09	9.1	1			
18	-33.93115	119.98309	25-Sep-09	12.2	6	patch; creekline (extends upslope to NW)		
19	-33.93136	119.9842	25-Sep-09	13.1	+			
55	-33.93093	119.98816	25-Sep-09	22.9	+	seedlings 30 cm tall		
56	-33.93084	119.98806	25-Sep-09	18	+			dscn6356 (N)
					2042			
East Mt Barren (WAHERB & DEFL):								
255Mp	-33.91666	120.03333	19 11 1985					
256Mp	-33.95	119.91667	30 09 1972					

	No. Plants	% FRNP population
Hamersley Drive upgrade	2,000+	est. <2%
FRNP	100,000+	

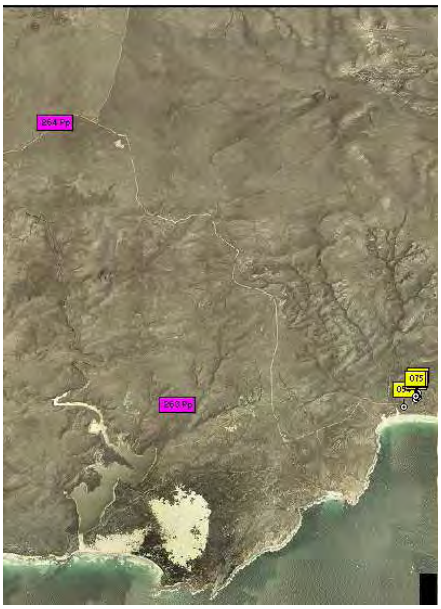


Pimealea physodes (Priority 4)

Surveyed by Gillian Craig – October 2009

Waypoint	Latitude	Longitude	Date	Altitude	Plant Count	Notes	CollNo	DigiPic
Hamersley Drive upgrade:								
54	-33.93219	119.99658	29-Sep-09	19.5	1	old track		
57	-33.93047	119.99976	29-Sep-09	23.8	1			
58	-33.9304	119.99983	29-Sep-09	23.2	12			dscn6375-83
61	-33.92988	120.00023	29-Sep-09	31.7	1			
72	-33.92893	120.0004	29-Sep-09	36.3	3			
74	-33.92957	119.9999	29-Sep-09	32.9	3			
75	-33.92966	119.99982	29-Sep-09	32.9	6			
32	-33.92337	120.03024	16-Oct-09	91.1	1			
115	-33.9231	120.03055	16-Oct-09	71.6	2			
121	-33.92186	120.03068	16-Oct-09	89.3	+			
72	-33.92024	120.03219	23-Oct-09	85.3	3			
75	-33.92092	120.03103	23-Oct-09	88.4	5			
77	-33.9211	120.03132	23-Oct-09	87.8	+			
78	-33.92097	120.03143	23-Oct-09	87.5	+			
79	-33.92074	120.0317	23-Oct-09	85	+			
					ca. 50			
East Mt Barren (WAHERB & DEFL):								
260Pp	-33.91833	120.01333	29 08 1962					
261Pp	-33.91833	120.01333	22 10 1961					
262Pp	-33.91833	120.01333	17 09 1965					
263Pp	-33.93333	119.93333	12 09 1983					
264Pp	-33.86858	119.89684	29 05 2000					
265Pp	-33.92861	120.0125	29 09 1999					

	No. Plants	% all population
Hamersley Drive upgrade	50	est. <0.2%
FRNP	common	
Ravensthorpe Range	occasional	



Appendix 5: Plant species list

Preliminary list of plant species found during survey for Hamersley Drive upgrade. Collection numbers of specimens to be vouchered in the WA Herbarium are indicated.

TAXON NAME	COLLECTION NO.
Aizoaceae	
Carpobrotus virescens	
Anthericaceae	
Corynotheca micrantha	
Johnsonia acaulis	
Thysanotus sp.	
Apiaceae	
Platysace compressa	
Xanthosia huegelii	
Boraginaceae	
Halgania cyanea	GFC8579-1
Caesalpiniaceae	
Labichea lanceolata subsp. brevifolia	
Casuarinaceae	
Allocasuarina corniculata	
Allocasuarina humilis	
Chenopodiaceae	
Atriplex cinerea	
Rhagodia baccata	
Sarcocornia quinqueflora	
Suaeda australis	
Cyperaceae	
Caustis dioica	
Gahnia ancistrophylla	
Gahnia lanigera	
Gahnia trifida	
Lepidosperma sp. Ravensthorpe (G.F. Craig 5188)	GFC8583-1
Lepidosperma sp. U1 big heads (A.S. George 11294)	
Mesomelaena stygia	
Schoenus brevisetis	GFC8554-2
Schoenus grandiflorus	
Schoenus pleiostemoneus	
Schoenus sublaxus	GFC8564
Dasypogonaceae	
Lomandra mucronata	
Dilleniaceae	
Hibbertia gracilipes	
Hibbertia hamulosa	
Hibbertia mucronata	GFC8590
Hibbertia papillata	GFC8614
Hibbertia racemosa	
Hibbertia rupicola	
Droseraceae	
Drosera paleacea subsp. trichocaulis	GFC8560
Epacridaceae	
Acrotriche cordata	
Andersonia parvifolia	

Astroloma tectum	GFC8550
Leucopogon carinatus	GFC8551
Leucopogon compactus	GFC8559-2
Leucopogon conostephioides	GFC8596
Leucopogon flavescens var. brevifolius	
Leucopogon revolutus	
Lysinema ciliatum	
Oligarrhena micrantha	
Sphenotoma dracophylloides	
Sphenotoma gracilis	
Styphelia melaleucoides	GFC8548
Euphorbiaceae	
Phyllanthus calycinus	
Stachystemon polyandrus	GFC8557
Goodeniaceae	
Dampiera angulata	
Dampiera deltoidea	
Dampiera juncea	GFC8549
Dampiera loranthifolia	
Goodenia coerulea	
Goodenia scapigera	
Lechenaultia formosa	
Lechenaultia heteromera	
Scaevola aemula	GFC8589
Scaevola thesioides subsp. filifolia	GFC8584
Velleia trinervis	
Gyrostemonaceae	
Gyrostemon subnudus	GFC8581
Haemodoraceae	
Conostylis vaginata	
Haloragaceae	
Glischrocaryon aureum	
Gonocarpus hispidus	
Iridaceae	
Patersonia lanata	
Patersonia occidentalis	
Lamiaceae	
Pityrodia sp. Dalwallinu (M. Hislop 1860)	
Loganiaceae	
Logania buxifolia	
Logania serpyllifolia	
Loranthaceae	
Nuytsia floribunda	
Malvaceae	
Alyogyne wrayae ms	GFC8583-2
Menyanthaceae	
Villarsia parnassiifolia	
Mimosaceae	
Acacia argutifolia	GFC8630
Acacia cedroides	
Acacia cochlearis	
Acacia cyclops	
Acacia delphina	
Acacia gonocarpa	
Acacia moirii subsp. dasycarpa	
Acacia myrtifolia	GFC8585
Acacia rostellifera	

Acacia subcaerulea	
Myoporaceae	
Myoporum tetrandrum	
Myrtaceae	
Agonis baxteri	
Baeckea ovalifolia	
Beaufortia anisandra	
Beaufortia micrantha	
Beaufortia schaueri	
Calothamnus gracilis	
Calothamnus macrocarpus	
Calothamnus pinifolius	
Calothamnus quadrifidus	
Calothamnus validus	GFC8598
Calytrix leschenaultii	
Conothamnus aureus	
Darwinia vestita	
Eucalyptus angulosa	
Eucalyptus burdettiana	
Eucalyptus coronata	
Eucalyptus falcata	
Eucalyptus leptocalyx	
Eucalyptus occidentalis	
Eucalyptus pleurocarpa	
Eucalyptus preissiana	
Eucalyptus uncinata	
Hypocalymma strictum	
Leptospermum maxwellii	
Leptospermum sp. Bandalup Hill (G. Cockerton 11001)	
Leptospermum spinescens	
Melaleuca citrina	
Melaleuca cuticularis	
Melaleuca nesophila	
Melaleuca papillosa	GFC8562
Melaleuca pentagona	GFC8592
Melaleuca pulchella	
Melaleuca rigidifolia	
Melaleuca striata	
Melaleuca suberosa	
Melaleuca subtrigona	
Regelia velutina	
Taxandria conspicua subsp. abrupta	
Taxandria spathulata	
Verticordia tumida subsp. therogana	
Olacaceae	
Olax benthamiana	
Papilionaceae	
Chorizema glycinifolium	GFC8546
Chorizema trigonum	
Chorizema uncinatum	GFC8582
Daviesia emarginata	
Daviesia incrassata subsp. reversifolia	
Daviesia striata	
Dillwynia pungens	
Eutaxia neurocalyx ms	GFC8554-1
Gompholobium knightianum	
Gompholobium polymorphum	GFC8576

Gompholobium tomentosum	GFC8586
Jacksonia furcellata	
Jacksonia viscosa	
Kennedia coccinea	
Kennedia nigricans	
Sphaerolobium daviesioides	GFC8570
Sphaerolobium racemulosum	GFC8559-1
Templetonia neglecta	
Templetonia retusa	
Poaceae	
Amphipogon amphipogonoides	
Neurachne alopecuroidea	
Polygalaceae	
Comesperma flavum	
Polygonaceae	
Muehlenbeckia adpressa	
Proteaceae	
Adenanthos cuneatus	
Adenanthos ellipticus	
Adenanthos labillardierei	
Adenanthos oreophilus	
Adenanthos venosus	
Banksia baueri	
Banksia coccinea	
Banksia lemanniana	
Banksia media	
Banksia oreophila	
Banksia repens	
Banksia violacea	
Conospermum distichum	
Conospermum teretifolium	
Dryandra cirsioides	
Dryandra falcata	
Dryandra nivea	
Dryandra obtusa	
Dryandra plumosa	
Dryandra quercifolia	
Grevillea coccinea	
Grevillea nudiflora	
Grevillea tripartita subsp. macrostylis	
Hakea ferruginea	GFC8547
Hakea nitida	
Hakea pandanicarpa subsp. crassifolia	
Hakea prostrata	
Hakea trifurcata	
Hakea victoria	GFC8599
Isopogon formosus	
Isopogon polycephalus	
Isopogon sp. Fitzgerald River (D.B. Foreman 813)	
Isopogon teretifolius	
Isopogon trilobus	
Petrophile linearis	
Petrophile seminuda	
Petrophile squamata subsp. northern (J. Monks 40)	GFC8561
Stirlingia anethifolia	
Stirlingia latifolia	
Synaphea favosa	

Synaphea spinulosa	GFC8580
Ranunculaceae	
Clematis pubescens	
Restionaceae	
Anarthria laevis	
Anarthria prolifera	GFC8563
Anarthria scabra	
Desmocladus flexuosus	GFC8566
Hypolaena exsulca	
Lyginia barbata	
Rhamnaceae	
Cryptandra myriantha	GFC8587
Pomaderris myrtilloides	
Stenanthemum intricatum	
Stenanthemum tridentatum	
Rutaceae	
Boronia albiflora	
Boronia crassifolia	
Boronia spathulata	GFC8553-2
Santalaceae	
Exocarpos sparteus	
Leptomeria axillaris	
Solanaceae	
Anthocercis fasciculata	GFC8600
Anthocercis littorea	
Stackhousiaceae	
Stackhousia monogyna	
Sterculiaceae	
Guichenotia ledifolia	
Lasiopetalum quinquenervium	GFC8605
Stylidiaceae	
Stylidium albomontis	GFC8597
Stylidium breviscapum	GFC8588
Stylidium galioides	
Stylidium schoenoides	
Thymelaeaceae	
Pimelea drummondii	GFC8591
Pimelea lehmanniana	GFC8555
Pimelea physodes	
Xanthorrhoeaceae	
Xanthorrhoea platyphylla	

Appendix 6: Location of monitoring quadrats

GPS locations of Chapman and Newbey (1995) quadrats in the vicinity of the Hamersley Drive upgrade and Moir Track

SITE NO.	ZONE	EASTING	NORTHING	(GDA94 datum)	
40 A	50H	775941	6241362	burnt Dec 89, Sept 06	Mylies Beach
43A (2)	50H	225919	6242252	burnt Dec 89, Sept 06	Four Mile Beach
44A	50H	774850	6240122	burnt Dec 89	West Beach Rd
47A	50H	771449	6240365	burnt Dec 89	Hamersley Inlet Rd
46B	50H	773590	6241635	?burnt Dec 89	Hamersley Drive
62B	50H	769688	6250585	burnt Dec 89	Moir Track- east side
63B	50H	769804	6251120	burnt Dec 89	Moir Track - east side

ADDENDUM to report:

Craig GF & EJ Hickman 2009 ***Fitzgerald River National Park Hamersley Drive Upgrade: Vegetation & Flora.*** Report prepared for Main Roads Western Australia, Great Southern Region, Albany. October 2009.

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Executive Summary

Declared Rare and Priority flora

Field surveys were carried out in spring 2009 and identified five Declared Rare flora (DRF) - *Adenanthos ellipticus, Eucalyptus burdettiana, Eucalyptus coronata, Kunzea similis* subsp. *similis* and *Stylidium galioides* - growing on the wave-cut bench on the south side of East Mt Barren, in the proposed area of disturbance. A sixth DRF species, *Verticordia pityrhops,* was found during a later survey in December 2009.

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4. Field Investigation

Declared Rare Flora

Verticordia pityrhops **(Endangered)**
Endemic to East Mt Barren, the only known population is on the wave-cut bench, south-west of the mountain, in the same area as *Kunzea similis*. *Verticordia pityrhops* was surveyed by DEC Albany in 2009 and the population estimated to be approximately 2,000 plants in 10 ha. *Verticordia pityrhops* is killed by fire and no seedling recruitment was found where the 2006 prescribed burn escaped into the population. It is very slow to regenerate from seed (Robinson and Coates 1995).

This species was not found during the survey in October 2009, however it was located a couple of months later in December. The low, dark, pine-like shrubs, 0.2-1 m tall were noticeable in an *Adenanthos venosus* vegetation unit. The plants were vegetative, but their white calyxes remained on the shrub, despite the seed having been dispersed. Again, no seedling recruitment was found in the 2006 burn area.

	No. Plants	% EMB population	% all populations
Hamersley Drive upgrade	38	2	2
[1] East Mt Barren	+/- 2000		

[1] DEC Albany 2009

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Appendix 4

***Verticordia pityrhops* (DRF)**

Surveyed by Gillian Craig – December 2009

Species	Cons Code	Wpt	Latitude	Longitude	Date	Altitude	PlantCount
Verticordia pityrhops	R	72	-33.931126	120.01329	22 12 2009	29.6	1
Verticordia pityrhops	R	73	-33.931108	120.01344	22 12 2009	29.6	1
Verticordia pityrhops	R	74	-33.931089	120.01353	22 12 2009	29.6	1
Verticordia pityrhops	R	87	-33.930794	120.013	22 12 2009	30.5	1
Verticordia pityrhops	R	88	-33.93077	120.01306	22 12 2009	30.5	1
Verticordia pityrhops	R	89	-33.930785	120.01305	22 12 2009	30.5	1
Verticordia pityrhops	R	90	-33.93076	120.01305	22 12 2009	30.5	1
Verticordia pityrhops	R	91	-33.930789	120.01304	22 12 2009	30.5	1
Verticordia pityrhops	R	92	-33.930992	120.01293	22 12 2009	29.9	1
Verticordia pityrhops	R	93	-33.931012	120.01294	22 12 2009	29.9	1
Verticordia pityrhops	R	94	-33.931017	120.01288	22 12 2009	29.9	1
Verticordia pityrhops	R	95	-33.931044	120.01292	22 12 2009	29.9	1
Verticordia pityrhops	R	96	-33.931022	120.01284	22 12 2009	29.9	1
Verticordia pityrhops	R	98	-33.931105	120.01278	22 12 2009	29.6	1
Verticordia pityrhops	R	99	-33.931114	120.01278	22 12 2009	29.6	1
Verticordia pityrhops	R	100	-33.931103	120.01281	22 12 2009	29.9	1
Verticordia pityrhops	R	101	-33.931106	120.01281	22 12 2009	29.9	1
Verticordia pityrhops	R	104	-33.931049	120.01304	22 12 2009	29.9	1
Verticordia pityrhops	R	105	-33.931119	120.01304	22 12 2009	29.6	1
Verticordia pityrhops	R	106	-33.931146	120.01329	22 12 2009	29.6	1
Verticordia pityrhops	R	107	-33.931149	120.01329	22 12 2009	29.6	1
Verticordia pityrhops	R	108	-33.931146	120.0133	22 12 2009	29.6	1
Verticordia pityrhops	R	109	-33.930994	120.01348	22 12 2009	29.9	1
Verticordia pityrhops	R	110	-33.930993	120.01346	22 12 2009	29.9	1
Verticordia pityrhops	R	111	-33.931123	120.01333	22 12 2009	29.6	1
							38
		East Mt Barren (WAHERB & DEFL):					
Verticordia pityrhops	R	302Vp	-33.92931	120.01484	6/05/1999		
Verticordia pityrhops	R	303Vp	-33.92931	120.01484	6/05/1999		
Verticordia pityrhops	R	304Vp	-33.93083	120.01278	3/04/2002		
Verticordia pityrhops	R	305Vp	-33.91833	120.01333	23 01 1969		
Verticordia pityrhops	R	306Vp	-33.93333	120.03333	04 10 1966		
Verticordia pityrhops	R	307Vp	-33.91833	120.01333	31 01 1960		
Verticordia pityrhops	R	308Vp	-33.91833	120.01333	24 01 1969		
Verticordia pityrhops	R	309Vp	-33.91833	120.01333	31 01 1960		
Verticordia pityrhops	R	310Vp	-33.91666	120.01667	25 10 1982		
Verticordia pityrhops	R	311Vp	-33.93194	120.0125	07 09 1986		
Verticordia pityrhops	R	312Vp	-33.91833	120.01333	25 05 1968		
Verticordia pityrhops	R	313Vp	-33.91833	120.01333	24 10 1984		
Verticordia pityrhops	R	314Vp	-33.93125	120.01706	24 05 1999		
Verticordia pityrhops	R	315Vp	-33.91666	120.03333	17 03 1972		
Verticordia pityrhops	R	316Vp	-33.91833	120.01333	05 1970		
Verticordia pityrhops	R	317Vp	-33.91833	120.01333	08 04 1988		

		% EMB population	% all populations
Hamersley Road upgrade	38	2%	2%
[1] East Mt Barren	+/- 2000		

[1] DEC Albany 2009

***Verticordia pityrhops* (DRF) – cont.**

FLORA SURVEY

PORTION OF LOT 6382 STEEREDALE ROAD, HOPETOUN, W.A.

PROPOSED GRAVEL EXTRACTION SITES FOR HAMMERSLEY DRIVE UP-GRADE WORK

A report prepared for

Main Roads Western Australia
Chester Pass Road, ALBANY WA 6330

November 2009

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EXECUTIVE SUMMARY

Main Roads Western Australia is undertaking upgrade works to widen and seal Hamersley Drive in the Fitzgerald River National Park (Shire of Ravensthorpe) on behalf of the Department of Environment and Conservation (DEC).

The proposed upgrade work requires gravel extraction. Lot 6382, Steeredale Road north of Hopetoun was selected as an appropriate source for gravel extraction, and a vegetation and flora survey was conducted at three sites.

The vegetation of the proposed gravel extraction sites is open *Eucalyptus pleurocarpa* mallee heath and open *Banksia speciosa* shrubland, neither of which are classified as Threatened or Priority Ecological Communities.

Two species of Threatened Flora were located in association with these sites, *Acacia moirii* subsp. *dasycarpa* and *Banksia porrecta*, both Priority Four Flora species.

At the time of this survey the vegetation was considered to be healthy and in excellent condition. If the sites are used for gravel extraction then it is recommended that;

1. all machinery be cleaned prior to use on the sites, to limit the introduction of weeds and plant pathogens;
2. top soil is stock piled for use in restoration;
3. any soil or water introduced to the site during extraction and/or restoration should be obtained from disease-free sources;
4. only seed and plants sourced from local provenance should be used in restoration to limit future problems with plant genetics.

1. INTRODUCTION

Background

Main Roads Western Australia is undertaking upgrade works on Hamersley Drive in the Fitzgerald River National Park (Shire of Ravensthorpe) on behalf of the Department of Environment and Conservation (DEC). The works will involve widening and sealing of the existing road for tourism purposes, and will remain on its current horizontal alignment.

The proposed upgrade work requires gravel extraction. Since it was deemed there would not be sufficient gravel sources available within the Fitzgerald River National Park without opening new gravel pits, which is not desirable due to the sensitiveness of the area, other appropriate sources of gravel were sort outside the national park. Lot 6382, Steeredale Road north of Hopetoun was deemed appropriate and three proposed gravel extraction sites were identified.

Main Roads Western Australia requires flora surveys of the portions of Location 6382 identified for gravel extraction to provide an appropriate examination and description of the receiving environment to ensure that all aspects of biological/ecological significance are identified and recorded.

Study Area

Lot 6382 Steeredale Road is located within the Esperance Plains Region in the Shire of Ravensthorpe, approximately 3 kilometres north of Hopetoun townsite, and is bounded by the Hopetoun-Ravensthorpe Road to the east, and Steeredale Road to the North. The specific study sites are three areas of remnant native vegetation in the north west of the location (Fig 1.).

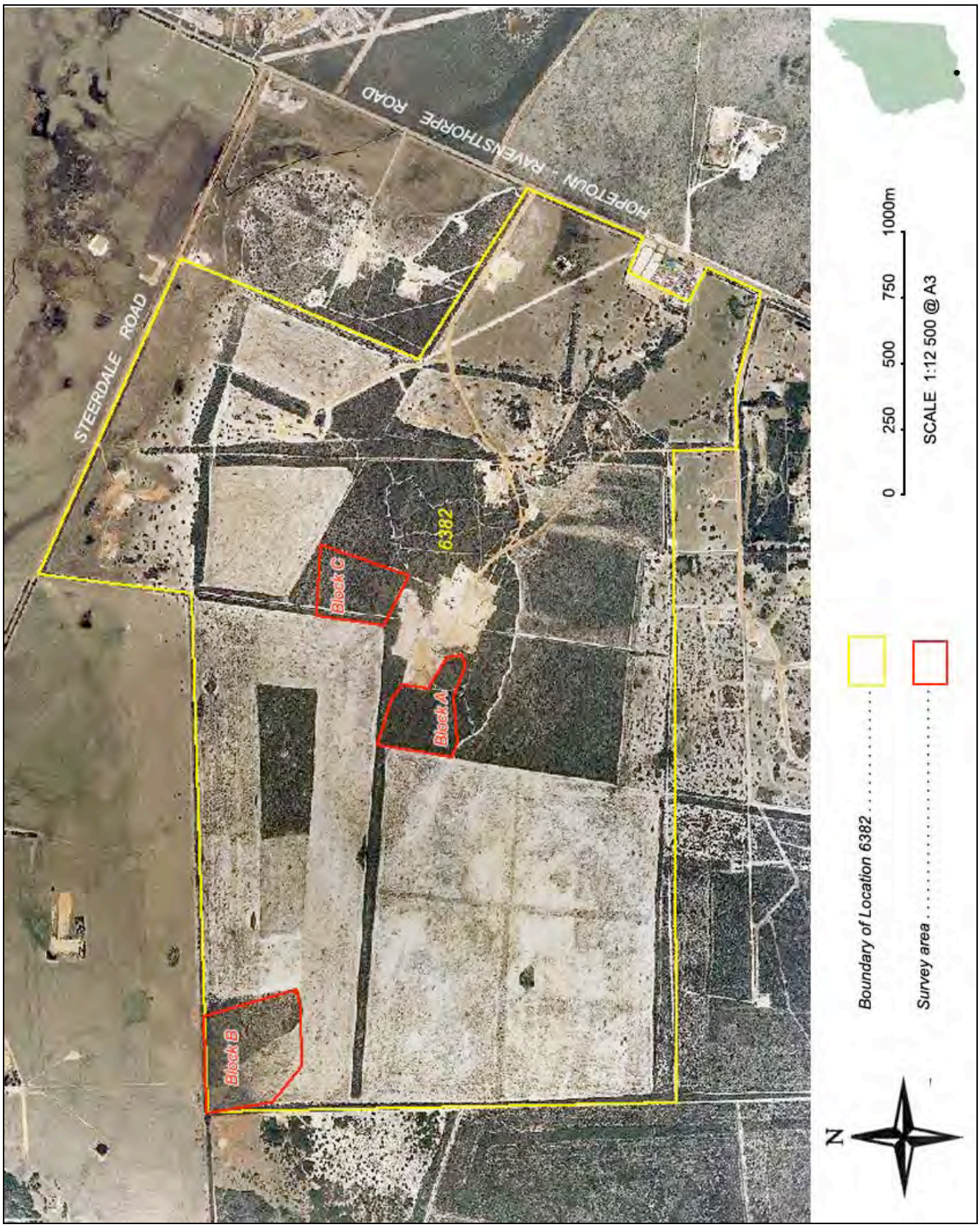

Fig 1. Location of proposed gravel extraction sites on Lot 6382, Steeredale Road, Hopetoun.

2. METHODS

Desktop

Previous reports and publications relevant to the area were reviewed.

A search of the Department of Environment and Conservation (DEC) Threatened Flora Database (DEFL), WA Herbarium database (WAHerb) and Declared Rare and Priority Flora Species List was undertaken.

Field Survey

A foot traverse of each of the three proposed gravel extraction areas was undertaken on 28th September, 2nd and 20th October 2009. The weather was cool to warm (15°C – 28°C max) and sunny or overcast with slight to moderate winds.

Any threatened flora located was marked as waypoints on a Garmin GPS 60 using the GDA94 datum.

Plant specimens were verified using the Albany and Ravensthorpe Regional Herbaria, nomenclature follows WAHERB.

Waypoints were downloaded from the GPS using DNR Garmin software. The waypoints were exported as text files to be imported into Excel to allow for sorting the data into individual files for each species.

3. DESKTOP ASSESSMENT

Physical Environment

Climate

The survey area is located within a region of warm to hot summers and cool, wet winters. The nearest weather station is Hopetoun North, for which the last 13 years of data is available (Table 1). Mean maximum temperature recorded at Hopetoun in the hottest month (February) is 26oC. Mean minimum temperature in the coldest months (July-August) is 8oC. The highest recorded temperature of 46 ^{o}C was recorded in January 1997, while the lowest of -0.3 ^{o}C was in July 2000. Frosts have been recorded by farmers in the catchment during winter and spring, but are usually rare on the coast.

The rainfall is typical of a Mediterranean climate with a pronounced winter maximum and a long dry summer. The mean annual rainfall on the coast is about 500 mm, but has been highly variable over the past 10 years with the maximum of 610 mm in 2001, followed by a very dry year in 2002 when only 274 mm fell. Sporadic heavy rainfall events can occur in summer as a result of cyclonic events in the north of the State - the highest monthly rainfall of 185 mm was recorded in January 2000.

Table 1: Climate data for Hopetoun North (BOM 2009)

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature													
Maximum temperature													
Mean maximum temperature (^{o}C)	25.2	25.8	25	23.3	21.6	19.2	18.2	18.9	20.5	21.4	23.1	24.4	**22.2**
Minimum temperature													
Mean minimum temperature (^{o}C)	15.2	15.7	14.3	12.6	10.5	8.5	7.7	7.9	8.7	10	12.2	13.9	**11.4**
Rainfall													
Mean rainfall (mm)	48.6	18.1	29.3	44.5	36.8	49.5	66.3	54.1	49.1	39.5	37.4	24	**496.4**
Highest rainfall (mm)	185	72.4	69.4	138	78.4	106	126	127	109	70.4	97.2	54.6	**609.8**
Date	2000	1997	2006	2007	1999	2005	2001	2001	1996	2008	2008	2008	**2001**
Lowest rainfall (mm)	0	0.2	0	0	8.2	14.4	30	19.6	5.2	14.4	1.4	3.2	**274**
Date	1998	2008	2008	2008	2002	2002	1996	1996	2000	2006	2007	2006	**2002**
Mean number of days of rain	6.5	5.4	7.8	11.5	12.5	13.8	15	14.8	13.9	10.9	8.1	6.7	**126.9**

Geology and Soils

The survey area is located in the Esperance Plains Region that is formed predominantly of Eocene sediments with outcrops of granites and quartzite (Beard 1990). This region is generally a coastal plain, gently rising to 200m from almost sea level, dissected by quartzite ranges and granite domes. The project area lies to the east of East Mt Barren. The soils are described as sandy neutral yellow-mottled containing different levels of ironstone gravel in the surface sand, alternating with leached sands, and are underlain by a substrate of clay at depths of up to 1.5 m. Hard alkaline and neutral yellow- mottled soils occur in the valleys and support mallee vegetation (Beard 1981).

Previous Biological Surveys

Vegetation and flora surveys have been carried out by:

- Beard (1979, 1990) mapped the vegetation at 1:250 000 scale
- Craig (2005) surveyed north-eastern part of Loc 6382 for potential locations for the Hopetoun Waste Water Treatment Plant. That study recorded 46 vascular plant species, one of which was a Priority 2 taxon, *Andersonia macranthera*. This taxon has since been removed from the CALM Priority list (Department of Conservation and Land Management 2005).
- Woodman Environmental (2006) Flora and Vegetation Study as part of rezoning application. That study recorded 118 vascular plants, one of which was the Priority 2 taxon, *Caesia viscida.* It was found in the southern portion of the survey area. Prior to this location it was only recorded from Cape Arid east of Esperance and was poor represented in the herbarium collections.
- Hickman (2007) Follow-up Flora Survey to assess extent of *Caesia viscida* populations within Location 6382.

Vegetation Classification

The project area is located within the Esperance System of the Eyre Botanical District of the south West Province, and defined and mapped by Beard (1979, 1990).

The Esperance System extends eastwards of the Qualup System, rising from sea-level to a height of 180 metres. It is described as a plain incised by valleys of minor seasonally intermittent rivers. The surface of the plain contains numerous small depressions that form intermittent freshwater lakes or paperbark and yate swamps.

The predominant community is mallee-heath on lateritic soils. The mallees occurring comprise *Eucalyptus tetragona, E. tetraptera* and *E. incrassata*, with the predominant large shrubs including *Banksia baueri, Calothamnus quadrifidus, Dryandra longifolia* and *Lambertia inermis. Acacia, Hakea* and *Isopogon* spp. are typical of the medium shrub layer. The small shrubs and herbaceous plants that form the heath layer include *Andersonia parvifolia, Conospermum distichum, Darwinia diosmoides, Leschenaultia formosa, Petrophile phylicoides, Synaphea polymorpha* and *Verticordia chrysantha*

(Beard 1973).

Where the sand is greater than approximately 90 centimetres in depth, the vegetation changes from a *Eucalyptus tetragona* dominated mallee-heath to a scrub heath dominated by *Banksia speciosa*. Occurring as far east as the Oldfield River is *Banksia baxteri* and *B. coccinea. Lambertia inermis* becomes common and *Nuytsia floribunda* is present. Otherwise the florisitic composition appears to be similar to those comprising the mallee-heath (Beard 1973).

The mallee of the valley slopes is thought to be similar to that of the Qualup system where *Eucalyptus uncinata* and *E. redunca* are the dominant species. *Melaleuca* spp comprise the lower storey. *E. goniantha* appears to be associated with *E. redunca* in the Esperance system.

Woodland comprising patches of virtually pure stands of *E. occidentalis* occur in the valleys. There are no associated trees or shrubs in this woodland and there is very little ground cover.

Woodman Environmental identified and mapped four plant communities and two disturbances units within Location 6382 as part of their Flora and Vegetation Assessment in 2006, these are described below:

- **W**: Low Woodland of *Eucalyptus tetragona* and *Eucalyptus decurva* over *Xanthorrhoea platyphylla* and mixed shrubs on yellow sand with lateritic gravel
- **S**: Open Shrubland of *Banksia speciosa* and *Banksia coccinea* over *Melaleuca striata* and *Beaufortia empetrifolia* over a herb layer dominated by sedges on yellow sand
- **T**: Thicket of *Banksia speciosa* and *Eucalyptus* x *tetragona* over tall shrubs dominated by *Beaufortia empetrifolia, Melaleuca striata* and *Adenanthos cuneatus* on yellow or brown sand
- **H**: Heath dominated by *Beaufortia empetrifolia, Hibbertia mucronata, Melaleuca striata* and *Isopogon trilobus*, with emergent *Eucalyptus decurva*, on yellow sand over limestone

The proposed gravel extraction sites occur mostly within the **S** vegetation type extending into **H** vegetation type on the south boundary of Blocks A and the east boundary of Block C and into **W** vegetation type on the west boundary of Block B.

Threatened Ecological Communities

The search of DEC's Threatened Ecological Communities database found no known occurrences of threatened ecological communities in the study area (M. Hunter, pers.comm.). However, there are occurrences of the following ecological communities within approximately 5 km of the survey area:

- The 'Vulnerable' threatened ecological community – 'Thumb Peak - Mid-Mount

Barren - Woolburnup Hill (Central Barren Ranges) *Eucalyptus acies* mallee heath'

- The 'Priority 1' ecological community – 'Very open mallee over *Melaleuca* sp. Kundip (GF Craig 6020) dense heath'.

Declared Rare and Priority Flora

The WAHERB and DEFL searches found 20 species of threatened flora in the vicinity of the survey area, with one species of Declared Rare Flora. Table 2 below contains a list of these species with their associated conservation codes (see Appendix 1 for definitions).

Table 2: Threatened Flora from near Location 6382 Steeredale Road, Hopetoun.

Species Name	DEC Conservation Code
Acacia aemula subsp. *aemula*	P4
Acacia empelioclada	P4
Acacia moirii subsp. *dasycarpa*	P4
Andersonia carinata	P2
Antherocercis fasciculata	P4
Calochilus pruinosus	P2
Cryptandra craigiae	P1
Dampiera sericantha	P3
Dodonaea hexandra	P1
Eucalyptus famelica	P3
Eucalyptus oleosa subsp. *corvina*	P3
Eucalyptus x *stoataptera*	P2
Hibbertia hamata	P3
Jacksonia compressa	P4
Lechenaultia acutiloba	P3
Mitreola minima	P3
Spyridium montanum	P2
Spyridium oligocephalum	P3
Thysanotus brachiatus	P2
Verticordia pityrhops	R
Verticordia vicinella	P4

4. FIELD INVESTIGATIONS

Vegetation

The majority of the survey area is in open mallee heath of *Eucalyptus pleurocarpa* and *E.decurva* (Fig 2.) or open shrubland of *Banksia speciosa* (Fig 3.).

Fig 2. Open mallee of *Eucalyptus pleurocarpa* and *E.decurva*

Fig 3. Open shrubland of *Banksia speciosa*

The survey identified a total of 144 vascular plants species across the survey area. These species are listed in Appendix 2 and their presence in each of the three proposed gravel extraction sites are recorded in Appendix 3.

Threatened Ecological Communities

No Threatened or Priority Ecological Communities were found during this field survey.

Threatened Flora

Two species of threatened flora were identified during this survey. A summary of each is given below and details of GPS locations are listed in Appendix 4.

***Acacia moirii subsp. dasycarpa* (P4)**

This species is Priority Four Flora species. One plant was located in Block A and 354 plants were located in Block B.

This is an erect spreading shrub 0.15 – 0.6 m high which is densely hairy, has yellow flowers from May to August followed by hairy pods. It is widespread on sandplain from Hammersley Inlet to Munglinup. It occurs on grey, yellow or gravelly sand, sandy clay or loam, rocky loam or quartzite. It is most common after disturbance such as fire. It is recommended for removal from the threatened flora list.

***Banksia porrecta* (P4)**

This species is a Priority Four Flora species. One plant was located in Block B.

This is a prostrate, sprawling, mat-forming shrub 0.2 to 0.35 m high and 0.6 to 4 m wide. It has white, cream flowers from July to August. It occurs on white/grey sand, or sandy loam near Manjimup in the west to east of Ravensthorpe and north to Hyden.

Vegetation Condition

The vegetation was generally in excellent condition with no weed species recorded. Block A and C have not been cleared. Block B vegetation has been cleared and sown to pasture in the past however it has not been maintained and the native vegetation is regenerating well.

A concurrent survey to assess the presence of dieback and other plant pathogens was conducted by Malcom Grant.

5. CONCLUSION & RECOMMENDATIONS

The vegetation of the proposed gravel extraction sites surveyed on Location 6382 Steeredale Road, Hopetoun, is open *Eucalyptus pleurocarpa* mallee heath and open *Banksia speciosa* shrubland, neither of which are classified as Threatened or Priority Ecological Communities.

The Ten Clearing Principles as outlined in Schedule 5 of the Environmental Protection Act 1986 are that native vegetation should not be cleared if;

1. it comprises a high level of biological diversity;
2. it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia;
3. it includes, or is necessary for the continued existence of, rare flora;
4. it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community;
5. it is growing in, or in association with, an environment associated with a watercourse or wetland;
7. the clearing of the vegetation is likely to cause appreciable land degradation;
8. the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area;
9. the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water;
10. the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

The only principle limiting the proposed gravel extraction is that the survey areas comprise vegetation that has a high level of biological diversity.

Two species of Threatened Flora were located in association with these sites, *Acacia moirii* subsp. *dasycarpa* and *Banksia porrecta*, both Priority Four Flora species.

DEC ranks plant taxa considered to be threatened under a series of conservation codes, depending on their degree of threat (see Appendix 1). Taxa listed as Declared Rare Flora require permission from the Minister responsible for the Wildlife Conservation Act 1950, if any portion of the plant is to be, or likely to be, disturbed. As Priority Flora does not require permission from the Minister, application for clearance permits will not be required for the proposed extraction of gravel from these sites.

At the time of this survey the vegetation was considered to be healthy and in excellent condition. If the sites are used for gravel extraction then it is recommended that;

1. all machinery should be cleaned prior to use on the sites, to limit the introduction of weeds and plant pathogens;
2. top soil is stock piled for use in restoration;
3. any soil or water introduced to the site during extraction and/or restoration should be obtained from disease-free sources;
4. only seeds and plants sourced from local provenance should be used in restoration to limit future problems with plant genetics.

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APPENDIX 1: Department of Environment and Conservation's declared rare and priority flora list

Rare flora legislation and guidelines for gazettal

The State Conservation Strategy, Wildlife Conservation Act,1950, and Conservation and Land Management Act 1984 provide the guidelines and legislative basis for the conservation of the State's indigenous plant and animal species. Under the Wildlife Conservation Act, the Department of Environment and Conservation (DEC) is responsible for the protection of flora and fauna of all lands and waters throughout the State. Section 23F of the Act gives the Minister responsible for the Act statutory responsibility for the protection of those classes of flora declared to be rare.

The Wildlife Conservation Act (1950-1985) protects all classes of indigenous flora throughout the State. Protected flora includes:

Spermatophyta – flowering plants, conifers and cycads
Pteridophyta – ferns and fern allies
Bryophyta – mosses and liverworts
Thallophyta – algae, fungi and lichens

Section 23F of the Act provides special protection to those taxa (species, subspecies, varieties) considered by the Minister to be:

- in danger of extinction – the taxon is in serious risk of disappearing from the wild state within one or two decades if present land use and other factors continue to operate;

- rare – less than a few thousand adult plants of the taxon existing in the wild;

- in need of Special Protection – the taxon is not presently in danger of extinction but is at risk over a longer period through continued depletion, or occurs largely on sites likely to experience changes in land use which could threaten its survival in the wild;

  or

- presumed Extinct – taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently.

This is achieved by declaring them to bee 'rare' by notice published in the Government Gazette. DEC's Policy Statement No.9 discusses the legislation relating to Declared Rare Flora and outlines the criteria for gazettal.

Under the provisions of Section 23F, the 'taking' of Declared Rare Flora is prohibited by any person on any category of land throughout the State without the written consent of the Minister. A breach of the Act is liable to a penalty of up to $10 000. The legislation refers only to wild growing populations and applies equally the Government officers and private citizens on Crown or private land.

To 'take' in relation to any flora includes 'to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means'. This includes not only direct destruction or injury by human hand or machine but also such activities as allowing grazing stock, introducing pathogens, altering water tables so as to inundate or deprive the flora of adequate soil moisture, allowing air pollutants to harm foliage, and burning.

The schedule published in the Government Gazette is revised annually to accommodate additions and deletions to the Declared Rare Flora. To qualify for gazettal, plants must satisfy certain requirements as defined in Policy Statement No.9, namely:

- the taxon (species, subspecies, variety) must be well-defined, readily identifiable and represented by a voucher specimen in the State or National Herbarium. It need not be formally described under conventions in the International Code of Botanical Nomenclature, but such a description is preferred and should be undertaken as soon as possible after listing on the schedule;
- the taxon must have been thoroughly searched for in the most likely habitats in the wild by competent botanists during the past five years;

- the searches have established that the plant in the wild is either rare, endangered or deemed to be threatened and in need of special protection.

Plants may be deleted from the Rare Flora schedule where:

- recent botanical survey has shown that the taxon is no longer rare, endangered or in need of special protection;
- the taxon is shown to be a hybrib;
- the taxon is no longer in danger of extinction because it has been adequately protected by reservation of land on which it occurs or because population numbers have increased beyond the danger point.

DEC's Priority Species List

DEC maintains a priority species list to determine the need for survey of plants of uncertain conservation status. The list comprises some 1000+ taxa that are poorly known and in need of high priority survey or are adequately surveyed but in need of monitoring. The poorly known taxa are possibly at risk but do not meet the survey requirements for gazettal as Declared Rare Flora (DRF), as outlined in Policy Statement No.9. Only those plants considered to be threatened on the basis of thorough survey or presumed extinct can be included on the DRF schedule.

The priority flora list is divided into the following categories according to the degree of threat.

Priority One (P1) – 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 mining leases, etc., or 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.

Priority Two (P2) – 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.

Priority Three (P3) – Poorly Known Taxa

Taxa which are known from several 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 need of further survey.

Priority Four (P4) – Rare Taxa

Taxa which are considered to have been adequately surveyed and which, while being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

APPENDIX 2: Vascular Plant Species Recorded within Survey Area 2009

Family	Species Name
Aizoaceae	*Carpobrotus modestus*
Anthericaceae	*Agrostocrinum scabrum*
	Johnsonia acaulis
	Laxmannia brachyphylla
Asteraceae	*Olearia ciliata*
Boraginaceae	*Halgania anagalloides var. Southern (A.E. Orchard 1609)*
Casuarinaceae	*Allocasuarina humilis*
	Allocasuarina thuyoides
Cyperaceae	*Caustis dioica*
	Cyathochaeta avenacea
	Gahnia ancistrophylla
	Lepidosperma sp. Mt Burdett (M.A. Burgman & C. Layman MAB 3287)
	Lepidosperma sp. Halleys
	Mesomelaena stygia
	Mesomelaena tetragona
	Schoenus caespititius
	Schoenus curvifolius
	Schoenus obtusifolius
	Schoenus pleiostemoneus
	Schoenus subbarbatus
	Tricostularia neesii
Dasypogonaceae	*Calectasia grandiflora*
Dilleniaceae	*Hibbertia acerosa*
	Hibbertia lineata
	Hibbertia mucronata
	Hibbertia racemosa
	Hibbertia racemosa
	Hibbertia recurvifolia
	Hibbertia rupicola
Droseraceae	*Drosera erythrorhiza*
	Drosera paleacea subsp. trichocaulis
Epacridaceae	*Acrotriche cordata*
	Andersonia macranthera
	Andersonia parvifolia
	Astroloma prostratum
	Leucopogon conchifolius
	Leucopogon conchifolius
	Leucopogon conostephioides
	Leucopogon crassifolius
	Leucopogon obtusatus
	Lysinema ciliatum
	Oligarrhena micrantha
Euphorbiaceae	*Stachystemon polyandrus*
Goodeniaceae	*Dampiera fasciculata*
	Dampiera linearis
	Goodenia incana
	Lechenaultia formosa
	Lechenaultia heteromera

Family	Species Name
Haemodoraceae	*Anigozanthos humilis*
	Anigozanthos rufus
	Conostylis serrulata
	Conostylis vaginata
Iridaceae	*Patersonia lanata*
	Patersonia pygmaea
Lamiaceae	*Microcorys barbata*
Loranthaceae	*Nuytsia floribunda*
Mimosaceae	*Acacia crassiuscula*
	Acacia cyclops
	Acacia moirii subsp. dasycarpa
	Acacia rostellifera
	Acacia subcaerulea
	Acacia varia var. parviflora
Myrtaceae	*Baeckea pachyphylla*
	Beaufortia micrantha
	Calothamnus gracilis
	Calytrix decandra
	Calytrix leschenaultii
	Chamelaucium megalopetalum
	Conothamnus aureus
	Darwinia sp. Ravensthorpe (G.J. Keighery 8030)
	Darwinia vestita
	Eucalyptus decurva
	Eucalyptus falcata
	Eucalyptus pleurocarpa
	Leptospermum spinescens
	Melaleuca striata
	Melaleuca subtrigona
	Melaleuca thymoides
	Melaleuca tuberculata var. macrophylla
	Taxandria spathulata
	Verticordia roei subsp. roei
Orchidaceae	*Caladenia longicauda*
	Thelymitra campanulata
Papilionaceae	*Chorizema aciculare*
	Daviesia incrassata subsp. reversifolia
	Daviesia retrorsa
	Daviesia teretifolia
	Eutaxia neurocalyx subsp. leptophylla ms
	Gastrolobium spinosum
	Gompholobium knightianum
	Gompholobium scabrum
	Kennedia nigricans
	Sphaerolobium daviesioides
	Templetonia retusa
Phormiaceae	*Dianella revoluta*
Pittosporaceae	*Billardiera heterophylla*
Poaceae	*Amphipogon turbinatus*
	Neurachne alopecuroidea

Family	Species Name
Polygalaceae	*Comesperma virgatum*
Polygonaceae	*Muehlenbeckia adpressa*
Proteaceae	*Adenanthos cuneatus*
	Adenanthos flavidiflorus
	Banksia baxteri
	Banksia coccinea
	Banksia obovata
	Banksia porrecta
	Banksia pteridifolia
	Banksia pulchella
	Banksia repens
	Banksia speciosa
	Conospermum distichum
	Conospermum teretifolium
	Franklandia fucifolia
	Grevillea coccinea
	Grevillea nudiflora
	Hakea corymbosa
	Hakea ferruginea
	Hakea obliqua
	Hakea trifurcata
	Isopogon polycephalus
	Isopogon teretifolius subsp. teretifolius
	Isopogon trilobus
	Lambertia inermis
	Lambertia inermis
	Lambertia inermis
	Lambertia inermis
	Persoonia teretifolia
	Petrophile seminuda
	Petrophile teretifolia
	Stirlingia anethifolia
	Synaphea oligantha
Restionaceae	*Anarthria gracilis*
	Anarthria prolifera
	Anarthria scabra
	Chordifex crispatus
	Harperia lateriflora
	Hypolaena exsulca
	Lepidobolus chaetocephalus
	Lyginia barbata
Rhamnaceae	*Cryptandra pungens*
	Stenanthemum notiale subsp. notiale
Rubiaceae	*Opercularia vaginata*
Rutaceae	*Boronia crassifolia*
	Boronia ramosa subsp. anethifolia
Stylidiaceae	*Stylidium crassifolium*
	Stylidium piliferum
	Stylidium pilosum
	Stylidium schoenoides
Xanthorrhoeaceae	*Xanthorrhoea platyphylla*

APPENDIX 3: Vascular Plant Species Recorded within each Proposed Gravel Extraction Block.

Species Name	Block A	Block B	Block C
Acacia crassiuscula		*	
Acacia cyclops		*	
Acacia moirii subsp. dasycarpa	*	*	
Acacia rostellifera		*	
Acacia subcaerulea		*	*
Acacia varia var. parviflora	*	*	
Acrotriche cordata		*	
Adenanthos cuneatus	*	*	*
Adenanthos flavidiflorus		*	
Agrostocrinum scabrum		*	
Allocasuarina humilis	*	*	*
Allocasuarina thuyoides		*	*
Amphipogon turbinatus	*	*	*
Anarthria gracilis	*	*	
Anarthria prolifera	*		
Anarthria scabra	*	*	*
Andersonia macranthera	*		*
Andersonia parvifolia		*	*
Anigozanthos humilis		*	
Anigozanthos rufus	*		*
Astroloma prostratum		*	
Baeckea pachyphylla		*	
Banksia baxteri	*		
Banksia coccinea	*		*
Banksia obovata	*	*	*
Banksia porrecta		*	
Banksia pteridifolia		*	
Banksia pulchella	*		*
Banksia repens	*	*	
Banksia speciosa	*	*	*
Beaufortia micrantha	*	*	*
Billardiera heterophylla		*	
Boronia crassifolia	*	*	
Boronia ramosa subsp. anethifolia	*		*
Caladenia longicauda	*	*	
Calectasia grandiflora	*		*
Calothamnus gracilis	*	*	*
Calytrix decandra	*	*	*
Calytrix leschenaultii	*	*	*
Carpobrotus modestus		*	
Caustis dioica	*	*	*
Chamelaucium megalopetalum	*		*
Chordifex crispatus	*	*	*
Chorizema aciculare		*	
Comesperma virgatum		*	
Conospermum distichum	*	*	*
Conospermum teretifolium	*		*
Conostylis serrulata	*		*
Conostylis vaginata	*	*	*

Species Name	Block A	Block B	Block C
Conothamnus aureus	*	*	*
Cryptandra pungens		*	
Cyathochaeta avenacea		*	*
Dampiera fasciculata		*	
Dampiera linearis	*	*	*
Darwinia sp. Ravensthorpe (G.J. Keighery 8030)		*	
Darwinia vestita	*	*	*
Daviesia incrassata subsp. reversifolia	*	*	*
Daviesia retrorsa			*
Daviesia teretifolia		*	
Dianella revoluta		*	
Drosera erythrorhiza	*		*
Drosera paleacea subsp. trichocaulis	*		*
Eucalyptus decurva	*	*	*
Eucalyptus falcata		*	
Eucalyptus pleurocarpa	*	*	*
Eutaxia neurocalyx subsp. leptophylla ms	*	*	*
Franklandia fucifolia			*
Gahnia ancistrophylla		*	
Gastrolobium spinosum		*	
Gompholobium knightianum	*	*	*
Gompholobium scabrum			*
Goodenia incana		*	
Grevillea coccinea		*	
Grevillea nudiflora		*	
Hakea corymbosa	*		*
Hakea ferruginea	*		
Hakea obliqua	*		*
Hakea trifurcata	*		*
Halgania anagalloides var. Southern (A.E. Orchard 1609)		*	
Harperia lateriflora	*	*	
Hibbertia acerosa		*	
Hibbertia lineata	*		
Hibbertia mucronata	*	*	*
Hibbertia racemosa		*	
Hibbertia recurvifolia	*		*
Hibbertia rupicola	*	*	*
Hypolaena exsulca	*	*	*
Isopogon polycephalus	*	*	*
Isopogon teretifolius subsp. teretifolius		*	
Isopogon trilobus	*	*	*
Johnsonia acaulis	*	*	*
Kennedia nigricans		*	
Lambertia inermis	*	*	*
Laxmannia brachyphylla	*	*	*
Lechenaultia formosa		*	
Lechenaultia heteromera	*	*	*
Lepidobolus chaetocephalus	*	*	*
Lepidosperma sp.		*	
Lepidosperma sp. Mt Burdett (M.A. Burgman & C. Layman MAB 3287)		*	

Species Name	Block A	Block B	Block C
Leptospermum spinescens	*	*	*
Leucopogon conchifolius	*		*
Leucopogon conostephioides	*		
Leucopogon crassifolius	*	*	*
Leucopogon obtusatus		*	
Lyginia barbata	*	*	*
Lysinema ciliatum	*	*	*
Melaleuca striata	*	*	*
Melaleuca subtrigona			*
Melaleuca thymoides	*	*	*
Melaleuca tuberculata var. macrophylla	*	*	
Mesomelaena stygia	*	*	*
Mesomelaena tetragona	*	*	*
Microcorys barbata	*		
Muehlenbeckia adpressa		*	
Neurachne alopecuroidea		*	
Nuytsia floribunda	*	*	*
Olearia ciliata		*	
Oligarrhena micrantha	*	*	*
Opercularia vaginata		*	
Patersonia lanata	*	*	*
Patersonia pygmaea		*	
Persoonia teretifolia		*	
Petrophile seminuda		*	
Petrophile teretifolia	*		*
Schoenus caespititius	*	*	
Schoenus curvifolius			*
Schoenus obtusifolius	*		
Schoenus pleiostemoneus	*	*	*
Schoenus subbarbatus			*
Sphaerolobium daviesioides	*	*	
Stachystemon polyandrus	*	*	*
Stenanthemum notiale subsp. notiale		*	
Stirlingia anethifolia	*	*	*
Stylidium crassifolium			*
Stylidium piliferum		*	
Stylidium pilosum	*		
Stylidium schoenoides		*	*
Synaphea oligantha	*	*	*
Taxandria spathulata	*	*	*
Templetonia retusa		*	
Thelymitra campanulata	*		*
Tricostularia neesii			*
Verticordia roei subsp. roei	*		
Xanthorrhoea platyphylla	*	*	

APPENDIX 4: Threatened flora locations

Acacia moirii subsp *dasycarpa* (P4)

Waypoint	Latitude	Longitude	Date	Alt	Plant count
16	-33.90844353	120.1180097	29-Sep-09	53	1
1	-33.90172468	120.102235	2-Oct-09	16	8
2	-33.90171203	120.1022605	2-Oct-09	17	4
3	-33.90170675	120.1023786	2-Oct-09	15	2
4	-33.90164279	120.1024982	2-Oct-09	15	1
5	-33.9016878	120.1025383	2-Oct-09	16	10
6	-33.90171127	120.1027111	2-Oct-09	17	14
7	-33.90176643	120.102919	2-Oct-09	18	16
8	-33.90178939	120.1030413	2-Oct-09	22	4
9	-33.90179451	120.1032281	2-Oct-09	18	12
10	-33.90172888	120.1035155	2-Oct-09	19	7
11	-33.90169015	120.1036399	2-Oct-09	18	12
12	-33.90170725	120.1038563	2-Oct-09	17	12
13	-33.90176819	120.104262	2-Oct-09	16	5
14	-33.90179191	120.1044349	2-Oct-09	21	9
15	-33.90174857	120.104592	2-Oct-09	15	14
16	-33.90193373	120.1059486	2-Oct-09	20	7
17	-33.90204437	120.106033	2-Oct-09	23	1
21	-33.90253019	120.1054691	2-Oct-09	23	17
22	-33.90253144	120.1051261	2-Oct-09	23	3
23	-33.90257654	120.104737	2-Oct-09	23	10
24	-33.90262499	120.1046078	2-Oct-09	23	17
25	-33.90258182	120.1044491	2-Oct-09	23	7
26	-33.90258249	120.1043087	2-Oct-09	23	18
27	-33.90258995	120.1040535	2-Oct-09	23	2
31	-33.90273211	120.1027048	2-Oct-09	19	5
32	-33.90277837	120.1024556	2-Oct-09	19	3
33	-33.90279195	120.1023758	2-Oct-09	18	5
34	-33.90283487	120.1021595	2-Oct-09	17	8
35	-33.90275331	120.1019415	2-Oct-09	17	3
36	-33.90348036	120.1023843	2-Oct-09	17	10
37	-33.9033558	120.1027948	2-Oct-09	21	13
38	-33.90328305	120.1030121	2-Oct-09	22	18
41	-33.90310703	120.1040997	2-Oct-09	22	6
43	-33.90316243	120.1051818	2-Oct-09	25	3
44	-33.90319252	120.10544	2-Oct-09	24	2
45	-33.90322739	120.1062527	2-Oct-09	27	10
46	-33.90432928	120.1060053	2-Oct-09	29	5
48	-33.90418972	120.1051826	2-Oct-09	28	12
51	-33.90420103	120.1044546	2-Oct-09	27	3
52	-33.90416021	120.1039341	2-Oct-09	24	2
53	-33.90400934	120.1033734	2-Oct-09	22	4
55	-33.90399207	120.102954	2-Oct-09	21	12
56	-33.90401948	120.1025751	2-Oct-09	20	10
57	-33.90402636	120.1021505	2-Oct-09	19	8
					355

Banksia porrecta (P4)

Waypoint	Latitude	Longitude	Date	Alt	Plant count
27	-33.90258995	120.1040535	2-Oct-09	23	1
					1

Appendix B - Fauna Survey

FAUNAL CONSIDERATIONS FOR PROPOSED UPGRADE OF HAMERSLEY DRIVE FROM EAST MT BARREN TO HAMERSLEY INLET IN FITZGERALD RIVER NATIONAL PARK, WESTERN AUSTRALIA.

REPORT PREPARED FOR MAIN ROADS WESTERN AUSTRALIA

By ANDREW CHAPMAN
NOVEMBER 2009

FAUNAL CONSIDERATIONS FOR PROPOSED UPGRADE OF HAMERSLEY DRIVE - EAST MT BARREN TO HAMERSLEY INLET IN FITZGERALD RIVER NATIONAL PARK, WESTERN AUSTRALIA.

SUMMARY The road upgrade per se is most unlikely to impact on any critical habitat for vertebrate fauna. However, there are water harvesting and drainage considerations that pertain to the entire route and particularly to the East Mt Barren section where there are micro wetland habitats of particular significance. These issues need to be addressed at the design stage. The East Mt Barren section also provides habitat for more species of vertebrate fauna of particular conservation significance than other sections. Some species here will be vulnerable to increased traffic volume and speed. Means of mitigating this and some associated risks also need to be considered at the design stage as well as in on-going management of the park.

1.0 Introduction and purpose of assessment

Fitzgerald River National Park (FRNP) is a large, 329 000 ha, national park on the south coast of Western Australia between the coastal towns of Bremer Bay and Hopetoun that extends to 55 km inland. The area has been managed as a national park since 1972.

Since the mid nineteenth century when James Drummond's plant collection arrived in England the area was recognised for '*its fine and remarkable species*' (W.J. Hooker quoted in Erickson 1975). It was more than a century later that the park's faunal attributes were found to be comparable. In today's parlance the park is often (and appropriately) described as a local biodiversity hotspot within, and major contributor to, the regional hotspot that is the south west of WA.

Some of the conservation values of FRNP are reasonably well known and documented e.g.:

- very high vascular plant species richness with 1 665 species or 29% of the flora of south west WA (Newbey & Hickman 2008)
- with 23 species of native mammal it has more than any other conservation reserve in south west WA (Chapman & Newbey 1995)
- core area of internationally acclaimed Fitzgerald Biosphere Reserve
- "*FRNP is without doubt the most important Mediterranean ecosystem reserve in the world.....*" Dr Bernd von Drost of UNESCO
- as opposed to other large south coast conservation areas, the park is largely free of dieback disease

As a national park (as opposed to a nature reserve under WA legislation) there is a reasonable expectation that the park should accommodate a degree of recreational opportunities and access to enable them that does not compromise its conservation values. To meet this need and in response to the perceived economic consequences to the towns of Hopetoun and Ravensthorpe of BHPBilliton's closure of Ravensthorpe nickel mine in January 2009, in June 2009 the Commonwealth and WA Governments allocated funding to upgrade access to the park. The intention was that improved access will encourage further tourist and visitor use and provide an economic stimulus for the two towns.

The specific purpose of this assessment is to address the following considerations that were provided by Main Roads WA in consultation with Department of Environment and Conservation (DEC). To address the following issues and provide:

- an inventory of the vertebrate fauna species in the survey area. This does not require a trapping program but will require a targeted search and opportunistic recording of species; There are recorded occurrences of the Western Whipbird (western mallee subspecies) and Western Bristlebird throughout the study area
- Where there are significant, proven, cave or other habitable karst features within the

survey area the assessment should include a consideration of karst fauna;
- a review of the fauna species considered to be rare or in need of special protection;
- a review of the presence and abundance of pest, declared or feral animals;
- identify any habitats of significance;
- an assessment of the value of the roadside in providing habitat and facilitating movement between conservation areas;

Management and Rehabilitation

- information directed towards practical management techniques for mitigating impact and maintaining the value of roadsides for conservation of flora and fauna species known to exist within, or use, the survey area; and
- where variance occurs, offsets consistent with the offset principles, see Appendix B, should be provided.

In addition to these considerations this assessment also takes into account implications for fauna of both gravel removal for the upgrade from private property on location 638 (Chris Fisher) and significantly increased traffic volume and speed on upgraded sections.

2.0 Sources of data and methods of assessment

The inventory of vertebrate fauna for the route of the upgrade (Appendix I) is drawn from the following sources:

1. biological survey quadrats 40A, 43A, 44A & 47A that were along the upgrade route (see Chapman & Newbey 1995)
2. DEC's threatened fauna data base
3. reliable personal communications from people with knowledge of the park e.g. rangers, park users and biologists including birdwatchers
4. consultants reports for subdivisions between Hopetoun and Culham Inlet

Four field days were spent with time divided between logistic tasks e.g. relocating biological survey quadrats and listening for western whipbird and western bristlebird in previously known and possibly expected locations, identifying habitats of particular significance and examining proposed gravel pits within the park and on private property.

3.0 Results of assessment

3.1 Fauna inventory

Appendix I lists 79 species of vertebrate including 11 species of particular conservation significance (see 3.3 below) that have been recorded within 100m of either side of the proposed upgrade. One inclusion, western ground parrot, has not been recorded along the upgrade route but a pair was observed in 1985 on Moir Track near a proposed gravel pits site. It is <u>not</u> a predictive list which would be much more extensive. Culham Inlet waterbirds of which there are 30+ species are not included.

3.2 Cave and/or karst features

Cave and/or karst features are not known from the proposed upgrade route in the national park. There are two karst sink-holes south of Hamersley Drive opposite the Hopetoun golf course. Although of considerable biological interest as they may host relictual, troglodytic invertebrate fauna they will not be impacted by the upgrade.

3.3 Vertebrate fauna of particular conservation significance

Eleven species of particular conservation significance have been recorded along the upgrade route (but see comment on western ground parrot above). Listed species are either critically endangered (CR), endangered (EN), vulnerable (VU) or priority listed at P4 or P5 i.e. 'taxa in need of monitoring'. These determinations are made under WA Wildlife Conservation Act.

- Western brush wallaby, *Macropus irma* (P4). Recently recorded between East Mt Barren and Mylies Beach probably in response to opportunity to feed in green pick from September 2006 wildfire.
- Chuditch, *Dasyurus geofroii* (VU) Recorded from Hopetoun townsite and coastal moort woodland east of Hamersley Inlet in late 1990s and in 2009 between Culham Inlet and FRNP boundary. With its recent recovery in numbers locally, chuditch could turn up anywhere along the upgrade route.
- Dibbler, *Parantechinus apicalis* (EN) Recorded at East Mt Barren and in coastal moort woodland east of Culham Inlet in the late 1990s.
- Southern brown bandicoot, *Isoodon obesulus fusciventer* (P5) Recorded in 2009 from Hopetoun Golf Club driveway within 20 m of Hamersley Drive.
- Carnaby's cockatoo, *Calyptorhychus latirostris* (EN) Recorded between Hopetoun and Culham Inlet in *Banksia speciosa* shrubland or *Eucalyptus pleurocarpa* mallee. Recently regularly seen in flocks to 200 along upgrade route between West Beach and Hamersley Inlet turn-offs.
- Western whipbird, *Phosphodes nigrogularis oberon* (P4) Recorded regularly in vicinity of East Mt Barren, occasionally at Mylies Beach turn-off, West Beach turn-off and coastal vicinity, road into Hamersley Inlet and few other locations along Hamersley Drive.
- Western bristlebird, *Dasyornis longirostris* (VU) Recorded regularly in vicinity of East Mt Barren, occasionally along road into Hamersley Inlet and outside of review area in vicinity of Sepulcralis Hill.
- Western ground parrot, *Pezoporus wallicus flaviventris* (CR) Only recorded from one pair in 1985 from close to where Moir Track intersects Hamersley Drive. This is outside the upgrade route but close to a proposed gravel extraction site.
- Recherche Cape Barren goose, *Cereopsis novaehollandiae grisea* (VU) Occasional visitor, one pair present near edge of Culham Inlet near roadside in 1986.
- Malleefowl, *Leipoa ocellata* Occasional records from Hamersley Drive approximately 0.5 km east of Culham Inlet in late 1990s
- Carpet Python, *Morelia spilota imbricata* (P4) Regular records from vicinity of East Mt Barren.

With the possible exception of heath rat, *Pseudomys shortridgei* which may turn up, it is likely that the eleven species above account for the vertebrate fauna of particular significance in the assessment area.

3.4 Pest and/or feral species

Foxes have been recorded at East Mt Barren and their tracks are sometimes present on beaches adjacent to the upgrade route. Rabbits have been recorded at Mylies Beach day use area, near Four Mile campsite and at Hamersley Inlet. Feral cats are certainly present, their abundance is difficult to assess due to their cryptic nature and lack of signs of their presence but they are likely to be quite abundant. Only one species of feral bird, laughing kookaburra, is present in FRNP; it is restricted to woodlands in the north of the park. Feral bees are present and can be abundant. They are a factor in conservation management due to their aggressive competition against other insects for nectar and pollen (and possibly the honey possum), their occupancy of refugia such as hollows, cracks and crevices. They are also implicated in plant hybridization and are a factor in recreational management in natural environments as many people are allergic to bee sting. They are dependent upon freshwater; therefore management of water harvesting and drainage is an issue for the upgrade project (see Discussion – below).

3.5 Habitats of particular significance

The freshwater drainages and micro wetlands on the seaward side of East Mt Barren and Hamersley Drive are habitats of particular significance identified by this assessment (see plates 1,2,& 3). These subtle drainages certainly provide habitat for frogs, in particular the quacking frog, *Crinia geogiana*, and possibly relictual or range restricted invertebrates. There are 3-4 drainages, the best example is at the westernmost rare flora marker on the seaward side of East Mt Barren. They provide at least permanently moist soil and even in fairly dry conditions trickling, fresh surface water may be present. They terminate in the steep gully cliffs along the wave cut bench 90 m above sea level that have dense and vigorous vegetation due to their enhanced moisture status. They are significant because they maintain small patches of mesic environment in an otherwise very fire prone and possibly drying environment. At the time of this assessment there was passage of water through the micro wetlands near the rare flora marker that was not maintained by flow through the culvert. The flow appears to depend on the porosity of the road base under the surface of the road.

3.6 Role of the roadside in habitat enhancement

One of the consequences of road construction on adjacent vegetation can be to promote growth by limiting competition on the inner side and the creation of moisture gaining sites along the table drain. This can be observed along Hamersley Drive in the vicinity of East Mt Barren. While this enhancement of habitat can provide a brilliant display of flowering, readily accessible plants which delight birdwatchers, wildflower enthusiasts and photographers, it creates a management requirement to provide appropriate vehicle stopping places or other facilities e.g. walk trails, to enable people to stop and look. There is also a road safety issue if sight distances are reduced and a visual amenity issue if the 'wide open vista' aspect of landscape or seascape, which many value, is diminished.

3.7 Gravel pits assessment on Steeredale Road, location 6382 (Chris Fisher)

Proposed gravel pit #1 approx. 5.5 ha (plate 4) is within an envelope designated 'extractive industries' immediately west of the limestone quarry. The vegetation of both proposed areas has been described in detail as part of the overall assessment and need not be repeated here. The vegetation here is dominantly *Banksia speciosa* shrubland with occasional *Eucalyptus pleurocarpa, E. falcata* and *Nuytsia floribunda* on deep sand overlying the gravel deposit. Understorey species are dense and floristically diverse with a predominance of proteaceous species. Although there is extensive peripheral disturbance the vegetation is in good condition. The moribund appearance of some *B. speciosa* is due to wind breakages from recent extremely heavy winds. Additionally some banksias are infected with a black fungus on upper stems and leaves. The vegetation is further infected by air borne canker (Malcolm Grant – personal communication). Five bird species and *Rattus fuscipes* (burrows) were recorded over two hours; foxes have also been present.

Proposed gravel pit #2 approx. 8.5 ha (plate 5) is within an envelope designated 'rural conservation' at the north west corner of location 6382. This proposal has many plant species in common with #1 but the vegetation structure is very different (compare plates 4 & 5) due to much shallower sand over gravel with the dominant upper storey being *Eucalyptus falcata, E. pleurocarpa* and *Nuytsia floribunda*. With the exception of the south west corner of this piece, which is regeneration from clearing (and some 40% of its area) the vegetation here is also in good condition. Nine species of bird were recorded in two hours. Rabbit and fox burrows were present.

Although both pieces have vegetation that is in good condition, as vertebrate habitats both are remnants that will become increasingly isolated with future development. They are unlikely to provide critical habitat to threatened vertebrates, although Carnaby's cockatoos may occasionally use either for feeding or as roosts while flying to feeding areas. From a faunal conservation point of view there is little to choose between the

two as alternatives for gravel extraction. However, in the context of sub-regional planning, #1 might be a better option because a) it is already allocated to 'extractive industry' and b) with the co-operative management of the owner of location 95, #2 if left would augment the patently inadequate littoral vegetation on the eastern foreshore of Culham Inlet.

Gravel extraction from #1 would require that the black fungus on *Banksia speciosa* be assessed for its risk to FRNP vegetation.

4.0 Discussion of assessment and implications for management

The road upgrade *per se* is most unlikely to impact on any critical habitat for vertebrate fauna. However, there will be on-going issues of management following construction that need to be addressed at the design stage. These include water harvesting, drainage and resulting enhanced soil moisture impacts. Water ponding in table drains or in natural or constructed impoundments may be an issue in fauna and flora management by:

- enhancing the opportunity for weed establishment
- enhancing the opportunity for feral fauna to penetrate the park e.g. starlings and feral bees (note that although not considered feral, a similar situation applies to dingo)
- encouraging some fauna e.g. kangaroos and emus to congregate at the roadside to drink or take green pick

The minor drainages off East Mt Barren maintain a small system of micro wetlands that have been identified as a habitat of particular significance for the road upgrade project. It is important that the subtle drainage here is not interrupted by the upgrade. The engineering options would appear to be to maintain the porosity of the road base by not over compaction or selection of material or to lower the level of the culverts.

The route of the upgrade from Four Mile Beach turn-off to the East Mt Barren walk trail car park, some 3.5 km, is further identified as providing habitat for more species of vertebrate of particular conservation significance than any other section. Vertebrates known from here are: dibbler, chuditch, carpet python, western whipbird and western bristlebird. Carpet python and chuditch are vulnerable to either accidental or deliberate road kill. There is a strong case to use both appropriate signage and some traffic calming method to restrict speed to a further reduced value through this section. Consideration should also be given to using a road surface colour and texture to make fauna more visible during low light conditions on this section. Department of Environment and Conservation should consider a ranger implemented plan to monitor all road kill over the entire route with particular emphasis on the East Mt Barren section. This is necessary because animal populations are constantly changing in distribution and abundance and there will be changes that will not have been apparent at the time of assessment.

Vehicle occupant safety and vehicle damage from collision with larger fauna may be an issue on the upgraded route. The risk can be mitigated by appropriate signage and design and maintenance of sight distances. Note that this risk is substantially increased where either prescribed burning or wildfire impinges on the roadside due to larger fauna coming in to the green pick which results from the fire.

4.0 References

Chapman, A. & Newbey, K.R. 1995. A biological survey of the Fitzgerald area, Western Australia. *CALMScience* Supplement No. 3. Department of Conservation and Land Management, Perth.

Erikson, R. 1975. *The Drummonds of Hawthornden.* Lamb Paterson, Perth.

5.0 Acknowledgements

Gil Craig, Paul Cory and Melissa O'Toole provided comments on a draft. Sarah Comer and Deon Utber provided data on threatened species and advice.

APPENDIX I VERTEBRATES RECORDED ON HAMERSLEY DRIVE BETWEEN HOPETOUN AND HAMERSLEY INLET

BIRDS

CASUARIIDAE

Dromaius novaehollandiae Emu

MEGAPODIIDAE

Leipoa ocellata Malleefowl

ANATIDAE

Cereopsis novaehollandiae Cape Barren Goose

FALCONIDAE

Falco cenchroides Nankeen Kestrel

COLUMBIDAE

Phaps chalcoptera Common Bronzewing

Ocyphaps lophotes Crested Pigeon

PSITTACIDAE

Calyptorhynchus latirostris Carnaby's Cockatoo

Cacatua roseicapilla Galah

Glossopsitta porphyrocephala Purple-crowned Lorikeet

Platycercus zonarius Australian Ringneck

Purpureicephalus spurius Red-capped Parrot

CUCULIDAE

Cacomantis flabelliformis Fan-tailed Cuckoo

CAPRIMULGIDAE

Eurostopodus argus Spotted Nightjar

MEROPIDAE

Merops ornatus Rainbow Bee-eater

MALURIDAE

Malurus pulcherrimus Blue-breasted Fairy-wren

Stipiturus malachurus Southern Emu-wren

PARDALOTIDAE

Pardalotus punctatus Spotted Pardalote

Pardalotus striatus Striated Pardalote

DASYORNITHIDAE

Dasyornis longirostris Western Bristlebird

ACANTHIZIDAE

Sericornis frontalis White-browed Scrubwren

Calomanthus campestris Rufous Fieldwren

Smicrornis brevirostris Weebill

Acanthiza apicalis Broad-tailed Thornbill

Acanthiza chrysorrhoa Yellow-rumped Thornbill

MELIPHAGIDAE

Anthochaera carunculata Red Wattlebird

Anthochaera lunulata Western Little Wattlebird
Manorina flavigula Yellow-throated Miner
Lichenostomus leucotis White-eared Honeyeater
Melithreptus brevirostris Brown-headed Honeyeater
Melithreptus chloropsis Western White-naped Honeyeater
Lichmera indistincta Brown Honeyeater
Phylidonyris novaehollandiae New Holland Honeyeater
Phylidonyris nigra White-cheeked Honeyeater
Phylidonyris melanops Tawny-crowned Honeyeater
Acanthorhynchus superciliosus Western Spinebill

PETROICIDAE
Drymodes brunneopygia Southern Scrub-robin

CINCLOSOMATIDAE
Psophodes nigrogularis Western Whipbird

PACHYCEPHALIDAE
Pachycephala pectoralis Golden Whistler
Colluricincla harmonica Grey Shrike-thrush

DICRURIDAE
Rhipidura fuliginosa Grey Fantail
Rhipidura leucophrys Willie Wagtail

CAMPEPHAGIDAE
Coracina novaehollandiae Black-faced Cuckoo-shrike

CRACTICIDAE
Cracticus torquatus Grey Butcherbird
Cracticus tibicen Australian Magpie
Strepera versicolor Grey Currawong

CORVIDAE
Corvus coronoides Australian Raven

HIRUNDINIDAE
Hirundo neoxena Welcome Swallow

ZOSTEROPIDAE
Zosterops lateralis Silvereye

MAMMALS

TACHYGLOSSIDAE
Tachyglossus aculeatus Echidna

DASYURIDAE
Dasyurus geoffroii Western Quoll, Chuditch
Parantechinus apicalis Dibbler
Sminthopsis g. griseoventer Grey-bellied Dunnart

PERAMELIDAE
Isoodon obesulus fusciventer Southern brown bandicoot

MACROPODIDAE
Macropus fuliginosus Western Grey Kangaroo
Macropus irma Western Brush Wallaby

PHALANGERIDAE
Trichosurus v. vulpecula Common Brushtail Possum
BURRAMYIDAE
Cercartetus concinnus Western Pygmy-possum, Mundarda
TARSIPEDIDAE
Tarsipes rostratus Honey-possum, Noolbenger
MURIDAE
Mus musculus House Mouse
Pseudomys albocinereus Ash-grey Mouse
Rattus fuscipes Western Bush Rat
LEPORIDAE
Oryctolagus cuniculus Rabbit
CANIDAE
Vulpes vulpes Fox

FROGS

HYLIDAE
Subfamily Pelodryadinae
Litoria cyclorhyncha Spotted-thighed Frog
MYOBATRACHIDAE
Subfamily Limnodynastinae
Limnodynastes dorsalis Western Banjo Frog
Subfamily Myobatrachinae
Crinia georgiana Quacking Frog

REPTILES

SCINCIDAE
Acritoscincus trilineatum Western Cool Skink
Ctenotus impar Eleven-striped Ctenotus
Hemiergis p. peronii Peron's Earless Skink
Lerista distinguenda Southwest Lerista
Lerista dorsalis Southern Lerista
Lerista microtis microtis Western Small-eared Lerista
Morethia obscura Dark Morethia
Tiliqua r. rugosa Western Bobtail
VARANIDAE
Varanus rosenbergi Rosenberg's Monitor
BOIDAE
Morelia spilota imbricata Southwest Carpet Python
ELAPIDAE
Notechis scutatus Western Tiger Snake
Pseudonaja a. affinis Dugite

Plate 1. Micro wetland on seaward side of Hamersley Drive with East Mt Barren in background.

Plate 2. Detail of micro wetland.

Plate 3. Coastal gully cliifs Where mico wetland drainage maintains dense vegetation.

Plate 4. View of proposed gravel pit #1

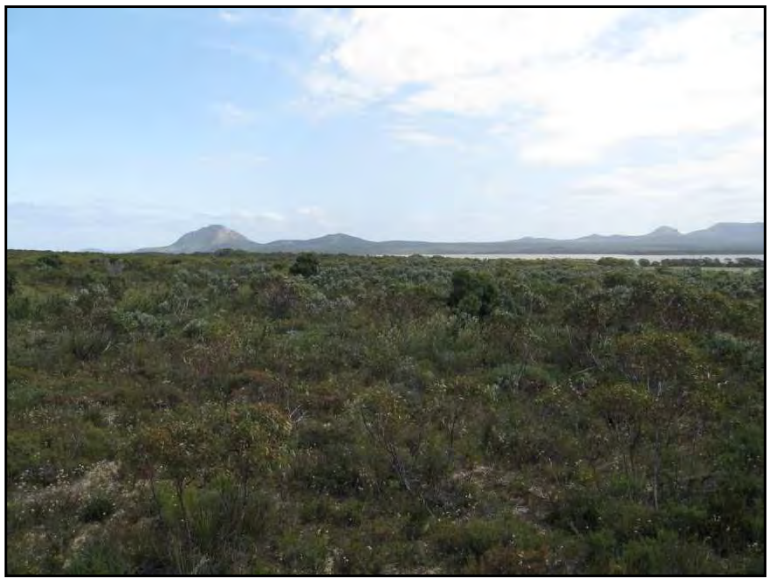

Plate 5. View of proposed gravel pit #2. Culham Inlet in background.

Plate 6. Southern bush rat, *Rattus fuscipes.* A native rodent and perhaps the most abundant and widespread mammal along Hamersley Drive. Photo Jenny Chambers

Appendix C - Dieback Survey

NRG CONSULTANCY

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ABN: 33 472 877 368

Survey for Dieback Disease caused by *Phytophthora cinnamomi* on Hammersly Drive Fitzgerald River National Park Spring 2009 for Main Roads Department Great Southern Regional Office

1 Introduction

1.1 Background

Dieback disease caused by the pathogen *Phytophthora cinnamomi* is a major threat to the biodiversity of south-western Australia. The spread of this water mould is facilitated by the movement of soil infested with spores, particularly under warm, moist conditions. Consequently, a major component is the strategy to constrain this disease involves managing access and soil-disturbance activities within native vegetation. Knowledge of the occurrence of the disease in the landscape is therefore an essential prerequisite to formulating suitable hygiene management practices.

1.2 Location of area surveyed and Dates of the survey for Dieback Disease

The survey for the presence of Dieback disease was undertaken along the eastern end of Hammersly Drive within the Fitzgerald River National Park from Hammersly Inlet road junction east to the start of the bitumen seal at East Mt Barren, Hammersly Inlet road, West Beach road and East and West Mylies roads.

The survey commenced on the 15th September and finished on the 29th September 2009

1.3 Historical Land Use and Past Disturbances

The above mentioned roads were historically established as four wheel drive access tracks into the Crown lands that in the early 1970's were gazetted as the Fitzgerald River National Park. Many of these tracks were established in the 1920's and have been regularly used in all weather conditions over the many years.

In the late 1970's and early 1980's the National Parks Board commenced rationalising the road network in the National Park, realigning many sections and sheeting portions of the road network with gravel sourced from within the National Park.

Major road gravel sheeting and realignment programs were then undertaken by the Department of Conservation and Land Management in the mid 1980's again using gravel sourced from within the National Park. This program of gravel sheeting and upgrading the standards of the road surfaces continues to this day across the entire National Park.

Dieback Disease Hygiene protocols for such major soil moving operations commenced with the first of the operations being supervised by the Department of Conservation and Land Management staff. Fortunately the early National Parks Board operations were undertaken in summer months for ease of operational delivery and this factor may have well contributed to reducing the risk of introducing the soil borne pathogen with these historical operations.

Unfortunately recent lapses in attitudes about dieback disease hygiene by the now Department of Environment and Conservation has seen a major road re sheeting and realignment operation on Hammersly Drive around East Mt Barren being undertaken in the middle of the very wet Spring of 2008 in conditions that were high risk for the introduction and spread of Dieback disease.

These sorts of lapses in hygiene standards pose significant threat to the nature conservation values of this incredible National Park. In addition there has now been a period of below average rainfall for the last eighteen months since this operation. There exists the potential for disease propagules to have been introduced during this operation and without the necessary suitable climatic conditions having prevailed over the last eighteen months these propagules may yet have not germinated and established a disease centre.

1.3 Historical Knowledge of Phytophthora species in the Eastern portion of Fitzgerald River National Park

There have been numerous dieback disease survey efforts to date in the eastern portion of the Fitzgerald River National Park having been undertaken by staff from the Department of Conservation and Land Management and the Department of Environment and Conservation. These surveys have either been undertaken in advance of planned road upgrade operations, car park upgrades, patch gravelling - re sheeting operations and or opportunistically when climatic factors have created suitable conditions for the germination, spread and demise of native vegetation susceptible to Phytophthora species.

To date there has been no positive recoveries of *Phytophthora cinnamomi* from any samples taken in the eastern end of the Fitzgerald River National Park.

There has been however an extensive outbreak of *Phytophthora megasperma* in 1988, 1992 and again in 1995 following above average and short duration rainfall events. These disease outbreaks resulted in considerable demise of susceptible native vegetation at the time of epidemic. However once the landscape dried out and the epidemic ceased there was no annual outbreaks following winter rainfall which is unlike the normal behaviour of *Phytophthora cinnamomi*.

It is now impossible to map the extent of the *Phytophthora megasperma* outbreak in the field as disease killed plants have collapsed and infested sites have returned to a relatively "healthy" situation.

2. Methods

2.1 Interpretation

Interpretation of roads and tracks followed the standard methods and operating procedures described in the document titled "Volume 2 - *Phytophthora cinnamomi* and disease caused by it: Interpreter guidelines for detection, diagnosis and mapping" (CALM 2001).

This survey was undertaken along both sides of the

- eastern end of Hammersly Drive within the Fitzgerald River National Park from Hammersly Inlet road junction east to the start of the bitumen seal at East Mt Barren,
- Hammersly Inlet road,
- West Beach road and
- East and West Mylies roads.

My survey technique was to walk both sides of the above mentioned roads, the road side drains and areas down slope of these searching for any evidence of dead and or dying native vegetation known to be susceptible to *Phytophthora cinnamomi*.

This survey technique improves the opportunity to locate symptoms of dieback disease that may be attributable to *Phytophthora cinnamomi*, particularly in those areas where the landscape has been recently burnt and the dieback susceptible native vegetation species are only small in stature and not easily identified from within a motor vehicle.

2.2 Soil and Tissue Sampling

Twenty four soil and tissue samples associated with dead and dying and native vegetation were taken within the survey effort to confirm absence and or presence of *Phytophthora cinnamomi*. All sample location points were captured using a Gobal Positioning System (GPS) hand held unit.

These soil and tissue samples were taken forwarded to the Department of Environment and Conservations Vegetation Health Service Laboratories in Kensington where diagnostic baiting was conducted.

3. Results

3.1 Disease Distribution

- **Hammersly Drive**

20 soil and tissue samples were collected from road side drains and the road side along Hammersly Drive in this survey effort. No samples returned positive to the presence of *Phytophthora cinnamomi* taken along Hammersly Drive. Four samples returned positive to the presence of *Phytophthora multivora* and one sample has returned positive to a new yet to be named species of Phytophthora.

The native vegetation along this section of Hammersly Drive can be divided into two levels of interpretability based upon the age since last being burnt by fire. The vegetation around the eastern side of East Mt Barren and from West Beach Road to Hammersly Inlet Road junction is mature and was last burnt in December 1997. The native vegetation within these areas is mature in stature with average Banksia and Hakea plants being about 1m to 1.5m in height and as a result is readily interpretable for the symptoms of dieback disease.

The native vegetation at the eastern end of Hammersly Drive and from the tight bend overlooking Mylies Beach west to West Beach road junction was last burnt in September 2006. This vegetation is now only 4 years old and is still less than 50 cm in height. In these situations where there native susceptible plants are small in stature it is very important to walk the area being interpreted for the presence of dieback so as to ensure that all dead and dying plants that may have been affected by the pathogen can be identified. Fortunately in this landscape there are numerous healthy grass trees, *Xanthorhoeae platyphylla*, that provide very important supporting evidence on the absence of *Phytophthora cinnamomi* along the road sides and road side drains.

- **Hammersly Inlet Road**

1 soil and tissue samples were collected from road side drains and the road side along Hammersly Inlet road. No samples returned positive to the presence of *Phytophthora cinnamomi* taken along Hammersly Inlet road.

The native vegetation along this section of Hammersly Inlet road is mature and was last burnt in December 1997. The native vegetation within these areas is mature in stature with average Banksia and Hakea plants being about 1m to 1.5m in height and as a result is readily interpretable for the symptoms of dieback disease.

- **West Beach Road**

3 soil and tissue samples were collected from road side drains and the road side along West Beach road. No samples returned positive to the presence of *Phytophthora cinnamomi* taken along Hammersly Inlet road.

The native vegetation along the first section of West Beach road is now only 4 years old having been burnt in September 1996and is still less than 50 cm in height. In these situations where there native susceptible plants are small in stature it is very important to walk the area being interpreted for the presence of dieback so as to ensure that all dead and dying plants that may have been affected by the pathogen can be identified. Fortunately in this landscape there are numerous healthy grass trees, *Xanthorhoeae platyphylla*, that provide very important supporting evidence on the absence of *Phytophthora cinnamomi* along the road sides and road side drains.

The native vegetation along the final portion of West Beach road into the West Beach car park is mature in age being last burnt in December 1997 and as a result the Banksia and Hakea heaths are readily interpretable for the presence of *Phytophthora cinnamomi*.

- **East Mylies Road**

No dead and dying native vegetation susceptible to *Phytophthora cinnamomi* was observed on the sides of the road or up road side drains and so no soil and tissue samples were collected from along East Mylies road.

The native vegetation along East Mylies road is now only 4 years old having been burnt in September 1996 and is still less than 50 cm in height. In these situations where there native susceptible plants are small in stature it is very important to walk the area being interpreted for the presence of dieback so as to ensure that all dead and dying plants that may have been affected by the pathogen can be identified. Fortunately in this landscape there are numerous healthy grass trees, *Xanthorhoeae platyphylla*, that provide very important supporting evidence on the absence of *Phytophthora cinnamomi* along the road sides and road side drains.

- **West Mylies Road**

No dead and dying native vegetation susceptible to *Phytophthora cinnamomi* was observed on the sides of the road or up road side drains and so no soil and tissue samples were collected from along West Mylies road.

The native vegetation along West Mylies road is now only 4 years old having been burnt in September 1996 and is still less than 50 cm in height. In these situations where there native susceptible plants are small in stature it is very important to walk the area being interpreted for the presence of dieback so as to ensure that all dead and dying plants that may have been affected by the pathogen can be identified. Fortunately in this landscape there are numerous healthy grass trees, *Xanthorhoeae platyphylla*, that provide very important supporting evidence on the absence of *Phytophthora cinnamomi* along the road sides and road side drains.

4. Recommendations

4.1 Hygiene Management

This survey has been undertaken in advance of plans by the State Government to upgrade Hammersly Drive into Hammersly Inlet and including West Beach, East and West Mylies access roads into a road with a bitumen sealed road surface.

Given the scale of such a planned operation, hygiene planning to avoid accidental introduction of the pathogen *Phytophthora cinnamomi* is paramount and will require careful monitoring and supervision for compliance with all key attributes of such a plan.

4.2 General Recommendations

- **Vehicle Hygiene**

All machinery, such as light vehicles 2wd and 4wd, bob cats or similar, trucks, bucket loaders, graders, dozers, rollers and post hole boring equipment will be required to be washed down prior to entry into the National Park so as to be free of all adhering soils and vegetation matter.

It is recognised that many light and some heavy earth moving machinery that will be returning to Hopetoun town site at the end of each days operations. Given that the road is sealed into Hopetoun it is not considered necessary to wash down the vehicles prior to their return into the National Park, as long as these vehicles have not access any other gravel roads during their absence from the Park.

It is considered the Hopetoun Carwash facility will meet the requirements to successfully clean light and heavy machinery down prior to access and commencement of operations within the National Park.

- **Operations during and post rainfall**

Should rainfall occur during the road construction operation it is important to manage vehicle hygiene so as to not accidentally introduce and or spread the pathogen within the National Park.

It has been historically recognised that the gravel road surface becomes very sticky, with road surface soils adhering to the underside of vehicles and so hygiene becomes difficult to manage when greater than 7.5mm of rain has fallen in one event and or 100 mm in combined events occurs.

It is recommended that all operations temporarily cease until the road running surfaces dry out to permit hygienic access and operations.

- **Basic Raw Materials source for road upgrade**

It is strongly recommended that all materials being sourced for use in the construction of road upgrade are free of Phytophthora propagules and have been sampled to confirm this disease free status. This includes all gravels soils, all sand soils and any rock, crushed or otherwise that may contain soil materials being brought into the National Park.

- **Road side spoil Management**

In the event that road side spoil is produced in greater quantities than will be used on the direct road side shoulder for base material and is required to be removed from the site it is strongly recommended that this material is not available for relocation and use within any section of the remainder of the planned road upgrade.

It is recommended that this surplus road side spoil be relocated to a known Phytophthora megasperma infested site in the lower reaches of the Hammersly Inlet road gravel pit.

5.0 Conclusion

The Spring 2008 upgrade operation on Hammersly Drive around East Mt Barren has posed an considerable dilemma in ascertaining the disease status of Hammersly Drive.

It must be recognised that there is still a considerable element of uncertainty with the disease status of this section of Hammersly Drive given the below average rainfall experienced since this operation that has yet triggered the potential for disease germination and expression within the susceptible native flora.

At this point in time the survey and sampling effort can confirm the *Phytophthora cinnamomi* free status of the road side native vegetation along Hammersly Drive from the East Mt Barren walk trail car park west to Hammersly Inlet road junction, East Mylies, West Mylies and West Beach roads.

Basic vehicle and soil moving equipment hygiene conditions need to be imposed and complied with during the entire operation. All operations need to comply with the shutdown after a single greater than 7.5 mm rainfall or combined greater than 10mm rainfall event situations. This shutdown will be required for the period of time until the road surface has dried to the extent that surface soils are not being picked up on the under bodies of motor vehicles.

Once early winter rains arrive it is paramount that the operation cease and that the operation only recommences once the risk of spring rainfall has ceased.

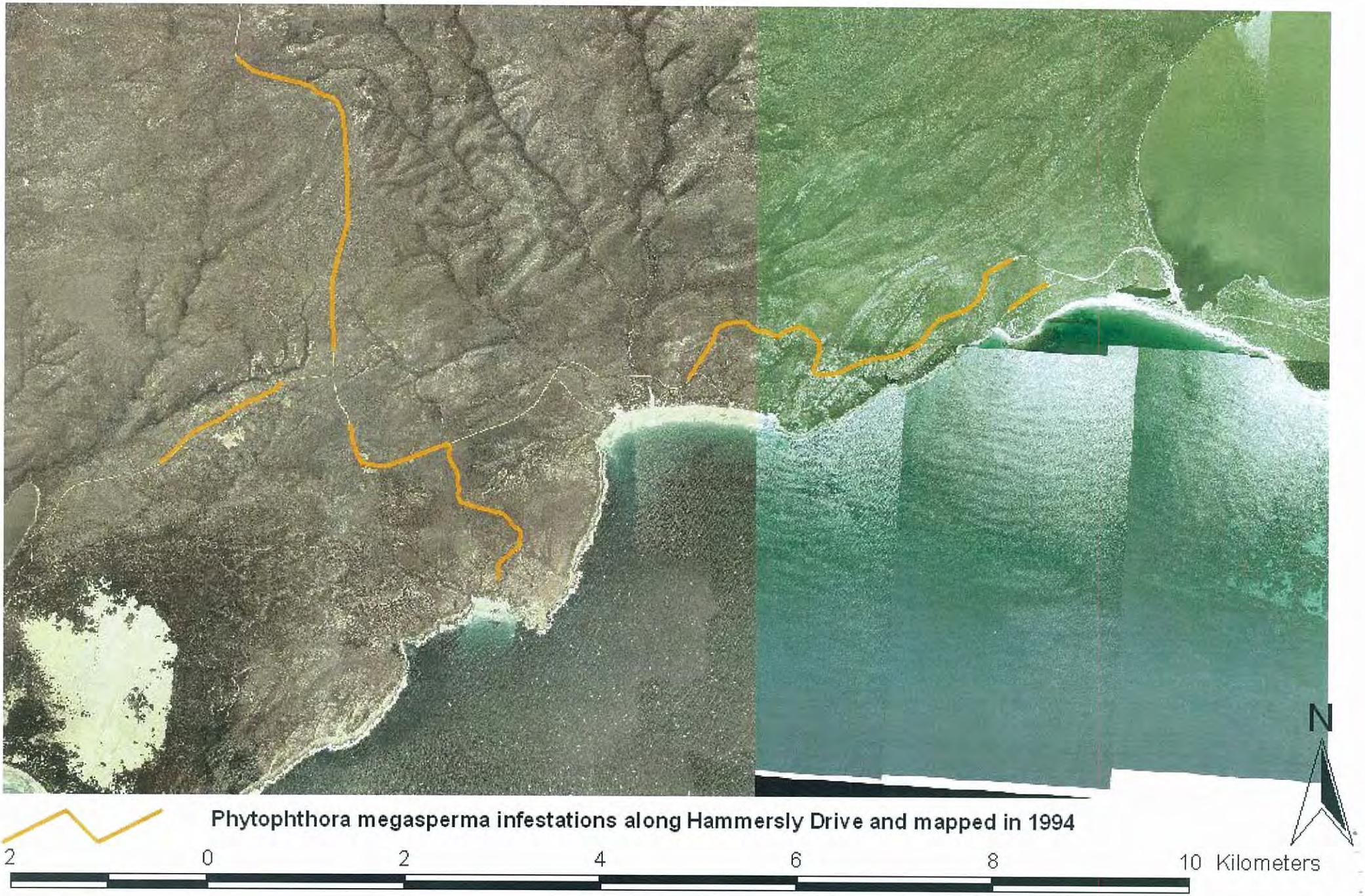
Dieback Survey Sample Location Points Hammersly Drive Hammersly Inlet Road, West Beach Road and East and West Mylies Roads

Sample Location Points FRNP Spring 2009.shp

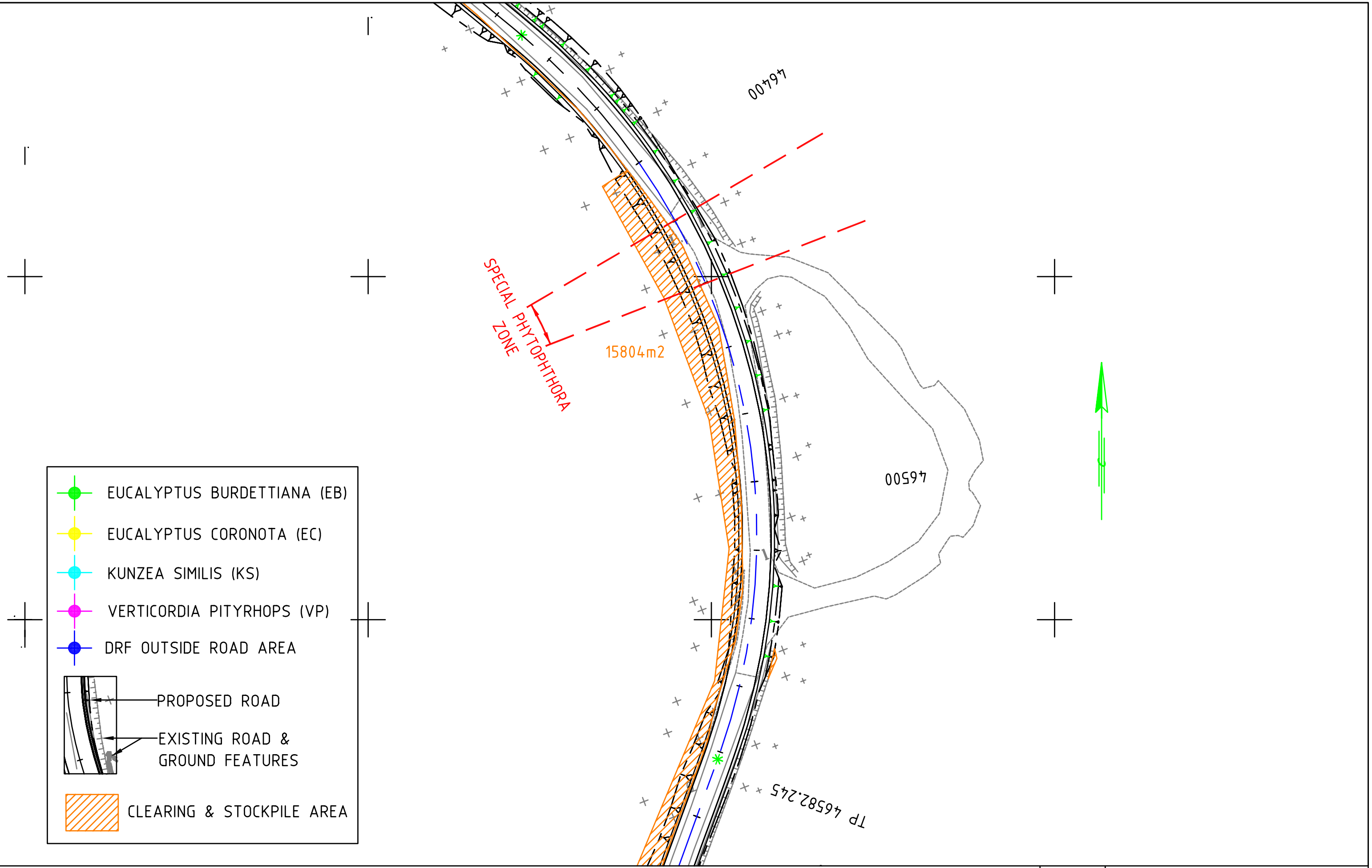
2 0 2 4 Kilometers

N

Phytophthora megasperma Infestation along Hammersly Drive as mapped in 1994



Appendix D - Road Plan of Key Environmental Features



SCALE
1 : 1000

HAMERSLEY DRIVE
ROAD PLAN OF
KEY ENVIRONMENTAL FEATURES

SHEET 1 OF 10

DRG:\DRF PLAN A3.DWG

244100N

TP 46582.245

46600

61m2

46700

47000

46800

ZONE 5

MICRO-CATCHMENT BOUNDARY 46825

ZONE 4

8m2

12m2

244000N

CRITICAL DRF ZONE
(NO ACCESS BEYOND FENCELINE)

EUCALYPTUS BURDETTIANA (EB)

EUCALYPTUS CORONOTA (EC)

KUNZEA SIMILIS (KS)

VERTICORDIA PITYRHOPS (VP)

DRF OUTSIDE ROAD AREA

PROPOSED ROAD

EXISTING ROAD & GROUND FEATURES

CLEARING & STOCKPILE AREA

SCALE
1 : 1000

HAMERSLEY DRIVE
ROAD PLAN OF
KEY ENVIRONMENTAL FEATURES

SHEET 2 OF 10

DRG:\DRF PLAN A3.DWG

47000
47100
47200
47300
47400
12m2
95m2
7m2
53m2
41m2
WETLANDS
SPECIAL PHYTOPHTHORA ZONE
NO ACCE

EUCALYPTUS BURDETTIANA (EB)
EUCALYPTUS CORONOTA (EC)
KUNZEA SIMILIS (KS)
VERTICORDIA PITYRHOPS (VP)
DRF OUTSIDE ROAD AREA
PROPOSED ROAD
EXISTING ROAD & GROUND FEATURES
CLEARING & STOCKPILE AREA

SCALE
1 : 1000

HAMERSLEY DRIVE
ROAD PLAN OF
KEY ENVIRONMENTAL FEATURES
SHEET 3 OF 10

DRG:\DRF PLAN A3.DWG

47800

CRITICAL DRF ZONE
(NO ACCESS BEYOND FENCELINE)

47700

25m2

47600

73m2

WETLANDS

47400

CRITICAL DRF ZONE
(NO ACCESS BEYOND FENCELINE)

262m2

126m2

MICRO-CATCHMENT BOUNDARY
47603

ZONE 4

ZONE 3

WETLANDS

SPECIAL PHYTOPHTHORA
ZONE

EUCALYPTUS BURDETTIANA (EB)

EUCALYPTUS CORONOTA (EC)

KUNZEA SIMILIS (KS)

VERTICORDIA PITYRHOPS (VP)

DRF OUTSIDE ROAD AREA

PROPOSED ROAD

EXISTING ROAD &
GROUND FEATURES

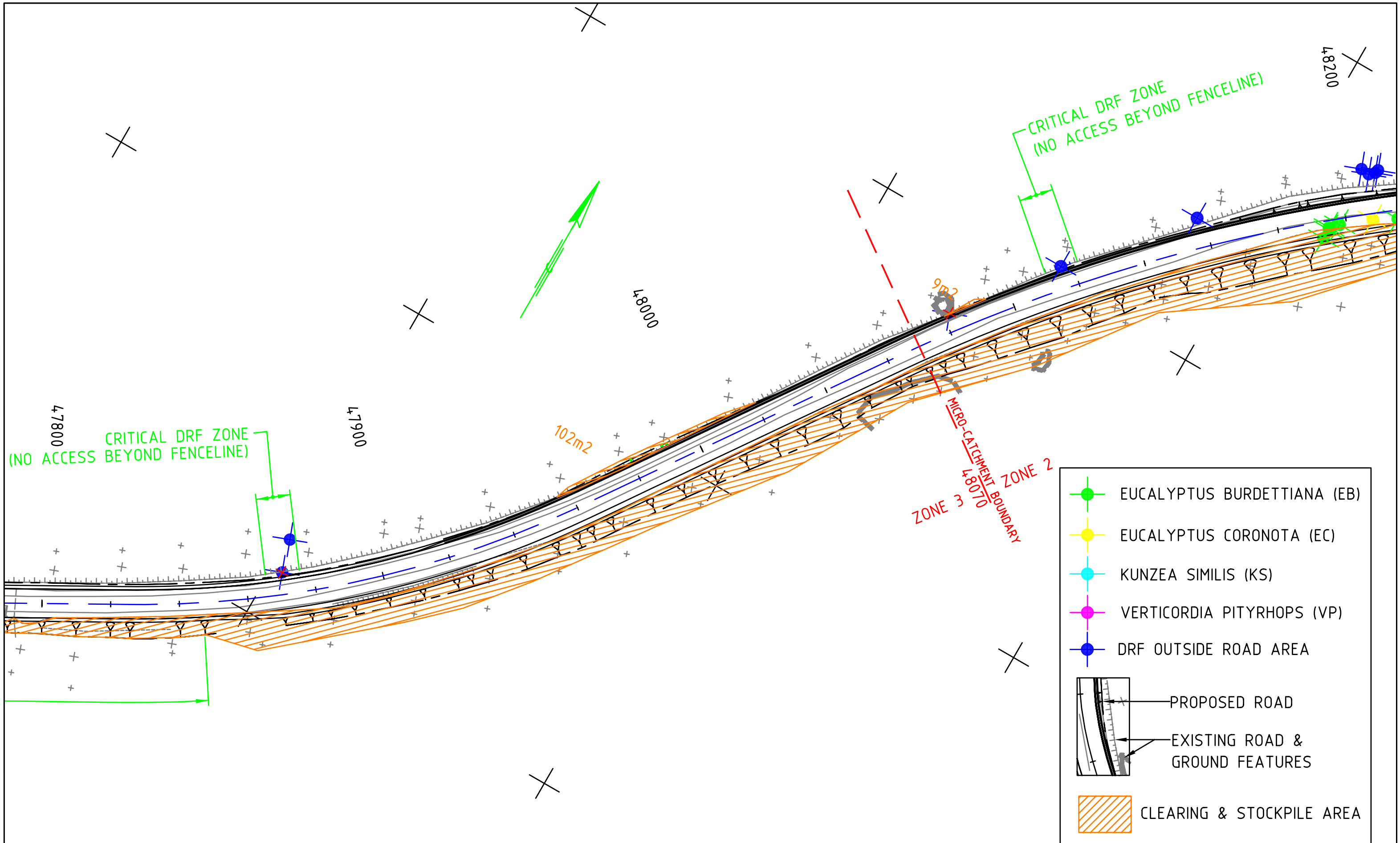
CLEARING & STOCKPILE AREA

SCALE
1 : 1000

HAMERSLEY DRIVE
ROAD PLAN OF
KEY ENVIRONMENTAL FEATURES

SHEET 4 OF 10

DRG:\DRF PLAN A3.DWG

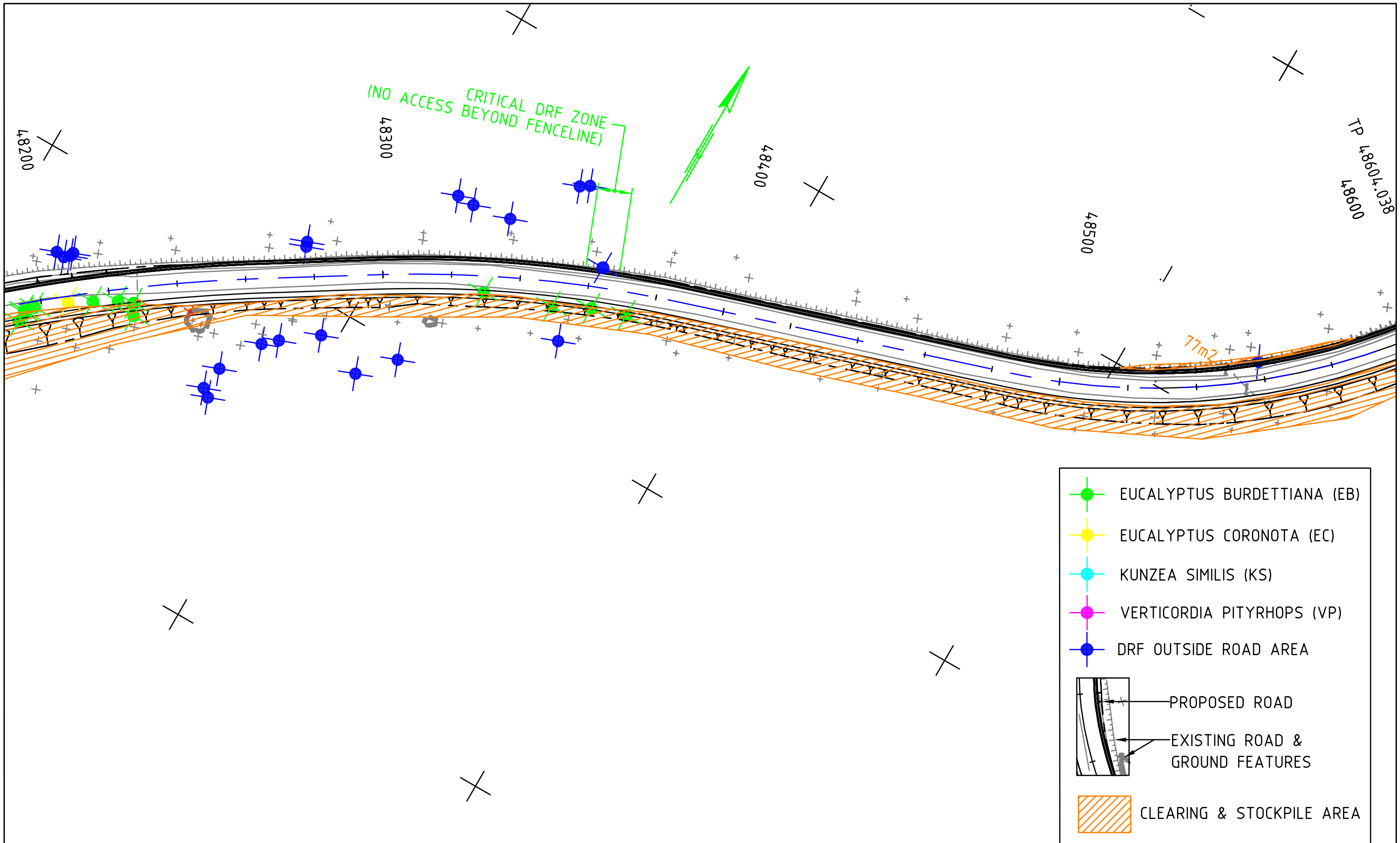


SCALE
1 : 1000

HAMERSLEY DRIVE
ROAD PLAN OF
KEY ENVIRONMENTAL FEATURES

SHEET 5 OF 10

DRG:\DRF PLAN A3.DWG



SCALE
1 : 1000

HAMERSLEY DRIVE
ROAD PLAN OF
KEY ENVIRONMENTAL FEATURES

SHEET 6 OF 10

DRG:\DRF PLAN A3.DWG

TP 48906.115
48900
TP 48871.115
TP 48785.971
48800
TP 48756.971
TP 48671.107
TP 48700.107
48700
TP 48604.038
48600
MICRO-CATCHMENT BOUNDARY
48940
ZONE 1
ZONE 2
5m2
CAR PARK, NOT TO BE BUILT IN
2009/2010 CONSTRUCTION SEASON

EUCALYPTUS BURDETTIANA (EB)
EUCALYPTUS CORONOTA (EC)
KUNZEA SIMILIS (KS)
VERTICORDIA PITYRHOPS (VP)
DRF OUTSIDE ROAD AREA
PROPOSED ROAD
EXISTING ROAD & GROUND FEATURES
CLEARING & STOCKPILE AREA

SCALE
1 : 1000

HAMERSLEY DRIVE
ROAD PLAN OF
KEY ENVIRONMENTAL FEATURES

SHEET 7 OF 10

DRG:\DRF PLAN A3.DWG

TP 48994.175

49000

TP 49029.175

49100

49200

TP 49272.288

TP 49307.288

751m2

6m2

22m2

350m2

SPECIAL PHYTOPHTHORA ZONE

EUCALYPTUS BURDETTIANA (EB)

EUCALYPTUS CORONOTA (EC)

KUNZEA SIMILIS (KS)

VERTICORDIA PITYRHOPS (VP)

DRF OUTSIDE ROAD AREA

PROPOSED ROAD

EXISTING ROAD & GROUND FEATURES

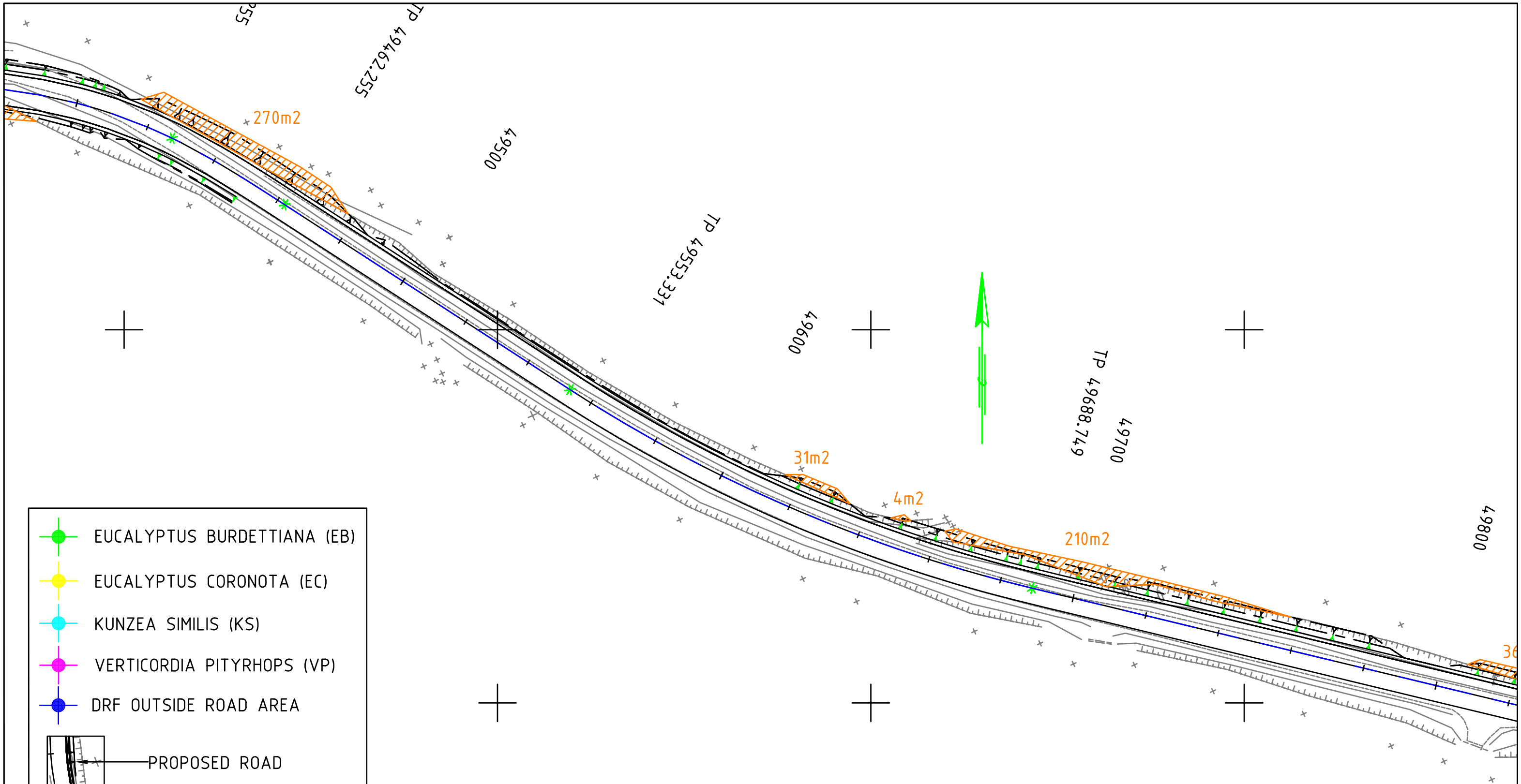
CLEARING & STOCKPILE AREA

SCALE
1 : 1000

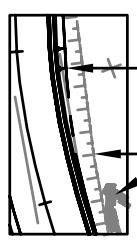
HAMERSLEY DRIVE
ROAD PLAN OF
KEY ENVIRONMENTAL FEATURES

SHEET 8 OF 10

DRG:\DRF PLAN A3.DWG



- EUCALYPTUS BURDETTIANA (EB)
- EUCALYPTUS CORONOTA (EC)
- KUNZEA SIMILIS (KS)
- VERTICORDIA PITYRHOPS (VP)
- DRF OUTSIDE ROAD AREA



PROPOSED ROAD

EXISTING ROAD & GROUND FEATURES

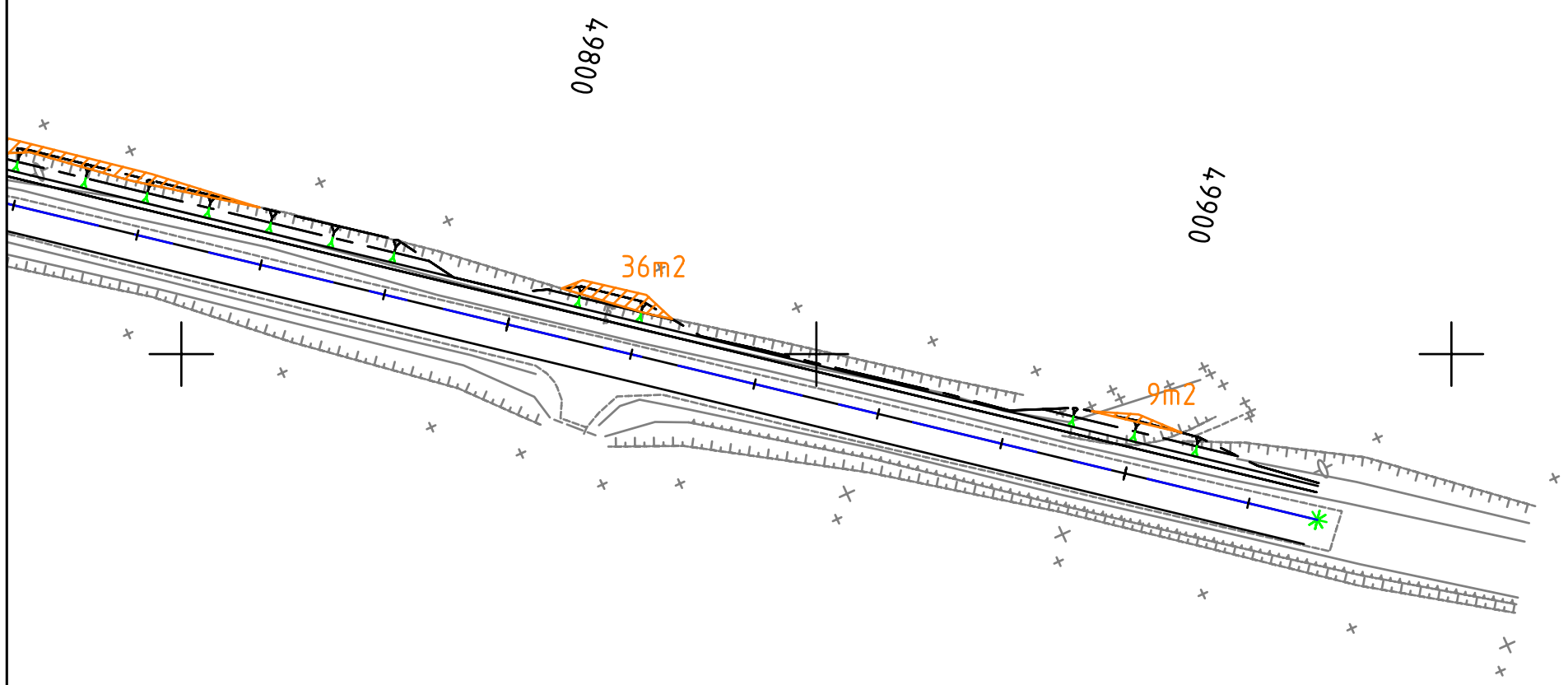
CLEARING & STOCKPILE AREA

SCALE
1 : 1000

HAMERSLEY DRIVE
ROAD PLAN OF
KEY ENVIRONMENTAL FEATURES

SHEET 9 OF 10

DRG:\DRF PLAN A3.DWG



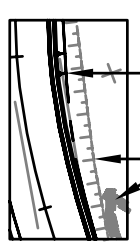
EUCALYPTUS BURDETTIANA (EB)

EUCALYPTUS CORONOTA (EC)

KUNZEA SIMILIS (KS)

VERTICORDIA PITYRHOPS (VP)

DRF OUTSIDE ROAD AREA



PROPOSED ROAD

EXISTING ROAD & GROUND FEATURES

CLEARING & STOCKPILE AREA

SCALE 1 : 1000

HAMERSLEY DRIVE ROAD PLAN OF KEY ENVIRONMENTAL FEATURES

SHEET 10 OF 10

DRG:\DRF PLAN A3.DWG

Appendix E - Cyclical Environmental Checklist

CYCLICAL ENVIRONMENTAL CHECKLIST

Environmental Aspect	Requirements	Checked/Comments
Drainage	Monitor drainage to micro wetlands to ensure no damage/change to vegetation	
	Monitor worksfor erosion/scours	
Topsoil	Monitor stockpiled windrows to ensure correct shape and that they are not damaged by machinery etc	
Gravel and Sand Extraction	Monitor clearing against clearing lines	
	Monitor stockpile sites for hygiene	
	Monitor vehicle hygiene at pit sites	
Weeds and Disease	Monitor vehicle hygiene during construction	
	Monitor movement of soil or vegetative matter so none is transported between micro catchments	
	Monitor personnel to ensure boots and tools cleaned when required	
	Monitor rainfall and forecasts to provide advice to Project Manager regarding stop work requirements	
Fauna	Monitor and report fauna encounters	
Declared Rare Flora	Monitor the “Critical DRF Sties” to ensure no impacts	

	Ensure compliance with Permit to Take	
Visual Amenity	Monitor work site for litter etc	
Aboriginal Heritage	Ensure instructions and advice given by archaeologist and monitors is followed	
Waste	Monitor work site for overall cleanliness and waste management	
Vegetation Clearing	Monitor clearing to ensure none occurs outside clearing limits	
	Monitor clearing lines post-clearing to ensure no change	
	Monitor windrows to ensure they are not affected during construction	
Dust	Monitor vegetation to ensure no damage is caused by excessive dust	
Hazardous Substances	Ensure all spills are reported and documented immediately	

…….
Signed

…….
Date

Appendix F - Permit to Take Declared Rare Flora

Government of **Western Australia**
Department of **Environment and Conservation**

Your ref:
Our ref:
Enquiries: Kelly Poultney
Phone: (08) 9334 0422
Fax: (08) 9334 0278
Email: kelly.poultney@dec.wa.gov.au

Mr Andrew Duffield
Main Roads Western Australia
Great Southern Region
PO Box 503
ALBANY WA 6331

Dear Mr Duffield

PERMIT TO TAKE DECLARED RARE FLORA (DRF)

Please find attached the approved DRF permit for section 3 of the Hamersley Drive upgrade project. It would be appreciated if you could ensure that all permit conditions are complied with, including the submission of reports where necessary.

Should you have any queries regarding this permit and its conditions please contact Kelly Poultney (A/Flora Administrative Officer) on (08) 9334 0422.

Yours sincerely

for Keiran McNamara
DIRECTOR GENERAL

15 March 2010

Department of
Environment and Conservation
Our environment, our future

WILDLIFE CONSERVATION ACT 1950 AS AMENDED - SECTION 23F

PERMIT TO TAKE DECLARED RARE FLORA

The undermentioned person may take Declared Rare Flora as shown below for the purpose described subject to the terms and conditions of this permit. Please note: DRF in this permit = Declared Rare Flora.

1. PERMIT NO: 125 – 0910

2. PERMIT HOLDER: Andrew Duffield
ADDRESS: Regional Manager
Main Road Western Australia Great South Region
PO Box 503
Albany WA 6331

3. DESCRIPTION OF PLANT:

3.1 SCIENTIFIC NAME: *Eucalyptus coronata*, *Eucalyptus burdettiana*, *Verticordia pityrhops*, and *Kunzea similis* subsp. *similis*.

3.2 PARTS TO BE TAKEN: Seed, above ground parts and whole plants where unavoidable (note condition 8.1).

3.3 QUANTITY OF SEED: As much as required from plants that are to be taken and no more than 20% of seed available from each plant for remaining plants.

3.4 QUANTITY OF PLANTS: *Eucalyptus coronata*: 1 plant, *Eucalyptus burdettiana*: 16 plants, *Verticordia pityrhops*: 3 plants, and *Kunzea similis* subsp. *similis*: 14 plants.

4. PURPOSE OF TAKING: Road upgrade (widen & seal) Hamersley Drive, Fitzgerald River National Park, and collection of seed for conservation purposes.

5. METHOD OF TAKING: Machine and by hand.

6. AREA TO WHICH PERMIT RELATES: 3km of existing Hamersley Drive (maintaining current alignment) Fitzgerald River National Park, west of Culham Inlet (section 3, as outlined in permit application).

7. PERIOD FOR WHICH PERMIT IS VALID: From date of signature below to 15 March 2011.

8. CONDITIONS:

8.1 Seed collection must be endorsed by the Manager of the Department of Environment and Conservation's Threatened Flora Seed Centre (TFSC) and all DRF seed forwarded to the TFSC. The DRF seed collected can not be used for revegetation purposes, unless it is endorsed through an approved translocation proposal.

8.2 Post disturbance monitoring must be undertaken of the adjacent DRF populations to the areas disturbed, and the DRF's response to the disturbance recorded for two seasons following the disturbance. The results must be provided to the Director General, Department of Environment and Conservation, via the Flora Administrative Officer.

8.3 Hygiene measures, specifically for *Phytophthora* dieback, are to be undertaken at all times when undertaking the works, and especially when entering DRF habitat.

8.4 No original DRF material taken under authority of this permit shall be used for commercial purposes.

8.5 Copies of any report or publication on the DRF covered by this permit shall be provided to the Director General, Department of Environment and Conservation.

Please note: conditions are continued on page 2 of DRF Permit No. 125 - 0910

.....
(Delegates initials)

Permit conditions continued – DRF Permit No. 125 - 0910

8.6 The location of DRF populations shall be treated as confidential and under no circumstances disclosed to other persons (unless it benefits the species), without the written permission of the Director General, Department of Environment and Conservation.

8.7 This permit also covers the activities of other persons involved in the operation under the supervision of the permit holder.

8.8 The Permittee shall notify the Director General, Department of Environment and Conservation within 14 days of the expiration of this permit as to whether the works detailed in this permit have been undertaken and the impact on the DRF.

8.9 The permit holder shall produce this permit whenever requested to do so by a Wildlife Officer, or by any person appointed by the body or authority which has the care or control of the land from where the DRF is taken. This permit must be produced with any other approval letters that may be in force during the period of this permit.

.....

DELEGATE OF THE MINISTER
FOR THE ENVIRONMENT
(in accordance with section 133(1) of the CALM Act 1984)
DATE: 12/ March /2010

Appendix G - EPBC Act Referral Documentation

Australian Government

Department of the Environment, Water, Heritage and the Arts

Referral of proposed action

What is a referral?

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) provides for the protection of the environment, especially matters of national environmental significance (NES). Under the EPBC Act, a person must not take an action that has, will have, or is likely to have a significant impact on any of the matters of NES without approval from the Australian Government Environment Minister. To obtain approval from the Environment Minister, a proposed action should be referred. The purpose of a referral is to obtain a decision on whether your proposed action will need formal assessment and approval under the EPBC Act.

Your referral will be the principal basis for the Minister's decision as to whether approval is necessary and, if so, the type of assessment that will be taken. These decisions are made within 20 business days, provided that sufficient information is provided in the referral.

Who can make a referral?

Referrals may be made by a person proposing to take an action, the Commonwealth or a Commonwealth agency, a state or territory government, or agency, provided that the relevant government or agency has administrative responsibilities relating to the action.

When do I need to make a referral?

A referral must be made for actions that are likely to have a significant impact on the following matters protected by Part 3 of the EPBC Act:

World Heritage properties (sections 12 and 15A)

National Heritage places (sections 15B and 15C)

Wetlands of international importance (sections 16 and 17B)

Listed threatened species and communities (sections 18 and 18A)

Listed migratory species (sections 20 and 20A)

Protection of the environment from nuclear actions (sections 21 and 22A)

Commonwealth marine environment (sections 23 and 24A)

The environment, if the action involves Commonwealth land (sections 26 and 27A), including:

- actions that are likely to have a significant impact on the environment of Commonwealth land (even if taken outside Commonwealth land);
- actions taken on Commonwealth land that may have a significant impact on the environment generally;

The environment, if the action is taken by the Commonwealth (section 28)

Commonwealth Heritage places outside the Australian jurisdiction (sections 27B and 27C)

You may still make a referral if you believe your action is not going to have a significant impact, or if you are unsure. This will provide a greater level of certainty that Commonwealth assessment requirements have been met.

To help you decide whether or not your proposed action requires approval (and therefore, if you should make a referral), the following guidance is available from the Department's web site:

the Policy Statement titled Significant Impact Guidelines 1.1 – Matters of National Environmental Significance. Additional sectoral guidelines are also available.

the Policy Statement titled Significant Impact Guidelines 1.2 - Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies.

the interactive map tool (enter a location to obtain a report on what matters of NES may occur in that location).

Can I refer part of a larger action?

In certain circumstances, the Minister may not accept a referral for an action that is a component of a larger action and may request the person proposing to take the action to refer the larger action for consideration under the EPBC Act (Section 74A, EPBC Act). If you wish to make a referral for a staged or component referral, read 'Fact Sheet 6 Staged Developments/Split Referrals' and contact the Referral Business Entry Point (1800 803 772).

Do I need a permit?

Some activities may also require a permit under other sections of the EPBC Act. Information is available on the Department's web site.

What information do I need to provide?

Schedule 2 of the EPBC Regulations sets out the information that must be included in a referral. Completing all parts of this form will ensure that you submit the required information and will also assist the Department to process your referral efficiently.

You can complete your referral by entering your information into this Word file.

Instructions

Instructions are provided in green text throughout the form.

Attachments/supporting information

The referral form should contain sufficient information to provide an adequate basis for a decision on the likely impacts of the proposed action. You should also provide supporting documentation, such as environmental reports or surveys, as attachments.

Coloured maps, figures or photographs to help explain the project and its location should also be submitted with your referral. Aerial photographs, in particular, can provide a useful perspective and context. Figures should be good quality as they may be scanned and viewed electronically as black and white documents. Maps should be of a scale that clearly shows the location of the proposed action and any environmental aspects of interest.

Please ensure any attachments are below two megabytes (2mb) as they will be published on the Department's website for public comment (Note: the Minister may decide not to publish information that is commercial-in-confidence). To minimise file size, enclose maps and figures as separate files if necessary. If unsure, contact the Referral Business Entry Point for advice. Attachments larger than two megabytes (2mb) may delay processing of your referral.

How do I submit a referral?

Referrals may be submitted by mail, fax or email.

Mail to:

Referral Business Entry Point
Environment Assessment Branch
Department of the Environment, Water, Heritage and the Arts
GPO Box 787
CANBERRA ACT 2601

- If submitting via mail, electronic copies of documentation (on CD/DVD or by email) are appreciated.

Fax to: 02 6274 1789

Faxed documents must be of sufficiently clear quality to be scanned into electronic format.

Address the fax to the mailing address, and clearly mark it as a 'Referral under the EPBC Act'.

Follow up with a mailed hardcopy including copies of any attachments or supporting reports.

Email to: epbc.referrals@environment.gov.au

Clearly mark the email as a 'Referral under the EPBC Act'.

Attach the referral as a Microsoft Word file and, if possible, a PDF file.

Follow up with a mailed hardcopy including copies of any attachments or supporting reports.

What happens next?

Following receipt of a valid referral (containing all required information) you will be advised of the next steps in the process, and the referral and attachments will be published on the Department's web site for public comment (**Note: the Minister may decide not to publish information that is commercial-in-confidence**).

The Department will write to you at the end of 20 business days to advise you of the outcome of your referral and whether or not formal assessment and approval under the EPBC Act is required. There are a number of possible decisions regarding your referral, including:

The proposed action is NOT LIKELY to have a significant impact and does NOT NEED approval

No further consideration is required under the environmental assessment provisions of the EPBC Act and the action can proceed (subject to any state or local government requirements).

The proposed action is NOT LIKELY to have a significant impact IF undertaken in a particular manner

The particular manner in which you must carry out the action will be identified as part of the final decision. You must report your compliance with the particular manner to the Department.

The proposed action is LIKELY to have a significant impact and does NEED approval

If the action has, will have or is likely to have a significant impact it is called a *controlled action* and the particular matters upon which the action may have a significant impact (such as World Heritage or threatened species) are known as the *controlling provisions*.

The proposed action is subject to a public assessment process before it can be considered for approval. The assessment approach will usually be decided at the same time as the controlled action decision. (Further information about the levels of assessment and basis for deciding the approach are available on the Department's web site.)

Compliance audits

The Department may audit your project at any time to ensure that it was completed in accordance with the information provided in the referral or the particular manner specified in the decision. If the project changes, such that the likelihood of significant impacts could vary, you should write to the Department to advise of the changes.

For more information

call the Department of the Environment, Water, Heritage and the Arts Community Information Unit on 1800 803 772 or

visit the web site www.environment.gov.au/epbc

All the information you need to make a referral, including documents referenced in this form, can be accessed from the above web site.

Referral of proposed action

Project title: Road upgrades and walk trail development to and in Fitzgerald River National Park

1 Summary of proposed action

1.1 **Short description**

The Western Australian Government is proposing to upgrade and seal existing roads at the eastern and western ends of the national park, and construct a coastal walk trail, in (and just outside) the Fitzgerald River National Park on the south coast of Western Australia. This proposal keeps roads to the scale of a tourist road with small scale tourist facilities, in keeping with the national park's management plan and is not proposing a highway or major tourist development. Road upgrades, which will need to include associated facilities such as additional parking and recreation facilities, are based on existing unsealed. The walk trail will include shelters set at a distance of a day's walk apart. The proposal aims to increase the reliability of access to the park for visitors and tour operators by providing year-round guaranteed access. The walk trail will provide a new recreation opportunity within the park.

1.2 **Latitude and longitude**

	Latitude			Longitude		
location point	degrees	minutes	seconds	degrees	minutes	seconds
See Attachment 1 for the GPS locations along the indicative road and walk trail alignments. See Attachments 2a and 2b for maps showing the indicative alignments.						

1.3 **Locality**

Fitzgerald River National Park is located on the south coast of Western Australia between Bremer Bay and Hopetoun, close to Ravensthorpe and Jerramungup. The nearest regional centres are Albany to the west and Esperance to the east.

1.4	**Size of the development footprint or work area (hectares)**	Estimated at 421 hectares, with approximately 80% of the proposal footprint to be located on existing roads, tracks and sites.
1.5	**Street address of the site**	Point Ann Road, Murray Road, Swamp Road, Pabelup Drive, Hamersley Drive, coastal walk trail between Hopetoun and Bremer Bay.

1.6 **Lot description**

Fitzgerald River National Park comprises two A class reserves 31737 and 31738, encompassing about 329,039 hectares. The national park extends to the low water mark of the Southern Ocean. Other reserves include local government road reserves.

1.7 **Local Government Area and Council contact (if known)**

Approval for some parts of the road upgrades will be required from Ravensthorpe and Jerramungup Local Government Areas.
CEO – Shire of Ravensthorpe – Pascoe Durtanovich
CEO – Shire of Jerramungup – Bill Porter

1.8 **Timeframe**

Planning and the approvals process can commence immediately. Pending approvals, it is estimated that construction may commence in late 2009 with completion planned for 2011/2012.

1.9	**Alternatives** Does the proposed action include alternative timeframes, locations or activities?	✓	No
			Yes, you must also complete section 2.2
1.10	**State assessment** Is the action subject to a state or territory environmental impact assessment?		No
		✓	Yes, you must also complete Section 2.4
1.11	**Component of larger action** Is the proposed action a component of a larger action?	✓	No
			Yes, you must also complete Section 2.6
1.12	**Related actions/proposals** Is the proposed action related to other actions or proposals in the region (if known)?		No
		✓	Yes, provide details: Fitzgerald River National Park is managed by the Department of Environment and Conservation (DEC), which implements conservation and visitor services works consistent with the park's management plan.
1.13	**Australian Government funding** Has the person proposing to take the action received any Australian Government grant funding to undertake this project?	✓	No
			Yes, provide details:

2 Detailed description of proposed action

2.1 Description of proposed action

The proposal will improve access management in Fitzgerald River National Park by upgrading existing roads and establishing a walk trail, as shown at attachment 2. The proposal will utilise existing road alignments. Road upgrades will involve widening and sealing. Realignments will be required in some areas to ensure compliance with Australian Standards. Roads identified in this proposal within the national park have a width of 5 metres to 9 metres. This proposal aims to upgrade roads within the national park to a speed limit of 60km per hour which will require a road width of 9 metres. Widening and realignments will be undertaken in such a way as to avoid significant impacts. Measures to avoid and reduce impacts are outlined in section four.

Road upgrades will need to include associated facilities such as additional parking and recreation facilities to manage visitor impacts at Mylies beach, West beach, Four Mile campground, Barrens beach, East Mt Barren and Hamersley Inlet in the east of the park and St Mary's campground, Point Ann, Little Boondalup and Trigelow in the west of the park. Recreation facilities will be consistent with the park's management plan and may include parking and ablution facilities, lookouts and interpretive signage. Recreation site development will be undertaken in such a way as to avoid significant impacts whilst catering for increased visitor numbers. Measures to avoid and reduce impacts are outlined in section four.

This proposal also includes the development of a coastal walk trail. A walk trail will require a minor amendment to the park management plan. The walk trail will replace an existing unformed walking route, which will be closed. The new walk trail is to be developed on an improved alignment with shelters located a distance of a day's walk apart. Shelters will include drinking water storage from off-roof catchments. Walk trail and shelter development will be undertaken in such a way as to avoid significant impacts. Measures to avoid and reduce impacts are outlined in section four.

The rationale for the proposal is to reduce the risk of spreading the pathogen *Phytophthora cinnamomi* (dieback). Roads in the park are currently closed under wet conditions, consistent with the park's statutory management plan, to reduce this risk. Currently there is a risk of spreading dieback from road repairs following wet weather, or as a result of unauthorised visitor access during wet conditions. At the same time, the proposal will improve road and walk trail facilities to and in the park to manage the increasing demand by visitors for access to the park and the coast. The proposal will also provide reliable year-round access to the park for visitors and tour operators. The upgrade will involve improved siting, drainage and sealing to allow all-weather operation. This will result in improved environmental and recreation outcomes. In the event there is any road realignment to provide better environmental protection, the existing road alignment will be ripped and rehabilitated. In doing so the Department will undertake flora and dieback surveys and instigate other measures as outlined in section four to ensure there will be no significant impact on any matters of national environmental significance.

These upgrades are consistent with the management of the national park according to statutory requirements and accepted park management practices and standards.

2.2 Alternative locations, time frames or activities that form part of the referred action

n/a

2.3 Context, planning framework and state / local government requirements

Fitzgerald River National Park is managed under the *Fitzgerald River National Park Management Plan 1991 – 2001*, which is a statutory management plan prepared under the *Conservation and Land Management Act 1984* (CALM Act) (Attachment 3). Under the CALM Act, the plan remains in force until it is formally revised. Fitzgerald River National Park is vested in the Conservation Commission of Western Australia, which is a statutory body under the CALM Act.

One of the strategies in the management plan is to ensure that roads, tracks and paths are well-located and well-drained to minimise the chances of the pathogen *Phytophthora cinnamomi* (dieback) to survive. The management plan also lists upgrading of roads to meet these standards as a priority. The Conservation Commission has indicated that the roading upgrades proposed herein are consistent with the management plan for the park. The Conservation Commission has indicated that it supports the sealing of these roads due to the environmental and visitor benefits that will result.

The Conservation Commission has supported the walk trail concept and has indicated that a minor amendment to the management plan may be required to allow this, which it will support and progress. Advice will be sought on an ongoing basis from the Conservation Commission on more detailed plans as they are developed.

The *Fitzgerald River National Park Management Plan 1991-2001* establishes a wilderness zone that covers the centre of the park in which "access is non-motorised except in emergency situations and for essential management purposes. The level of management is low". As such, there is no unauthorised access permitted to the wilderness zone of the national park. Authorisation to enter this area can only be provided by the Director General of the Department of Environment and Conservation and the Chairman of the Conservation Commission following consideration of proposals. For example, research activities into the endangered western ground parrot in the wilderness zone must be in accordance with these authorisations and attached conditions. Conditions may include restrictions on movements off formed management tracks (an example of an application and approval for mechanised access within Fitzgerald River National Park is provided at Attachment 4).

The values in the Fitzgerald River National Park are outlined in the management plan and are reproduced below.

- Fitzgerald River National Park is one of Australia's richest conservation reserves for plants and animals. It is also an extremely important remnant, as much of the south-west has been cleared for agriculture. Some 20% of the known plant species of Western Australia occur within the 0.1% of the State occupied by the park. At least 75 of these occur only within the Park. The park also contains 10 species of declared rare mammals and birds.
- The Fitzgerald landscapes, with extensive vistas showing little to no evidence of human occupation or use, are a major attraction.
- The park has a rich cultural history with numerous sites of historical and archaeological importance.
- The park is one of only two international biosphere reserves in Western Australia. The biosphere reserve values are enhanced by local community interest in the park, and local adoption of the biosphere reserve concept.
- Fitzgerald provides a range of recreation opportunities in a natural setting.

- The park is well-placed to attract tourists travelling in the south-west and south-east of the State.

The management goals for Fitzgerald River National Park recognise the significant values of this park. Conservation is the highest management priority and management goals recognising this priority are described in the management plan (listed below).

CONSERVATION GOALS

- Conserve all native plant communities, animal communities, species, and the natural processes which sustain them, especially the large numbers of rare species and those in need of special protection.
- Conserve the park's landscapes, in particular the extensive vistas free of human disturbance.
- Conserve the rich Aboriginal and European history of the Park, including numerous historical and archaeological sites.

RECREATION GOAL

- Fulfil the nature-based recreation requirements of visitors to the extent that they are compatible with conserving the park's flora, fauna and landscape values, wilderness qualities and cultural heritage.

EDUCATION GOAL

- Foster a sense of stewardship for the park by the community at all levels - local, State, national and international - emphasising its special conservation, landscape, recreation, cultural and historic values.

RESEARCH AND MONITORING GOALS

- Promote and undertake the scientific study and monitoring of those physical, biological and social values and natural processes special to the park.
- Measure and control impacts of management activities and human use on the park environment.

2.4 Environmental impact assessments under Commonwealth, state or territory legislation

This proposal may be referred to the Western Australian Environmental Protection Authority under the *Environmental Protection Act 1986* (WA) for advice on whether formal impact assessment is required. However, it is considered unlikely that the proposal will have a significant adverse impact on the environment. The Environmental Protection Authority seeks the advice of the Conservation Commission on any referred proposals and the Conservation Commission's advice will be sought throughout the planning phase. In addition, flora and fauna that is specially protected as threatened flora or fauna under the *Wildlife Conservation Act 1950* (WA) cannot be removed without approval from the Western Australian Minister for Environment.

The Environmental Protection Authority's *Guidance Statement No. 56 Guidance for the Assessment of Environmental Factors - Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) (see Attachment 5); and *Guidance Statement No. 51 Guidance for the Assessment of Environmental Factors - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) (see Attachment 6) will be applied by DEC and Main Roads Western Australia.

2.5 Consultation with Indigenous stakeholders

Should the proposal proceed, consultation with Indigenous stakeholders including the South West Aboriginal Land and Sea Council would be undertaken. Aboriginal heritage surveys will be conducted and best practice management protocols will be applied, including appropriate consultation with

elders in the event a cultural heritage site is discovered in or near the area to be disturbed. The action will be implemented in accordance with the *Aboriginal Heritage Act 1972* and the *Heritage of Western Australia Act 1990*. If cultural heritage sites are discovered during construction, works will be stopped immediately and appropriate archaeological and/ or ethnographic surveys and consultation with elders will be undertaken.

Broader consultation with the community, including key stakeholders, will be undertaken on the detailed proposal.

2.6 A staged development or component of a larger project

Not applicable.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

3.1 (a) World Heritage Properties

Description

No World Heritage properties lie within or near the project area.

3.1 (b) National Heritage Places

Description

Fitzgerald River National Park is being assessed for inclusion on the National Heritage List.

Nature and extent of likely impact

National Heritage values have not yet been provided as the place has not been included on the National Heritage List at this stage.

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Description

No wetlands of international importance lie within or near the project area.

3.1 (d) Listed threatened species and ecological communities

Description

Threatened species that are potentially found in the project area are listed in Table 1.

Table 1 Threatened species potentially found in project area

Birds		
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo	Endangered	Species or species habitat likely to occur within area
Dasyornis longirostris Western Bristlebird	Vulnerable	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl	Vulnerable	Species or species habitat likely to occur within area
Pezoporus wallicus flaviventris Western Ground Parrot	Endangered	Species or species habitat likely to occur within area
Psophodes nigrogularis oberon Western Whipbird (western mallee)	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll	Vulnerable	Species or species habitat likely to occur within area
Parantechinus apicalis Dibbler	Endangered	Species or species habitat likely to occur within area

Phascogale calura Red-tailed Phascogale	Endangered	Species or species habitat may occur within area
Pseudomys shortridgei Dayang, Heath Rat	Vulnerable	Species or species habitat likely to occur within area
Plants		
Adenanthos dobagii Fitzgerald Woollybush	Endangered	Species or species habitat likely to occur within area
Adenanthos ellipticus Oval-leaf Adenanthos	Vulnerable	Species or species habitat likely to occur within area
Anigozanthos bicolor subsp. *minor* Little Kangaroo Paw, Two-coloured Kangaroo Paw	Endangered	Species or species habitat likely to occur within area
Coopernookia georgei Mauve Coopernookia	Endangered	Species or species habitat likely to occur within area
Daviesia obovata Paddle-leaf Daviesia	Endangered	Species or species habitat known to occur within area
Eremophila denticulata subsp. *denticulata* Fitzgerald Eremophila	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus burdettiana Burdett Gum	Endangered	Species or species habitat likely to occur within area
Eucalyptus coronata Crowned Mallee	Vulnerable	Species or species habitat likely to occur within area
Grevillea infundibularis Fan-leaf Grevillea	Endangered	Species or species habitat likely to occur within area
Myoporum cordifolium Jerramungup Myoporum	Vulnerable	Species or species habitat likely to occur within area
Ricinocarpos trichophorus Barrens Wedding Bush	Endangered	Species or species habitat likely to occur within area
Stylidium galioides Yellow Mountain Triggerplant	Vulnerable	Species or species habitat likely to occur within area
Verticordia crebra	Vulnerable	Species or species habitat likely to occur within area
Verticordia helichrysantha Coast Featherflower	Vulnerable	Species or species habitat likely to occur within area
Verticordia pityrhops	Endangered	Species or species habitat likely to occur within area

Nature and extent of likely impact

Minimal impact as this proposal mainly involves utilising existing road alignments. During the detailed planning process, impacts on threatened species will be avoided by following guidelines and policies for best practice.

3.1 (e) Listed migratory species

Description

Migratory species that are potentially found in the project area are listed in Table 2.

Table 2 Migratory species potentially found in the project area

Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl	Migratory	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Pezoporus wallicus flaviventris Western Ground Parrot	Migratory	Species or species habitat likely to occur within area
Migratory Wetland Species		

Birds		
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Sterna caspia Caspian Tern	Migratory	Breeding likely to occur within area

Nature and extent of likely impact

Minimal impact as this proposal mainly involves utilising existing road alignments. During the detailed planning process, impacts on migratory species will be avoided by following guidelines and policies for best practice.

3.1 (f) Commonwealth marine area

Description

There is no Commonwealth marine area within the project area.

3.1 (g) Commonwealth land

Description

There is no Commonwealth land within the project area.

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, or actions taken on Commonwealth land

3.2 (a)	**Is the proposed action a nuclear action?**	✓	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment

3.2 (b)	**Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?**	✓	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment

3.2 (c)	**Is the proposed action to be taken in a Commonwealth marine area?**	✓	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))

3.2 (d)	**Is the proposed action to be taken on Commonwealth land?**	✓	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))

3.3 Other important features of the environment

3.3 (a) Soil and vegetation characteristics

LANDFORM	GEOLOGY	SOIL TYPE	VEGETATION
Upland	Granites, gneisses	• extensive areas of shallow loamy sand • skeletal soils associated with granite exposures	• very open mallees of *E. redunca* or *E. tetragona* • Allocasuarina, Grevillea and Acacia scrub/heath associated with granite outcrops
Plain	Spongolite, siltstone	• duplex shallow sandy loams, colluvial sands and cracking clays • skeletal soils on bedrock exposures	• very open mallee of *E. decipiens* widespread • elsewhere open to very open shrub mallee
Valleys	Spongolite, siltstone	• sandy loam – shallow on walls, deeper on valley floor	• open shrub mallee of *E. conglobata* and *E. incrassata* on valley floors and drainage lines • low woodland on slopes and rims • open mallee on mesas
Ranges	Quartzite, phyllite, dolomite, conglomerates	• quartzite sand on quartzite • phyllitic loamy sand or schist duplex soils	• Banksia scrub and Adenanthos open low scrub on quartzite • very open shrub mallee of *E. incrassata*, and Banksia and Allocasuarina low scrub on phyllitic schists
Dunes	Sand over spongolite or quartzite	• loose calcareous or siliceous sands	• mallee and shrubland becoming lower and denser heath closer to coast
Inlets	Incised in quartzite, spongolite or limestone	• saline soils next to inlet • narrow deposits of colluvium and alluvium spongolite, at some slope and cliff bases	• Melaleuca woodland or shrubland on edges • Samphire heath on flats
Rivers, swamps and lakes	Granites, spongolite, quartzite	• dependent on underlying rock	• *E. occidentalis* woodland dominant

3.3 (b) Water flows, including rivers, creeks and impoundments

There are four main rivers in Fitzgerald River National Park: the Gairdner, Fitzgerald, Hamersley and Phillips. These run roughly from north-west to south-east through the Park. All have at least part of their catchments in cleared agricultural land. A number of shorter rivers and streams, most notably the St Mary and Dempster, have catchments within the Park. All rivers in the Park are intermittent, with the majority of flows occurring during winter and spring.

Fitzgerald River National Park has numerous ephemeral swamps, particularly on the plains. They are covered wholly or largely by woodland and/or shrubland. At least part of their floor is covered by a few centimetres of water during winter and spring. Floods may add up to 1.5 metres of water which may remain for up to 18 months. Water quality varies from fresh to brackish. A number of fresh (eg. Pabelup Lake) and saline (eg. Doggers Swamp) wetlands also occur.

All major rivers in Fitzgerald River National Park terminate in inlets which are normally closed to the sea by a sand bar. Only occasionally is river flow sufficient to fill any of the inlets so they overflow into the sea. Once open, inlets remain so for days to many months.

The majority of surface and groundwater in the park is saline. However, a thin layer of freshwater, overlying brackish or saline water, is likely to be present in the coastal sediments.

3.3 (c) Outstanding natural features, including caves

- Fitzgerald River National Park is one of Australia's richest conservation reserves for plants and animals. It is also an extremely important remnant, as much of the south-west has been cleared for agriculture. Some 20% of the known plant species of Western Australia occur within the 0.1% of the State occupied by the Park. At least 75 of these occur only within the Park. The Park also contains threatened animals and plants (see 3.1(d) above).
- The Fitzgerald River National Park landscapes, with extensive vistas showing little to no evidence of human occupation or use, are a major attraction.
- The park has a rich cultural history with numerous sites of historical and archaeological importance.
- The park is one of only two international biosphere reserves in Western Australia. The biosphere reserve values are enhanced by local community interest in the Park, and local adoption of the biosphere reserve concept.
- Fitzgerald River National Park provides a range of recreation opportunities in a natural setting.
- The park is well-placed to attract tourists travelling in the south-west and south-east of the State.

3.3 (d) Gradient (or depth range if action to be taken in a marine area)

The five major landforms are the upland, plains, incised valleys, ranges and dunes:

- The upland is characterised by a gently undulating terrain on the Archaean granites which underlie the northern part of the Park.
- The plains, immediately inland from the coast, are flat, with numerous swamps, depressions and large areas with no run-off. They are developed on the deeply weathered Plantagenet Group of Eocene sediments. This is the most extensive landform in the Park.
- Steep-sided valleys cut through the plain, creating the distinct, incised valley landform. The erosional scarp of the valleys is often capped by laterite. Flat mesaform hills also appear as relics on the plain.
- The ranges landform is also distinctive as it is emergent above the gently sloping plain. It has developed on the Proterozoic quartzites. Narrow sand dune systems occur along several sections of the coastline.
- The coastal dunes are readily eroded by wind, particularly when sparsely vegetated, or where wave action is likely to further decrease stability. The steeper, younger, more sparsely vegetated dunes closer to the coast are more susceptible than older stabilised dunes further inland.

3.3 (e) Buildings or other infrastructure

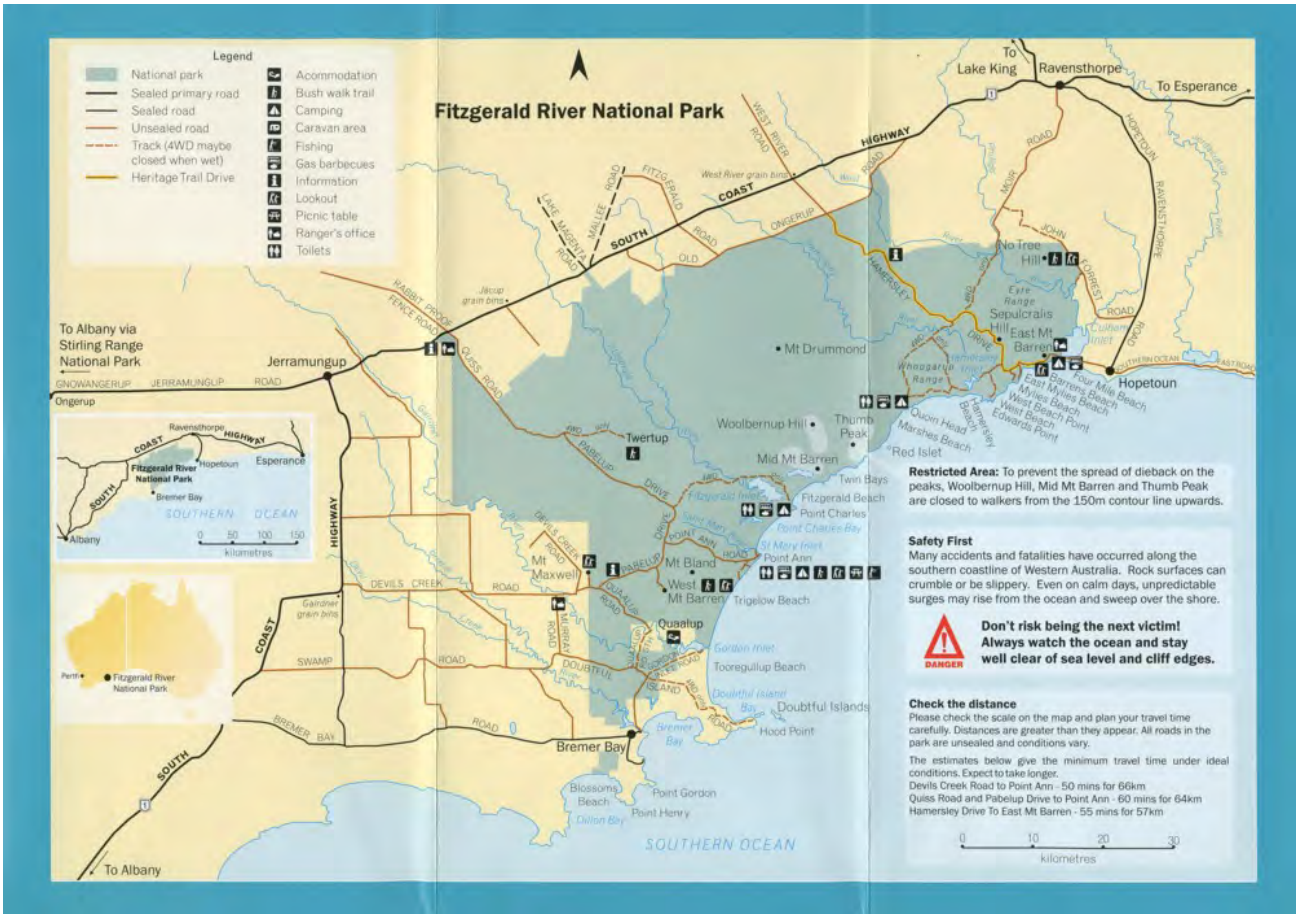
Historic buildings and infrastructure

- John Wellstead squatted at "Quaalup". He built Quaalup homestead, which is located just outside the park's boundary, in 1858. Ruins of a shepherd's hut, built by the Wellsteads, still remain near Fitzgerald Inlet. Ruins of various homesteads, including the Parsons, King, Neil and Waters families, can be found in the eastern end of the park.
- The Western Australian section of the East/West Telegraph Line was completed in 1877 after commencement in 1875. The Bremer Bay station was closed down in 1929 when the telegraph line was re-routed inland from Balladonia direct to Perth.
- The remains of a copper and manganese mine on Copper Mine Creek are still visible. The remains of an early twentieth century (c. 1910-1920) head frame, associated with the search for oil, are located near Jonacoonack on the Fitzgerald River. Nearby are a number of hut sites and a small dam.

- The No. 2 Rabbit Proof Fence was completed in 1905. It was abandoned in the 1960s, with the length between Nyabing and Point Ann being the last persisting section. Although no longer functional, parts of the fence still remain in the park (L. Sandiford, 1988).
- A small house, formerly the Twertup Field Study Centre, was built from spongolite at a quarry site in the park, but has now been destroyed by fire.
- The remains of a large concrete trough used for cleaning salmon can still be seen at Fitzgerald Inlet.

Recreation Facilities

There are about 28 recreation sites currently used in the park. Of these, 11 are used for both day use (parking and/or picnicking) and overnight camping, 13 for day use only and 4 for camping only (see map below). Some facilities have been damaged by fire in recent years and are being progressively replaced.



3.3 (f) Marine areas

There are no marine reserves located off the coast of the Fitzgerald River National Park. The 1994 Report of the Marine Parks and Reserves Selection Working Group recommended that "the area of State coastal waters between the mouth of Gordon Inlet and the mouth of Culham Inlet, should be considered for reservation as a marine reserve for conservation of flora and fauna and recreation, and that it should be added to the Fitzgerald Biosphere Reserve". No action has yet been taken on this recommendation.

3.3 (g) Kinds of fauna & flora

Flora

With 1,748 identified plant species, including 75 endemics, the Fitzgerald River National Park is one of the richest flora conservation areas in Western Australia. The park contains 20% of known plant species (both named and unnamed) for Western Australia and 42% of the known species for the South-West Botanical Province. The number of species will continue to increase as survey continues.

The Fitzgerald area is one of three nodes of high species richness in south-west Australia. Fitzgerald River National Park also has a high proportion of endemic, geographically restricted and rare species. Although the flora is typical of the Eyre Botanical District, it also contains some elements of the wetter forest and drier Goldfields flora (eg. *Gnephosis intosa* and *Ptilotus holosericeus*).

The flora of Fitzgerald River National Park consists of 5 families of fern and 87 of flowering plants. The major families represented are Myrtaceae (220 species), Proteaceae (130), Asteraceae (108) and Cyperaceae (97). Dwarf shrubs are the dominant life-form, followed by annuals and small shrubs.

The upland and plains contain the highest numbers of plant species. They are also the most extensive landforms identified in Fitzgerald River National Park.

In Fitzgerald River National Park, peak flowering occurs over August-November while the least number of species bloom in February. There is a rapid decline in the number of species flowering through the summer months. The most important summer flowering group is the eucalypts. Autumn-flowering species such as *Hakea laurina*, *Dryandra quercifolia* and Banksia media are important for the survival of honeyeaters and honey possums.

Fauna

The park has more species of vertebrate fauna than any other conservation reserve in south-west Australia. It has 22 species of native mammals (7 declared rare), 184 species of bird (3 declared rare and 2 declared as otherwise in need of special protection), 41 species of reptile (1 declared in need of special protection), 12 species of frog and 4 species of inland fish.

The very high number of vertebrates present is partially due to an overlap of arid region species and those adapted to moister conditions. The park also forms part of a corridor of uncleared vegetation from the coast to the southern wheatbelt and Goldfields. The large size of the park and lack of widespread habitat degradation, such as frequent burning and grazing by stock, enhance these values. Habitats can be degraded by dieback.

There is a concentration of rare fauna in the northern upland. This faunal richness is associated with three factors. First, the upland corresponds with the Archaean shield which underlies much of the wheatbelt. Much of the fauna is a remnant of a formerly widespread and richer wheatbelt fauna. Second, habitats exist in a tight mosaic of soil/vegetation types due to the presence of granitic outcrops and numerous minor watercourses. Third, some of the soils are not as extensively weathered and leached as those on the southern plains, and thus have a higher nutrient status.

Therefore, the northern part of Fitzgerald River National Park is a small remnant of a formerly widespread and rich faunal area. Today, it is likely that species continue to disperse, perhaps via river valleys, from the upland to the southern plains and elsewhere.

3.3 (h) Current state of the environment in the area

Fitzgerald River National Park is a 330,000 hectare area of natural vegetation in excellent overall condition, which is protected by its tenure as a A Class reserve for the purpose of national park.

The major management concern in the park is the spread of *Phytophthora cinnamomi* (dieback). The flora is highly susceptible to the disease, and this problem is compounded by summer rainfall which provides warm, moist conditions favourable to the survival and spread of *Phytophthora*. *Phytophthora* is most commonly introduced and spread in infected soil, mud or moist gravel on the wheels and underbodies of vehicles. Loss of vegetation to dieback would seriously reduce the park's conservation and recreation values.

The future of the rare fauna is also a management concern. A number of these species appear to have very specific habitat requirements, such as periods greater than 15 years between fires and protection from introduced predators such as foxes.

There is also concern about the effect of large-scale fires on the park's ecological and landscape values, as well as on adjoining farmlands and nearby towns. Fire has been a feature of the park's history over the last 40 to 50 years with some large fires burning significant areas of the park.

Another major issue is the increasing demand for visitor access to the coast for fishing, camping and beach activities. Many parts of the park, and especially the coast, are fragile and access needs to be managed to provide for enjoyable visitor experiences whilst minimising visitor impact.

3.3 (i) Other important or unique values of the environment

See above.

3.3 (j) Tenure of the action area (eg freehold, leasehold)

The area of the proposal lies mainly within the Fitzgerald River National Park. The roads to be sealed exit the park into Local Government Authority road reserves. The proposed walk trail lies within the Fitzgerald River National Park and other Crown reserves.

3.3 (k) Existing land / marine uses of area

The majority of the area is a national park and is used predominantly for a range of low-key recreational activities. The park is surrounded by farmland, townships and other Crown reserves. The coast is not heavily utilised due to its relative remoteness, with limited marine usage at present, mainly by recreational and commercial fishers.

3.3 (l) Any proposed land / marine uses of area

As an A class reserve for the purpose of “national park”, the tenure of the park is secure and non-conforming uses are not permitted. The State waters adjacent to the park may be considered for marine reservation in the future.

4 Measures to avoid or reduce impacts

In the development of a detailed project proposal, significant impacts to threatened or migratory species listed under the EPBC Act will be avoided by ensuring the alignment of roads and tracks does not cause significant impacts. During the development of the detailed proposal, on-site survey of the proposed areas will be undertaken to determine the location of conservation significant and threatened species so that those areas are avoided. If amendments to road alignments are required to enable compliance with Australian Standards for roading, the proposal and adjusted alignment will be subject to protection of significant protected flora and fauna populations and habitat to ensure minimal impacts to these values.

The Main Roads Environmental Management System will be implemented and is integrated into all key processes including planning, delivery, maintenance, network operations and supporting services. Main Roads seeks to maintain certification to ISO 14001:2004.

In addition, the proposal will be implemented in a manner consistent with relevant DEC policies including *Management of Phytophthora and disease caused by it, Policy No. 3*; *Recreation, tourism and visitor services, Policy No. 18*; *Visual resource management on lands and waters managed by the Department of Conservation and Land Management, Policy 34*; *Road management, Policy 40* (in review); *Visitor Risk Management Policy, Policy No. 53*; *Identification of Wilderness and surrounding areas, Policy 62*.

Environmental management protocols will be implemented to ensure that road and facilities construction follow best practice and are carried out in a manner that minimises environmental impact.

Vegetation and fauna habitat management

- Special environmental areas (for instance, containing threatened species under the EPBC Act; declared rare, priority or significant flora, areas of priority and protected fauna habitat under Western Australian legislation; wetlands etc) will be mapped during the design phase and road alignment and facilities will be designed to avoid them.
- Special environmental areas will be clearly delineated on site prior to commencement of construction to avoid unintentional impacts.
- Facilities will be designed to avoid clearing of vegetation.
- If clearing of vegetation is required, appropriate authorisation will be obtained and flora surveys will be undertaken.
- If clearing of vegetation is required, road alignments and facilities will be designed to minimise the amount of clearing required and avoid clearing areas containing threatened species under the EPBC Act, declared rare, priority or significant flora and areas of priority and protected fauna habitat.
- Opportunities to translocate flora, particularly threatened species under the EPBC Act, declared rare, priority or significant flora, will be investigated if clearing of vegetation is unavoidable. No clearing of conservation significant flora (including EPBC Act listed flora) will be undertaken where this significantly affects the conservation status of the species.
- The limits of clearing will be clearly demarcated on site prior to commencement of construction, to avoid unintentional clearing of vegetation.
- Any areas disturbed during construction that will not have infrastructure located on them will be rehabilitated with local species.
- Logs and dead trees will be retained for fauna habitat, providing safety requirements are met.
- Construction materials will be obtained from outside Fitzgerald River National Park where possible. If materials are required from within the park, these are to be obtained from existing gravel or sand pits.

Dieback and weed management protocols

- An example of a disease action plan developed for use by the western ground parrot research team in Fitzgerald River National Park is provided (Attachment 7).
- The response plan for the management of *Phytophthora cinnamomi* in the Fitzgerald River National Park 2006 – 2011 applies.
- A dieback and weed hygiene management plan will be developed to include the following aspects:
  - Construction will be undertaken in summer/ autumn to minimise the risk of dieback spread.
  - The development area will be surveyed and mapped to inform road alignment and recreation facilities design.
  - All vehicles, machinery and equipment will be clean on entry to the Fitzgerald River National Park.
  - All materials imported into Fitzgerald River National Park will be clean of dieback, weeds and weed seeds.
  - Dieback uninterpretable areas will be clearly identified on site and vehicles and machinery will not be permitted to move from these areas to dieback-free areas.
  - Clean-down stations will be installed at appropriate locations (away from special environmental areas) to prevent the introduction of dieback.
  - Weeds will be surveyed prior to construction.
  - Weed control will be undertaken during and following construction to manage any weeds resulting from construction disturbance. Weed control will be planned to prioritise the use of non-herbicide methods if possible, or to apply appropriate herbicides and rates if required.
  - Stockpiles, if required, are to be located within cleared areas and within the construction zone and are to avoid special environmental areas.
  - Stockpiles are to be treated for weeds if necessary.
  - Monitoring of dieback and weed spread will be undertaken following construction and appropriate mitigation will be undertaken if dieback or weeds are found to have spread.

Visual landscape management
- Design of the roads and facilities will take into account the visual landscape values of the area and seek to minimise the impact of constructed facilities.
- Design will be undertaken to maintain the aesthetic values of roads and facilities.

Access management
- Fencing or suitable barriers should be installed and maintained during construction to manage uncontrolled and unauthorised access from the construction site.

Fire management
- A fire access and management plan will be prepared to minimise the risk of fire from construction.

Drainage management
- Drainage will be designed to minimise the impact of stormwater on adjacent vegetation, and minimise the spread of dieback.
- Drainage will not be directed into natural wetlands.
- Actions will be implemented to control run-off and erosion from the construction site.

Cultural heritage
- Areas containing Registered Aboriginal sites or sites on the State Register of Heritage Places will be mapped and the road alignment and facilities will be designed to avoid these areas.
- If clearing of vegetation is required, surveys of these areas would identify any archaeological or ethnographic sites within or near the proposed area of disturbance and best practice management protocols would be applied, including appropriate consultation with elders in the event a cultural heritage site is discovered.

- Should an impact on a Registered Aboriginal site or a site on the State Register of Heritage Places be unavoidable, appropriate approvals will be sought under the *Aboriginal Heritage Act 1972* and the *Heritage of Western Australia Act 1990*.
- If cultural heritage sites are discovered during construction, works will be stopped immediately and appropriate archaeological and/ or ethnographic surveys and consultation with elders will be undertaken.

Construction management

- Dust will be managed by avoiding unnecessary clearing and applying water if required.
- Contractors will be required to dispose of any construction waste or other rubbish off-site.
- Appropriate incident reporting protocols will be established.

Training and site inductions

- All personnel involved in working on site will be appropriately trained and inducted about the values of the area and environmental protocols that are to be met.

Cumulative and/or consequential impacts

- The current park management plan contains principles that the management goal for Fitzgerald River National Park is to conserve all flora and fauna, particularly rare species and those in need of special protection, and to fulfil the nature-based recreation requirements of visitors to the extent that they are compatible with conserving the park's flora and fauna. It also refers to specific limits on camping numbers and booking systems. These objectives will be continued in any reviewed management plan and, even though the action may result in increased visitor numbers to the park, DEC will continue to manage the park to ensure there are no increased detrimental impacts on species listed as threatened under the EPBC Act, or other matters of national environmental significance.

Conclusion

Management of the impact of visitors on the Fitzgerald River National Park will be improved as a consequence of this proposal. In Fitzgerald River National Park, poorly located access routes and camping areas in coastal areas are leading to localised water and wind erosion. Inland, erosion is largely restricted to tracks and firebreaks. Experience in other areas of the south-west has shown that *Phytophthora* spore survival is minimised on well-drained, hard-surfaced roads. They limit the opportunity for infected soil to be picked up or spread by vehicles. The construction of suitable car parks and recreation facilities at the end of upgraded roads will aid management of any adverse impacts that may be expected from an increase in visitation to Fitzgerald River National Park. The construction of the coastal walk trail will formalise an existing less-formal walking route. The trail will improve management of walkers through the area by provision of better information to encourage minimal impact activity as well as improved trail alignment and camping facilities.

5 Conclusion on the likelihood of significant impacts

Identify whether or not you believe the action is a controlled action (ie. significant impacts on the matters protected under the Act are likely) and the reasons why. If you think that the action is a controlled action, you must also identify the relevant protected matters in section 5.3. (An action is a controlled action if it has, will have, or is likely to have a significant impact on a matter protected by a provision of Part 3 of the EPBC Act).

5.1 Do you THINK your proposed action is a controlled action?

✓	No, complete section 5.2
	Yes, complete section 5.3

5.2 Proposed action IS NOT a controlled action.

The Western Australian Government considers that this proposal does not constitute a 'controlled action', as defined by the EPBC Act, in that it:

- does not have any potential to affect:
    - World Heritage properties;
    - National Heritage places; and/or
    - wetlands of international importance;
- is not a nuclear action;
- does not impact Commonwealth land; and
- is not being implemented by a Commonwealth agency.

While there are listed threatened and migratory species within the proposal area, the proposed actions will be undertaken following strict protocols to protect those values. In addition, the proposed road works are based on utilisation of existing unsealed roads which are therefore already disturbed sites.

This proposal will result in an improved environmental outcome by:

- improving management of visitor access to the park; and
- minimising the threat of the spread of infection by *Phytophthora*;

In addition, the proposal will increase the reliability of access to the park for visitors and tour operators by providing year-round guaranteed access and better facilities for visitors.

6 Environmental history of the responsible party

NOTE: If a decision is made that a proposal needs approval under the Act, the Minister will also decide the assessment approach. The EPBC Regulations provide for the environmental history of the party proposing to take the action to be taken into account when deciding the assessment approach for actions that need approval under the Act.

		Yes	No
6.1	**Does the party taking the action have a satisfactory record of responsible environmental management?** **Provide details** The Department of Environment and Conservation's mission is: "Working with the community, we will ensure that Western Australia's environment is valued, protected and conserved, for its intrinsic value, and for the appreciation and benefit of present and future generations." (DEC 2007). The department has the lead responsibility for protecting and conserving the State's environment on behalf of the people of Western Australia (DEC 2007). This includes managing the State's national parks, marine parks, conservation parks, State forests and timber reserves, nature reserves, marine nature reserves and marine management areas (DEC 2007). The department maintains and adds to the conservation values of parks while providing opportunities for people to experience WA's remarkable and varied natural environments (DEC 2008). DEC employs experts and specialists with high level skills in such areas as *Phythophthora* dieback mapping and management. Main Roads has a wealth of specialised knowledge relating to the design and construction of roads and bridges and management of associated environmental aspects (Main Roads 2009). This expertise has been used to develop guidelines, standards and specifications for use by internal staff, and external consultants working for Main Roads (Main Roads 2009). This specialised knowledge plays an important part in the planning, design, construction and maintenance of Western Australia's road network (Main Roads 2009). The Western Australian Government operates in accordance with strict policies and guidelines as described in this document.		
6.2	**Has the party taking the action ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?** Not applicable. **If yes, provide details**		
6.3	**If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?** Not applicable.		

If yes, provide details of environmental policy and planning framework

6.4 Has the person proposing to take the action previously referred an action under the EPBC Act? ✓

Main Roads Western Australia has previously referred an action under the EPBC Act.

Provide name of proposal and EPBC reference number (if known)

2009/4692	Main Roads Western Australia/Transport - land/City of Mandurah, 3km N-East of Mandurah Post Office/WA/Construction of Mandurah Entrance Road	06 Jan 2009
2007/3515	Main Roads Western Australia/Transport - land/Busselton/WA/Monaghan's Roundabout Project - Intersection of Bussell Highway and Caves Road, Shire of Busselton	25 Jun 2007
2005/2193	Main Roads Western Australia/Land transport/Perth to Bunbury/WA/Construction of New Perth Bunbury Highway project	28 Jun 2005
2002/846	Main Roads Western Australia/Land transport/Caves Road/WA/Three Turning Pockets West of Busselton Townsite	25 Oct 2002
2002/781	Main Roads Western Australia/Tourism, recreation and conservation management/Canning Vale/WA/Translocation of orchids (Caladenia huegelii) from Roe Hway Reserve	27 Aug 2002
2001/470	Main Roads Western Australia/Land Transport Infrastructure/Armadale/WA/Tonkin Highway Extension	10 Oct 2001
2001/325	Main Roads Western Australia/Land Transport Infrastructure/South West Region/WA/South Western Highway - Wokalup to Brunswick Junction - Upgrade	20 Jun 2001
2000/83	Main Roads Western Australia/Land Transport Infrastructure/Shark Bay/WA/Useless Loop Road Upgrade	14 Nov 2000

7 Information sources and attachments

(For the information provided above)

7.1 References

Department of Conservation and Land Management (CALM). 1991. Fitzgerald River National Park Management Plan 1991 – 2001. Management Plan No 15. Government of Western Australia, Perth WA.

Department of Environment and Conservation (DEC). 2007. Corporate Plan 2007-2009. Government of Western Australia, Perth WA. [http://www.dec.wa.gov.au/about-us/about-dec/corporate-plan.html accessed 22 May 2009]

Department of Environment and Conservation (DEC). 2008. Annual Report 2007-2008. Government of Western Australia, Perth WA. [http://www.dec.wa.gov.au/about-us/annual-reports/dec-annual-report-2007-2008.html accessed 22 May 2009]

Main Roads Western Australia. 2009. Main Roads website: [http://standards.mainroads.wa.gov.au/NR/mrwa/frames/standards/standards.asp?G={E582C897-FF5E-4C02-8B46-51E88C1E5DD8} accessed 22 May 2009]

Marine Parks and Reserves.1994. Report of the Marine Parks and Reserves Selection Working Group

Giummarra, G.J. 2009. *Unsealed roads manual – Guidelines to good practice*. 3rd edition March 2009, ARRB Group Ltd, Victoria.

Department of Environment and Conservation. 2006. *Recreation, Tourism and Visitor Services Policy Statement 18* and associated guidelines. Government of Western Australia, Perth WA.

Department of Environment and Conservation. *Management of Phytophthora and disease caused by it, Policy No. 3*. Government of Western Australia, Perth WA.

Department of Environment and Conservation. *Visual resource management on lands and waters managed by the Department of Conservation and Land Management, Policy 34*. Government of Western Australia, Perth WA.

Department of Environment and Conservation. *Road management, Policy 40* (in review). Government of Western Australia, Perth WA.

Department of Environment and Conservation. *Visitor Risk Management Policy, Policy No. 53*. Government of Western Australia, Perth WA.

Department of Environment and Conservation. *Identification of Wilderness and surrounding areas, Policy 62*. Government of Western Australia, Perth WA.

Environmental Protection Authority. 2004. *Guidance Statement No. 56 Guidance for the Assessment of Environmental Factors - Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*. Government of Western Australia, Perth WA.

Environmental Protection Authority. 2004. *Guidance Statement No. 51 Guidance for the Assessment of Environmental Factors - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia.* Government of Western Australia, Perth WA.

7.2 Reliability and date of information

Management plan information has been cross checked by Department of Environment and Conservation staff in the region. Personal communication with key management staff in the region and staff who specialise in environmental impact management was undertaken.

7.3 Attachments

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	2a and 2b
	figures, maps or aerial photographs showing the location of the project in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	2a and 2b
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.3)		
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.4)		
	copies of any flora and fauna investigations and surveys (section 3)		
	technical reports relevant to the assessment of impacts on protected matters and that support the arguments and conclusions in the referral (section 3 and 4)		
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)		

8 Contacts, signatures and declarations

NOTE: Providing false or misleading information is an offence punishable on conviction by imprisonment and fine (s 489, EPBC Act).

Under the EPBC Act a referral can only be made by:

- the person proposing to take the action; or
- a Commonwealth, state or territory government, or agency that is aware of a proposal by a person to take an action, and that has administrative responsibilities relating to the action[1].

Project title: **Road upgrades and walk trail development to and in Fitzgerald River National Park**

8.1 Person proposing to take action

Name	Keiran McNamara
Title	Director General
Organisation	Department of Environment and Conservation
ACN / ABN (if applicable)	ABN 38 052 249 024
Postal address	Locked Bag 104, Bentley Delivery Centre WA 6983
Telephone	(08) 6467 5500
Email	keiran.mcnamara@dec.wa.gov.au
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading. I agree to be nominated as the proponent for this action.
Signature	Peter Thorp for K. McNamara Date 22/6/09

Name	Director, Parks + Visitor Services
Title	
Organisation	
ACN / ABN (if applicable)	
Postal address	
Telephone	
Email	
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading. I agree to be nominated as the proponent for this action.
Signature	Date

[1] *If the proposed action is to be taken by a Commonwealth, state or territory government or agency, section 8.1 of this form should be completed. However, if the government or agency is aware of, and has administrative responsibilities relating to, a proposed action that is to be taken by another person which has not otherwise been referred, please contact the Referrals Business Entry Point (1800 803 772) to obtain an alternative contacts, signatures and declarations page.*

8.2 Person preparing the referral information (if different from 8.1)

Individual or organisation who has prepared the information contained in this referral form.

Name	Peter Sharp
Title	Director Parks and Visitor Services
Organisation	Department of Environment and Conservation
Postal address	Locked Bag 104, Bentley Delivery Centre WA 6983
Telephone	(08) 442 0304
Email	peter.sharp@dec.wa.gov.au
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading.
Signature	Peter Sharp Date 22/6/09

If the referring party is a small business (fewer than 20 employees), estimate the time taken, in hours and minutes, to complete this form (include your time reading the instructions, working on the questions and obtaining the information and time spent by all employees in collecting and providing this information).

Hours	Minutes

REFERRAL CHECKLIST

NOTE: This checklist is to help ensure that all the relevant referral information has been provided. It is not a part of the referral form and does not need to be sent to the Department.

HAVE YOU:

- ❑ Completed all required sections of the referral form?
- ❑ Included accurate coordinates (to allow the location of the proposed action to be mapped)?
- ❑ Provided a map showing the location and approximate boundaries of the project area?
- ❑ Provided a map/plan showing the location of the action in relation to any matters of NES?
- ❑ Provided complete contact details and signed the form?
- ❑ Provided copies of any documents referenced in the referral form?
- ❑ Ensured that all attachments are less than two megabytes (2mb)?
- ❑ Sent the referral to the Department (electronic and hard copy preferred)?

Hamersley Drive

X	Y	Length
119° 56' 32.84" E	33° 56' 22.55" S	1.8
119° 41' 22.29" E	33° 44' 21.88" S	7.0
119° 42' 12.81" E	33° 45' 46.52" S	1.8
119° 44' 29.65" E	33° 46' 44.12" S	4.0
119° 44' 50.51" E	33° 47' 26.63" S	1.4
119° 45' 1.94" E	33° 47' 31.41" S	0.3
119° 45' 47.42" E	33° 47' 13.59" S	1.3
119° 46' 35.70" E	33° 47' 22.44" S	1.3
119° 47' 15.04" E	33° 48' 36.98" S	2.5
119° 48' 23.37" E	33° 49' 31.07" S	2.4
119° 49' 19.91" E	33° 50' 10.50" S	1.9
119° 49' 33.27" E	33° 50' 48.39" S	1.2
119° 50' 27.17" E	33° 51' 39.63" S	2.1
119° 52' 36.15" E	33° 52' 30.66" S	3.7
119° 53' 9.51" E	33° 52' 30.37" S	0.9
119° 54' 3.35" E	33° 51' 59.73" S	1.7
119° 54' 55.02" E	33° 52' 14.62" S	1.4
119° 55' 15.23" E	33° 53' 10.65" S	1.8
119° 55' 41.86" E	33° 53' 23.62" S	0.8
119° 56' 23.05" E	33° 53' 19.83" S	1.1
119° 56' 54.94" E	33° 53' 49.84" S	1.2
119° 56' 55.97" E	33° 54' 13.94" S	0.8
119° 57' 32.61" E	33° 54' 29.17" S	1.1
119° 57' 34.98" E	33° 55' 55.88" S	2.7
119° 55' 37.65" E	33° 56' 52.35" S	1.7
119° 41' 57.41" E	33° 44' 49.45" S	2.2
119° 57' 47.51" E	33° 56' 24.05" S	1.9
119° 58' 55.62" E	33° 56' 2.70" S	0.6
119° 59' 9.73" E	33° 55' 47.09" S	1.2
119° 59' 51.83" E	33° 55' 56.15" S	0.7
120° 0' 6.34" E	33° 55' 37.93" S	0.9
120° 0' 38.30" E	33° 55' 34.60" S	0.4
120° 0' 46.03" E	33° 55' 45.72" S	2.2
120° 1' 55.68" E	33° 55' 13.67" S	2.3

60.6 km

+10% allowing for bends and re-alignments

Total Length 66.6 km

Pt Anne Road

X	Y	Length
119° 17' 25.02" E	34° 24' 7.12" S	3.1
119° 17' 25.02" E	34° 22' 27.55" S	2.9
119° 16' 16.38" E	34° 21' 14.16" S	1.9
119° 15' 10.25" E	34° 20' 44.94" S	2.5
119° 14' 22.18" E	34° 19' 36.88" S	2.1
119° 13' 26.84" E	34° 18' 45.66" S	2.4
119° 15' 0.42" E	34° 18' 48.96" S	0.7
119° 15' 24.69" E	34° 18' 37.05" S	1.7
119° 15' 53.07" E	34° 17' 45.82" S	0.8
119° 16' 24.03" E	34° 17' 42.72" S	8.4
119° 16' 1.79" E	34° 13' 12.99" S	2.9
119° 20' 8.19" E	34° 12' 38.20" S	6.4
119° 23' 55.45" E	34° 11' 20.87" S	2.3
119° 25' 20.53" E	34° 11' 3.87" S	1.2
119° 25' 50.75" E	34° 10' 36.29" S	2.8
119° 26' 12.55" E	34° 9' 7.87" S	1.6
119° 27' 11.80" E	34° 9' 18.20" S	1.7
119° 28' 12.84" E	34° 8' 55.55" S	2.3
119° 29' 29.77" E	34° 9' 29.69" S	0.8
119° 30' 0.94" E	34° 9' 33.79" S	1.6
119° 30' 38.68" E	34° 10' 14.91" S	1.4
119° 31' 27.32" E	34° 10' 33.82" S	2.1
119° 34' 41.38" E	34° 10' 22.24" S	0.7
119° 32' 49.55" E	34° 10' 45.06" S	3.0
119° 19' 5.05" E	34° 12' 45.70" S	1.7
119° 17' 52.68" E	34° 13' 11.26" S	2.1

61.4 km

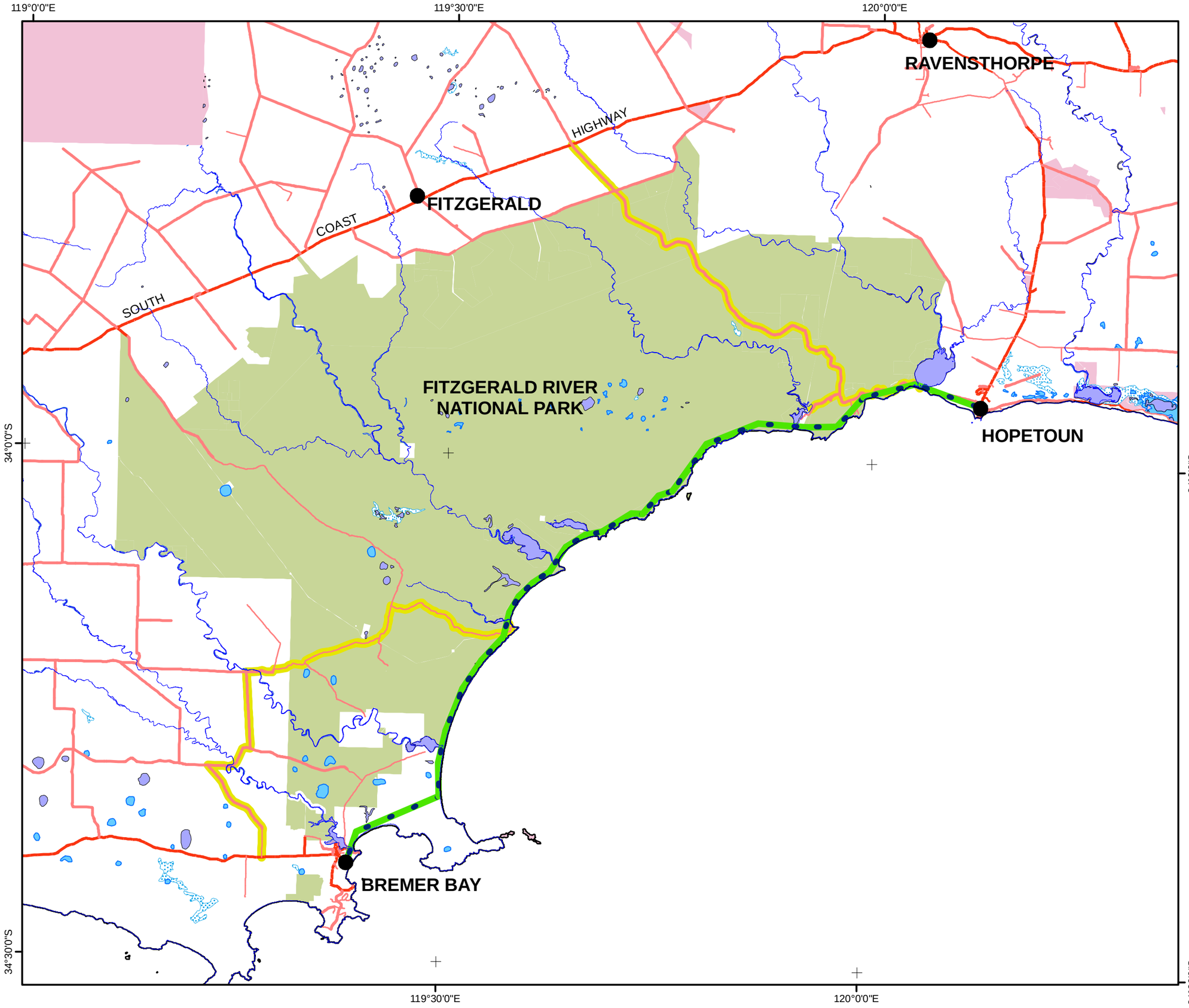
+10% allowing for bends and re-alignments

Total Length 67.5 km

Coastal Walk Trail

X	Y	Length	
119° 59' 15.72" E	33° 56' 6.72" S		
119° 57' 26.28" E	33° 57' 53.28" S	5.8	
119° 55' 15.96" E	33° 57' 56.52" S	4.3	
119° 51' 51.48" E	33° 57' 48.96" S	3.3	
119° 48' 15.09" E	33° 59' 6.91" S	5.3	
119° 45' 55.08" E	34° 1' 55.92" S	6.1	
119° 44' 56.76" E	34° 2' 13.56" S	6.3	
119° 43' 51.24" E	34° 3' 20.16" S	1.6	
119° 43' 3.72" E	34° 3' 19.08" S	2.7	
119° 41' 1.32" E	34° 4' 26.40" S	1.2	
119° 39' 50.76" E	34° 4' 39.36" S	3.8	
119° 38' 27.96" E	34° 5' 23.28" S	1.9	
119° 37' 21.72" E	34° 6' 52.56" S	2.5	
119° 36' 11.16" E	34° 7' 33.24" S	3.2	
119° 35' 13.56" E	34° 8' 22.56" S	2.2	
119° 34' 35.40" E	34° 9' 20.16" S	2.1	
119° 34' 12.71" E	34° 10' 47.56" S	2.0	
119° 32' 41.64" E	34° 12' 11.52" S	2.8	
119° 31' 23.16" E	34° 13' 54.12" S	3.5	
119° 30' 16.17" E	34° 16' 23.66" S	3.7	
119° 29' 47.43" E	34° 18' 19.19" S	4.9	
119° 29' 54.22" E	34° 20' 17.48" S	3.6	
119° 24' 5.96" E	34° 22' 29.12" S	3.7	
119° 23' 25.08" E	34° 24' 19.08" S	9.8	
120° 2' 52.44" E	33° 55' 14.16" S	3.5	
120° 7' 34.68" E	33° 56' 31.56" S	7.6	
		97.5	Indicative a
	Proposed Trail Length	100.0	km

FITZGERALD RIVER NATIONAL PARK



Proposed Walk Trail
- Indicative Alignment

Proposed Road Upgrade
- Tourist Sealed Road

1:400,000 (A3)

0 5 10 15 20 25 km

Department of
Environment and Conservation
Our environment, our future

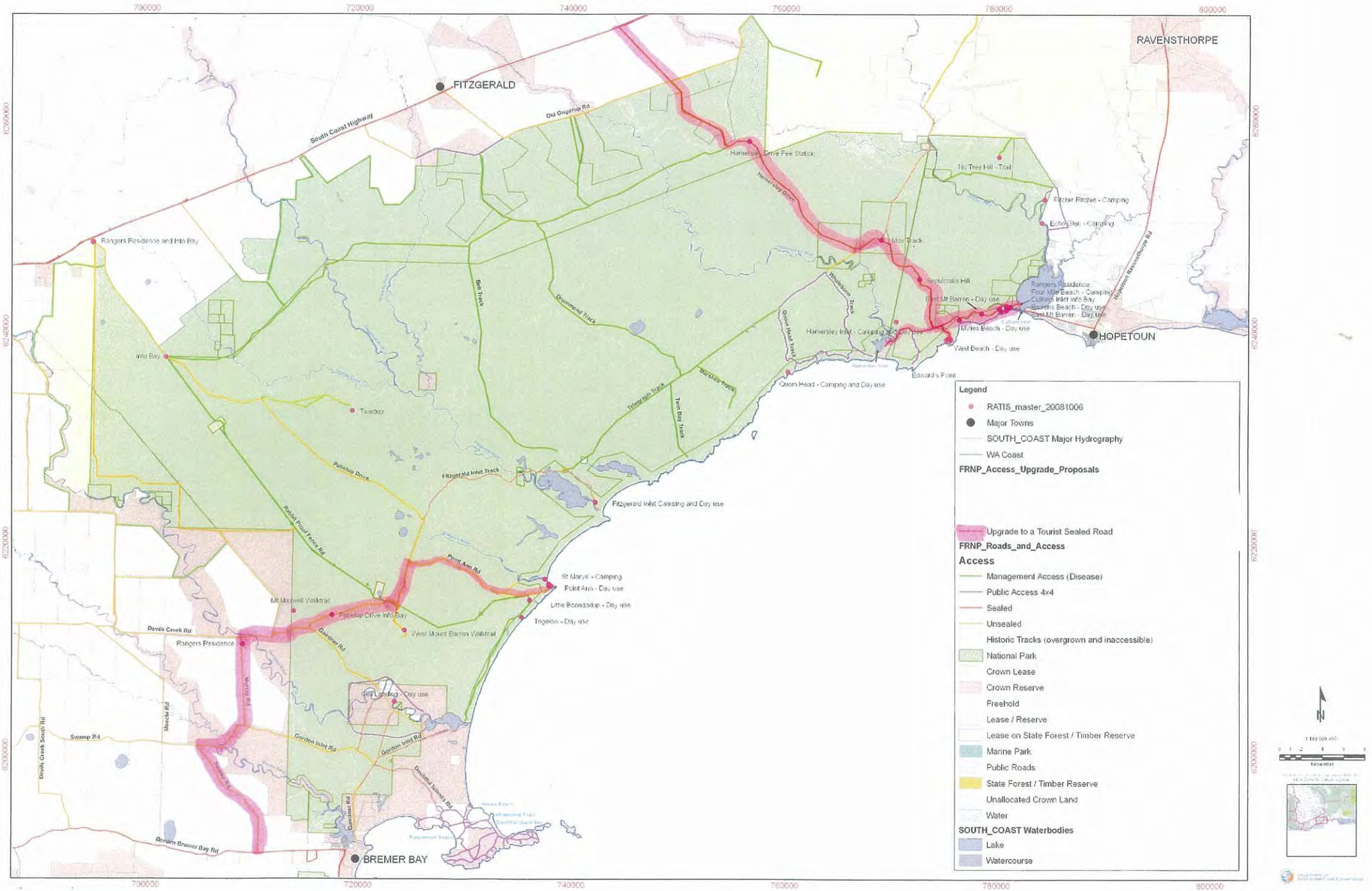
Graticule shown at 20 minutes intervals
Grid shown at 20000 metre intervals

Projection: Universal Transverse Mercator
MGA Zone 50. Datum: GDA94

Produced at 10:32am, on May 25, 2009

Produced under the Direction of
Keiran McNamara
Director General, Department of
Environment and Conservation

Fitzgerald River National Park



FIRE MANAGEMENT STRATEGY FOR THE WILDERNESS ZONE OF THE FITZGERALD RIVER NATIONAL PARK, 1999 - 2001

OVERVIEW AND RATIONALE

The Fitzgerald River National Park (330 000 ha) lies on the central south coast of Western Australia, 420 km south east of Perth, between Bremer Bay and Hopetoun in the Shires of Jerramungup and Ravensthorpe. It is one of the largest and most biologically significant National Parks in Australia and provides an opportunity to maintain substantial parts of a south coast National Park in an undisturbed state.

Major values and attractions include the highly diverse flora (almost 20% of the State's described species), numerous rare species of flora, extensive natural landscapes with rugged coastal ranges, sea cliffs, gorges, inlets, and opportunities for nature study, bush walking, camping, fishing and swimming. The Park also has richer fauna that any other conservation area in the south-west of Western Australia. It contains several threatened fauna species and offers one of the best long-term survival prospects in Western Australia for the Ground Parrot and Dibbler. Many of these values are recognised nationally and internationally.

The Fitzgerald River National Park wilderness zone is approximately 78 000 ha in size and is located in the central section of the Park (Map 1). It comprises a mixture of rugged quartzite coastal ranges, broad inland plains and uplands, and parts of the Fitzgerald and Hamersley River system including gorges and valley breakaways.

The wilderness zone is surrounded by the balance of the National Park, roughly 30-40 km wide in the south west and west, generally 10 km wide to the north and 10-20 km wide to the north east and east. Additional uncleared land surrounds much of the National Park boundary especially to the north east in the Phillips River - Ravensthorpe area.

Maintenance of Natural Values

Fitzgerald River National Park is one of the richest areas for plants in Western Australia with 1 748 identified species. About 75 of these are endemic (found nowhere else) and some 250 species are either vary rare or geographically restricted. The Park contains almost 20% of the State's described plant species. Although endemics occur throughout the Park, the highest concentration is in the Barren Ranges.

The Park also contains several threatened fauna species. The rare animals are mostly concentrated in the northern part of the Park, which overlies the granitic shield of the southern wheatbelt.

Due to the restrictions on vehicular access into the wilderness zone, there have been few additional biological or landscape surveys since 1991. However, in 1995 the detailed results of a major biological survey undertaken in 1985-87 concluded that no significant landscape impacts have occurred. The very high nature conservation and landscape status of the wilderness zone, particularly the coastal ranges, appears to have been maintained over the past five years.

Protection from Wildfires

Any fire protection strategies for the wilderness zone must address the threats of fire:

1. Entering the zone from the outside;
2. Originating in and remaining within the wilderness zone; and
3. Originating within the wilderness zone with the potential to threaten surrounding areas of National Park (e.g. adjoining special conservation zone and recreation sites at Quoin Head and Fitzgerald Inlet).

Experience gained during the suppression of wildfires in and near the Fitzgerald River National Park in the early 1990's demonstrated that the establishment of slashed or scrub-rolled buffers at least 50 m wide are highly effective in containing summer wildfires in heath and low mallee vegetation. These slashed buffers reduce fire intensity allowing fire fighters a safety margin and a greater likelihood of success in extinguishing wildfire. Buffers also provide a prepared base from which to initiate backburns against wildfires.

It has been suggested that the impact of fire on faunal species which require long unburnt habitat within the wilderness zone should be better understood before any broadscale mosaic burning is introduced. However, recently it was shown that the Ground Parrot is able to re-establish in areas burnt as recently as 6-7 years ago and may not necessarily require vegetation unburnt for at least 15 years. Fuel modification by slashing or scrub rolling, an alternative to burning, may also lead to changes in habitat at a localised level. Therefore a balance must be achieved to protect nature conservation values from risk of wildfire.

The following principles for the wilderness zone were presented in the Fitzgerald River National Park Management Plan in June 1991:

- "Owing to the unique opportunity which exists in Fitzgerald River National Park, it is highly desirable to maintain a significant cross-section of the Park as a wilderness area including coastal areas, mountains and inland gorges.

- The wilderness area should be of sufficient size and quality to meet nationally accepted criteria for wilderness designation.

- Future management intervention within the wilderness zone should be strongly discouraged other than in exceptional circumstances."

Any fire management proposals for the wilderness zone of the Park must take into consideration two scenarios:

1. Fire originating within the wilderness zone itself; and

2. Fire originating outside the wilderness zone.

In either case the nature conservation values of the zone and the contribution of any fire protection measures in the zone towards overall fire protection of the remainder of the National Park and towards Park neighbours have to be considered.

It is also important to recognise that the areas of the National Park with the highest known fauna values are located within the special conservation zone, the 10 km wide area along the northern boundary of the wilderness zone.

As a general rule protection measures such as prescribed burning, establishment of reduced fuel areas through techniques such as vegetation slashing, provision of water points for fire fighters, and safe access tracks to allow deployment of fire fighting vehicles, are successful in helping to control wildfires. However, in extreme weather situations the value of such protection work may be significantly reduced.

As in so many aspects of natural area management, the challenge is to get the balance right without jeopardising other values, in this case balancing fire protection measures against the nature conservation and recreation values of the wilderness zone.

GENERAL OBJECTIVES AND CONSTRAINTS

The overall fire management objective for the Fitzgerald wilderness is:

> **To protect the wilderness itself and surrounding areas of National Park from extensive wildfires using the minimum of human intervention.**

All operations in the Fitzgerald River National Park are subject to prior completion of environmental checklists, dieback hygiene evaluations and job safety analyses as a matter of course. Such prescriptions and checklists are to be approved by the Regional Manager prior to implementation.

In the case of the Fitzgerald River National Park wilderness there are specific constraints over and above these standard procedures:

Wilderness Values
Fitzgerald River National Park is one of the few areas on the south coast of Western Australia that is of suitable size, terrain and condition to allow its partial designation as a wilderness area. As management intervention is to be strongly discouraged in the wilderness zone, only essential or emergency works are to occur.

Biosphere Reserve Status
The Park is one of two international biosphere reserves in Western Australia - it has special value as a baseline area for monitoring long term changes in the biosphere as a whole. The wilderness zone is essentially a 'core' area within a larger biosphere reserve core. The wilderness core area should therefore be left in as natural a state as possible.

Dieback Disease
The greatest management concern in the Fitzgerald River National Park is dieback disease caused by soil fungi. Much of the regional flora is highly susceptible to the disease, and this problem is compounded by summer rainfall which provides warm, moist conditions favourable to the survival and spread of the dieback fungi. Dieback is most commonly introduced and spread in infected soil, mud or moist gravel on the wheels and underbodies of vehicles. Loss of vegetation to dieback will seriously reduce the Park's conservation and recreation values.

Dieback is now confirmed from 3 separate sites within the wilderness zone and 2 sites upslope adjacent to the zone. It is suspected from other sites along closed tracks within the zone.

All road and track maintenance, vegetation modification (i.e. slashing or scrub-rolling) and vehicular access will only be permitted *under strict dieback hygiene measures* namely dry soil conditions and clean vehicles.

In view of the above sensitivities in the wilderness zone, additional checks are to be put in place before any works in the wilderness zone may commence:

1. Environmental checklists and dieback hygiene evaluations are also to be endorsed by the Directors of National Parks and Nature Conservation.
2. Any significant departure from the broad prescriptions below is to be referred to the NPNCA.
3. Advice is to be provided by and sought from the Research and Monitoring Group (see below) as appropriate.
4. All vehicle entries are to be endorsed by the Directors of National Parks and Nature Conservation.

RESEARCH AND MONITORING GROUP

A major criticism appearing in public submissions to the draft fire management proposals for the wilderness zone was that insufficient research and monitoring had taken place to provide better information on:

a) *In situ* biological values of the wilderness
b) Impacts of fire, fire management and associated operations (e.g. track maintenance, vegetation slashing etc.)

A Research and Monitoring Group will therefore be established comprising of:

- an experienced general ecologist with local knowledge;
- an experienced fire ecologist; and
- an expert on dieback disease in South Coast vegetation.

The group will be convened by the Director of Science and Information.

It will provide input to the fire management program for the wilderness zone in the context of impacts upon biological values. It will provide advice immediately should significant findings emerge.

It will initiate appropriate research.

It will provide advice on request of the NPNCA, CALM Directors or Regional Manager. The FRNP Advisory Committee and Fire Working Group have access to advice through the Regional Manager.

The primary function of this group is to focus upon the wilderness zone and other key areas of the National Park in particular the Special Conservation Zone to the north of the wilderness.

The December 1997 Wildfire

On the morning of Saturday 27 December, 1997, two fires were started in the Thumb Peak area of the wilderness as a result of lightning strikes. The most easterly of these fires moved relatively slowly downslope on a north westerly influence but then travelled up to 5 km/hr in a north easterly direction under the influence of strong (50 km/hr) south westerly winds which persisted from mid afternoon until early evening.

Due to threats to life and property caused by other fires to the east of Hopetoun in the Jerdacuttup area, heavy equipment and fire fighting personnel which had been assembled to combat the Thumb Peak fire were redirected to assist outside the National Park. As a result the Fitzgerald fire was not able to be prevented from crossing Hamersley Drive where it was intended to stop its run at existing fuel reduced buffers. This fire was eventually contained within the Park in the Phillips and West River valley systems and northern Park boundary and to the east of Drummond Track.

The western fire on Thumb Peak remained a threat to the western sections of the National Park and was isolated by back burning along Twin Bays Track on Thursday 15 January, 1998.

The total burnt area is shown on Map 1. The wildfire itself and emergency measures taken to control it effectively implemented several of the strategies being proposed for fire management in the wilderness zone for the period 1997-2001.

Area 1 of the original proposal (see below) was not affected by the 1997 wildfire, Areas 2 and 4 were partially burnt, and Area 3 was almost totally burnt.

THE PLAN

For the purposes of fire protection strategies, the wilderness zone and some adjoining country is broken into six areas based upon:

- current fire history (including 1997 wildfire);
- existing management access; and
- natural features.

These areas are shown on Map 1 and are described in Table 1.

Table 1. Areas and Fire Risks in the Wilderness Zone

Area	Description	Fire Risks
1	Section of unburnt vegetation in north- west of wilderness zone. Area on east side effected by wildfire in 1989.	"No planned burn area" Potential for lightning strikes.
2a	The regenerating area of the 1989 fire and not affected by the 1997 fire.	The regeneration of continuous even aged vegetation over the 1989 fire area.
2b	The regenerating area of the 1989 fire which was partially burnt in the 1997 fire.	Currently limited due to deep edging burnt around entire cell.
3	The area to the north of Telegraph Track between Hamersley Drive and Drummond Track, unburnt in 1989 but burnt in 1997	Currently nil.
4a	The section of unburnt coastline between Twin Bays Track and the Dempster Inlet south of Telegraph Track.	Potential for lightning strikes in coastal peaks.
4b	Previously unburnt section of coastline between Quoin Head and Twin Bays Track, south of Telegraph Track but burnt in the 1997 fire.	Currently nil.

Fire management objectives and strategies for the six areas are illustrated on Map 1 and are as follows:

AREA 1

Objective

Seek to retain the unburnt vegetation in the north-west section of the wilderness zone fire-free for the duration of this plan.

Strategies

1.1. Pursue the implementation of fuel reduction programmes in adjacent areas as nominated in the existing Fitzgerald River National Park Management Plan with minimal burning of riparian vegetation where possible (Map 1).

1.2. Ensure existing firebreaks and management tracks bordering the northern boundary of this area are maintained. This will be achieved by a combination of grading and slashing adjacent vegetation to a minimum width of three metres. Erosion control measures will be considered and undertaken where necessary.

AREA 2a

Objective

Seek to create a broad mosaic of vegetation ages across the 1989 fire regrowth by the introduction of mosaic burning towards the end of the present plan (1999-2001).

Strategies

2.1. Maintain Drummond Track as a strategic fire access track suitable to be travelled by low loader traffic. This entails:

2.1.1. Clear running surface to width of four metres and resheet soft sandy sections with gravel where required.

2.1.2. Clearing of regrowth vegetation.

2.1.3. Maintaining in a well drained condition with all water course crossings established.

In its present condition Drummond Track meets these standards.

2.2. Maintain Telegraph Track from Fitzgerald Inlet Track to Quoin Head Track as a strategic fire access track suitable to be travelled by heavy duty fire trucks. This entails:

2.2.1. Maintaining a running surface to width of three metres.

2.2.2. Maintaining in a well drained condition with major water course crossings established.

In its present condition the section of Telegraph Track from Drummond Track to Quoin Head Track meets these standards and the balance of Telegraph Track from Drummond Track west to Fitzgerald Inlet nearly meets these standards.

2.3. Maintain a low fuel zone associated with Drummond Track as is now in place due to the 1997 fire.

This strategic break will assist in preventing and/or controlling a major east-west or west-east running wildfire.

2.4. Introduce some fire into the 1989 fire area between Drummond Track and the former Bell Track to contribute to the development of a broad mosaic of vegetation ages across the Park.

This would involve a once only introduction of fire, mainly using aerial ignition, towards the end of the plan period (1999-2001) with the aim of reducing fuels in approximately 10-30% by area of the cell. Ignition would be undertaken on westerly winds under moderate fire index ratings Work along the north side of Telegraph Track (2.2 above) will be required to reduce risk of fire crossing into area 4a. This is to be either or a combination of edge lighting or slashing.

2.5 Establish water point adjacent to southern end of Drummond Track in moisture gaining site.

2.6 Assess the impact of mosaic burning on ecological indicators such as effect of drought stress, seed set and faunal implications.

AREA 2b

Objective

Seek to maintain the mosaic of vegetation ages in this 1989 fire regrowth area which was partially re-burnt in the 1997 fire.

Strategy

2.7 Apply sections 2.1 to 2.3 of section above.

AREA 3

Objective

Maintain until at least 2001 with no planned fire activities.

Strategies

3.1. Undertake erosion control work on degraded section of Telegraph Track between Hamersley River and Quoin Head Track and design detour.

3.2 Undertake roadside slashing to a minimum width of 3 m on the north side of Telegraph Track between Drummond Track and Hamersley Drive. This would be done during the latter stages of the plan as regrowth occurs. Due consideration to be given to vegetation changes and visual impact.

AREA 4a

Objective

Seek to retain the area of coastal vegetation south of Telegraph Track between Twin Bays Track and Dempster Inlet unburnt for the duration of this plan.

Strategy

4.1. Maintain access for light 4WD fire units only along Twin Bays Track.

AREA 4b

Objective

Maintain until at least 2001 with no planned fire activities.

Strategy

4.2. Undertake a general biological survey at the site for future comparison with burnt sites.

EXISTING FIRE MANAGEMENT

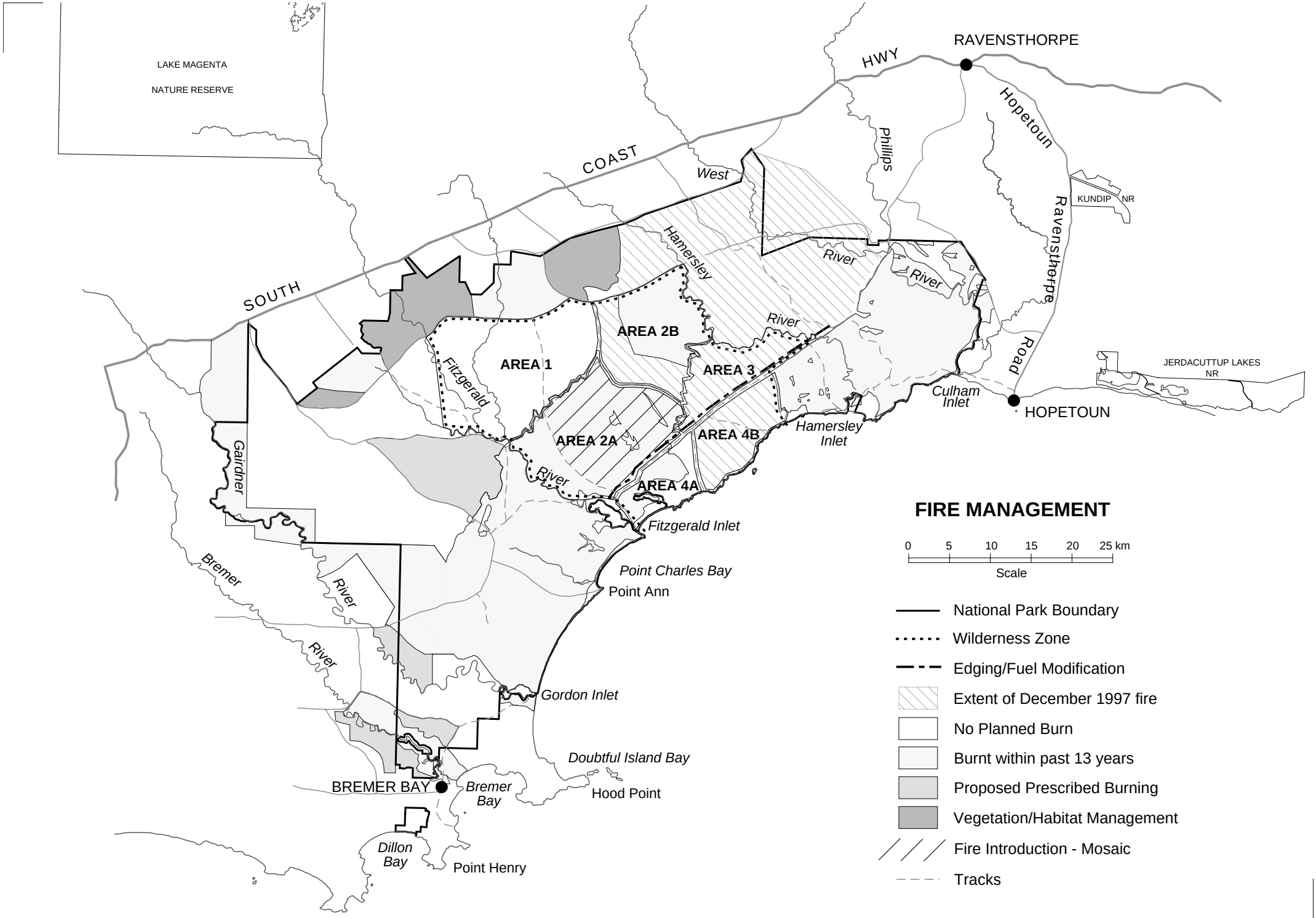
Other additional strategies required to ensure suitable fire protection measures are in place for the remainder of the Park, are contained within the original intent of the current management plan. These strategies will be continued to be prioritised by the Fire Working Group and implemented by CALM.

IMPLEMENTATION

These proposals will be implemented by CALM in liaison with the Fitzgerald River National Park Advisory Committee and the Fitzgerald River National Park Fire Working Group.

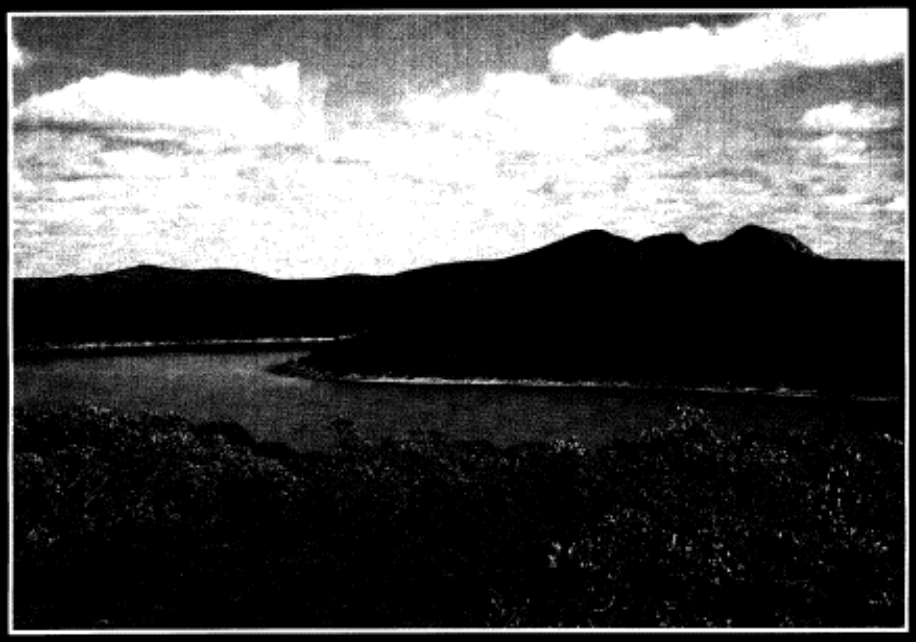
REVIEW

These proposals once adopted and/or amended will remain in force until such time as further review by the NPNCA or as part of the review of the Fitzgerald River National Park Management Plan, scheduled for the year 2001.


LAKE MAGENTA
NATURE RESERVE
RAVENSTHORPE
HWY
COAST
SOUTH
West
Phillips
Hopetoun
KUNDIP NR
Ravensthorpe
Road
River
Hamersley
River
River
River
AREA 1
AREA 2B
AREA 3
AREA 2A
AREA 4B
AREA 4A
Fitzgerald
Gairdner
Culham Inlet
Hamersley Inlet
JERDACUTTUP LAKES NR
HOPETOUN
Fitzgerald Inlet
Point Charles Bay
Point Ann
Bremer
River
River
Gordon Inlet
Doubtful Island Bay
BREMER BAY
Bremer Bay
Hood Point
Dillon Bay
Point Henry
FIRE MANAGEMENT
0 5 10 15 20 25 km
Scale
National Park Boundary
Wilderness Zone
Edging/Fuel Modification
Extent of December 1997 fire
No Planned Burn
Burnt within past 13 years
Proposed Prescribed Burning
Vegetation/Habitat Management
Fire Introduction - Mosaic
Tracks

Fitzgerald River National Park

Management Plan 1991-2001



MANAGEMENT PLAN No 15

Department of Conservation and Land Management

FITZGERALD RIVER NATIONAL PARK

MANAGEMENT PLAN

1991 - 2001

Project Team

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PREFACE

Most national parks and nature reserves in Western Australia are vested in the National Parks and Nature Conservation Authority (NPNCA). The Department of Conservation and Land Management (CALM) manages these parks and reserves.

The NPNCA is responsible for the preparation of management plans for all lands which are vested in it. Area plans for individual national parks and nature reserves are prepared on a priority basis. CALM and its two controlling bodies - the National Parks and Nature Conservation Authority (NPNCA) and the Lands and Forest Commission (LFC) - are also responsible for the preparation of regional management plans. These provide a framework for individual area management plans. CALM's South Coast Regional Management Plan, which is currently being prepared, includes reference to the Fitzgerald River National Park.

A draft management plan for Fitzgerald River National Park was prepared by CALM and issued by the NPNCA for public comment. After considering public comment, the NPNCA submitted the revised plan to the Minister for the Environment for approval. The Minister approved this document as the management plan for Fitzgerald River National Park on 6 June 1991.

On 7 May 1991, the Bush Fires Board endorsed this plan under Section 34(l) of the Bush Fires Act (1954) as the basis for the preparation of an annual works program by the fire advisory group (refer to Prescription 8, Section 9.2).

ACKNOWLEDGEMENTS

The advice provided by the Fitzgerald River National Park Advisory Committee has formed the basis of this plan. The Committee's honorary members - Tom Atterby (Chairman), Keith Bradby, Alan Carmichael, Rodney Daw, Rex Edmonson, Pam Forbes, Wilma Goddard, Bill Lullfitz, Max Meade, Ken and Brenda Newbey and John Watson (CALM) - have willingly given their time, enthusiasm and knowledge. Their contribution is gratefully acknowledged.

The dedication of the Fitzgerald River National Park Association, particularly Ken and Brenda Newbey and Andrew Chapman is gratefully recognised. The support and assistance provided by the Fitzgerald River National Park Rangers and their wives (Chris and Mary Hart, Bob and Pam Newlands and Geoff and Norma Keen) is also acknowledged.

Many other interested people and groups from inside and outside CALM have contributed to this plan. Officers from the Mines Department, Water Authority of Western Australia, Fisheries Department and Environmental Protection Authority have provided valuable information and advice. The assistance of Terry Maher, Hugh Chevis, Chris Haynes, Frank Batini, Rick Sneeuwjagt and Ian Herford from CALM, and Max Churchward from CSIRO is particularly appreciated.

The efforts of CALM's Peter Bowen, John Forster, Alan Clarke, Rod Properjohn and Chris Simms in preparing the maps for this plan, and Debbie Bowra for the typing, are also gratefully acknowledged.

SUMMARY

Fitzgerald River National Park covers an area of about 329 039 ha and lies on the central south coast of Western Australia, 420 km south-east of Perth, between Bremer Bay and Hopetoun in the Shires of Jerramungup and Ravensthorpe. It is one of the largest and most botanically significant national parks in Australia.

Fitzgerald River National Park (FRNP) represents an opportunity to maintain substantial parts of a large south coast national park in an undisturbed state. Without proper management and public support this important opportunity will be lost.

Values

FRNP is one of the richest areas for plants in Western Australia, with 1748 identified species. About 75 of these are endemic, that is, they are found nowhere else, and some 250 species are either very rare or geographically restricted. The Park contains 20% of the State's described species.,,

Although endemics occur throughout the Park, the highest concentration is in the Barren Ranges.

FRNP has a richer fauna than any other conservation area in the south-west of Western Australia. The following numbers of species have been identified: 184 birds (3 declared rare and 2 declared in need of special protection), 22 native mammals (7 declared rare), 12 frog species and 41 reptiles (I declared in need of special protection). The Park offers the best long-term survival prospects in Western Australia for the Ground Parrot and Dibbler. It is the only conservation reserve with the Heath Rat and the largest reserve with Tammar, Red-tailed Wambenger, Woylie, Western Mouse, Western Bristlebird and Western Whipbird. The rare animals are concentrated in the northern Part of the Park, which overlies the granitic shield of the southern wheatbelt.

The Park is one of only two International Biosphere Reserves in Western Australia (the other is Prince Regent River Nature Reserve). This status was originally conferred because of the Park's extremely high floral diversity. The Biosphere Reserve values are enhanced by local community interest and local adoption of the Biosphere concept.

The Park's diverse landscapes, with extensive vistas free of any signs of human disturbance, hold a particular appeal. These landscapes include a combination of windswept and protected beaches, rugged sea-cliffs, the steep Barren Ranges rising to 450 m, extensive plains and abrupt river valleys ending in inlets. The natural vegetation forms an important element in the appeal of the Park and is an integral part of its conservation and recreation values.

A range of recreation opportunities, based on natural settings, is provided in the Park. This includes sightseeing, bushwalking, swimming, camping, fishing and nature study.

The Park also has a rich human history, of both historical and archaeological importance.

Management Concerns

The greatest management concern in FRNP is dieback disease caused by soil fungi. Much of the regional flora is highly susceptible to the disease, and this problem is compounded by summer rainfall which provides warm, moist conditions favourable to the survival and spread of the dieback fungi. Dieback is most commonly introduced and spread in infected soil, mud or moist gravel on the wheels and underbodies of vehicles. Loss of vegetation to dieback will seriously reduce the Park's conservation and recreation values.

The future of the rare fauna is also a management concern. A number of these species appears to have very specific habitat requirements, such as periods greater than 15 years between fires and protection from introduced predators, such as foxes.

There is widespread concern about the effect large scale fires have on the Park's ecological and landscape values as well a's adjoining farmlands and nearby towns. Fire has been a feature of the Park's history over the last 40 to 50 years. Lightning-caused wildfires in December 1989 burnt 40% of the Park.

Another major issue is the increasing access to the coast for fishing, camping and beach activities. Many parts of the Park, and especially the coast, are fragile and cannot support the existing levels of use without environmental damage. These areas are likely to degrade further unless they are managed.

Management Goals

The principal management goal for FRNP is to conserve all flora and fauna, particularly the large number of rare species and those in need of special protection. A complementary goal is to conserve the Park's landscapes, in particular, the extensive vistas free of human disturbance.

The other important goal is to fulfil the recreation needs of visitors to the extent that they are compatible with flora, fauna and landscape conservation.

Management Prescriptions

INTERNATIONAL BIOSPHERE RESERVE STATUS

14 support the locally-based Fitzgerald Biosphere sphere Project Committee.

15 recognise the whole of FRNP as the "'core" of the Fitzgerald Biosphere Reserve. Such designation means minimum human interference.

MANAGEMENT ZONES

· designate and manage four management zones - special conservation, wilderness, natural environment and recreation.

The special conservation zone covers the northern part of the Park where there is a concentration of rare fauna. Vehicle access through this zone is by Hamersley and Pabelup Drives. There is usually no other motorised access, except for research and essential management. The level of management activity in this zone is high.

The wilderness zone covers the centre of the Park. Access' is non-motorised except in emergency situations and for essential management purposes. The level of management is low.

The natural environment zone covers much of the Park. Access is by designated 4WD tracks or on foot. Non-motorised access is preferred. The level of management is low to moderate.

The recreation zone is based on 2WD roads and recreation sites and includes almost all of the popular visitor destinations in the Park. The level of management is moderate to high.

CONSERVATION

Disease

1) regularly update maps of current dieback distribution and susceptible vegetation. Use these maps as the basis for disease management in the Park.
2) evaluate the consequences of introducing or spreading dieback, before approving any development or management actions in the Park.
3) exclude vehicles from the Dempster and "Lake Nameless" catchments and three small coastal catchments in the centre of the Park, to minimise the risk of further dieback introduction and spread. Allow vehicle access in these areas under strict permit, subject to NPNCA approval.
4) monitor known infections, while continuing to survey for additional infections.
5) request Park visitors to clean soil and mud off their vehicles and shoes before entering the Park.
6) continue to provide detailed training for rangers and other Park workers on dieback control and enforce such controls in day-to-day work practices.

7) widely disseminate information to increase the community's awareness and understanding of dieback.

Rare Flora

1) protect priority species by surveying, mapping and monitoring populations.
2) concentrate protective management and research on the Barren Ranges.

Rare Fauna

1) survey distribution and research habitat requirements, life history characteristics and effects of fire regimes and predation, on rare mammals, birds and reptiles.
2) concentrate research effort on the northern part of FRNP.
3) develop and implement- management programs to protect and enhance rare fauna habitats.

Fire

1) provide a combination of burnt buffers, mosaic burning within cells and areas from which planned fire is excluded for ecological reasons. The priority for buffers will be the Park boundaries, then the southern edge of the rare fauna zone. Other internal buffers should follow.
2) ensure all suppression strategies take full account of dieback risks.
3) aim to contain wildfires within a cell defined by buffers.
4) minimise direct attack in the wilderness and natural environment zones.
5) continue mutual aid arrangements with the local community, in carrying out prescribed burning and fire suppression.

RECREATION

Access

- maintain public access to designated parts of the Park, while controlling dieback to protect the Park's biological values.
- assess all roads, tracks (including management-only) and paths to determine treatments required to minimise dieback introduction and/or spread. Carry out required works consistent with landscape and safety requirements.
- provide two 2WD all-weather loop roads through the Park (Hamersley and Pabelup Drives) and several spur roads to the coast and other features. If necessary, these roads will be closed following rain to reduce dieback risk.
- provide a number of 4WD tracks (Fitzgerald Inlet, Quoin Head, Hamersley Dunes/Edwards Point and Moir Track). If necessary, close following rain to reduce dieback risk.
- provide a range of walking and hiking opportunities. For safety reasons, self-registration will be encouraged for walks into remote areas. Close Mid Mt Barren, Woolbernup Hill and Thumb Peak to all access, including walking, to keep these peaks and their rare plants free of dieback.

- retain provision in this plan for temporary or permanent closure, realignment or treatment of particular roads, tracks, paths or areas if a high risk of dieback introduction or spread is identified.
- keep Trigelow, Point Charles Bay, Fitzgerald and Hamersley Beaches open to 4WDs. All other beaches will remain closed to vehicles and foot access will be encouraged. 4WD use Of particular beaches will be monitored for impacts on wildlife, safety risks, and damage to foredunes.
- retain a minimum number of -management-only tracks. These will only be used in dry soil conditions in management vehicles from which all soil has been removed.

Recreation Sites

- continue to provide and maintain a number of day use/parking areas close to natural attractions such as beaches.
- provide a range of 2WD, 4WD and foot-only accessible campsites, plus selected sites for club and group camping. Sites are:
    1. 2WD-accessible camping: St Marys, The Peninsula (east of Quaalup on Gairdner River), Paperbark Flat (at the southern end of Pabelup Drive), Hamersley Inlet, Four Mile and Twertup.
    2. 4WD-accessible camping: Fitzgerald Inlet, Hamersley River crossing, Quoin Head and Hamersley dunes.
    3. backpackfoot-access-only camping: The Gorge, McCulloch's Crossing, "'Small Boondalup" River, Doggers Swamp and the eastern end of Fitzgerald Beach.
    4. vehicle-based group camping: The Peninsula, Wellstead Flats, Kybulup Pool and Hamersley Drive.
- close camping sites behind Trigelow Beach, at Point Charles, Edwards Point and West Hamersley because of erosion and degradation.
- change the use of Mylies and Point Ann from camping and day use to day use. Provide attractive camping alternatives. Both sites are highly degraded and eroding. They are limited in area and appear unable to sustain the pressures of camping in the longer term.

EDUCATION

- provide a range of interpretive opportunities and publications on Park values, including brochures.
- keep information bays at the Park entrances up-to-date, and provide theme-based information displays at key sites. Information on dieback and its control will be prominent.
- run seasonal interpretive programs.
- support use of Twertup by the FRNP Association.

RESEARCH AND MONITORING

1. establish a CALM Research Station in or near the Park. Jacup is a potential site.
2. implement an integrated survey, research and monitoring program for the Park which addresses both short and long-term information needs.

MANAGEMENT PRIORITIES

The six main priorities are:

1. determining practical procedures for dieback control to protect the Park's flora, particularly the priority species.
2. realigning and/or treating roads, tracks (including management-only) and paths designated in this plan, where necessary, to reduce dieback risks.
3. establishing (and relocating where necessary) boundary fire buffers.
4. changing Pt Ann and Mylies from camping and day use to day use only and providing attractive alternatives.
5. providing up-to-date Park publications, displays and signs.
6. conducting research into the habitat requirements of rare species such as the Ground, Parrot, Western Bristlebird and heath rat.

CONTENTS

MAPS

TABLES

PART A. INTRODUCTION

1.0 BACKGROUND

1.1 PARK OVERVIEW

Fitzgerald River National Park (FRNP) lies on the central south coast of Western Australia, 420 km south-east of Perth, between Bremer Bay and Hopetoun in the Shires of Jerramungup and Ravensthorpe (Map 1 a). The major values and attractions are the highly diverse flora, including rare species, rare fauna, extensive natural landscape including rugged coastal ranges, sea cliffs, gorges and inlets; and the opportunities for nature study, bushwalking, camping, fishing and swimming. The major management concerns are dieback disease, fire and soil erosion.

In Western Australia, a national park is 'a relatively large area set aside for its features of predominantly unspoiled natural landscape, flora and fauna, permanently dedicated for public enjoyment, education and inspiration and protected from all interference other than essential management practices, so that its natural attributes are preserved' (Jenkins, 1980). It is managed to allow such recreational use by the public as is consistent with the proper maintenance, restoration and protection of the environment. The significance of this area as a national park and its fulfillment of the dual conservation and recreation criteria are given in Section 2.0 Management Goals.

The Park names and features referred to in this plan are shown on Map 1b. It should be noted, however, that names on maps are not necessarily officially accepted nomenclature.

1.2 REGIONAL CONTEXT

FRNP is one of 13 national parks in CALM's South Coast Region. Parks closest to Fitzgerald River include Stokes (coastal, inlet and ocean), Frank Hann (inland heath and granite outcrops) and Stirling Range (inland peaks and wildflowers) (Map 1a). The south coast national parks offer a diversity of opportunities and experiences. Visitors come from overseas, interstate, Perth and locally. FRNP is being considered from a regional perspective in CALM's South Coast Regional Management Plan, which is currently being prepared (1991).

Numerous nature reserves are dotted throughout CALM's South Coast Region. Most are small and isolated amidst cleared farmland. Lake Magenta Nature Reserve (94 170 ha), which lies 40 km to the north-west of Fitzgerald River National Park, just outside the regional boundary, is the largest nature reserve near the Park. It is linked to the Park by a narrow corridor of uncleared vegetation in Crown reserves along the Fitzgerald River. Substantial areas of uncleared Crown land are still found around Ravensthorpe. One such area abuts the north-eastern boundary of the Park and links it to Cocanarup Timber Reserve (Map la).

1.3 NPNCA AND CALM MANAGEMENT POLICIES

This plan is based on NPNCA and CALM policies current at the time of writing (February, 1991). These policies derive from legislation, principally the CALM Act (1984), and associated regulations. Policies are published and distributed throughout CALM as policy statements. They are available to the public on request.

1.4 PRINCIPLES OF MANAGEMENT

This management plan is based on a number of "principles of management". The guiding principle is that the Park's ecosystem is composed of numerous interrelated parts. Damage or change to any part will ultimately affect the whole ecosystem. The following "principles" focus on dieback disease, fire, wilderness and recreational access.

Dieback Disease

Until recently, Fitzgerald River National Park was considered to be relatively free of dieback. In a sense this was an anomaly given the high impact of the disease along the remainder of the south coast of Western Australia, as far east as Cape Arid National Park. For example, the disease is widespread in the Stirling Range National Park, which is 120 km to the west of Fitzgerald River National Park.

In Fitzgerald River National Park the heavy rains of January 1990 appear to have stimulated a high level of disease activity. Dieback is now suspected to be more widespread than indicated in the draft management plan (published June, 1989). Many of the Park's plant species are potentially susceptible to dieback.

Areas which have been burnt by the recent wildfires will not now be interpretable for at least five to seven years; that is, the presence or absence of dieback can not be determined until susceptible plant species regenerate, allowing the dieback fungus to become reactivated in the soil. If soil conditions are not favourable to dieback activity it may take longer than five years for the disease to become active again.

Knowledge that more of the Park is infected with dieback than was previously thought means that extra care must be taken to protect the remaining uninfected areas. This may mean stricter control of access (including foot access) than was proposed in the draft plan.

Principles

1. Dieback remains the greatest single threat to maintenance of the Park's conservation values. It is the greatest management concern. It is essential to err on the side of caution when considering dieback.

2. Areas burnt by the December 1989 wildfires cannot be assumed to be either dieback free or dieback infected, and indications one way or the other are unlikely to appear for at least five years. However, those areas which are most likely to be uninfected include the remote coastal catchments and mountain ranges.

3. The more widespread occurrence of dieback, now confirmed within the Park, means that extra care must be taken to protect the remaining uninfected areas, and to minimise any further spread in areas already infected.

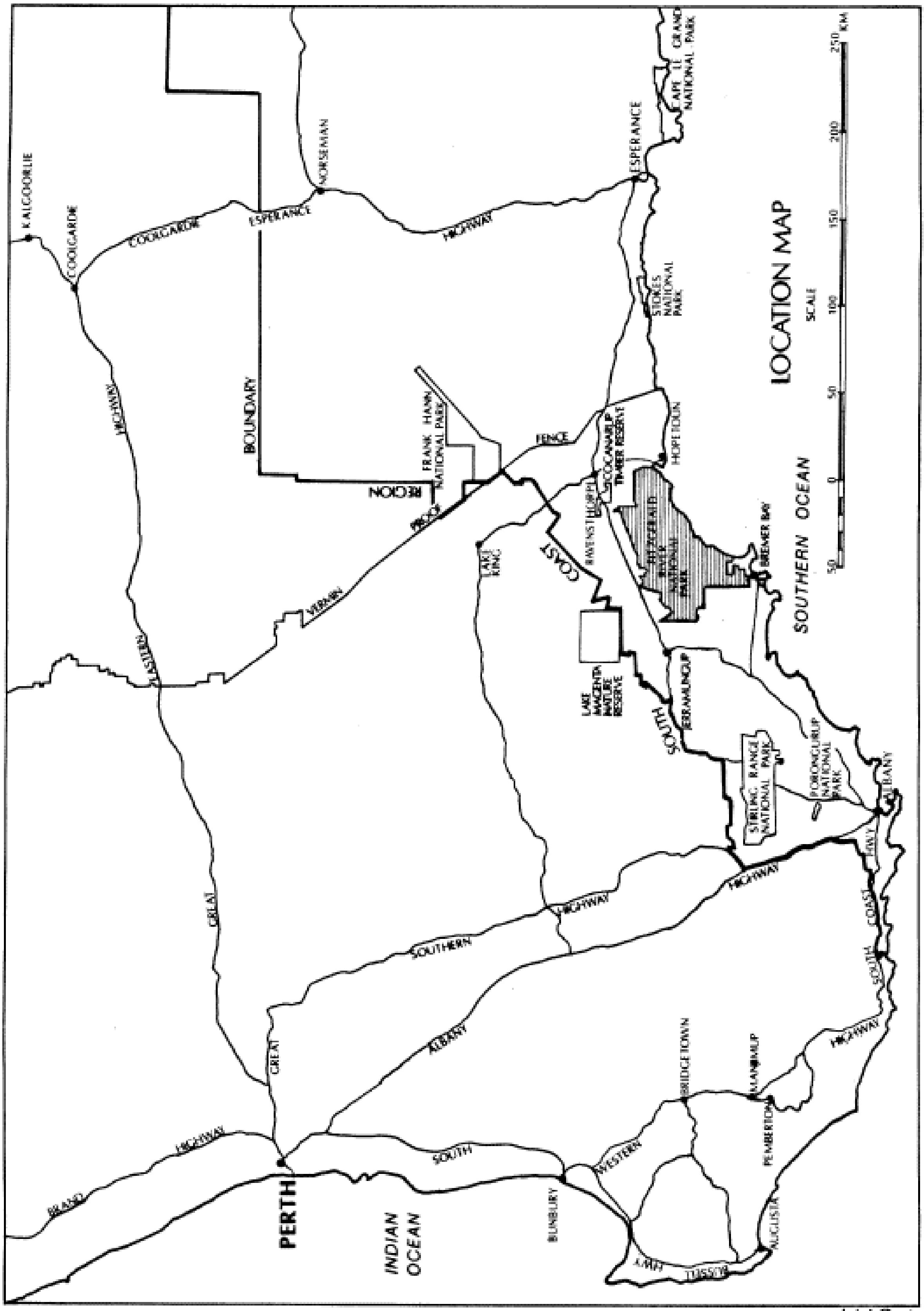
Fire

Fire management in Fitzgerald River National Park must meet the needs of both nature conservation and protection of the local community.

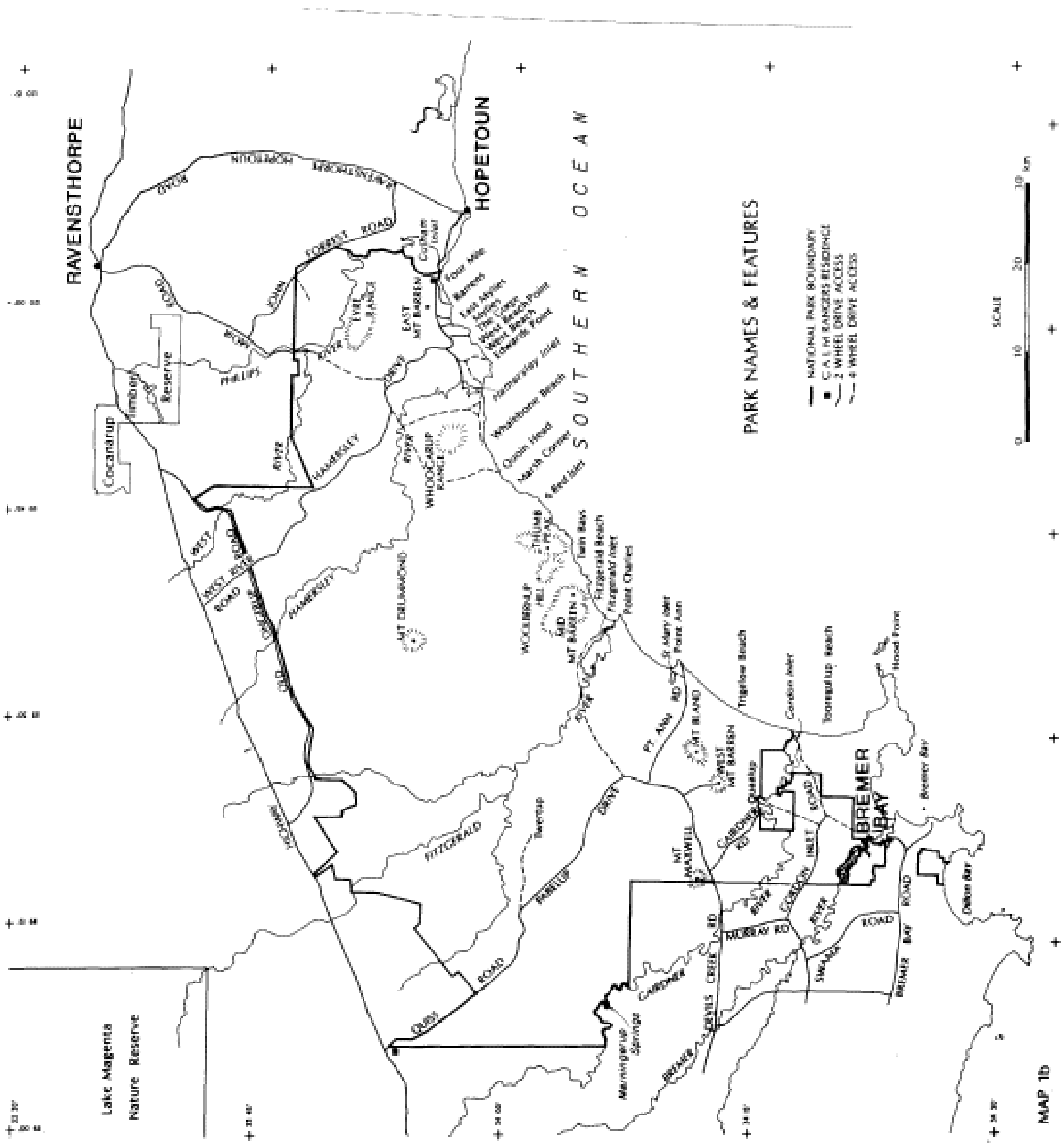
The major wildfires which occurred in December 1989 were, initially at least, natural phenomena. However, they were unacceptable from a nature conservation viewpoint given that Fitzgerald River National Park is an area of remnant vegetation. It is surrounded to the west and north, and partially to the east, by cleared farm land. Consequently if the entire Park was burnt at one time, re-colonisation by native fauna from surrounding areas would not be possible. Furthermore, burnt areas are not interpretable for dieback for five to seven years. The local community was also concerned about the magnitude of the fires and the damage incurred on neighbouring farms. Therefore, it is not acceptable, from either local community or nature conservation perspectives, to have large wildfires in Fitzgerald River National Park.

Although the December 1989 wildfires are the worst to have occurred in the Park area within living memory, and may not be repeated again for 50 or 100 years, they nevertheless showed that the proposal for fire protection in the draft management plan would not have greatly altered the end result.

Furthermore, the large unburnt north-west section of the Park now warrants even greater protection from future wildfires because it contains most of the Park's rare fauna.


LOCATION MAP
SCALE
50 0 50 100 150 200 250 KM
KALGOORLIE
COOLGARDIE
COOLGARDIE
ESPERANCE
NORSEMAN
HIGHWAY
ESPERANCE
CAPE LE GRAND NATIONAL PARK
BOUNDARY
FRANK HANN NATIONAL PARK
REGION
PROOF
FENCE
VERMIN
HIGHWAY
EASTERN
GREAT
STOKES NATIONAL PARK
HOPETOUN
SOUTHERN OCEAN
RAVENSTHORPE
FITZGERALD RIVER NATIONAL PARK
BREMER BAY
LAKE KING
COAST
LAKE MAGENTA NATURE RESERVE
JERRAMUNGUP
SOUTH
STIRLING RANGE NATIONAL PARK
PORONGURUP NATIONAL PARK
ALBANY
HWY
HIGHWAY
SOUTHERN
HIGHWAY
ALBANY
COAST
SOUTH
HIGHWAY
GREAT
BRIDGETOWN
MANJIMUP
PEMBERTON
HIGHWAY
BRAND
PERTH
SOUTH
WESTERN
INDIAN OCEAN
BUNBURY
AUGUSTA
BUSSELL HWY

MAP 1a


RAVENSTHORPE
HOPETOUN
SOUTHERN OCEAN
PARK NAMES & FEATURES
NATIONAL PARK BOUNDARY
C.A.L.M RANGERS RESIDENCE
2 WHEEL DRIVE ACCESS
4 WHEEL DRIVE ACCESS
SCALE
0 10 20 30 km
Cocanarup
Timber Reserve
Culham Inlet
EAST MT BARREN
WHOOGARUP RANGE
THUMB PEAK
MT DRUMMOND
MID MT BARREN
WEST MT BARREN
MT BLAND
MT MAXWELL
BREMER BAY
Lake Magenta Nature Reserve
MAP 1b

Principles

16 Excessively large wildfires which threaten environmental and human life values are not acceptable.

17 The unburnt north-west sector of the Park now has an even greater need for protection from large uncontrolled wildfires.

18 In retrospect, it appears clear that a more proactive approach to fuel reduction and vegetation/habitat management is required to minimise the risk of wildfires reaching similar proportions to those in 1989.

Wilderness

Fitzgerald River National Park is one of the few areas on the south coast of Western Australia that is of suitable size, terrain and condition to allow its designation as a wilderness area.

"Wilderness" is essentially an undisturbed area or a 'window into the past' where management intervention is kept to an absolute minimum and where the number of visitors is low because of the area's remoteness. Visitors travel on foot (NPNCA, 1990).

The "quality" of wilderness is often defined by the extent to which land or water is remote from, and substantially undisturbed by, the influence of modem technological society (CONCOM, 1986).

'Remoteness' and 'naturalness' are based on:

- remoteness from settlements or other points of permanent occupation
- remoteness from access, in particular constructed vehicle routes
- aesthetic naturalness or the degree to which the landscape is free from the presence of permanent structures
- biophysical naturalness or the degree to which the natural environment is free of biophysical disturbances caused by modem influences.

To be viable, it is generally agreed that wilderness areas need to be sufficiently large (minimum size of 10 000 ha or 5 000 ha on remote coastline) and should have a 'core' area which is at least 3 km from the zone boundary or any maintained road (Preece and Lesslie, 1987). The area potentially available for designation as a wilderness area in FRNP is much larger than this minimum (78 000 ha). This is the last opportunity to set aside a substantial wilderness area in southern Australia.

Existing 4WD tracks or firelines which are not actively maintained may be regarded as having no impact upon wilderness quality. Any road, track or fireline which is actively maintained would warrant a 3 km buffer zone.

Principles

8) Owing to the unique opportunity which exists in Fitzgerald River National Park, it is highly desirable to maintain a significant cross-section of the Park as a wilderness area including coastal areas, mountains and inland gorges.

9) The wilderness area should be of sufficient size and quality to meet nationally accepted criteria for wilderness designation.

10) Future management intervention within the wilderness zone should be strongly discouraged other than in exceptional circumstances.

Recreational Access

The principal management goal for Fitzgerald River National Park is to conserve all flora and fauna, particularly the species that are rare or in need of special protection. It is also vital to conserve the Park's landscapes. The other important goal is to fulfil the recreation needs of visitors to the extent that they are compatible with flora, fauna and landscape conservation. The Park has great appeal for visitors.

As a general strategy, CALM tries to provide for a range of recreational opportunities within any given national park. Where possible, visitors are provided with a choice of access types, from foot access in some areas to good sealed roads and carparks in other areas. Those with 4WD vehicles also like to be able to escape from the larger number of visitors who travel in conventional vehicles.

At first appearance Fitzgerald River National Park appears to be ideally suited to provide a range of access types. However, for dieback reasons, even 4WD tracks will need to be well formed and drained, and walkers may also be restricted from entry to remnant dieback-free areas, especially when these are located high in the landscape.

Recreational access should also be viewed from a regional perspective rather than in isolation. For example, other recreational opportunities may already exist in nearby areas, particularly along the coastline to the west (Doubtful Islands/Bremer Bay area) and east (Hopetoun-Starvation Boat Harbour).

Principles

3) The prevention of dieback introduction and spread should be the first consideration in any access provisions.
4) Recreational needs of visitors to Fitzgerald River National Park should be met to the extent that they are compatible with flora, fauna and landscape conservation.
5) Varied opportunities for recreation occur within the Park. As a general principle, a range of recreational access should be available so as to allow for personal choices to be made.
6) Recreational access should be viewed in a regional setting with due recognition of opportunities provided in nearby areas outside the Park.

The above principles provide the basis for the remainder of this plan.

1.5 PUBLIC PARTICIPATION

Preparation of this management plan has been based on consultation with the public between October 1987 and January 199 1. The following methods were used:

4) Fitzgerald River National Park Advisory Committee

The Committee was formed in October 1987 to provide advice on management plan preparation. The Committee took a lead role in preparation of the draft management plan and analysis of public submissions. Fifteen meetings were subsequently held as part of this preparation.

5) Pre-draft submissions

In response to a leaflet circulated to the community, organisations and Government, 39 written submissions were received over November-December, 1987 (Moore, 1988b).

6) Workshop

Forty-two people, representing a range of interests, attended a one-day workshop at Fitzgerald in March, 1988 (Moore, 1988a).

7) Visitor survey

Seven hundred and thirty questionnaire responses, data from eight traffic counters and survey details from 28 recreation sites were collected between November 1987 and April 1988 (Cavana and Moore, 1988). Some responses expressed concern that the visitor survey did not give a true indication of the number of local residents using the Park (Cavana, 1991).

8) Local government

Meetings were held with the Shires of Jerramungup and Ravensthorpe.

9) *Meetings*

Meetings were held with Ravensthorpe and Jerramungup District Soil Conservation Committees, South Coast Recreation Association, FRNP Association, Fitzgerald Biosphere Project Committee, Hopetoun Progress Association, W.A. Conservation Council and W.A. Wilderness Society.

10) *Government departments*

Numerous visits and discussions were conducted to gather information and develop prescriptions.

11) *Media releases*

Local and State-wide networks were utilised.

12) *Public submissions to the draft management plan*

A total of 178 submissions were received from individuals, community groups, Government departments and clubs/organisations. This includes 16 submissions which were received following an invitation for additional comments after the December 1989 wildfires.

The results of the above consultations are a vital component of this plan.

PART B. PRINCIPAL MANAGEMENT DIRECTIONS

2.0 MANAGEMENT GOALS

The management goals for Fitzgerald River National Park (FRNP) are based on those applicable to all national parks and on values and concerns specific to FRNP.

Management Goals for National Parks

The following management goals for national parks are derived from the Conservation and Land Management Act (1984) and Departmental policies. These goals are to:

6) Protect and conserve native plants and animals and their habitats.
7) Protect and conserve physical, cultural and scenic resources.
8) Provide opportunities and facilities for appropriate public recreation.
9) Regulate use to be consistent with the maintenance and protection of natural resource values and to minimise conflict between uses.
10) Promote visitor safety, awareness and appreciation of natural processes and the scientific and cultural attributes of park resources.
11) Provide information, education and interpretive programs.
12) Promote research and monitoring of the biological, physical and social environments to aid future management.

Values and Management Concerns

VALUES

- FRNP is one of Australia's richest conservation reserves for plants and animals. It is also an extremely important remnant, as much of the south-west has been cleared for agriculture. Some 20% of the known plant species of Western Australia occur within the 0. 1 % of the State occupied by the Park. At least 75 of these occur only within the Park. The Park also contains 10 species of declared rare mammals and birds.
- The Fitzgerald landscapes, with extensive vistas showing little to no evidence of human occupation or use, are a major attraction.
- The Park has a rich cultural history with numerous sites of historical and archaeological importance.
- The Park is one of only two international biosphere reserves in Western Australia. The biosphere reserve values are enhanced by local community interest in the Park, and local adoption of the biosphere reserve concept.
- Fitzgerald provides a range of recreation opportunities in a natural setting.
- The Park is well-placed to attract tourists travelling in the south-west and south-east of the State.

MANAGEMENT CONCERNS

- Until recently most of the Park was believed to be dieback free, which made it unique within the area of known dieback occurrence on the south coast of Western Australia. However, following

heavy summer rainfall in 1990, it appears that dieback is more widespread in the Park then previously thought. Furthermore, in areas burnt by the December 1989 wildfires, it will now be some five to seven years before signs of the disease occur, enabling disease mapping to be done.

- A number of the rare fauna appear to have specific habitat requirements, such as periods greater than 15 years between fires and protection from introduced predators, such as foxes.
- There is widespread concern about broadscale wildfires in the Park, especially lightning-caused wildfires. These have been a feature of the last 40 or 50 years in the Park. Wildfires in December 1989 burnt approximately 40% of the Park.
- Public use of the coast for fishing, camping and beach activities is increasing.
- Many areas in the Park, and especially those on the coast, are fragile and cannot readily support public use without environmental damage. Some coastal parts of the Park have already been damaged by visitor use and these areas are likely to degrade further unless they are rehabilitated and actively managed.

Management Goals for Fitzgerald River National Park

The following management goals for FRNP apply, based on the recognition that conservation is the highest management priority.

CONSERVATION GOALS

5. Conserve all native plant communities, animal communities, species, and the natural processes which sustain them, especially the large numbers of rare species and those in need of special protection.
6. Conserve the Park's landscapes, in particular the extensive vistas free of human disturbance.
7. Conserve the rich Aboriginal and European history of the Park, including numerous historical and archaeological sites.

RECREATION GOAL

3. Fulfil the nature-based recreation requirements of visitors to the extent that they are compatible with conserving the Park's flora, fauna and landscape values, wilderness qualities and cultural heritage.

EDUCATION GOAL

- Foster a sense of stewardship for the Park by the community at all levels - local, State, national and international - emphasising its special conservation, landscape, recreation, cultural and historic values.

RESEARCH AND MONITORING GOALS

- Promote and undertake the scientific study and monitoring of those physical, biological and social values and natural processes special to the Park.
- Measure and control impacts of management activities and human use on the Park environment.

3.0 LAND TENURE

3.1 NATIONAL PARK BOUNDARIES

The objective is to ensure that the Park and areas with high conservation values adjacent to it are adequately protected.

Background

Fitzgerald River National Park, comprised of two Class A reserves Nos 31737 and 31738, occupies an area of about 329 039 ha. Reserve No. 31737 (320 615 ha) occupies most of the Park area. Reserve No. 31738 (8 424 ha) occupies a 700 m wide strip along the coast. The Park extends to the low water mark of the Southern Ocean and includes Red Islet.

A small part of the Park lies separate from the remainder, on the northern edge of Dillon Bay. This part is relatively inaccessible and little used. The South Coast Regional Draft Management Plan (CALM, 1989) includes proposals for the broader Ravensthorpe-Jerramungup area. This plan deals only with Fitzgerald River National Park.

PRESCRIPTIONS

1. **Amalgamate Reserves 31737 and 31738 into a single Class A reserve for the purpose of national park.**

2. **Implement the changes in status for areas 1-10 in Table 1 and Map 2. These changes will lead to more effective management as they move the Park boundary to readily recognisable features, such as riverlines, roads or private property, and/or decrease the length of Park boundary.**

3. **Retain the provision that if future survey and assessment indicates that other adjacent public lands have high conservation and/or recreation values, a level of conservation and/or recreation management will be sought.**

TABLE 1. PROPOSED CHANGES TO THE PARK BOUNDARY

		CURRENT STATUS				
GENERAL LOCATION	**ID No. (Map 2)**	**RESERVE No.**	**PURPOSE**	**AREA (ha)**	**VESTING**	**PROPOSED STATUS**
Northern Boundary	1	C1029	Resting Place	229	Unvested	Add to FRNP
Western Boundary	2	VCL	---	---	---	Add to FRNP
Southern Boundary	3	C5055	Water	435	Unvested	Add to FRNP
	4	Pt C32666 (northern third)	Government Requirements	---	Unvested	Add to FRNP
	5	C23060	Public Utility	47	Unvested	Add to FRNP
	6	C21646	Recreation and Camping	405	Unvested	Add to FRNP
	7	Pt A31737	Dillon Bay section of FRNP	---	NPNCA	Change to Jerramungup Shire Reserve
	8	Pt A31737	Section of FRNP south east of Gordon Inlet Road	---	NPNCA	Change to Jerramungup Shire Reserve
	9	Pt A31737	Section of FRNP between Bremer Bay town and Bremer River	---	NPNCA	Add to Jerramungup Shire Reserve (C22355, recreation and camping)
	10	Pt C22355 (northern bank of Bremer River)	Recreation and Camping	---	Shire of Jerramungup	Add to FRNP

3.2 SHIRE RESERVES

The objective is to ensure that management of the Shire reserves and surrounding Park is coordinated.

Background

Two Shire reserves are surrounded by FRNP, one vested in the Shire of Jerramungup, the other in the Shire of Ravensthorpe (Map 2). The boundaries of both are poorly defined, particularly the Jerramungup Reserve which straddles the Bremer River. This Reserve of 372 ha, for recreation and camping, stretches for about 5 km along the lower reaches of the Bremer River. The Ravensthorpe Reserve of 97 ha, for camping, lies on the eastern edge of Hamersley Inlet.

Four unformed tracks currently provide access through the Park to the Jerramungup Reserve. These are generally water-logged and eroding, with numbers of detours evident and increasing. Access and camping sites appear to require resolution. Selection of stable access to the Reserve will require very careful planning and considerable expense, given the highly dissected nature of the river margins.

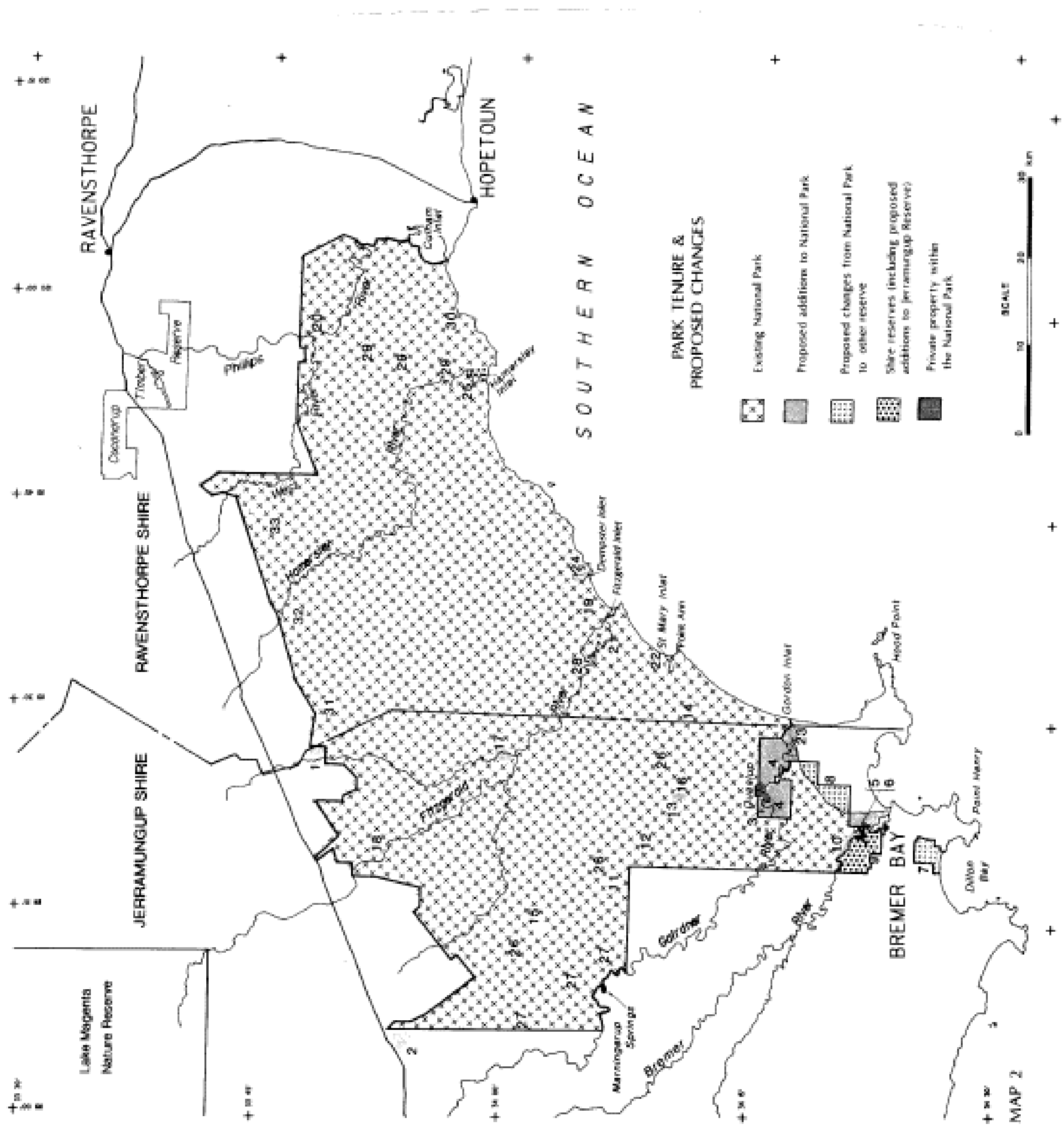
A recently formed road provides access to the edge of Hamersley Inlet in the northern part of the Ravensthorpe Shire Reserve. The southern beach end of the Reserve is accessible through the Park by 4WD vehicles via the mobile Hamersley dunes. This beach is a salmon-fishing destination during early autumn. There is no safe, stable alignment that will allow a road or track to be brought through the Reserve to the beach. Access to the two Shire Reserves is through FRNP. Any road development through the Park to the Shire Reserves must be approved by CALM and be consistent with management goals in this plan. In practice, approvals have been assisted by co-operative interaction between CALM and the Shire concerned.

PRESCRIPTIONS

1) **In consultation with the Shire of Jerramungup, adjust the Jerramungup Reserve so that its boundaries are delineated by natural features, that is Bremer River, Peters Creek and Wellstead Estuary in the north and east, and private property and a Crown reserve in the west and south (Map 2; area 9). This will increase the area of the Shire Reserve, while adding the relatively inaccessible northern bank of the Bremer River to FRNP.**

2) **Liaise with the Shires of Jerramungup and Ravensthorpe to ensure that the management of the two Shire Reserves is coordinated with management of the surrounding Park.**

3) **Encourage the Shires to prepare management plans for and allocate management resources to these Reserves.**


RAVENSTHORPE
HOPETOUN
SOUTHERN OCEAN
RAVENSTHORPE SHIRE
JERRAMUNGUP SHIRE
Lake Magenta
Nature Reserve
BREMER BAY
PARK TENURE &
PROPOSED CHANGES
Existing National Park
Proposed additions to National Park
Proposed changes from National Park to other reserve
Shire reserves (including proposed additions to Jerramungup Reserve)
Private property within the National Park
SCALE
MAP 2

3.3 OTHER CROWN LAND WITHIN THE NATIONAL PARK BOUNDARY

The objective is to rationalise and simplify Park management by adding to the Park other Crown reserves (excluding Shire reserves), unused road reserves and inlets within the Park.

Background

Ten small unvested reserves lie within the National Park boundary (areas 11-20 in Table 2 and Map 2). Most were created to provide water points for maintenance crews working on the rabbit proof fence. The fence is no longer operational. These reserves are managed on a *de facto* basis by CALM. Addition of these areas to the National Park will formalise this arrangement.

There are four inlets within the Park: St. Mary, Fitzgerald, Dempster and Hamersley. None are currently managed by CALM. These inlets, plus Gordon Inlet, are proposed for management by CALM (areas 21-25 in Table 2 and Map 2). Their addition to FRNP and/or reservation as marine reserves will allow CALM to manage them to enhance their conservation values, maximise public safety and minimise conflict between different user groups. Potential marine parks off-shore from Fitzgerald River National Park are being assessed as part of a State-wide review.

Several unused road reserves and unmade road alignments are shown on maps of FRNP (areas 26-33 in Table 2 and Map 2). Most of these were created in the days when FRNP was vacant Crown land and there was a need to ensure access prior to the land being alienated. All are historic anomalies, given that access is now provided by Park roads. In addition, these proposed roads if constructed, would duplicate existing access, could compromise Park values and may not maximise available views.

To ensure that dieback risks are minimised and that road construction and maintenance are in sympathy with Park values, Park roads should be part of the National Park, not separate road reserves. This also means that CALM, rather than the local authority, meets construction and maintenance costs for roads used by a significant number of nonratepayers.

PRESCRIPTION

1) Implement the changes in status for areas 11-33 in Table 2 and Map 2.

TABLE 2. PROPOSED CHANGES TO CROWN LAND WITHIN THE PARK BOUNDARY

		CURRENT STATUS				
LAND TYPE	**ID No. (Map 2)**	**RESERVE No.**	**PURPOSE**	**AREA (ha)**	**VESTING STATUS**	**PROPOSED**
RESERVES	11	C12121	Water Rabbit Dept	4	Unvested	Add to FRNP
	12	C12122	Water Rabbit Dept	2	Unvested	Add to FRNP
	13	C12123	Water Rabbit Dept	2	Unvested	Add to FRNP
	14	C12124	Water supply, rabbit proof fence	8	Unvested	Add to FRNP
	15	C10133	Water supply, rabbit proof fence	130	Unvested	Add to FRNP
	16	C10135	Water supply, rabbit proof fence	121	Unvested	Add to FRNP
	17	C1406	Water	259	Unvested	Add to FRNP
	18	C20393	Water	40	Unvested	Add to FRNP
	19	512	Public Purposes	10	Unvested	Add to FRNP
	20	C10865	Water Act 56, Vic No 20	64	Unvested	Add to FRNP
INLETS	21	Fitzgerald Inlet	VCL	---	---	Marine reserve/ add to FRNP+
	22	St Mary Inlet	VCL	---	---	Marine reserve/ add to FRNP+
	23	Gordon Inlet	Government Requirements	---	Unvested	Marine reserve+
	24	Dempster Inlet	VCL	---		Marine reserve/ add to FRNP+
	25	Hamersley Inlet	VCL	---		Marine reserve+
ROADS	26	Rabbit Proof Fence Road	---	---	---	Add to FRNP
	27	Protected Road (Darlingup 1:50 000 Sheet)	---		---	Add to FRNP
	28	Road section (Dempster 1:50 000 Sheet)				Add to FRNP
	29	Road No. 6284	---	---		Add to FRNP
	30	Road Section (Whoogarup 1:50 000 Sheet)	---		---	Add to FRNP
	31	Road Section (Drummond Road)	---		---	Add to FRNP
	32	Road Section (Wooganup Road)	---		---	Add to FRNP
	33	Road Section (Hamersley Drive)	---	---	---	Add to FRNP

+ refer to Section 10.2 Commercial Fishing for details.

3.4 PRIVATE PROPERTY ENCLAVES IN THE NATIONAL PARK

The objectives are:

1. *Rationalise and simplify Park management by eventually adding existing alienated lands within the Park to it*
2. *Provide for the complementary management of the Park and adjoining private properties, particularly enclaves.*

Background

Following finalisation of changes to Park boundaries (see 3.1 National Park Boundaries), 13 private properties at Quaalup will be surrounded by National Park (Map 2).

The presence of private enclaves greatly increases management complexity. Some of the problems include domestic animals on private property wandering into the Park if the properties are not fenced, animals from the Park damaging crops and stock, weed infestation and fire control. The provision and use of roads and power, water and telephone lines may also place Park values at risk from dieback and weed introduction, soil erosion and landscape impacts.

PRESCRIPTIONS

1. **Prioritise all Quaalup properties in terms of lack of disturbance and natural and cultural environmental significance. Use this priority list to guide their purchase from willing sellers.**

2. **Purchase properties adjacent to the Park that have exceptional conservation or recreation values, or management benefits, or that could protect areas with these values within the Park, when they are available and subject to funds and a suitable selling price.**

3. **Encourage complementary management between the Park and enclaves or adjoining private land.**

4. **Use a co-ordinated approach between the relevant authorities, departments and landowners to ensure that land uses or sub-divisions on enclaves or adjoining private land do not adversely affect Park values.**

3.5 CROWN LAND ADJACENT TO THE NATIONAL PARK

The objective is to maximise the contribution that adjacent public lands can make to the values of the Park.

Background

Substantial areas of Crown land abut the National Park.

Existing reserves are associated with the Bremer, Gairdner, Fitzgerald, Susetta, Hamersley and West Rivers. Most of these linear, north-south orientated reserves touch the northern boundary of the Park. They are set aside for various purposes including water collection, rest, recreation, parklands, and Government requirements. Little is known of their conservation values, although the almost continuous corridor of vegetation along the Fitzgerald River serves to link the Park and Lake Magenta Nature Reserve. Parts of these corridors also have recreational values.

An extensive area of vacant Crown land links Cocanarup Timber Reserve (8 853 ha) to the north-eastern comer of the Park. A corridor reserved for Government requirements abuts the Park's western boundary. A smaller area of VCL abuts the Park's north-western comer. Surveys in both areas indicate high conservation values. The heath rat and western mouse (both declared rare) occur in the north-eastern VCL, while both areas contain the Western Whipbird (also declared rare) and poorly known plant species.

Cocanarup Timber Reserve is managed by CALM. No department or agency is formally responsible for day-to-day management of the other areas.

PRESCRIPTION

a. Liaise with relevant agencies to achieve management of Crown land adjacent to the Park which enhances the values of the Park. This means complementary fire management, recreational management, pest, weed and disease control, and research and monitoring.

4.0 INTERNATIONAL BIOSPHERE RESERVE STATUS

The objectives are:

- *Recognise the special significance of the Park as an International Biosphere Reserve and manage it accordingly.*
- *Promote integrated management of the Park and adjacent lands and waters.*

Background

The State Government nominated Fitzgerald River National Park as an International Biosphere Reserve (IBR) in 1978. 'Ibis nomination was accepted by the United Nations Educational Scientific and Cultural Organisation (UNESCO) in the same year. A biosphere reserve is a protected area of land and coast large enough to be an effective conservation unit, and to accommodate different uses without conflict. It should have special value as a baseline for measuring long-term changes in the biosphere as a whole.

The main technique used to minimise conflict within a biosphere reserve is zoning. The ideal biosphere reserve consists of at least one core area surrounded by one or more buffer zones. The central core area is the most 'natural' and must be of sufficient size to allow the flora and fauna of the ecosystem to self-perpetuate in a self-sustaining manner with minimum human interference (Anon., 1983). The surrounding buffer zones may contain human-modified examples of the ecosystem. The buffer zone may also contain degraded areas which are to be restored to more natural conditions.

Given the above definition of IBRs, the FRNP is not a typical biosphere reserve, since it represents only the core zone. To satisfy the IBR definition additional buffering areas and modified landscapes should become part of the Fitzgerald Biosphere Reserve. The locally-based Fitzgerald Biosphere Project Committee suggest that the Fitzgerald's ability to function as a genuine biosphere reserve, incorporating the Park and surrounding natural and modified landscapes, involves acceptance of a large 'zone of co-operation' surrounding the Park as part of the Biosphere Reserve. This Committee recognises the values to the Park of surrounding natural areas (Bradby *et al.,* in prep).

The Fitzgerald Biosphere Reserve (Fitzgerald River National Park) is currently managed by CALM for the National Parks and Nature Conservation Authority.

PRESCRIPTIONS

1. **Recognise FRNP as the "core" of the Fitzgerald Biosphere Reserve. Such designation is consistent with national park goals for the area.**

2. **Encourage the recognition and utilisation, by the Commonwealth and Western Australian Governments, the local community and other bodies, of a broader Fitzgerald Biosphere Reserve, incorporating buffer areas and a "zone of co-operation" beyond the Park boundaries.**

3. **Support activities which bring benefits of Biosphere Reserve status to the Park and surrounding areas.**

4. **Formalise links between the Fitzgerald Biosphere Project Committee and CALM.**

5. **Recognise the close interaction between the Park and its surrounds as a major influence on the prescriptions in this plan.**

5.0 MANAGEMENT ZONES

The objectives are to implement a system of management zones which:

1. *minimises conflict between conservation values and recreational use, and between different recreational uses.*
2. *specifies the type and extent of public access, recreational development, and interpretive, research and management activities, appropriate to maintaining the biological, physical and cultural resources, and natural processes of the Park.*

Background

Management zones establish a framework for the protection of conservation values and the provision of a range of recreation uses, and indicate the different levels of management required.

Management zones for Fitzgerald River National Park were identified using the following methods:

- Mapping and describing rare flora and fauna, landform and associated erosion hazard, Aboriginal and European cultural sites, and existing and potential access and recreation sites.
- Reviewing the conservation status of the Park's rare flora and fauna on an Australiawide basis.
- Reviewing recreation opportunities available elsewhere.
- Identifying the environmental effects of recreation use and the likely future public use through visitor surveys, public submissions, and a workshop.

Using the information collected, overlays of the mapped information and the management zone definitions given in Table 3, zones were delineated *which protect and enhance the conservation values of the Park while allowing for recreation use.* The zones maximise protection of the Park environment, particularly the rare flora and fauna; contribute to recreation diversity; minimise the adverse effects of any proposed change in recreational use on any one user group; and can be implemented feasibly.

The management zones used in FRNP are:

1. Special Conservation

   This management zone covers the northern part of the Park with its concentration of declared rare birds and mammals. A number of these species require habitat which has not been burnt for 15 years or more and protection from introduced predators, particularly foxes. Vehicle access through this zone is by Hamersley and Pabelup Drives. There is usually no other motorised access, except for research and management.

2. Wilderness

An extensive area in the middle of the Park (78 000 ha) is maintained in a wilderness state. No motorised access is permitted, except for emergency and essential management operations.

3. Natural Environment

Areas will be maintained as natural environments. Included are several 4WD accessible tracks (eg. Fitzgerald Inlet track, Quoin Head Track). Generally, motorised access is restricted. Facilities are semi-primitive and predominantly in natural settings.

4. Recreation

These are small areas associated with vehicle access routes and recreation and interpretation sites. In FRNP, this zone is based on roads and recreation sites accessible to 2WD vehicles. Facilities are basic and in natural settings which may show signs of modification.

Allocation of the above zones is based on information and prescriptions given in this Part, and Parts C, D, E and F.

PRESCRIPTION

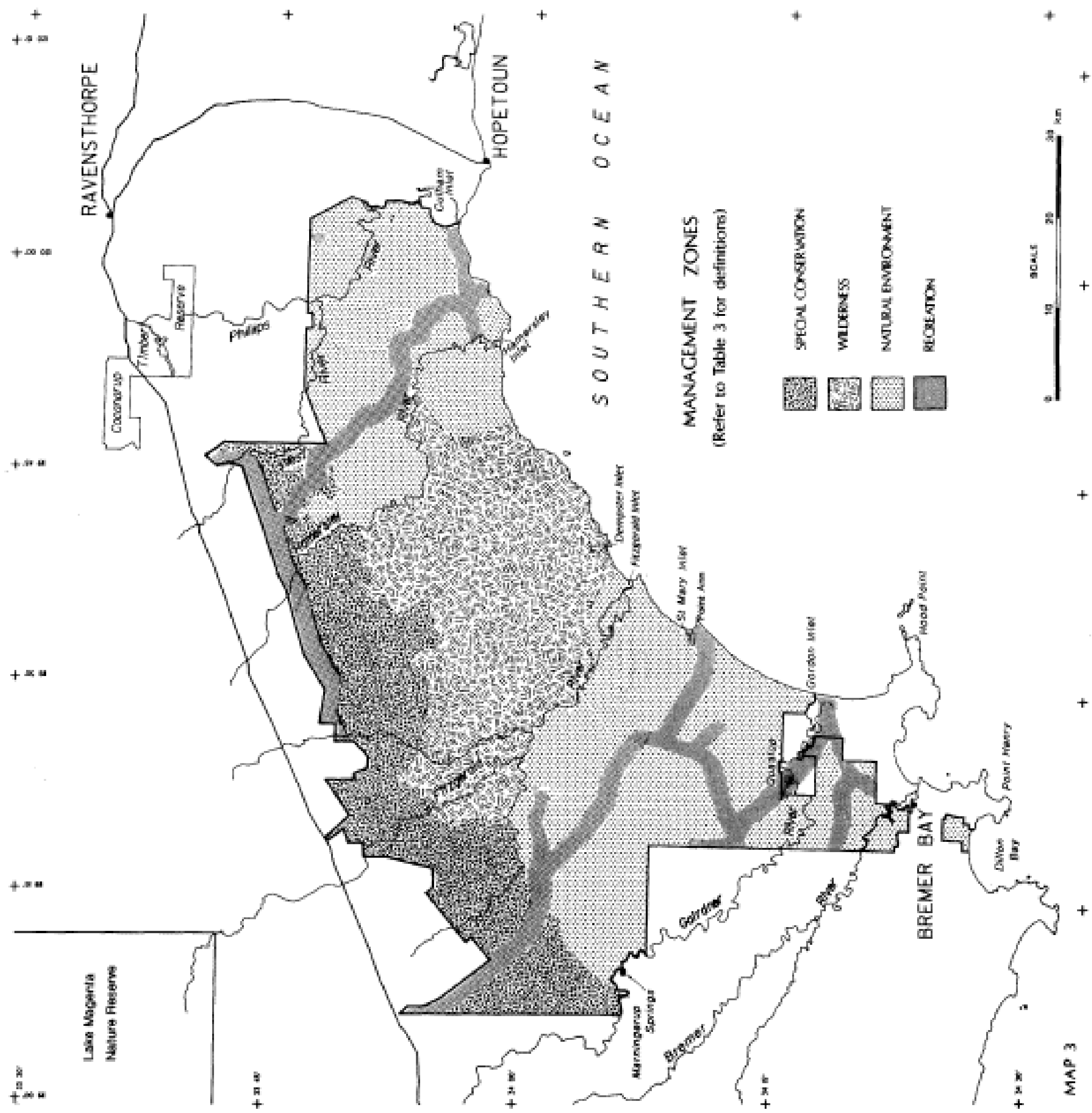
1. Use the above management zones (Table 3 and Map 3) as the basis for integrated management of FRNP.

Practical implementation of management zones may differ from the boundaries given on Map 3. Most communities and species have requirements which extend beyond these artificially delineated boundaries.

TABLE 3. FITZGERALD RIVER NATIONAL PARK MANAGEMENT ZONES

			MANAGEMENT FRAMEWORK		
MANAGEMENT ZONES	**GENERAL DESCRIPTION**	**BOUNDARY CRITERIA**	**RESOURCES**	**PUBLIC OPPORTUNITY**	**LEVEL OF MGT**
1. SPECIAL CONSERVATION	Specific areas which contain unique, rare or endangered features or the best examples of natural features.	'Me natural extent and buffer requirements of designated features.	Strict resource conservation.	- Usually non-motorised access, except for research and management purposes. - Visitor appreciation consistent with resources, conservation.	High
2. WILDERNESS	Extensive areas which will be maintained in a wilderness state.	The extent of natural systems in areas of 10 000 ha or greater.	Strict resource conservation.	- Non-motorised access only, except for emergency and essential management. - Primitive facilities, if any.	Low
3. NATURAL ENVIRONMENT	Areas which can sustain, with a minimum of impairment, a selected range of low-density outdoor activities with a minimum of related facilities.	The extent of natural environments and surrounding zones.	Conservation of the natural environment.	- Includes 4WD tracks; however, motorised access restricted. - Semi-primitive camping facilities.	Low to Moderate
4. RECREATION	Limited areas that can accommodate a broad range of outdoor recreation opportunities.	The extent of outdoor opportunities and facilities and their area of immediate impact.	Minimal impact of activities and facilities on natural landscape.	Access motorised and non-motorised. Basic camping facilities	Moderate to High

.


RAVENSTHORPE
HOPETOUN
S O U T H E R N   O C E A N
MANAGEMENT ZONES
(Refer to Table 3 for definitions)
SPECIAL CONSERVATION
WILDERNESS
NATURAL ENVIRONMENT
RECREATION
BREMER BAY
Lake Magenta Nature Reserve
Timber Reserve
Cocanarup
Phillips
Hamersley Inlet
Dempster Inlet
Fitzgerald Inlet
St Mary Inlet
Point Ann
Gordon Inlet
Point Henry
Dillon Bay
Gairdner
Bremer
Mannengarup Springs
MAP 3

PART C. MANAGEMENT FOR CONSERVATION

GOALS:

1. Conserve all native plant communities, animal communities, species, and the natural processes which sustain them, in the Park, especially the large numbers of rare species and those in need of special protection.

2. Conserve the Park's landscapes, in particular the extensive vistas free of human disturbance.

3. Conserve the rich Aboriginal and European history of the Park, including numerous historical and archaeological sites.

6.0 PHYSICAL RESOURCE MANAGEMENT

6.1 GEOLOGY

The objective is to protect important geological features in the Park.

Background

(Based on contributions by Geological Survey of Western Australia, Mines Department)

Fitzgerald River National Park lies on the southern edge of the Yilgarn Block and the adjoining Albany-Fraser Province.

The bedrock of the northern edge of the Fitzgerald River National Park is part of an ancient (2500 - 2900 million years old), essentially stable, crustal segment known as the Yilgarn Craton. Granite and gneiss are the predominant rock types with minor enclaves of altered sedimentary and mafic igneous rocks. One such form of mafic igneous rock is the West River greenstone belt south-west of Ravensthorpe.

The somewhat younger rocks (1100- 1800 million years old) of the Albany - Fraser Province form the bedrock across the southern portion of the Park. These rocks are dominated by the metasediments of the Mount Barren Group, with smaller enclaves of slightly older granitic gneiss appearing along the coast from Bremer Bay to Point Charles.

The Mount Barren Group forms the Barren Ranges which lie along the coast from Hopetoun to east of Bremer Bay. This group consists of a folded and faulted sequence of metasediments of quartzite, phyllite, dolomite and conglomerate which are generally slightly altered. Development of the Barren Ranges, through folding and faulting of the Mount Barren Group, is thought to have occurred between 1100 and 1400 million years ago. Subsequent changes in sea level have lead to the formation of elevated benches on various peaks within the Barren Ranges.

The Plantagenet Group was deposited in shallow, warm waters near sea level 40-50 million years ago (Eocene Period). Changing sea levels led to deposition under both marine and non-marine conditions. The Werillup Formation, the lower part of the group, is composed of grey and black clay, siltstone, lignite and carbonaceous siltstone. The lignite ranges up to 3 m thick and occurs in the Fitzgerald River area and around Nornalup Inlet. The Werillup Formation is overlain by the Pallinup Siltstone, a horizontally bedded white, brown or red siltstone and spongolite. The Plantagenet Group is exposed along all the major riverlines in the Park.

Laterite, a weathering product of the Tertiary Period (between 26 and 2 million years old), has developed over many of the rock types present through the Park. Also from the late Tertiary is a shell bed of considerable interest near the east side of Hamersley Inlet.

Sandplains and recent coastal deposits are a product of the Quaternary period (within the last 2 million years). Sandplains and associated swamps cover extensive areas between the rivers in the central and western parts of the Park. Sand-dunes and coastal limestone occur near Trigelow Beach, Point Charles and Hamersley Inlet.

The Kybulup Schist unit of the Mount Barren Group occurs within the Park, north of Culham Inlet on the Phillips River (Lat. 33•5 1'1 3 " S, Long. 120•04'41 "E).

Mining and mineral values are discussed in 10. 1 Mining.

PRESCRIPTIONS

1. **Provide interpretive information regarding the Park's diverse geology and geological history and its relationship with the flora and fauna.**

2. **Provide interpretive information on structural features such as the spongolite valleys (gorges), Mt Barren ranges and precipitous sea-cliffs.**

3. **Protect the Kybulup Schist unit from disturbance from Park management activities.**

6.2 LANDFORMS, SOILS AND EROSION HAZARD

The objectives are:

1. *Protect all landforms and the processes that sustain them, especially those that are unique to the Park.*
2. *Minimise changes to drainage patterns, erosion and waterlogging, resulting from management activities such as road works, fire control and the provision of recreation opportunities.*

Background

Landform

The landforms of the FRNP are a product of the underlying rock and their deeply weathered condition. Water erosion has partly removed this mantle of weathering, exposing fresh rocks beneath the Eocene sediments. Wind action has created dunes on the coast as well as on sands further inland.

Chapman and Newbey (in prep.) identified five major and two minor landforms in the Park. Table 4 lists the landforms and their characteristics, including soils. Map 4 shows the five major landforms. The five major landforms are the upland, plains, incised valleys, ranges and dunes.

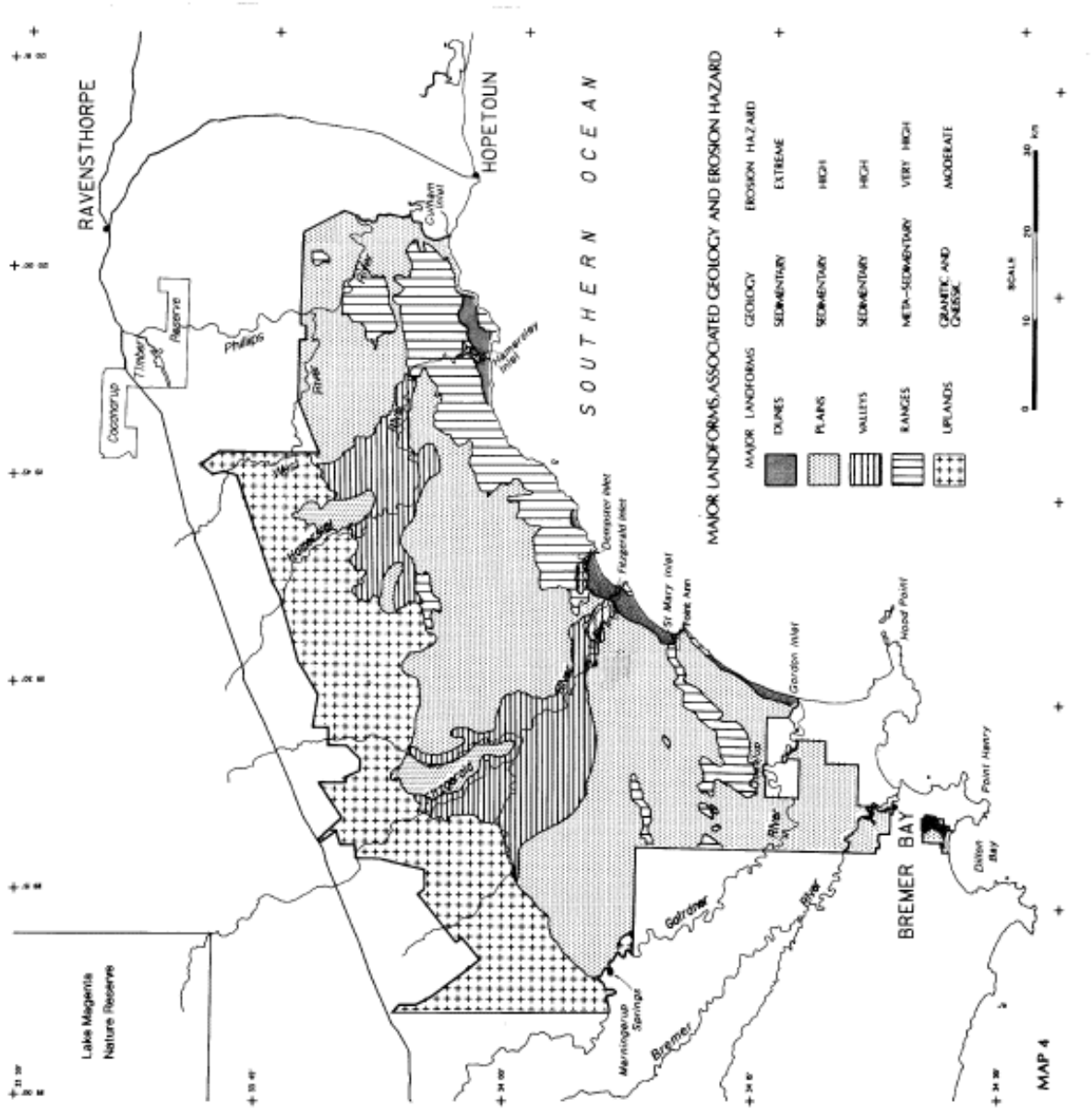
The upland is characterised by a gently undulating terrain on the Archaean granites which underlie the northern part of the Park. The plains, immediately inland from the coast, are flat, with numerous swamps, depressions and large areas with no run-off. They are developed on the deeply weathered Plantagenet Group of Eocene sediments. This is the most extensive landform. in the Park. Steep-sided valleys cut through the plain, creating the distinct, incised valley landform. The erosional scarp of the valleys is often capped by laterite. Flat mesaform hills also appear as relics on the plain.

TABLE 4. LANDFORMS, SOILS, VEGETATION AND EROSION HAZARD

LANDFORM	GEOLOGY	SOIL TYPE	VEGETATION	TOPOGRAPHY	DRAINAGE	EROSION HAZARD
Upland	granites, gneisses	• extensive areas of shallow loamy sand • skeletal soils associated with granite exposures	• Very open mallees of *E. redunca or E. tetragona* • Allocasuarina, Grevillea and Acacia scrub/heath associated with granite outcrops	• dominated by undulating plain: internal relief less than 10 m, slopes less than 2°. • V-shaped valleys: incised 100-160 m, 3-120 slopes	• undulating plain: dendritic and coarse • V-shaped valleys: single channel with flows in winter/spring • generally moderately well drained	**Moderate** • plain reasonably stable; skeletal soils associated with granite outcrops mod. susceptible to water erosion, V-shaped valleys moderately susceptible given slope and 1:5 year flooding
Plain	spongolite, siltstone	• duplex shallow sandy loams, colluvial sands and cracking clays • skeletal soils on bedrock exposures	• very open mallee of *E. decipiens* widespread • elsewhere open to very open shrub mallee	• flat plain: internal relief rarely exceeds 10 m, generally less than I* slope	• uncoordinated drainage: large areas with no run off, sumps and gilgais • dissected drainage on coast and river margins • water-logged winter/ spring at least, generally poorly drained	**High** • disturbance of water-logged areas leads to breakdown in soil structure and *pro* longed ponding, and/or increased run off. Fine silt soils susceptible to water and wind erosion, the latter particularly in coastal parts
Valleys	spongolite, siltstone	• sandy loam - shallow on walls, deeper on valley floor	• open shrub mallee of *E. conglobata* and *E. incrassata* on valley floors and drainage lines • low woodland on slopes and rims • open mallee on mesas	• steep-sided valleys cut into flat plain; flat, broad valley floors	• broad valleys, inter-mittent flow, small flow in winter/spring, generally small linear pools • moderately well drained in upper reaches to poorly drained near inlets	**High** • steep valley sides with shallow soils susceptible to water erosion; flat valley floors moderately susceptible

Table 4 cont.

LANDFORM	GEOLOGY	SOIL TYPE	VEGETATION	TOPOGRAPHY	DRAINAGE	EROSION HAZARD
Ranges	quartzite, phyllite, dolomite, conglomerates	• quartzite sand on quartzite • phyllitic loamy sand *or* schist duplex soils	• Banksia scrub and Adenanthos open low scrub on quartzite • Very open shrub mallee of *E. incrassata*, and Banksia and Allocasuarina low scrub on phyllitic schists	• rugged hills and stony rises 500 m ASL, slopes range from 45• to vertical	• rapid run-off • numerous short streams rapidly drain hills and rises • well drained	**Very High** unconsolidated soils and steep slopes with numerous drainage lines highly susceptible to erosion
Dunes	sand over spongolite or quartzite	• loose calcareous or siliceous sands	• mallee and shrubland becoming lower and denser heath closer to coast	• narrow sand-dunes occur on several coastal sections: 2-5 m high, varying slope depending on stability	• well drained • occasional areas of impeded drainage over limestone	**Extreme** • loose soils extremely susceptible to wind erosion (and wave erosion on occasions)
Inlets	incised in quartzite, spongolite or lime - stone	• saline soils next to inlet • narrow deposits of colluvium and alluvium spongolite, at some slope and cliff bases	• Melaleuca woodland or shrubland on edges • samphire heath on flats	• all major rivers in Park terminate in an inlet: incised to 100 m, only partially,filled expansive flat,floors generally fringed by steep slopes or cliffs	• water occupies only small portion of floor • generally barred from the sea • poorly drained	**High** • slopes and cliffs are highly susceptible to water and wind erosion (increases with proximity to the coastline); water logged soils of fine texture susceptible to degradation
Rivers, swamps and lakes	granites, spongolite, quartzite	• dependent on underlying rock	• *E. occidentalis* woodland dominant	• rivers generally single-channelled: v-shaped in upland; broad, cliffed meanders on plain • swamps generally on plain	• rivers moderately well drained • swamps poorly drained	**High** • silt soils, in particular, are highly susceptible to water erosion and degradation due to flood events and water-logging



The ranges landform is also distinctive as it is emergent above the gently sloping plain. It has developed on the Proterozoic quartzites. Narrow sand dune systems occur along several sections of the coastline.

The two minor landforms which together occupy only a small percentage of the Park area are inlets, and rivers, swamps and lakes. Many of the rivers terminate in an inlet which is closed to the sea for most of the time. Swamps and saline lakes are characteristic of the plains.

Soils and Erosion Hazard

The susceptibility of the soil to erosion and degradation has a major influence on management. This is dependent on geology, soil type, vegetation, topography and drainage. Likely hazard following

disturbance can be determined based on this susceptibility (Table 4). Most of the Park has a high erosion hazard.

The coastal dunes are the only landform to have an extreme hazard rating. They are readily eroded by wind, particularly when sparsely vegetated, or where wave action is likely to further decrease stability. The steeper, younger, more sparsely vegetated dunes closer to the coast are more susceptible than older stabilised dunes further inland. The ranges have a very high erosion hazard, given their steep slopes and coarse, poorly consolidated skeletal soils. Minor disturbances, such as footpaths, can lead to localised gully erosion.

The plains with their fine silty soils, are highly susceptible to water erosion, and to wind erosion closer to the coast. This landform is characterised by widespread impeded drainage. In these poorly drained areas, mechanical disturbance, such as firebreak and track construction, may lead to soil degradation, increased ponding and run-off. Dieback control is likely to be a particular problem. Boggy channels can develop over wetter months even with low levels of use. The valleys are also susceptible to erosion if disturbed, although the valley floors, if well-drained, are only moderately susceptible. Inlets, rivers and swamps also have a high erosion hazard, particularly in waterlogged situations and areas with fine silty soils or steep slopes.

When the soil surface is disturbed or vegetation removed, soil erosion can result in changes to the landform and soil structure. In national parks, the greatest effect on the soil resource occurs as a result of the construction and use of roads and facilities for public and management purposes. Soil erosion can also be exacerbated by reductions in plant cover through the spread of plant diseases, such as dieback, or by fire.

In FRNP, poorly located access routes, and camping areas in coastal areas are leading to localised water and wind erosion. Inland, erosion is largely restricted to tracks and firebreaks.

PRESCRIPTIONS

1. **Minimise management activities in, and public access to, the coastal dunes, all of which have an extreme erosion hazard. Where access is provided, plan according to specialist advice on prevailing wind direction, stabilisation and slopes.**

2. **During road and facility development and maintenance ensure that erosion hazards (Map 4 and Table 4) are a primary consideration, subject to specialist advice on a case-by-case basis. Carefully plan all developments. Any activity in the Ranges requires particular care as this landform has a very high erosion hazard rating.**

3. **Give particular attention, in any development and maintenance works, to drainage and ponding with respect to dieback.**

Research and Monitoring

4. **Use fixed points and aerial photography to monitor the movement of sand inland from unstable dunes, eg. Hamersley Inlet, Gordon Inlet.**

5. **Monitor beach access points, both footpaths and vehicle access points, and take remedial actions as required.**

6.3 HYDROLOGY

The objectives are:

1. *Ensure that, as far as possible, activities both inside and outside the Park do not harm the quality and quantity of the Park's water resources.*
2. *Minimise the effect of road construction and recreation development on natural drainage.*
3. *Ensure that roads and site developments are properly located and designed so that damage by heavy rainfall or unseasonal flow is minimised.*

Background

(Based on information supplied by the Water Authority of Western Australia).

There are four main rivers in FRNP: the Gairdner, Fitzgerald, Hamersley and Phillips. These run roughly from north-west to south-east through the Park. All have at least part of their catchments in cleared agricultural land. A number of shorter rivers and streams, most notably the St Mary and Dempster, have all of their catchment within the Park (Map 5). All rivers in the Park are intermittent, with the majority of flows occurring during winter and spring.

The Dempster, in particular, could provide a useful reference catchment. It is completely uncleared and lies entirely within FRNP (Map 5). As part of the wilderness zone, access will generally be on foot only (Map 3). Such limitations on access substantially reduce the risk of further introduction and spread of dieback.

FRNP has numerous swamps, particularly on the plains. They are covered wholly or largely by woodland and/or shrubland. At least part of their floor is covered by a few centimetres of water during winter and spring. Floods add up to 1.5 m of water which may remain for up to 18 months (Chapman and Newbey, in prep.). Water quality varies from fresh to brackish. A number of fresh (eg. Pabelup Lake) and saline (eg. Doggers Swamp) lakes also occur.

All major rivers in FRNP terminate in an inlet which is normally closed to the sea by a sand bar. Only occasionally is river flow sufficient to fill any of the inlets so they overflow into the sea. Once open, inlets remain so for days to many months (Hodgkin and Clark, 1990).

Water Quality

The majority of surface and groundwater in the Park is saline. However, a thin layer of freshwater, overlying brackish or saline water, is likely to be present in the coastal sediments (Geological Survey of W.A., pers. comm., 1988). Freshwater seeps occur at several places along the coastline. The Water Authority has suggested that fresh groundwater aquifers are present in certain parts of the Park, such as near the downstream end of the Hamersley River.

Management actions within the Park can affect water quality. Road works and road use can increase sediment loads through erosion. Boat use can result in fuel and oil spillage from motors and erosion of launching sites. Land-based facilities, such as camp grounds and toilets, can cause pollution and erosion.

Management actions outside the Park can also affect water quality, particularly given that the catchments of the Park's major rivers extend beyond the Park. In the Fitzgerald area, clearing for agriculture has increased salinity and sediment load of streams and rivers. The long-term effects on areas such as FRNP are uncertain. Replanting of parts of these catchments should help to counteract current water quality problems.

Water Supply Potential

Given the high salinity of water within the Park, it has limited potential for development of either surface or groundwater resources. In the past, the Water Authority proposed to carry out exploratory drilling to locate a new supply source for Hopetoun. The Environmental Protection Authority determined against the proposal and appears to have ruled out any water supply development within the National Park.

The Water Authority does, however, have interests in adjacent areas. The Bremer Bay Groundwater Area lies immediately south of the Park between Bremer and Dillon Bays. This Area incorporates Cardiminup Swamp, one of the few local, permanent, freshwater swamps. The Hopetoun Groundwater Area lies immediately east of the Park, abutting the eastern side of Culham Inlet. In the longer term, the Hunter River and Tooregullup Swamp, immediately north of Bremer Bay, and south of FRNP, have been identified as potential future sources of water supply.

Research and Facilities

One gauging station exists within the Park boundaries (Map 5). As the result of funding cuts it was closed in April 1987. Continued access to the site by Water Authority officers will be necessary if

monitoring resumes. Relevant hydrologic studies would require, as a minimum, a gauging station on the Fitzgerald, at or near the existing station, and one on either the Dempster or St Mary Rivers.

PRESCRIPTIONS

1. **Assist the Jerramungup and Ravensthorpe District Soil Conservation Committees and liaise with the Department of Agriculture, Environmental Protection Authority and local government to:**
   - **encourage land use practices upstream of the Park, such as tree planting or clearing limits, which will help ameliorate deterioration in water quality or changes in quantity;**
   - **achieve some improvements in water quality (i.e. a decrease in salinity).**

2. **Retain Dempster catchment and inlet as a reference area free from human disturbance. This means minimal vehicle access, motorised boat use or building structures.**

3. **Design roads, tracks, paths, facility areas and associated drainage to cater for occasional flooding.**

4. **Ensure developments avoid swamps, as they may retain water for up to 18 months following flooding.**

5. **Do not construct new structures or facilities on sand bars which periodically open to the sea.**

6. **Do not use machinery or other human-induced means to open the bars of any of the inlets in the FRNP, unless it can be shown to be desirable by competent scientific authorities.**

7. **Because fresh groundwater is very limited in the Park, drinking water cannot be provided at campsites. Maps for walking only areas may indicate the availability of limited fresh water.**

Research and Monitoring

8. **Support continued monitoring of river flow and quality, with particular emphasis on the Fitzgerald River. Continue to provide access for monitoring to the gauging station on the Fitzgerald River in the northern part of the National Park.**

9. **Encourage, in consultation with the Environmental Protection Authority, longer term research and monitoring of inlet dynamics, such as opening and closing of bars, water**

levels and rate of sediment accumulation. Use **the Dempster Inlet as an undisturbed reference.**

6.4 LANDSCAPE

The objective is to protect the Park's landscapes, particularly the extensive vistas, from visually intrusive human disturbances.

Background

One of the fundamental values of Fitzgerald River National Park is its spectacular landscapes, with coastal ranges, sandy beaches and extensive vistas free of any signs of human activity.

Two landscape character types have been identified in FRNP: the coastline and southern slopes (Map 6). For management purposes, differences in scenic quality within each landscape character type have been defined. Areas with outstanding features, or diversity of features, are identified as having high scenic quality. Those with the features and diversity commonly found in a particular character type are given a moderate classification. Areas lacking features and/or diversity are nominated as low scenic quality. Table 5 identifies high, moderate and low scenic quality classes; however, only high and moderate quality classes occur in the Park. This is because views throughout the Park are extensive and generally include the Barren Ranges.

View management in FRNP involves protecting' the landscape (including landform, vegetation and waterform) and locating and planning land-use developments so as to provide diverse views in a natural setting. The desired outcome is a positive response from visitors. In FRNP, the current alignment of a number of roads and tracks has a severe visual impact (refer to 13.0 Access for details). Their alignment and colour often contrasts sharply with natural landform and vegetation patterns, particularly in coastal landscapes.

TABLE 5. LANDSCAPE CHARACTER TYPES

LANDSCAPE CHARACTER TYPE	SCENIC QUALITY	LANDFORM	VEGETATION	WATERFORM	LAND USE
Coastline	**General Description**	• Extends to landward limit of marine influences. • Includes long wind-swept beaches, quartzite cliffs rising 80 m, extensive sand drifts (both consolidated and unconsolidated)and inlets.	• Low dense heath with very occasional patches of Melaleuca low woodland. • Mallee woodland associated with inlets.	• Inlets generally barred from the sea and associated riverlines, often steep-sided.	• Occasional site developments - low key day use and camping in carefully chosen locations only.
	High	• Cliffs and headlands. • Islands, stacks, off-shore sandbars and reefs. • Rock features, caves, faultlines, obviously banded sedimentary rocks. • Irregular coastline edges often emphasised by distinctive rock out croppings, bays, inlets, and sand deposition patterns. • Primary dimes which display areas of active weathering, steep slopes and/or sand blown edges.	• Windshaped, gnarled or dwarfed vegetation, unusual in form, colour or texture. • Single tree, shrubs or patches of vegetation which become focal points due to isolation or position in relation to rocks or water. • Strongly defined patterns of woodland, dune vegetation, Melaleuca scrub and/or barren rock.	• All estuaries, inlets, lakes and swamps • Unusual ocean shoreline motion such as eddies due to islands, reefs, surf zones and shoreline configuration.	• Human-imposed spot developments which are in harmony with naturally established forms, lines, colours and textures. • Harsh edge contrasts not evident.
	Moderate	• Expanses of beach of uniform width and colour without rock out croppings or focal features. • Regular coast edges without bays, inlets, promotories, stacks or cliffs.	• Predominantly heath or beach grasses with some variation in colour, texture or pattern. • Some contrast caused by different colours.	• Uniform ocean shoreline and motion characteristics with little diversity.	• Human-imposed spot develop ments in which form, line, colour and texture of introduced elements borrow significantly from natural factors but some discordant visual impacts are clearly apparent.

LANDSCAPE CHARACTER TYPE	SCENIC QUALITY	LANDFORM	VEGETATION	WATERFORM	LAND USE
	Low	• Expanses of uniform (indistinctly dissected) landform.	• Extensive areas of similar vegetation such as heath or beach grasses, with very limited variations in colour or texture.	• Waterforms absent.	• Developments in which form, line, colour and texture of introduced elements contrast sharply with natural features. • Severely disturbed area with little natural vegetation. • Transition between land-uses sharp and geometric, generally appearing as a line.
Southern Slopes	**General Description**	• Rugged hills rising to 500 m generally along the coastline. • Flat to undulating plain 80-300m in elevation, cut by steep-sided valleys.	• Scrub and low scrub of Banksia, Allocasuarina and Adenanthos on ranges. • Open to very open mallee on plain.	• Ranges: steep-sided short stream-lines only flowing after heavy downpours. • Plains: steep-sided valleys associated with major river lines, v-shaped valleys in northern part, elsewhere swamps.	• Main developments are roads and tracks to the coast, fire - breaks and limited number of walk trails.
	High	• Rugged hills and stony rises • Expanses of bare rock warped and folded. • Steep-sided valleys.	• Areas of high plant diversity which display distinctive colour and textural patterns. • Pockets of vegetation which become focal points due to isolation, unusual form, position in the landscape, or canopy variation. • Areas of colour which distinguish a plant group from its surroundings.	• Ranges: intermittent short steep streams which briefly flow following rain. • Plains: valleys with intermittent pools.	• Human-imposed spot developments which are in harmony with naturally established forms, lines, colours and textures. • Harsh edge contrasts not evident.

LANDSCAPE CHARACTER TYPE	SCENIC QUALITY	LANDFORM	VEGETATION	WATERFORM	LAND USE
	Moderate	• Flat to gently sloping areas with limited features of visual interest. • Rounded hills generally similar in gradient to surrounding landforms.	• Patterns evident in vegetation but lacking uniqueness or distinction relative to surrounding vegetation. • Transition from low ocean - side vegetation to heath and mallees gradual.	• Seasonal swamps and occasional shallow creeklines.	• Human-imposed developments in which form, line, colour and texture of introduced elements borrow significantly from natural factors but some discordant visual impacts are clearly apparent. • Transition between landuses combining both gradual and abrupt edges, seldom appearing as an unbroken line.
	Low	• Extensive flat areas with limited features of specific visual interest.	• Extensive areas of similar vegetation cover.	• Waterforms absent.	• Developments in which form, line, colour and texture of introduced elements contrast sharply with natural features. • Severely disturbed areas with little natural vegetation. • Transition between landuses sharp and geometric, generally appearing as a line.


Lake Magenta
Nature Reserve
RAVENSTHORPE
Cocanarup
Timber
Reserve
PHILLIPS
WEST
HAMERSLEY
FITZGERALD
DEMPSTER
EAST
MT
BARREN
QUOIN
MARSHES
WHALEBONE
HOPETOUN
GAIRDNER
ST MARY
*LAKE
NAMELESS*
TRIGELOW
BREMER
RUNTER
BREMER BAY
SOUTHERN OCEAN
HYDROLOGY
Gauging Station (Water Authority of Western Australia)
Catchment Boundary
Public Roads & Tracks
SCALE
0
10
20
30
km
MAP 5

PRESCRIPTIONS

1. **Incorporate the prescriptions given in Table 6 in all forms of management (eg. fire protection, gravel extraction).**

2. **Reduce or lessen existing negative visual impact by closing unnecessary roads and tracks. Rehabilitate and plant as necessary. Realign required tracks and redesign and/or relocate parking areas and campsites which are visually obtrusive. Details are provided in the access and recreation sections of this plan (Part D).**

3. **Seek advice on visual management of the Park, as required, from CALM landscape architects.**

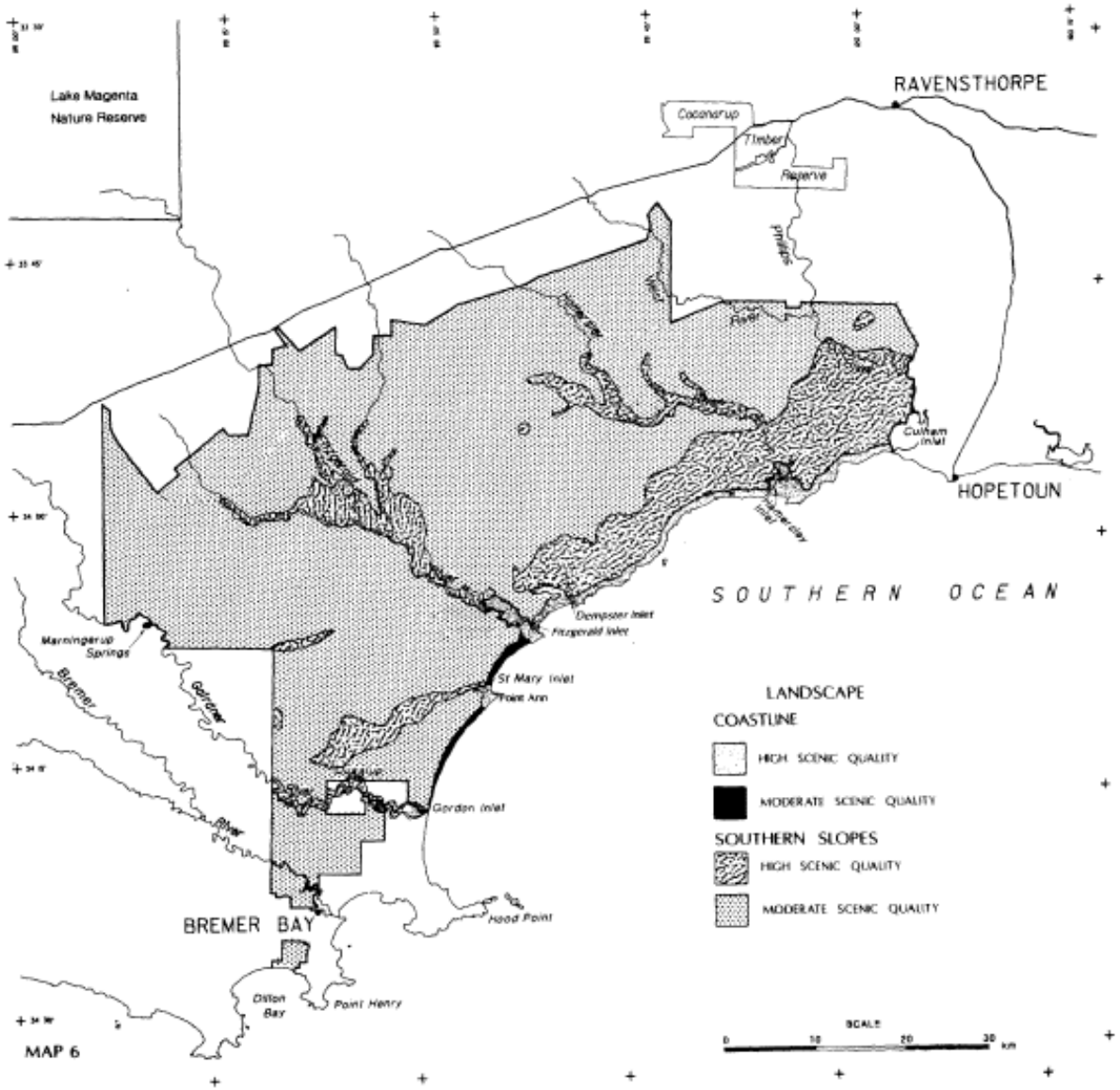

Lake Magenta
Nature Reserve
RAVENSTHORPE
Cocanarup
Timber
Reserve
Culham Inlet
HOPETOUN
SOUTHERN OCEAN
Dempster Inlet
Fitzgerald Inlet
Marringerup
Springs
St Mary Inlet
Point Ann
Gordon Inlet
BREMER BAY
Hood Point
Dillon
Bay
Point Henry
MAP 6
LANDSCAPE
COASTLINE
HIGH SCENIC QUALITY
MODERATE SCENIC QUALITY
SOUTHERN SLOPES
HIGH SCENIC QUALITY
MODERATE SCENIC QUALITY
SCALE
0
10
20
30
km

TABLE 6. PRESCRIPTIONS FOR LANDSCAPE MANAGEMENT

COASTLINE	SOUTHERN SLOPES
High Scenic Quality · alterations should remain subordinate to natural elements such as cliffs, dunes, inlets and wind-pruned vegetation, by borrowing extensively from their form, line, colour, texture and scale. · within one year of project completion alterations should not be evident. · activities which minimally disturb the environment should be encouraged, for example, walking, nature study, whale watching. · the number of roads and tracks should be minimised, with roads entering this landscape only to reach specific sites rather than following the coast east-west for long stretches. · firebreaks should not be constructed. Burnt buffers should be located so that they are visually unobtrusive from roads and tracks, beaches, headlands and inlets. · previously disturbed areas should be given the highest priority for rehabilitation until the desired standard of scenic quality is achieved. - gravel, sand and stone extraction should be excluded.	**High Scenic Quality** 7) alterations should remain subordinate to natural elements, such as the ranges, valleys, river pools and areas of high plant diversity, by borrowing from their form, line, colour, texture and scale. 8) within one year of project completion alterations should not be evident. 9) activities which minimally disturb the environment should be encouraged, for example, walking, wildflower appreciation, nature study. 10) road design, construction and maintenance should remain subordinate to landscape elements by using minimum clearing width, undulating edges, sensitive alignment and immediate revegetation of disturbed areas. 11) roads and tracks should be visually unobtrusive from vantage points. 12) firebreaks should not be constructed. 13) protection burning, where required, should be based on impact-minimising prescriptions. Burnt buffers should be located so that they are visually unobtrusive from travel routes and other vantage points. 14) previously disturbed areas should be given the highest priority for rehabilitation until the desired standard of scenic quality is achieved. - gravel, sand and stone extraction should be excluded where possible. If not, extraction should be limited in area and restricted to sites which can not be seen from travel routes and other vantage points.
Moderate Scenic Quality - alterations may be apparent but they should not dominate; they should borrow form, line, colour, texture and scale from natural elements.	**Moderate Scenic Quality** 13) alterations may be apparent but they should not dominate; they should borrow form, line, colour, texture and scale from natural elements. - the main visual appeal of this landscape is extensive vistas free of human disturbance. Roads, tracks~ firebreaks and burnt buffers should be visually unobtrusive where possible, primarily by borrowing from the natural form, line, colour and texture of the landscape.
Low Scenic Quality **8.** none of the FRNP landscape falls in this class.	**Low Scenic Quality** none of the FRNP landscape falls in this class

7.0 BIOLOGICAL RESOURCE MANAGEMENT

7.1 VEGETATION

The objectives are:

1. *Protect existing plant communities from impacts other than those arising from natural processes, except where necessary to provide an approved development, consistent with the goals for the Park (Section 2.0).*
2. *Rehabilitate plant communities which have been degraded.*

Background

Fitzgerald River National Park is dominated by open to very open mallee and shrubland. Heath is common throughout, while woodlands only occur along rivers and in swamps. There is a strong correlation between vegetation structure and distribution and the landform. and underlying soil or rock type.

The Park lies within the Eyre Botanical District of the South-West Botanical Province (Beard, 1980) and extends from the coast almost to the District's northern boundary. The Park is the only remaining uncleared, extensive, representation of the Eyre District. For most of the Park, the boundaries of the vegetation systems of Beard (1976) coincide with the boundaries of the landforms described by Chapman and Newbey (in prep.). These landforms, are given in Section 6.2 Landform, Soils and Erosion Hazard. The characteristics of the associated vegetation types are summarised in Table 4.

Most of the vegetation types in Fitzgerald River National Park are poorly represented in conservation reserves, particularly those associations found on the upland plains, valleys and ranges. Together these occupy about 90% of the Park area. Chapman and Newbey (in prep.) based the following comments on Newbey's field knowledge of other conservation reserves within the same climatic zone.

'The plains landform. is present only in FRNP. Large areas of upland are present in Frank Hann National Park and Lake Magenta Nature Reserve, with a small area in Corackerup Nature Reserve. However, these areas are dominated by undulating plain: they do not include v-shaped valleys as does FRNP. Although gorges are found in Corackerup, they do not match the extensive gorges of the Fitzgerald and Hamersley rivers. Ranges are an obvious feature of Stirling Range National Park; however, the coastal influences found on this landform. in FRNP are lacking in the Stirlings. Rivers, swamps and inlets are also poorly represented in the existing reserve system, although dunes are well represented in Stokes National Park' (Chapman and Newbey, in prep.).

PRESCRIPTIONS

1) **Protect the vegetation communities within the Park from dieback (see 9.1 Disease). Such protection is of paramount importance.**

2) **Protect the vegetation communities within the Park from introduced herbivores and weeds (see 9.3 Animal Pests and 9.4 Weeds). (Reducing the number of enclaves, and rationalising Park boundaries and numbers of management tracks will increase protection.)**

3) **Protect the vegetation communities within the Park from widespread human caused fires and frequent burning (see 9.2 Fire).**

4) **Minimise removal or damage to vegetation caused by development and maintenance of facilities and visitor use.**

5) **Rehabilitate degraded vegetation (refer to 9.5 Rehabilitation).**

Research and Monitoring

6. **Carry out research into management regimes (especially fire) required to maintain vegetation communities and fauna habitat.**

7.2 FLORA

The objective is to protect and maintain viable populations of all existing species, especially the rare species.

Background

With 1748 identified plant species, including 75 endemics, the Fitzgerald River National Park is one of the richest flora conservation areas in Western Australia. The Park contains 20% of known plant species (both named and unnamed) for Western Australia and 42% of the known species for the South-West Botanical Province. The number of species will continue to increase as surveying continues.

The Fitzgerald area is one of three nodes of high species richness in south-west Australia. FRNP also has a high proportion of endemic, geographically restricted and rare species. Although the flora is typical of the Eyre Botanical District it also contains some elements of the wetter forest and drier Goldfields flora (eg. *Gnephosis intosa* and *Ptilotus holosericeus).*

The flora of FRNP consists of 5 families of fern and 87 of flowering plants. The major families represented are Myrtaceae (220 species), Proteaceae (130), Asteraceae (108) and Cyperaceae (97). Dwarf shrubs are the dominant life-form, followed by annuals and small shrubs.

The upland and plains contain the highest numbers of plant species (Table 7). They are also the most extensive landforms identified in FRNP.

In FRNP, peak flowering occurs over August-November while the least number of species bloom in February. There is a rapid decline in the number of species flowering through the summer months. The most important summer flowering group is the eucalypts. Autumn-flowering species such as *Hakea laurina, Dryandra quercifolia* and *Banksia media* are important for the survival of honeyeaters and honey possums.

Rare Flora

Chapman and Newbey (in prep.) identified 250 plant species of very high conservation value. These species were geographically restricted or had populations of less than 1000 plants. Some plants were only present over small areas (eg. 1 ha or less) even though large areas of apparently suitable habitat existed. Their list is preliminary, having been prepared as part of a general flora survey, rather than a specific intensive survey for rare species.

Table 8 is derived from Chapman and Newbey's work. The Barren Ranges have the greatest number of priority plants (21 of the 42 priority species).

The Park contains 16 species of declared rare flora (declared rare under the Wildlife Conservation Act, 1950). A Ministerial permit must be obtained before disturbing or removing declared rare flora.

TABLE 7. NUMBER OF PLANT SPECIES PER LANDFORM

LANDFORM	AREA (ha)	FLORA (No. of Sp.)	% TOTAL FLORA	PRIORITY FLORA (No. of Sp.)
Upland	87300	877	50	7
Plains	166400	763	44	6
Valleys	45300	213	12	5
Ranges	39000	230	13	21
Dunes	6760	255	15	2
Inlets	negligible	197	11	1
Rivers, swamps and lakes	negligible	519	30	3

PRESCRIPTIONS

1. **Protect priority species (Table 8), especially those susceptible to dieback and those growing in locations known to be susceptible to erosion.**

2. **Set up an herbarium, with emphasis on the priority flora, within the Park.**

3. **Ensure that all information regarding the flora in FRNP, particularly the priority species, is stored in the CALM district office at Albany. Ensure that these records are consulted and appropriate action taken before development or management actions are undertaken.**

4. **Develop an ongoing exchange of information with the public regarding rare flora management, given the proviso that CALM is obliged to keep the location of rare flora confidential.**

5. **Plant nursery-raised specimens, with due regard for dieback hygiene, if necessary to enhance a rare species' chance of survival.**

Research and Monitoring

6. **Survey areas proposed for management activities for rare flora prior to the activity commencing.**

7. **Carry out detailed surveys within the Park and adjacent areas to locate other populations of priority flora (Table 8). Give priority to the Barren Ranges and areas likely to be disturbed.**

8. **Research the response to disturbance (such as dieback, fire, soil disturbance, weeds, grazing), reproductive biology and taxonomy of the priority flora.**

9. **Encourage surveys of the distribution, and research into the taxonomy, of the 250 important species identified by Chapman and Newbey (in prep.).**

TABLE 8. PRIORITY FLORA

1. Endemic, possibly rare, known from 5 or less populations and probably susceptible to dieback (Nos. of populations given In brackets)

SPECIES	LOCATION
**Adenanthos dobagii (3)*	*SP*
**Adenanthos ellipticus (1)*	QR
Brachyloma sp. KRN 11111 *(2)*	CD, IN, QR
Grevillea fistulosa (3)	QR
**Grevillea infundibularis (2)*	QR
Leucopogon lloydiorum (1)	*UP*
Leucopogon sp. KRN *4038 (5)*	QR
Leucopogon sp. KRN *4389 (1)*	*SV*
Styphelia sp. KRN *8266 (1)*	*SP*
**Verticordia aff. helichrysantha* (KRN *2763)*	*(2) SV*

2.Endemic, possibly rare and known from 1 population.

SPECIES	LOCATION
Acacia phlebopetala var. *pubescens*	*PS,* QR
Charnelaucium sp. KRN *2650*	*SP*
**Coopernookia georgei*	QR
Dampiera sp. KRN *11143*	QR
Gonocarpus hispidus	QR
Goodenia barilletti	QR
Goodenia sp. KRN *11369*	*UP*
Goodenia sp. KRN *1726*	RS
Goodenia stenophylla	QR, UP
Gyrostemon sessilis	*SV*
Kunzea sp. KRN *11119*	QR
Mirbelia sp. KRN *11203*	*UP*
Olearia sp. KRN *10843*	CD
Pimelea longiflora ssp. eyrei	QR
Plalysace sp. KRN *4852*	QR
Pomax sp. KRN *11459*	QR
Pultanaea sp. KRN *11012*	*SP*
Spyridium sp. KRN *5007*	*UP*
Styphelia sp. KRN *8266*	*SP*
**Verticordia helichrysantha*	*SP*
Verticordia cf. *helichrysantha* (KRN *9739)*	*SV*
Verticordia aff. harveyi (KRN *11120)*	QR

3. Endemic, declared rare and known from 5 or fewer populations.

SPECIES	LOCATION
**Acacia argutifolia (5)*	QR
**Eremophila denticulata (2)*	RS
**Eucalyptus burdettiana (2)*	QR
**Eucalyptus coronata (3)*	QR
**Lechenaultia superba (4)*	QR
**Stylidium galioides (5)*	QR

4. Declared rare, not endemic and known from 5 or fewer populations in the Park.

SPECIES	LOCATION
**Eremophila serpens*	RS
**Myoporum salsoloides*	*UP*
**Ricinocarpus trichophorus*	*SV*
**Thelymitra psammophila*	*UP*

	No. of Priority Sp.	%
SP: Plains	*6*	*14*
SV: Valleys	*5*	*12*
QR: Ranges	*21*	*50*
RS : Rivers, swamps and lakes	*3*	*7*
UP: Upland	*7*	*17*
CD: Dunes	*2*	*5*
IN : Inlets	1	*2*

* :declared rare

Endemic: 100% of known populations confined to FRNP

Possibly Rare : fewer than 1000 plants known in conservation reserves or few populations (K. Newbey field data)

KRN : collection number of K. Newbey for a voucher specimen deposited in the W.A. Herbarium.

7.3 FAUNA

The objectives are:

1. *Protect existing species, in particular those declared rare and in need of special protection.*
2. *Re-introduce native animals that once occurred within the Park if resources are available and if research findings indicate no disadvantages to the Park.*

Background

The Park has more species of vertebrate fauna than any other conservation reserve in south-west Australia. It has 22 species of native mammals (7 declared rare), 184 species of bird (3 declared rare and 2 declared in need of special protection), 41 species of reptile (1 declared in need of special protection), 12 species of frog and 4 species of inland fish (Chapman and Newbey, in prep.).

The very high number of vertebrates present is partially due to an overlap of and region species and those adapted to moister conditions. The Park also forms part of a corridor of uncleared vegetation from the coast to the southern wheatbelt and Goldfields (Watson, 1991). The large size of the Park and lack of widespread habitat degradation, such as frequent burning and grazing by stock, enhance these values (Chapman and Newbey, in prep.). Habitats can be degraded by dieback.

There is a concentration of rare fauna in the northern upland (Table 9). This faunal richness is associated with three factors (Chapman and Newbey, in prep.). First, the upland corresponds with the Archaean shield which underlies much of the wheatbelt. Much of the fauna is a remnant of a formerly widespread and richer wheatbelt fauna. Second, habitats exist in a tight mosaic of soil/vegetation types due to the presence of granitic outcrops and numerous minor watercourses. Third, some of the soils are not as extensively weathered and leached as those on the southern plains, and thus have a higher nutrient status.

Therefore, the northern part of FRNP is a small remnant of a formerly widespread and rich faunal area. Today, it is likely that species continue to disperse, perhaps via river valleys, from the upland to the southern plains and elsewhere.

A Ministerial permit must be obtained before rare fauna can be disturbed or removed.

Mammals

The mammals of the Western Australia wheatbelt have declined considerably since European settlement. This decline has been attributed to a number of factors, including clearing, feral cats, foxes, grazing, introduced diseases and changes in fire regimes. The loss of 40% of mammal species from FRNP is comparable with an overall loss of 42% in the whole wheatbelt (Kitchener *et al.,* 1980).

However, in the case of FRNP all remaining fauna species are on one piece of land managed by a single authority.

Of the 22 species of native mammal still present, eight are at risk according to Burbidge and McKenzie (1989). These are the seven declared rare species (Table 10) plus Mitchell's Hopping-mouse *(Notomys mitchelli).* This last species appears to be rare in FRNP. Research elsewhere in Western Australia has implicated the fox as an important factor adversely affecting the conservation of mammals (J. Kinnear, CALM Research Division, pers. comm., 1989).

Rare Mammals

The status and known habitat requirements of the seven declared rare species are given in Table 10.

TABLE 9. NUMBER OF NATIVE VERTEBRATE SPECIES PER LANDFORM

LANDFORM	AREA	BIRDS		MAMMALS+		REPTILES		AMPHIBIANS
	(ha)	No. Sp.	Dec. Sp.	No. Sp.	Dec. Sp.	No. Sp.	Dec. Sp.	No. Sp.
Upland	87300	77	3	16	6	27	1	9
Plain	166400	70	2	9	2	24	---	12
Valleys	45300	64	2	9	1	21	---	8
Ranges	39000	42	3	5	1	24	1	4
Dunes	6760	47	1	7	---	21	1	8
Inlets	negligible	102	2	7	---	---		--
Rivers, swamps and lakes	negligible	123	3	7	---	2	---	11
TOTAL		**184**	**5**	**22**	**7**	**41**	**1**	**12**

+ excludes bats

TABLE 10. DECLARED RARE MAMMALS

COMMON NAME	SCIENTIFIC NAME	GENERAL DISTRIBUTION AND STATUS	FRNP DISTRIBUTION AND STATUS	LANDFORM	HABITAT PREFERENCES FRNP
Woylie	*Bettongia* penicillata	Restricted to isolated pockets in southwest W.A. and eastern QLD. Rare.	Only one record from north-west comer of FRNP.	Upland	Clumped low, woody scrub.
Tammar Wallaby	*Macropus eugenii*	Disjunct populations in south west W.A. and southern S.A. Also found on several offshore islands. Common, limited.	Occur in very low numbers, and are scarce in the northwest of FRNP.	Upland	Tight mosaic of woodland and denser, low vegetation associated with watercourses. Often associated with *Allocasuarina campestris* ssp. *campestris* shrubland.
Dibbler	*Parantechinus apicalis*	Limited populations in south west W.A. Colonies known from Boullanger Island, Cheyne Beach, Torndirrup, FRNP and Ravens-thorpe Ranges. Rare, limited.	Readily located at several sites. Moderately common resident at these limited sites.	Upland Plains	Very open mallee over loamy sand, long unburnt vegetation (greater than 37 yrs) (Chapman and Newbey, in prep).
Red-tailed Wambenger	*Phascogale calura*	Known from several localities in the southern wheatbelt of of W.A. Common, limited, at risk.	Recorded from two locations in northwest of FRNP.	Upland	Long unburnt stands of *Allocasuarina huegliana.*
Western Mouse	*Pseudomys occidentalis*	Endemic to southwest W.A. Limited distribution in south-east wheatbelt north to Hyden, east to Ravensthorpe and west to Tambellup. Common, limited, at risk.	Occur in small area in northwest of of FRNP. Moderately common resident.	Valleys Upland	Very open mallee over loamy sand or fine sandy loam.
Heath Rat	*Pseudomys shortridgei*	Restricted to dry heathlands in	Present in low numbers in east	Upland	Very open mallee or heath

		southwest Victoria, and Ravensthorpe Range and FRNP in southwest W.A. Rare, limited.	and northeast FRNP. Uncommon resident.	Plains	over loamy sand, or mallee over loamy sand, long unburnt vegetation (greater than 37 yrs) (Chapman and Newbey, in prep).
Southern Brown Bandicoot	*Isoodon obesulus*	Restricted to dense scrub in south-west W.A., southern Victoria and Tasmania. Common, limited.	One record from northern FRNP and another from near West Mt Barren.	Upland Ranges	Dense, scrubby habitat or low ground cover. Also open mallee on sandy loam.

Chapman and Newbey (in prep.) found a correlation between the presence of rare fauna, time elapsed since last fire and areas underlain by granite (ie. the northern part of the Park Table 9). More research is required before definitive conclusions are drawn.

Birds

One hundred and eighty-four species of bird have been recorded in the Park. Bird richness is due to the wide diversity of habitats. The areas with the most birds are the wetlands, (coastline, rivers and inlets) followed by the upland and plains (Table 9). The wetlands are dominated by woodland, which has been identified by Kitchener *et al.* (1982) as being particularly important to birds in the Western Australian wheatbelt.

Although woodlands occur on all landforms in FRNP, they are very limited in distribution. The woodlands of swamp yate (*Eucalyptus occidentalis)* in drainage lines offer the only possible nesting sites for a number of species including owls, parrots and striated pardalotes. These areas are also favoured for camping.

The Barren Ranges do not appear to provide any unique habitat for birds.

In FRNP, birds appear to have a protracted breeding season (Chapman and Newbey, in prep.). The peak breeding months of October and November correlate with peak flowering in October (Section 7.2 Flora). May and June are the only months with no recorded breeding activity.

The high salinities of the Park's water bodies are tolerated by most species of duck, particularly the Chestnut Teal. The only exceptions are the Hardhead, Pink-eared Duck, and Blue-billed Duck which have only been recorded from the large, permanent, fresh waters of the Hunter River and Cardiminup Swamp outside the Park.

Rare Birds

Five species of birds declared rare or in need of special protection occur in FRNP. Their distribution and status are given in Table 11. The most vulnerable are the Ground Parrot, Western Bristlebird and Western Whipbird. The largest numbers of all three have been recorded in the northern upland of FRNP (Chapman and Newbey, in prep.).

Reptiles

The reptile fauna of the Park is less diverse than that of similar sized areas in the semi-arid and and zones, with 41 species in the Park, compared with 60-70 species elsewhere. Chapman and Newbey (in prep.) implicate the south coast climate, with its rapid temperature changes and frequent summer cloud cover, as the limiting factor. These rapid changes can result in reptiles, particularly the young of that season, dying. The species present are probably those that can grow fast enough to reach a

sufficient body weight to survive summer temperature changes and maintain metabolism during winter hibernation.

In the Park, the upland contains the greatest number of reptile species (Table 9) followed by the plains and ranges. Very open mallee across all landforms contains more species than any other vegetation, due probably to its occurrence on deep sandy soils.

Fallen timber is also important as it creates structural complexity and refugia for reptiles (Chapman and Newbey, in prep.). Thus, cool and patchy fires outside the breeding season favour reptiles. Reptiles have considerable capacity to survive wildfires by burrowing or using non-flammable refuges.

Rare Reptiles

Only the Carpet Python is declared in need of special protection, but it is considered secure within its range (Table 11).

The Long-necked Turtle *(Chelodina oblonga)* occurs at its most easterly limit in the Park. Normally regarded as a freshwater turtle, this species is known to tolerate, but only for short periods, brackish and even saline water with salinity levels as high as 13 200 mg/L (Chapman and Newbey, in prep.). Present salinity levels in the Park's rivers are close to this species' upper limit of salinity tolerance. Increases in salinity are, therefore, likely to cause its local extinction.

Amphibians

Twelve species of frog have been recorded from the Park. This richness is a result of an overlap of and region species and those adapted to moister conditions. Ten of the twelve species are endemic to the south-west of Western Australia. None of these is declared rare.

The plains and rivers, swamps and lakes support the greatest number of species (12 and I I respectively). This is because of the presence of deep sands for burrowing and swamps with ephemeral freshwater. Frog distribution and abundance is controlled more by these factors than by vegetation type. Although all species disperse widely, even into habitats without water, all except *Myobatrachus gouldii* require ponded water for breeding.

The size of the Park and its relative integrity seem to provide adequate conservation protection for its frogs.

TABLE 11. BIRDS AND REPTILES DECLARED RARE OR IN NEED OF SPECIAL PROTECTION

COMMON NAME	SCIENTIFIC NAME	GENERAL DISTRIBUTION AND STATUS	FRNP DISTRIBUTION AND STATUS	LANDFORM	HABITAT PREFERENCES FRNP
DECLARED RARE					
Western Bristlebird	*Dasyornis longirostris brachypterus*	W.A. subspecies restricted to area between Two Peoples Bay and Hopetoun in south-west W.A. Rare, limited, at risk.	Present in low numbers on the northern boundary of FRNP. Uncommon resident.	Upland Valleys	Very open mallee or heath with a dense shrub layer between 30 - 100 cm, long unburnt vegetation (greater than 15 yrs) (Smith, 1985).
Ground Parrot	*Pezoporus wallicus flaviventris*	W.A. subspecies restricted to Fitzgerald River and Cape Arid National Parks. Rare, limited, at risk.	Present in very low numbers. Scarce resident in FRNP. FRNP appears to contain majority of W.A. population.	Upland	Very open mallee, with mid-dense under storey (less than 1m high), and low sedge with at least 10% canopy cover, long unburnt vegetation (greater than 16 yrs) (Chapman & Newbey, in prep).
Western Whipbird	*Psophodes nigrogularis nigrogularis*	W.A. subspecies restricted to area between Two Peoples Bay and Ravensthorpe Range. Rare, limited, at risk.	Readily located in FRNP. Common resident in FRNP.	Upland	Varied habitat of mallee, very open mallee shrubland and tall heath. Usually 25 - 50% canopy cover of plants in 40 - 60 cm height range. Long unburnt veget ation (greater than 20 yrs) (Smith, 1985).
DECLARED IN NEED OF SPECIAL PROTECTION					
Peregrine Falcon	*Falco peregrinus*	Distributed over the greater part of the continent but is nowhere abundant. Common, at risk.	Only one record from upper Fitzgerald River. Rare, vagrant to FRNP.		Inland tree-lined watercourses, mountainous country and cliffs.
Red-eared Firetail	*Stagonopleura oculata*	Endemic to southwest W.A. north to the Darling Range and east to Cape Le Grand. Common, limited.	Readily located in FRNP. Common resident.	Rivers, swamps and lakes	Densely vegetated gullies, heath where there is thick, damp vegetation, river complex and creek fringes.
Carpet Python	*Morelia spilota imbricata*	Southwest W.A. north to Geraldton, Yalgoo, east to Pinjin, Norseman and Cape Le Grand. Also found on several offshore islands. Common, limited.	Uncommon restricted species known from several locations in FRNP.	Upland Ranges Dunes	Varied habitat preferences.

Fish

Species found in the Park include the Spotted Minnow *(Galaxias maculatus),* Hardyhead *(Atherinidae sp.),* Swan River Goby *(Pseudogobius olorum)* and Black Bream *(Acanthopagrus butcheri).* All are salt water species.

The Fitzgerald, Hamersley and Phillips Rivers support all four species. The Swan River Goby is the most widespread and abundant inland fish. Hardyheads and bream are more dependent than the other two species on deeper, less saline and more permanent pools.

The introduced Mosquito Fish *(Gambusia affinis),* which has the potential to outcompete native fish, is present in Western Australia from the Hutt to Pallinup, Rivers (Mees, 1977), but is not yet present in the Park. In the Pallinup it can withstand salinities to 13 000 mg/L (Scott, 1975). As the Pallinup and Gairdner Rivers share a common watershed in the vicinity of Jerramungup, there is potential for its spread into the Park's rivers.

Invertebrates

Past surveys for invertebrates in the Park have focused on specific orders of insects, or occurred as part of more widespread collection efforts over the region. Specific orders collected include ants and bees (Hymenoptera), flies (Diptera), moths and butterflies (Lepidoptera), beetles (Coleoptera) and grasshoppers (Orthoptera). Some collection of land snails, molluscs and spiders has also been carried out.

An extensive survey of all invertebrate types has not been conducted; however, the Park is known to contain at least 43 families from various orders. The Buprestidae (jewel beetles) are protected and a Ministerial permit is required for their collection.

PRESCRIPTIONS - GENERAL

1. **Protect habitats from dieback (Section 9.1), inappropriate fire regimes (Section 9.2) and human disturbance.**

2. **Control introduced species which are damaging, or could potentially damage, native fauna (9.3 Animal Pests and 9.4 Weeds).**

Research and Monitoring

3. **Identify and research keystone species (these are species that, if removed, will precipitate community collapse) to develop knowledge of community response to disturbances such as dieback, fire, recreation use and management actions, and of general community changes over time.**

PRESCRIPTIONS - RARE SPECIES

4. Priorities for the protection of rare mammals are the heath rat, dibbler, woylie, tammar and western mouse. Priorities for rare birds are the Ground Parrot, Bristlebird and Whipbird. These priorities are based on each species' status and distribution in FRNP and elsewhere.

5. Use the results of the investigations in Prescriptions 7 and 8 below to determine and implement the processes required, such as predator control and fire management, to maintain or improve populations of rare species.

6. Reintroduce former known rare fauna inhabitants if resources are available. Before any reintroductions are considered, the likely impact on existing fauna should be thoroughly understood.

Research and Monitoring

7. Investigate habitat requirements and ecology of rare species by:

a. conducting comprehensive surveys to determine broader distribution

b. studying each species to determine which habitats, including vegetation structures, compositions and fire ages, are used

c. studying life history characteristics of each species

d. determining the appropriate fire regime for each species.

8. Investigate the impacts of predation by introduced carnivores by baiting foxes in part of the Park for 3-4 years. Monitor small mammal and fox populations in both baited and unbaited parts of the Park to determine the effects of baiting. Identify prey species from fox stomach and gut analyses. Determine effective control mechanisms. Use the research findings to guide future management.

9. Update existing data on the Park's invertebrates. Subject to resource availability, carry out invertebrate surveys, and investigate the effects of fire and dieback on invertebrate communities.

8.0 CULTURAL RESOURCE MANAGEMENT

8.1 ABORIGINAL

The objectives are:

1. *Protect Aboriginal cultural features within the Park.*
2. *Allow for involvement of Aboriginal people as is consistent with the South Coast Regional Management Plan.*

Background

The Park area was extensively used by Aborigines. Tribes known from the region included the Mongup, Corackerup, Quaalup and Bremer Bay groups. Ethel Hassel of Jerramungup wrote in the 1870s of the 'Wheelman tribe' who centred their traditional area around "Jarramongup" Station, including the Twertup area.

The majority of known sites are archeological, mostly artefact scatters. These vary in size from isolated single artefacts to major sites with up to 1 000 artefacts. Most sites are located on level ground or on small rises with all-round views. Sites are either on the coast or associated with watercourses and swamps (Bird, 1985). Stone arrangements also exist. Limited information can be drawn from surface scatters. There is a need to locate and excavate stratified sites. These would give a better understanding of Aboriginal occupation in the area.

Recently, Aboriginal people have shown an interest in reestablishing cultural links with areas on the south coast that their ancestors previously inhabited. Closer cooperation and involvement of Aboriginal people should lead to a better understanding of the spiritual links and cultural aspirations in the area.

PRESCRIPTIONS

1. **Promote opportunities for continued consultation with Aboriginal people on matters of cultural interest as is consistent with the South Coast Regional Management Plan.**

2. **Survey for Aboriginal sites any areas to be developed prior to work commencing. Protect all identified sites during all operations.**

3. **Report immediately to the W.A. Museum any artefacts or materials found. The confidentiality and management of all sites is subject to guidelines and procedures established by the W.A. Museum.**

4. **Incorporate information on Aboriginal occupation and use in interpretive programs for the Park (see 16.0 Information, Interpretation and Education).**

Research and Monitoring

5. **Continue to investigate traditional Aboriginal knowledge of the area.**

6. **Encourage the W.A. Museum and other professional archaeologists to further study Aboriginal occupation and use of FRNP.**

8.2 EUROPEAN

The objective is to protect European cultural features within the Park.

Background

A number of European activities have focused on the Park area, including sealing and whaling, pastoralism, mining and agriculture.

In the early 1800s, whaling and sealing concentrated on the Doubtful Islands and Bremer Bay areas. In 1848, James Drummond travelled through the area and recognised its botanical value. At about the same time, Roe found lignite (brown coal) deposits in the Fitzgerald valley, beginning over a century of interest in the area's potential for mining.

Pastoralism and grazing in the Fitzgerald area began when John Hassell acquired "Jarramongup" in 1850. Soon after, John Wellstead squatted at "Quaalup". He built Quaalup homestead, which is located just outside the Park's boundary, in 1858. Ruins of a shepherd's hut, built by the Wellsteads, still remain near Fitzgerald Inlet. Sheep were regularly grazed along the Fitzgerald River. The Phillips and Gairdner Rivers were used as stock routes to the coast. In 1868, John and George Dunn brought the first sheep to Cocanarup and began permanent settlement.

Ruins of various homesteads, including the Parsons, King, Neil and Waters families can be found in the eastern end of the Park.

The Western Australian section of the East/West Telegraph Line was completed in 1877 after commencement in 1875. Sections of the accompanying service track are still in use today for access to parts of the Park. The Bremer Bay station was closed down in 1929 when the telegraph line was re-routed inland from Balladonia direct to Perth.

The search for prospective mineral fields brought many people to the area. The Ravensthorpe mineral period commenced in 1898 when the Dunn brothers found gold in the Phillips River. Copper and gold production in Ravensthorpe increased in the early 1900s. The remains of a copper and manganese mine on Copper Mine Creek are still visible. The remains of an early twentieth century (c. 1910-1920) head frame, associated with the search for oil is located near Jonacoonack on the Fitzgerald River. Nearby are a number of hut sites and a small dam. The Depression signalled the closure of smelters, however, and many people left the district. Some stripping of mallet bark occurred near Point Charles in the 1920s. In the 1930s, a temporary revitalisation of the mining industry around Kundip occurred with the establishment of a number of mines.

The No. 2 Rabbit Proof Fence was completed in 1905. It was abandoned in the 1960s, with the length between Nyabing and Point Ann being the last persisting section. The Fence ran from Point Ann on the south coast, 1 158 km (724 miles) to north of Yalgoo, where it swung north-east to join the No. 1 Fence. Although no longer functional, parts of the fence still remain in the Park (L. Sandiford, 1988).

Grazing leases were held along the Phillips and West Rivers and there was considerable grazing of bush areas. Farming around Hopetoun commenced with the first farm on the east bank of Culham Inlet. There was little further agricultural expansion in the area until the 1950s.

Following World War II, the era of clearing and broad acre cultivation saw an average of over 400 000 hectares State-wide released for farming every year until 1969. Most of the land allocated by the War Service Land Settlement authorities was in the Gairdner region. In light of this rapid clearing, the W.A. Naturalists' Club suggested that the area now comprising the National Park should be given legal protection. In 1950, the Minister for Lands gave his approval for the creation of the Fitzgerald Flora and Fauna Reserve and in 1954 the reserve was gazetted and given Class C status.

In 1965, a mining claim for building stone was granted on the western edge of the Fitzgerald River, near Twertup Creek. Horry Worth, a local identity, quarried blocks of spongolite out of the gorge wall. A small house, now the Twertup Field Study Centre, was built from spongolite at the quarry site.

A local commercial fishermen, D B Collett, applied for a fishing lease at Point Charles in 1968. Prior to this application, Collett cleared 12 km of track through what subsequently became the Park. The remains of his large concrete trough used for cleaning salmon can still be seen at Fitzgerald Inlet.

The late 1960s saw a Statewide boom in the mining industry and in 1970, a temporary ban was imposed withholding vacant Crown land from pegging. This ban did not include national parks and nature reserves. Consequently, about 12% of the Reserve was pegged for various minerals: kyanite, coal, copper, kaolinite, diatomite, quartzite and mineral sands. After a period of negotiation and

debate, particularly over the claim by Jupiter Minerals to mine coal for its montan wax content, the mining claims were disallowed and Fitzgerald River National Park was declared an A Class Reserve in 1973, and vested in the National Parks Board.

PRESCRIPTIONS

1. **Provide interpretive material on-site regarding the history Twertup house and quarry, the Wellstead ruins and other sites of historic interest. If use of any of these sites appears to be leading to site degradation take the necessary management actions.**

2. **Assess the condition of existing historic sites and take action as necessary to preserve them.**

3. **Reconstruct parts of the rabbit proof fence and telegraph line. Incorporate their interpretation and enjoyment as part of broader interpretive programs and systems of footpaths.**

4. **Incorporate information on structures associated with the area's mineral history in the Park's interpretive programs (16.0 Information, Interpretation and Education).**

5. **Implement safety measures, where possible, at potentially hazardous locations such as abandoned mine shafts.**

9.0 PROTECTION MANAGEMENT

9.1 DISEASE

The objectives are:

1. *Prevent the introduction of dieback and other diseases into disease-free areas.*
2. *Control the spread and intensification of, and where possible eradicate, dieback and other diseases where they are already present.*

Background

Dieback Disease

The greatest management concern in FRNP is dieback, the common name given to the disease caused by introduced microscopic soil-borne fungi, principally *Phytophthora cinnamomi.* The fungus produces small motile spores which are spread in water and wet soil. It will also survive in soil and plant material. The fungus infects plant roots and as the fungus establishes it rots the roots and stem tissue, resulting in death due to water stress. Plants such as banksia die rapidly after infection, but trees such as jarrah often die slowly, hence the common name for the disease -"dieback". The most likely way in which dieback is spread is in infected soil. This soil may be moved by earthworks, or on the wheels and underbodies of vehicles. It can also be spread by other means, such as in mud on shoes, or flowing water.

FRNP is at risk from dieback disease for several reasons. First, the area's warm, relatively moist climate favours the production of fungal spores, particularly after summer rains. The average number of raindays for Bremer Bay and Ravensthorpe is 118 and 109 respectively and occasional summer storms can bring 100 mm. of rain to both coastal and inland areas. This means that if dieback is introduced, it is highly likely to survive and spread rapidly in the warm moist conditions.

Second, clays which are a significant component of the soils, particularly the duplex soils of the southern plains, impede drainage. Subsurface ponding provides a suitable environment for the production of spores. Ponding also results in muddy conditions which cause infected soil to adhere to vehicles. An impeding clay layer also means that water tends to drain laterally, spreading the fungus further.

Third, the fungus is known to attack a wide range of plant species. The Proteaceae, Epacridaceae, Myrtaceae and Papilionaceae families, which together dominate many of the Park's plant communities, are particularly susceptible. Various members of these families are known only from Fitzgerald River National Park. For example, the Barren Ranges have a number of susceptible species known only from the Ranges.

Fourth, the Park has substantial populations of honey possums and honeyeaters. Both rely on flowering plants, many of them from the above families, for food. The honey possum, being far less mobile than the honeyeaters, is particularly dependent on a continuing local supply of nectar and pollen.

Fifth, the Park is generally reached via gavel roads of uncertain dieback status and management. CALM has no control over the dieback status of roads outside the National Park and therefore has no control over the potential of vehicles to carry dieback and infected soil under wet conditions. This makes vehicle cleanliness a critical issue.

Cost-effective techniques for eradication once the fungus is well-established are as yet unknown. Therefore, every effort must be made to protect the flora in the areas still free from dieback. The only effective protection, other than quarantine, is the continued use of measures designed to limit the artificial introduction and spread of the disease (hygiene measures).

A dieback hazard map for the Park has been produced. This map shows the different susceptibilities of different vegetation communities to dieback. Most of the Park has at least a moderate to high dieback hazard rating (Map 7b). This map should be regarded as a general guide, as detailed information is not yet available regarding the degree of susceptibility of many individual plant species in FRNP. Also, the interaction between the fungus and the environment (eg. position in the landscape, effects of impeded drainage and soil parent material) is still poorly understood on the south coast.

Therefore, a very conservative and consistent approach needs to be adopted. Every possible measure must be taken to preclude further spread, or spread to presently uninfected areas in the Park. It can not be stressed too strongly that the vegetation and recreation values of the Park are largely dependent on retention of the vegetation, much of which is susceptible to dieback disease. Experience in other areas of the south-west has shown that spore survival is minimised on well-drained, hard-surfaced roads. They limit the opportunity for infected soil to be picked up or spread by vehicles.

All south coast national parks from Walpole to Cape Arid are infected by dieback to some degree. Current knowledge indicates that Fitzgerald River National Park is the least infected Park in south-west of Australia.

Three species of *Phytophthora* are known from the area (Map 7b). These are *P. cinnamomi, P. citricola* and *P. megasperma* (var. *megasperma* and var. *sojae).* The most aggressive of these appears

to be *P. cinnamomi.* Until more is understood of the potential of each species, it should be assumed that all have equal destructive ability.

There are two confirmed *Phytophthora cinnamomi* infections, two confirmed *P. megasperma* infections and one confirmed *P. citricola* infection within the Park (Map 7b). *P. cinnamomi* has been identified near the Ranger station at Jacup, in association with the old rabbit proof fence. A major infection is located on Bell Track which was illegally constructed in 197 1. The area infected is greater than 6 km long and was originally described as a. linear infection. However, it has spread considerably and is now present in the Dempster catchment to the east and the Susetta Creek catchment to the west of Bell Track. *P. megasperma is* present at two locations along Hamersley Drive. The infection which originated in the old gravel pit on East Mount Barren has severely affected the *Banksia speciosa* population in this area. The disease has also spread along the southern side of East Mount Barren, along the old track alignment. *P. citricola* has been positively identified on Pabelup Drive near Twertup Track turnoff.

In addition, there is now considerable concern regarding widespread distribution of dieback in the Park. Much of the early survey and sampling conducted in the Park was based on experience from elsewhere in the south-west. This approach required considerable time on some sites to positively establish that *Phytophthora* was causing plant death. Methods more appropriate to the Fitzgerald, for confirming the presence of dieback fungus, are being developed. Areas in the Park, originally identified as potential dieback infections but not confirmed by early sampling, will continue to be regarded as suspect (Map 7b).

There are also other known *Phytophthora* infections adjacent to the Park. *P. cinnamomi* occurs in a disused gravel pit on Highway 1, to the east of Mallee Road, and in a pit on Mallee Road. *P.* citricola is also present in the pit on Mallee Road. These infections are in the catchment of the Fitzgerald River.

P. megasperma is present in Dunn Swamp on the eastern side of the Hopetoun-Ravensthorpe Road and along the Southern Ocean West Road on the eastern access to the Park.

Honey-Fungus (*Armillaria luteobubalina)*

This fungus has spores borne on gills, similar to a mushroom. The fruiting body is 12-15 cm across and golden yellow, generally growing in clumps on tree bases or stumps. A white mycelium mat is formed under the bark at the base of the affected tree. The fungus appears in the wetter months of the year (June/July). *Armillaria* spp. feed on new wood and bark, eventually girdling and killing their host. They have a large host range and are widespread throughout the world.

Unlike *Phytophthora cinnamomi, A. luteobubalina is* naturally occurring in the southwest. However, the method of spread is not. In an undisturbed environment the fungus spreads by infected roots growing towards and touching uninfected roots or by fungal hyphal growth, both slow processes. Air-borne spores landing on damaged bark may also establish infections. However, with the advent of large scale movement of soil and associated root material and wood, as part of management and construction works, the probabilities of spread are greatly increased. This enhanced spread involves the movement of fist-sized or larger pieces of root or infected woody material.

Armillaria luteobubalina has been recorded from Dunn Swamp and from two locations in the Park (Map 7b). Surveys for its presence are continuing.

PRESCRIPTIONS

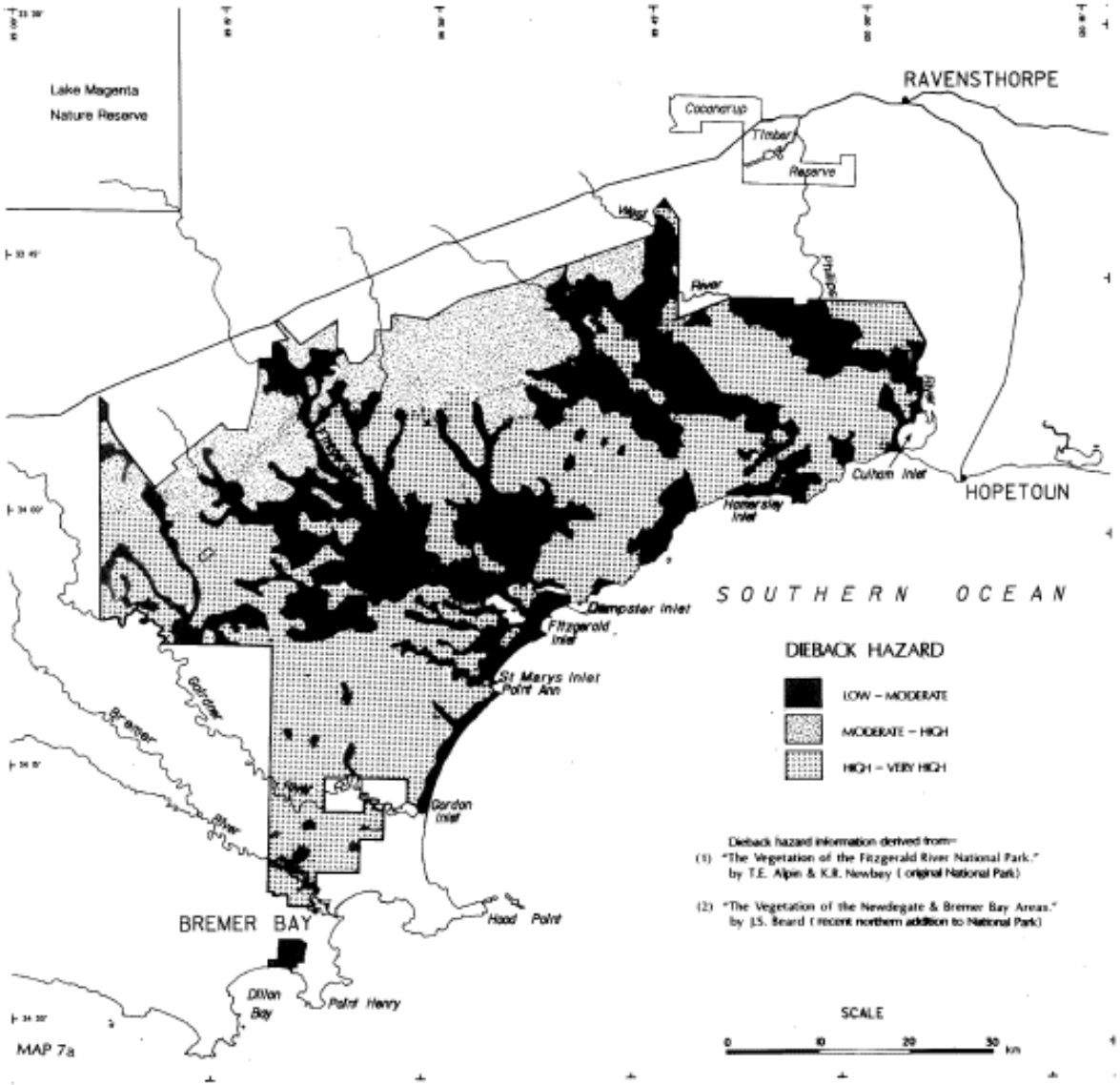
1. **Produce a dieback hygiene map (a map showing dieback distribution and risk of natural spread) for the Park, with particular emphasis on roads, tracks and paths. Use research and monitoring findings to regularly update this map.**

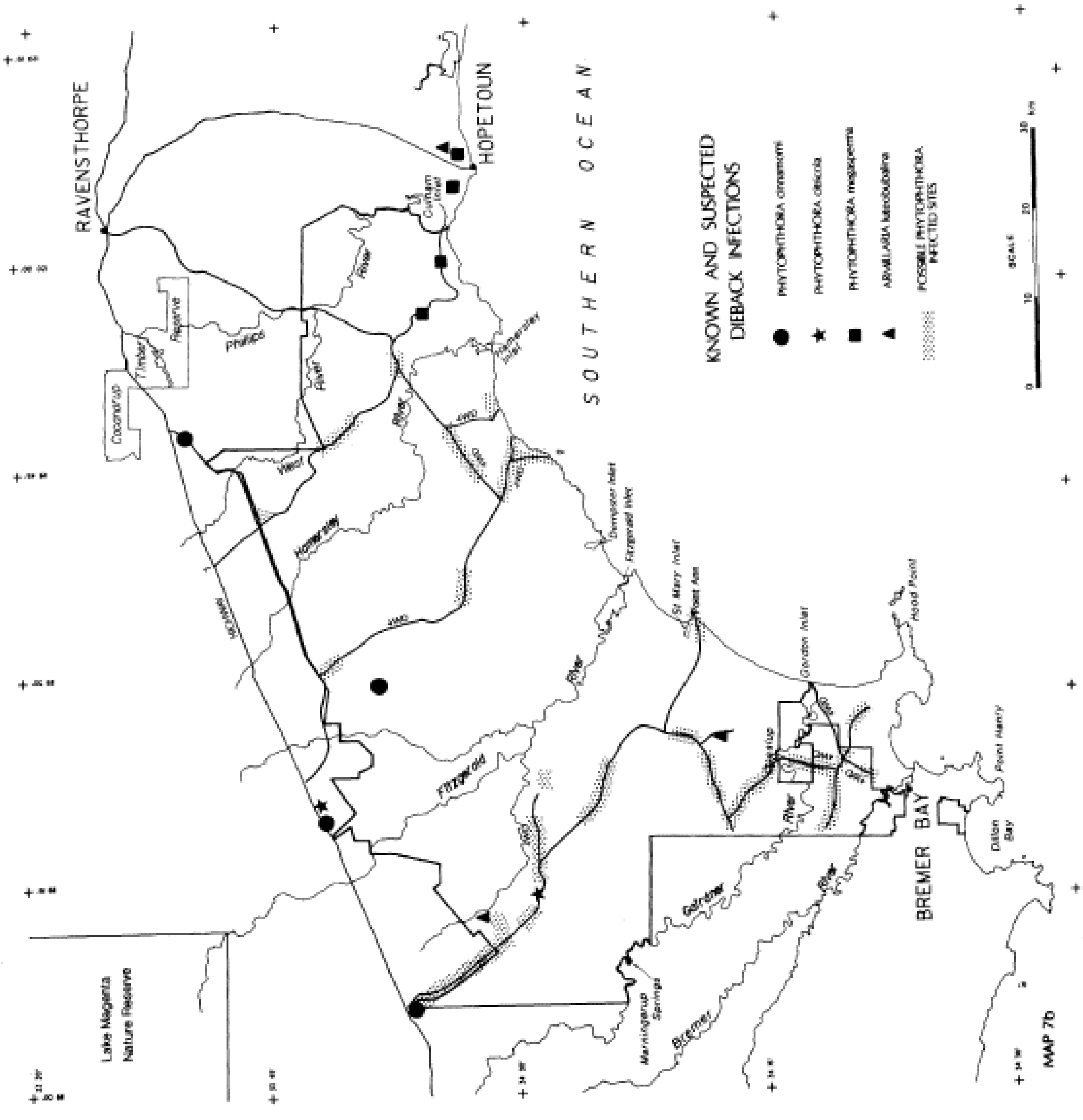
2. **Use this hygiene map and the hazard map (likely impact of dieback on the vegetation) given in this plan (Map 7a) as the primary consideration in any management activities undertaken in the Park. Use these maps as the basis of access management (refer to 13.0 Access). Use research and monitoring findings to regularly update the hazard map.**

3. **Subject all proposed maintenance and development activities to an evaluation of consequences of the activity (CALM Seven Way Test).**

4. **In all operations follow the hygiene practices given in the CALM Dieback Hygiene Manual. Continue to ensure that all staff and visiting scientists working in the Park follow dieback hygiene procedures. Develop new procedures as necessary.**

5. **Continue to ensure that staff associated with the Park are comprehensively trained in dieback recognition, sampling and management techniques.**


Lake Magenta
Nature Reserve
RAVENSTHORPE
Cocanarup
Timber
Reserve
River
Culham Inlet
HOPETOUN
Hamersley
Inlet
SOUTHERN OCEAN
Dempster Inlet
Fitzgerald
Inlet
St Marys Inlet
Point Ann
Gairdner
River
Gordon
Inlet
BREMER BAY
Hood Point
Dillon
Bay
Point Henry
MAP 7a
DIEBACK HAZARD
LOW – MODERATE
MODERATE – HIGH
HIGH – VERY HIGH
Dieback hazard information derived from:-
(1) "The Vegetation of the Fitzgerald River National Park."
by T.E. Alpin & K.R. Newbey (original National Park)
(2) "The Vegetation of the Newdegate & Bremer Bay Areas."
by J.S. Beard (recent northern addition to National Park)
SCALE
0
10
20
30
km


RAVENSTHORPE
HOPETOUN
SOUTHERN OCEAN
KNOWN AND SUSPECTED DIEBACK INFECTIONS
PHYTOPHTHORA cinnamomi
PHYTOPHTHORA citricola
PHYTOPHTHORA megasperma
ARMILLARIA luteobubalina
POSSIBLE PHYTOPHTHORA INFECTED SITES
BREMER BAY
Lake Magenta Nature Reserve
MAP 7b

6. **Exclude public vehicles from the Dempster, 'Lake Nameless' and three small coastal catchments (Twin Bays, Red Islet and Marshes) in the centre of the Park to reduce the risk of dieback introduction and/or spread to the lowest possible levels. For further details refer to 9.2 Fire and 13.0 Access.**

7. **Ensure that 2WD roads, 4WD tracks and paths are well-located and welldrained to minimise the chances of disease survival and spread. Ensure 2WD roads are all-weather. Treat as a priority upgrading sections of road which do not meet these standards.**

8. **Close roads, tracks and footpaths in the Park during/following rain, if they present a dieback risk. Implement closure in accordance with guidelines developed by District staff based on when vehicles can pick up soil/mud from road, track and path surfaces.**

9. **Close Mid Mt Barren, Woolbernup Hill and Thumb Peak to walkers because of the potential dieback risk and the botanical importance of these areas. Prescription 9 in 13.0 Access gives a more detailed explanation. Place explanatory signs at appropriate points.**

10. **If dieback is found on roads, tracks or footpaths, one or more of the following actions will be undertaken:**
    a. **closure (temporary after rain as outlined in Prescription 8, or permanent);**
    b. **resurfacing to decrease water ponding;**
    c. **drainage to prevent ponding in side drains;**
    d. **relocation lower in the landscape, where possible, to minimise the area infected.**

    Access should be based on accurate hygiene and hazard maps.

11. **Erect permanent signs at Park entrances which can be used to indicate which roads and tracks are open or closed and the reasons why.**

12. **Place signs at the beginning of paths, particularly up peaks, asking walkers to ensure that their boots are free of mud and earth; any soil should be scraped off into a waterproof rubbish bin provided for the purpose. Close paths in high hazard areas following rain using the criteria given in Prescription 10. Use signs to explain why closures are necessary.**

13. **Establish a 'Code of the Coast' in conjunction with local associations such as the South Coast Recreation Association and Fitzgerald River National Park Association. The 'Code' should include cleaning vehicles, particularly the underbody, before entering the Park and avoiding wet soil conditions which result in soil pick-up.**

14. Ensure that publications and displays associated with the Park explain why it is important to minimise the introduction and spread of dieback disease. Provide interpretation at a confirmed dieback site (such as East Mt Barren).

15. Provide washdown facilities at ranger stations. Continue to investigate means by which cost effective and efficient washdown can be achieved at all Park entrances.

16. Retain the provision in this plan for closure of particular areas, roads, tracks and footpaths if the presence of dieback is suspected or confirmed or if a high risk of dieback introduction or spread is identified.

Research and Monitoring

17. Continue developing techniques which will enable the rapid confirmation of the presence or otherwise of *Phytophthora* species in plant communities on the south coast.

18. Accurately determine boundaries of, and regularly monitor, known infections. Continue using aerial photography and any other image enhancement techniques which are shown to be effective in monitoring disease distribution.

19. Develop a comprehensive description of infected areas, including information on species affected, vegetation association, area and rate of spread, soil profile, topography and threat to ground and surface waters.

20. Continue to survey and sample roads, tracks (including management-only) and footpaths within the Park for signs of dieback disease.

21. Quantify the impact of each *Phytophthora sp.* This information is necessary in order to assign and predict hazard ratings for all vegetation associations in the Park.

22. Investigate control and eradication procedures while ensuring that they do not place other areas or values at risk. Eradication of isolated infections should be of the highest priority.

23. Focus research effort on determining practical methods for preventing dieback introduction and spread and accurately identifying high hazard locations. Effort should also be directed towards developing effective ways of controlling soil and water movement, particularly in relation to development and maintenance of roadworks and facilities. This work, although focusing on FRNP, should complement similar research across the CALM South Coast Region.

9.2 FIRE

The objectives are:

1. *Protect the lives of visitors, neighbours, staff and firefighters.*
2. *Protect community values in or near the Park, including settlements, private property, recreation facilities and public utilities.*
3. *Provide for the survival of populations of rare or restricted flora and fauna species by the maintenance of required habitat.*
4. *Where possible, restrict fires to a single cell.*
5. *Maintain an effective system of firebreaks and buffers, while minimising the construction of new firebreaks and the introduction and spread of disease and weeds by fire management operations.*
6. *Protect landscape values from damage and vulnerable soils from the risk of erosion as a result of wildfires, inappropriate fire regimes, firebreak locations or machinery activity.*
7. *Reduce the incidence of unplanned fires.*

Background

Fire History

Information on Aboriginal burning practices in the Fitzgerald area is not well documented.

More is known of early European practices. Records show that the coastal strip near Bremer and the granite valleys of the northern Fitzgerald were burnt to improve pasture. Between 1954 and 1969 a number of escapes from clearing bums burnt large areas of the northern part of the Park. A number of very small unburnt patches remained. Local farmers also lit fires during this time to 'open up' the bush. They encouraged the fires to bum for as long as fuels were available (G. Keen, pers. comm., 1988). Fires also occurred in the Barren Ranges during this time and were often started by lightning. They were generally small and confined to gullies and flanks on the western sides of the Ranges.

Approximately 157 000 ha of the Park were burnt in summer wildfires in 1989 as a result of four lightning strikes (Maps 8a and 8b) (McCaw *et al.*, 1991). Despite the extent of these fires, at least one third of the Park contains vegetation unburnt for at least 20 years. This includes much of the northern uplands which supports most of the known rare fauna populations.

Risk of fires generally increases with increasing visitor numbers. This problem will grow in FRNP if visitor numbers continue to increase. It will be offset to some degree by the decreasing risk of fires originating from agricultural areas as less and less new land is brought into production and clearing bums are no longer required. In some years, lightning can be a significant source of fires.

Fire Behaviour

Weather conditions suitable for the ignition and spread of fires typically occur on a regular basis from October until the latter part of April each year. Rainless periods during the cooler winter months may also provide opportunities for fire spread, particularly in drought years.

Northerly and north-westerley winds associated with the development of pre-frontal low pressure troughs have a pronounced influence on fire weather in the Park. During the summer months, the advent of a hot, dry northerly airflow frequently results in severe fire weather conditions. Analysis of fire weather forecasts for the Western South Coast forecast district indicate that, on average, Very High and Extreme fire danger may be expected to occur on 20 and seven days each fire season, respectively. Under such conditions, intense and fast-moving fires are possible in all fuel types, with the exception of areas with vegetation less than three years old. Direct suppression action on fires is neither effective nor safe in these conditions. The passage of a cold front typically brings south-westerly winds which may then result in a major run by the eastern flank of a fire. This situation occurred during the wildfires of December 1989 when some 100 000 ha of the Park were burnt in a ten-hour period (McCaw *et al*, 199 1).

During the cooler winter months, pre-frontal northerly winds may provide suitable conditions for prescribed burning, with fires usually being extinguished by the moist south-westerly winds that follow.

Major fuel types within the Park include open mallee-heath, scrub-heath and thicket, and woodland. Important differences in fire behaviour characteristics between these fuel types influence the conduct of fire management operations. Mallee-heath fuels are discontinuous and require specific threshold conditons of fuel moisture and wind speed in order to sustain fire spread. Forward spread rates for established mallee-heath fires are generally in excess of 1 km/hour, and may exceed 5 km/hour under severe weather conditions. Because of the erratic nature of fire behaviour in mallee-heath fuels, prescribed fires cannot readily be confined to narrow buffer strips between parallel tracks unless the vegetation has first been scrubrolled. The more continuous nature of fuels in scrub-heath and thicket communities allows for a greater range in the weather conditions under which fire spread is possible, and fires may sustain overnight and in the absence of wind. Woodland fuel types are distinguished by the presence of a layer of leaf litter and accumulations of woody material such as fallen branches and dead stumps. These fuels may remain alight for extended periods and generally require substantial rain before they will extinguish. Consequently, areas of woodland may provide ready sources for reignition of fires.

The potential for aerially ignited strips within cells to produce mosaics of burnt/unburnt vegetation on a large scale has been successfully demonstrated in the Ravensthorpe area in the summer of 1990. Mosaics can be produced over a range of vegetation types.

This technique requires clearly defined cell boundaries, some of which may need preparation such as scrubrolling, prior to burning. The benefits of this technique include a reduction of tracks within cells and the opportunity to complement the existing mosaic by prescribe burning at a later date.

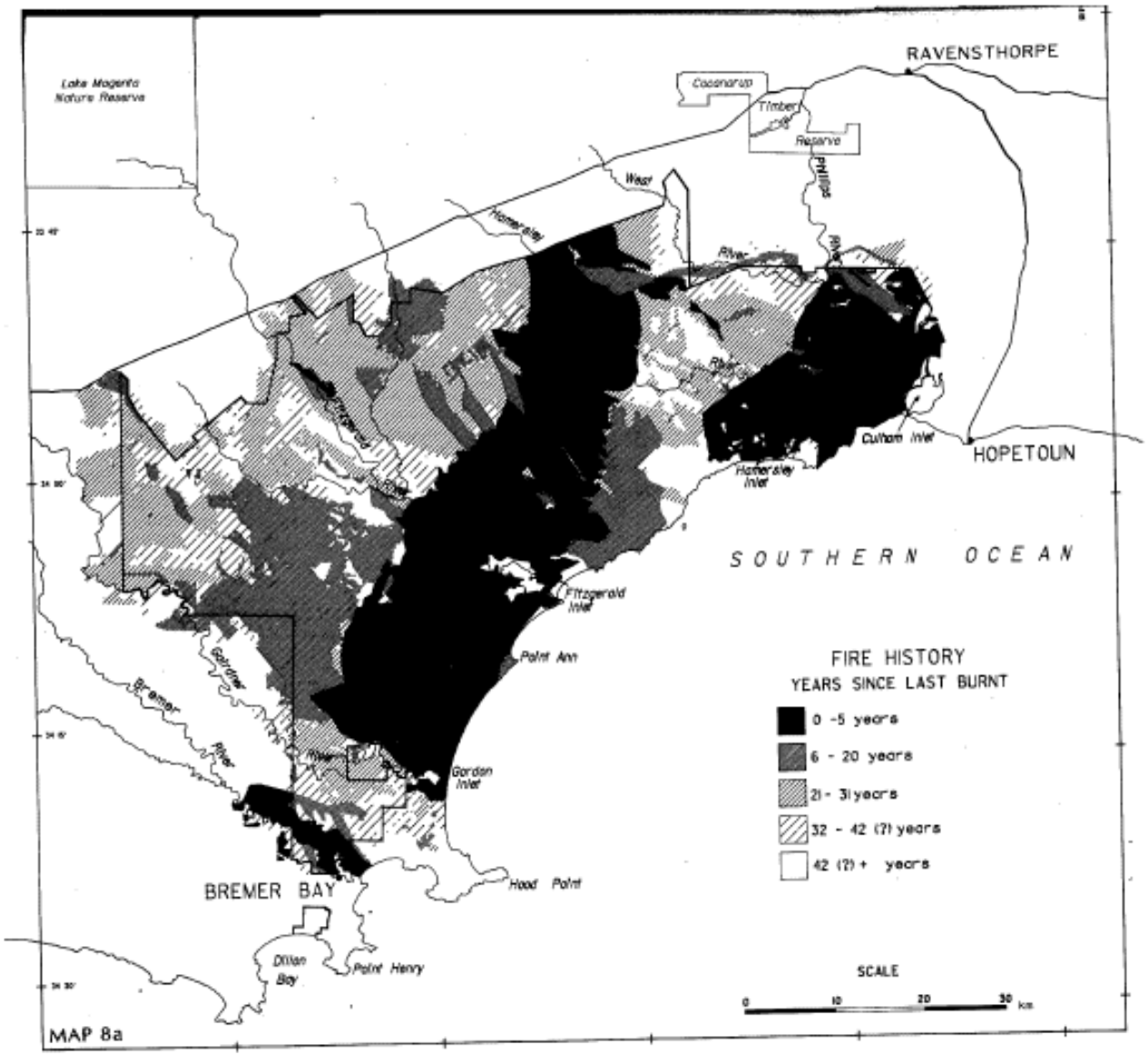
The reduction of tracks is a positive step in reducing dieback risks. Additionally, a mosaic of vegetation ages on a large scale should help to prevent the development of large bushfires and reduce the need for use of heavy machinery during suppression operations.

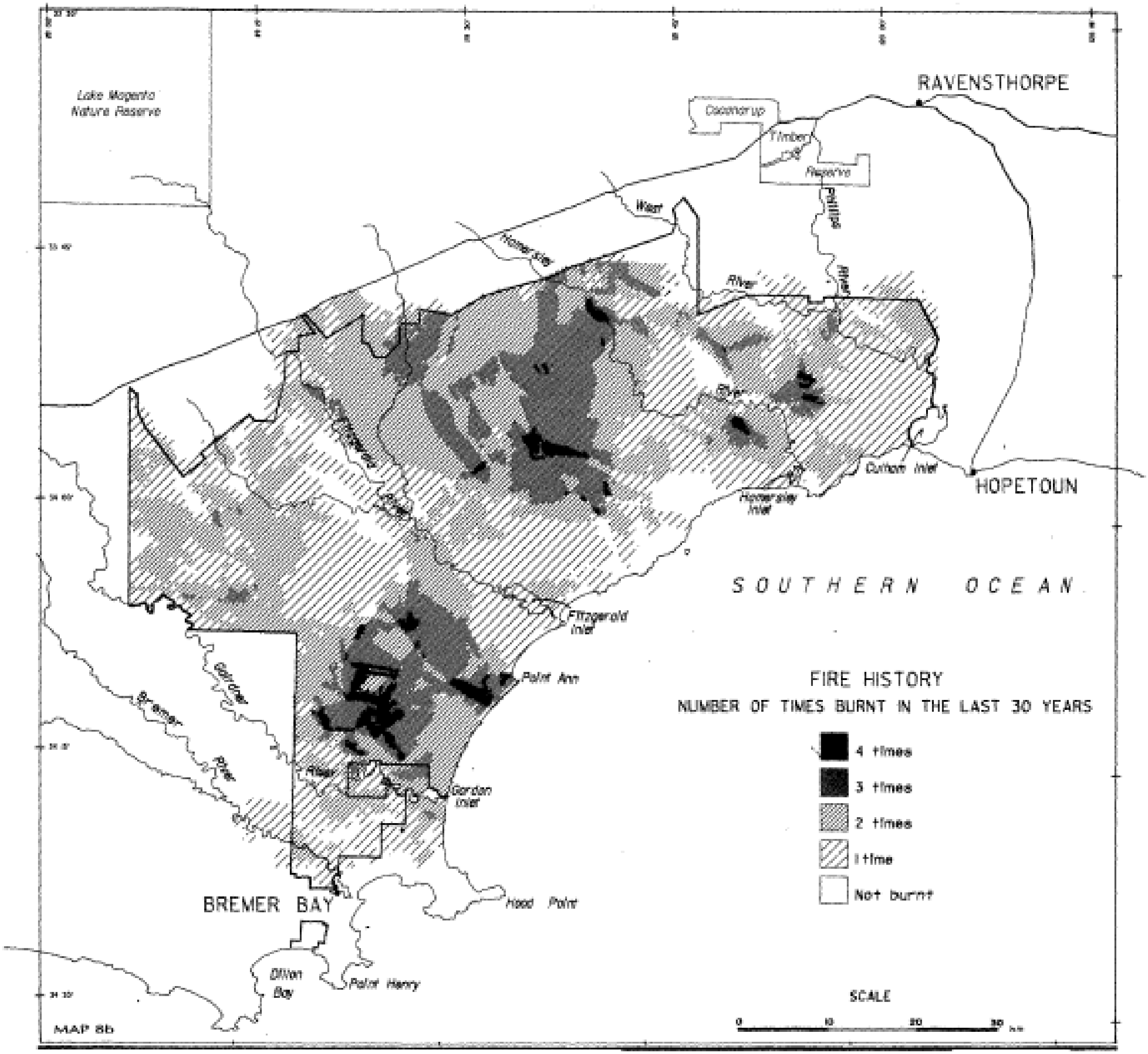
There has been some experimentation with the use of wind-driven fires to establish unconfined buffer strips during the cooler winter months, and good results have been obtained in scrub-heath and thicket fuel types (G. Duxbury, pers. comm., 1991). To date there has been little success in open mallee-heaths, probably due to moist fuel conditions at the time of lighting. Successful wind-driven fires could no doubt be achieved in mallee-heath fuels by burning under drier conditions, although this would have to be balanced against the risk of fires failing to extinguish completely. Reliable weather forecasts and a sound understanding of fire behaviour are essential elements in the implementation of this technique. This technique deserves further development because it offers the potential to establish fuel-reduced buffers in trackless areas.

Fire Ecology

Few studies have addressed specific aspects of the response of plants and animals in FRNP to different fire regimes. However, some tentative conclusions can be drawn from work by McNee (1986), Muir (1985), Newbey and Chapman (1985) and Watkins (1985). All researchers found a strong correlation between areas containing rare mammal and bird species, vegetation unburnt for at least 15 years and areas underlain by granite (the northern part of the Park).

In terms of fire, Chapman (1985) found that bird richness in FRNP mallees reaches a maximum at around 15 years after fire. Species restricted to 15 years plus vegetation are resident-insectivores such as the Grey Shrike Thrush and Blue-breasted Wren. The situation with mammals is very different, with numbers of species being greatest in five year old vegetation, declining at 15 years old and rising again in old vegetation (tentative conclusion only) (Chapman, 1985). Reptiles show a similar trend. Although these conclusions support the use of fire to maintain a range of habitat ages, a study in the Ravensthorpe Ranges reported abundant and rich fauna in mallee unburnt for at least 30 years (Chapman, 1984, in Chapman, 1985).


RAVENSTHORPE
Lake Magenta Nature Reserve
Cocanarup Timber Reserve
Phillips River
Hamersley Inlet
Culham Inlet
HOPETOUN
SOUTHERN OCEAN
Fitzgerald Inlet
Point Ann
Gairdner River
Gordon Inlet
BREMER BAY
Hood Point
Dillon Bay
Point Henry
FIRE HISTORY
YEARS SINCE LAST BURNT
0 -5 years
6 - 20 years
21 - 31 years
32 - 42 (?) years
42 (?) + years
SCALE
0 10 20 30 km
MAP 8a


RAVENSTHORPE
HOPETOUN
Lake Magenta Nature Reserve
Cocanarup
Timber Reserve
Phillips River
West River
Culham Inlet
Hamersley Inlet
Fitzgerald Inlet
Point Ann
Gordon Inlet
Hood Point
BREMER BAY
Dillon Bay
Point Henry
Gairdner
Bremer River
SOUTHERN OCEAN
FIRE HISTORY
NUMBER OF TIMES BURNT IN THE LAST 30 YEARS
4 times
3 times
2 times
1 time
Not burnt
SCALE
0
10
20
30
MAP 8b

Following fire in mallee over shrubland vegetation associations at Marningerup in 1984, Chapman and Newbey (in prep.) noted that approximately a quarter of the plant species recorded regenerated only from seed. If the frequency of fires is similar to, or shorter than, the time necessary for these species to flower and set viable seeds, then these species may decline.

Further information is required on the effects of fire season and intensity, and the relationship between underlying geology (or the land surface type) and rare fauna distribution and population sizes.

The effects of treatments involving scrubrolling and burning have been investigated in scrub-heath and woodland communities similar to those within the Park (McCaw and Schneider, in prep.). Low growing plants and those with flexible stems were largely unaffected by the scrubrolling and, therefore, exhibited their normal responses following fire. Tall woody species were affected to a greater degree by the scrubrolling; some decline was evident in the populations of obligate seed regenerating species with capsulestored seed. This was attributed to the destruction of seed released in the interval between scrubrolling and burning. Seed losses would be minimised by burning buffers within a few weeks of scrubrolling. All treatments resulted in increased species richness due to the regeneration of plants from soil-stored and dispersed seed stimulated by disturbance.

Other Considerations

Preventing the introduction and spread of dieback is the greatest management concern in the Park. Areas which have been burnt are not interpretable for at least five to seven years; that is, the presence or absence of dieback can not be determined until susceptible plant species regenerate, allowing the dieback fungus to become reactivated in the soil. A number of existing fire buffers are high in the landscape and cross numerous subcatchments, placing large areas of the Park at risk if dieback is introduced. In the longer term, spread of diseased soil is likely to have a much greater deleterious effect on the Park ecosystem than wildfires. In addition, machinery movement on fragile soils and hillsides could lead to severe water and wind erosion and decreases in visual quality. Also, foxes appear to use firebreaks as "access ways" (A. Chapman, pers. comm., 1989); therefore, firebreak construction into or around known rare fauna populations requires careful consideration.

Another management concern associated with perimeter buffers and firebreaks adjoining farmland is weed invasion. Pasture grasses readily invade disturbed areas, displacing native understorey species and leading to rapid build-up of hazardous fuels. This problem is aggravated if perimeters are burnt at a frequency that does not allow native vegetation to fully re-establish. The problem can be reduced by retaining a narrow strip of bush between agricultural lands and Park perimeter firebreaks or buffers.

The rare fauna species present in the special conservation zone are only known at this time to occur in vegetation unburnt for at least 15 years. Additionally, this zone has high life and property values adjacent to it. The wilderness and natural environment zones havelow life and low property values, but high conservation values. The recreation zone has high life and low property values.

Fire suppression is currently based on a combination of direct and indirect attack. Access for suppression forces and equipment to the fire front is usually a slow process, given the distances involved and rugged nature of the country. Where possible, fires are contained by existing firebreaks and roads. Boundaries of cells have been scrubrolled to enable back burning to be undertaken to contain wildfires. Firelines have been cut where no other opportunities for suppression were available, or risks associated with using existing firebreaks were too high. Mosaic burning will reduce the need to use heavy machinery.

A range of different roading is available for fire management from 2WD to 'fire emergency' access. Use of 'fire emergency' access will be strictly controlled. Section 13.0 Access provides further details.

Strategy - Fire Master Plan

The basic strategy proposed for the Park is to provide a network of fuel reduced areas so as to reduce the likelihood of remaining tracts of mature vegetation being burnt at the one time. Some areas will not be prescribe burnt in the long term and be retained as reference areas, that is, long unburnt areas with which burnt areas can be compared.

The existing network of roads, tracks, buffers and recently burnt areas will be used to provide cell boundaries in the Park. Firelines constructed in the 1989 fires will also be incorporated as cell boundaries where appropriate.

It will be at least five years before fire hazards develop in areas burnt by the December 1989 wildfires. A major review will be conducted in 1995. The management intent in the longer term is to carry out fuel reduction burning by aerial ignition. This will be considered in the review.

Four broad prescriptions for fire management will be used:

- narrow fuel-reduced buffers
- prescribed burning within cells
- no planned bum
- vegetation/habitat management

1. Buffers

Separation of cells by narrow, low-fuel buffers (up to 400 m wide) provides protection for individual cells and a basis for more extensive use of prescribed fire within cells. Scrub rolling supported by

prescribed burning will be used to establish buffers. These buffers by themselves are not capable of stopping large wildfires burning under severe conditions; however, they do provide positions from which to conduct suppression operations. Such buffers will help reduce the probability of large fires burning across the Park. This technique helped to control wildfires in the Park, under extreme conditions, in December 1989. Consideration will be given to widening some of the buffers within the life of the plan.

2. Prescribed Fire Within Management Cells

In areas designated, prescribed burning on a cell basis will be undertaken as indicated in Map 9. Approximately 30-70% fuel reduction will be sought using aerial ignition to develop a mosaic of vegetation ages within cells. Prescribed burning operations will most likely be carried out in late spring and autumn.

3. No Planned Burn

These areas will not be prescribe burnt for the duration of this plan. The intent is to retain these areas for reference in the long term. If a wildfire occurs in a 'no planned bum' area, consideration will be given to designating an alternative 'no planned bum' area. This should be part of the annual review by the fire advisory group (Prescription 8).

4. Vegetation/Habitat Management

To protect the high conservation value of the northern cells, some prescribed burning may be necessary. This will ensure this area is not completely burnt in a single wildfire. In addition, research may indicate the need for prescribed burning to maintain rare fauna habitat.

Cell boundaries will be protected by wide, open-edged buffers. Prescribed burning within cells will only occur after careful assessment to ensure rare fauna are not at risk. Consideration will be given to the use of aerially ignited mosaic burns.

PRESCRIPTIONS

General

1. **The following sources of information should be used in an ongoing commitment to determine the best fire regime for the Park:**
   a. **fire behaviour and ecology research and monitoring results achieved through implementation of the research and monitoring prescriptions given in this section;**
   b. **research results from areas with similar environmental conditions.**
   c. **experience and observations from fire-righting by bushfire organisations, members of the local community and CALM.**

Prescribed Burning

2. **Implement the fire master plan (Map 9). Fire access will be along managed buffers and these are either management only (no public access) or 2WD/4WD as specified in Section 13.0 Access.**

3. **Continue to apply standard Departmental requirements for an approved prescription prior to initiating planned fire. The prescription should take particular account of environmental values, especially the need for dieback control, landscape planning and visual assessment procedures.**

4. **Fire management tracks will be maintained according to CALM 7-way test guidelines and appropriate levels of approval.**

5. **Scrub-roll buffers prior to burning. Currently scrub-rolled buffers need to be tracked either side to ensure only the buffer strip is burnt. For this reason, scrub-rolling will be undertaken along existing roads/tracks. Investigation will continue to define the conditions under which scrub-rolling can be burnt without the need for tracking either side. Consideration will be given to landscape impacts and erosion potential before works are undertaken. Scrubrolling will only be carried out under dry soil conditions, following survey for rare flora and an assessment of impact on any known rare fauna**

6. **Carry out fuel reduction within cells only after consideration of the effects on the flora and fauna. Emphasis should be given to the development of practical aerially ignited mosaic burns which provide protection from large wildfires, minimise the need for on-ground suppression and meet the divergent needs of public safety, biological management and wilderness protection.**

7. **Carry out perimeter prescribed burning in conjunction with local volunteer fire brigades and neighbouring landholders.**

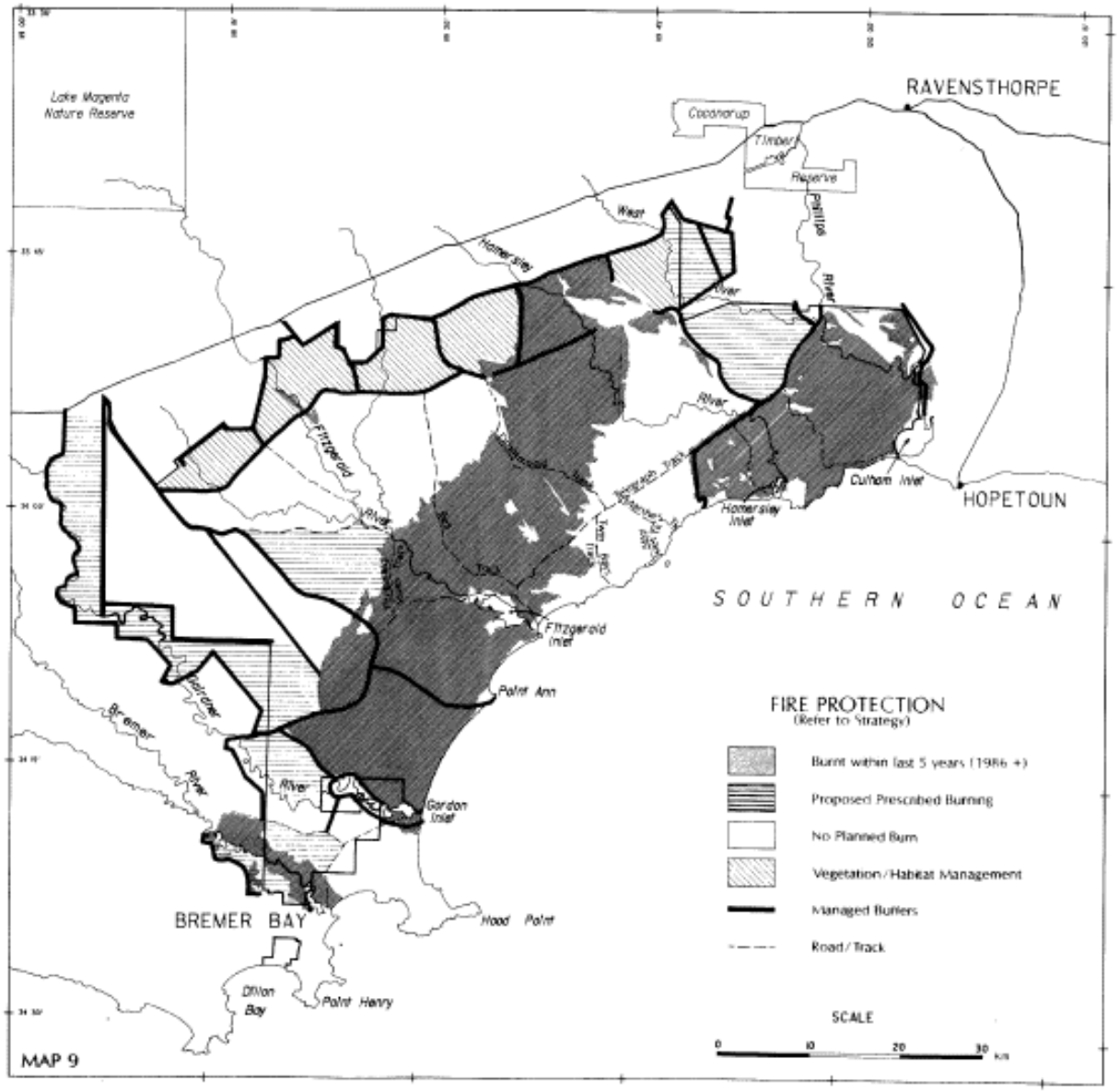
8. **Establish a fire advisory group with representatives from the two local bush fire organisations, Shires, Bush Fires Board and CALM to meet at least annually and review implementation of the fire plan and priorities. This group has the responsibility to set the program for the next year. CALM undertakes to implement each annual program so set out. This group will consider the introduction of new technica) knowledge and its application in fire management of the Park. The group shall report to the Shires, NPNCA, Bush Fires Board and CALM in a format determined by consultation with the respective organisations.**

9. As it will be at least rive years before fire hazards develop in areas burnt in the December 1989 wildfires, Telegraph Track (between Fitzgerald Inlet and Quoin Head turn-off), Drummond Track (south of the northern buffer), the southern half of Bell Track, the fireline between Mt Drummond and Red Peak, and the Fitzgerald South Track will not be accessed for fire management prior to July 1995 when a major review shall be completed. This would include the need for provision of fuel reduction burns to separate the coastal range system from the heath in the central section of the Park. Access to assess the dieback and fire management status will only be undertaken under strict permit, subject to NPNCA approval. The review shall include consideration of aerially ignited mosaic burns. If a life-threatening emergency arises requiring the use of vehicles within this area, entry will be authorised by the South Coast Regional Manager or a nominated representative. If the review described above recommends significant changes to this plan, amendments will be undertaken through the processes prescribed in the CALM Act (refer to Section 22).

10. Consideration will not be given to implementing prescriptions for fire management within areas burnt during the December 1989 wildfire, until the review has been completed (1995).

11. Review the fire plan after any major wildfire. The review group should comprise members of the fire advisory group listed in Prescription 8 above. If the review recommended significant changes to this plan, amendments will be undertaken through the processes prescribed in the CALM Act (refer to Section 22).

12. Local staff should maintain surveillance for fire on days of extreme risk and have fire fighting equipment on standby.


Lake Magenta
Nature Reserve
RAVENSTHORPE
Coconarup
Timber
Reserve
Pallinup
River
West
Hamersley
River
Fitzgerald
River
Culham Inlet
Hamersley
Inlet
HOPETOUN
SOUTHERN OCEAN
Fitzgerald
Inlet
Point Ann
Bremer
River
Gordon
Inlet
BREMER BAY
Hood Point
Dillon
Bay
Point Henry
MAP 9
FIRE PROTECTION
(Refer to Strategy)
Burnt within last 5 years (1986 +)
Proposed Prescribed Burning
No Planned Burn
Vegetation/Habitat Management
Managed Buffers
Road/Track
SCALE
0
10
20
30
KMS

Wildfire Suppression

13. **In the event of a major wildfire in the Park, CALM is to establish a control point and, by negotiation with all involved agencies, nominate one person as controller. Fire suppression must be in accordance with the gazetted fire plan (ie. this management plan). The expertise and resources of the volunteer bush fire brigades, local authorities and the Bush Fires Board are an integral part of the suppression force.**

14. **Endeavor to contain wildfires that enter or start in the Park within a cell defined by the strategic buffers given in Map 9. Depending on values at risk, dieback risk, fire behaviour, resources available and presence of buffers and tracks, suppression will involve: allowing the fire to burn out to low fuel buffers, backburning from existing tracks or direct attack.**

15. **Develop water points adjacent to roads and tracks for fire suppression. They will be located so as to minimise dieback risk and landscape impacts but must be no greater than 16 km apart on main access ways. Base their development on improving access to existing water, excavation, and limited use of demountable tanks. Water points should contain a minimum volume of 15 000 litres. The water points are to be developed as a matter of priority. The need for water points in the central area will be reviewed by July 1995.**

16. **Monitor water points to ensure they are not infected by Phytophthora species. Where appropriate, treat water at time of use with approved fungicide.**

Liaison

17. **Work with the local authorities and brigades, adjacent landowners and the Bush Fires Board to ensure an effective fire management force is in place. Arrange regular exercises with local brigades and the Bush Fires Board on cooperation techniques. Locate fire equipment within the local Bush Fire Brigade system. Station a heavy duty fire unit in the Ravensthorpe Shire. Continue mutual aid arrangements in carrying out burns and suppression activities in accordance with the Shire District Fire Plans.**

18. **Obtain UHF radios for CALM officers involved in fire management in FRNP to improve communications between CALM and local brigades.**

19. **Implement programs to inform and educate Park visitors regarding this fire management program, and fire safety and survival. This program will include information on campfires in the Park (refer to Section 14.2).**

Research and Monitoring

20. **Continue to investigate the practicality of using aerially ignited mosaic burns.**

21. **Record and analyse details of all fires, including available fire behaviour information.**

22. **Instigate a research and monitoring program to determine the level of environmental impact resulting from the prescribed fire regimes, fuel modification and wildfire suppression activities, and wildfires; and to examine the effectiveness of prescribed burning and wildfire suppression procedures.**

23. **Continue to strongly support the need for a geographic information system for the recording and analysis of information on fire in the Park.**

24. **Continue to investigate the use of computer modelling to aid fire management.**

9.3 ANIMAL PESTS

The objectives are:

1. *Control or eradicate species of animals causing major conservation problems.*
2. *Minimise the detrimental effects of control mechanisms on the Park environment, particularly its native fauna.*

Background

Feral animals present in the Park include foxes, cats, rabbits, cattle and horses. All species are present in low densities through the Park, the only exception being horses, which are only found in the northern FRNP, in very low numbers.

Honey possums, tammars, dibblers, bush rats, rabbits, house mice and a number of reptile species are eaten by foxes. Chapman and Newbey (in prep.) conclude that foxes in high numbers are a serious threat to native fauna. Many foxes are present in the Park and adjacent farmland (A. Chapman, pers. comm., 1989). This places the rare fauna in the northern FRNP at risk. No data are available from the FRNP regarding predation by cats. They most probably have a similar effect on small mammals to that of foxes.

At low densities, rabbits are unlikely to do much damage in FRNP (Chapman and Newbey, in prep.). The only exception is coastal areas where rehabilitation is underway. In these areas (eg. Mylies Beach) rabbits browsing on new shoots inhibit regrowth.

Feral bees occur throughout the Park. They are prolific swarmers and, in good seasons, are likely to be serious competitors for nest hollows which are rare in the Park. They may also adversely affect pollination in native flora. However, current infestations are impossible to control given current finances and resources. It is only possible to try to stop the situation worsening.

PRESCRIPTIONS

1. **Liaise with the Agriculture Protection Board, adjacent landholders and local authorities regarding pest control throughout the Park, especially on boundaries, in enclaves and on adjacent properties.**

2. **Remove feral cattle and horses where possible.**

3. **Implement appropriate control measures for foxes throughout the Park. (Refer to Prescription 6 under Rare Species in 7.3 Fauna for more details.)**

4. **Control cats. If research indicates that cats are a threat to rare fauna, implement further control measures.**

5. **Where necessary, control rabbits in coastal areas that are being rehabilitated.**

6. **Prevent invasion of the Park by other pest animals (eg. pigs, goats).**

Research and Monitoring

7. **Record the general extent and location of pest animals. Document control measures implemented and evaluate the success of these measures. Request the Agriculture Protection Board to do likewise.**

9.4 WEEDS

The objectives are:

1. Control or, if possible, eradicate weeds causing major conservation problems.

2. Minimise any detrimental side effects of control procedures on the Park environment.

Background

The Fitzgerald has at least 100 weed species. This is 6% of the Park's flora compared with 10.5% for the State as a whole. Weed infestation in the Park is not extensive and is essentially confined to rivers, swamps and lakes, uplands and coastal dunes (Newbey, in prep.).

Watercourses generally have the greatest biomass of introduced species, as well as the highest number of species, for the following reasons. First, many introduced plants are present on farmland and all major rivers in the Park have the upper part of their catchment in farmland. Second, riverine soils tend to provide more favourable soil moisture and fertility conditions than surrounding plain or hill soils. In the uplands, most introduced plants occur on skeletal or shallow soils associated with granite exposures. Human use is probably the main factor in the spread of introduced plants into coastal dunes. Most species are concentrated in areas of disturbance associated with camping, parking and tracks. Most of the introduced species are annuals, less than 30 cm high, with a small biomass.

Most introduced plants are unlikely to spread beyond their present distribution in FRNP, or are capable of only minor spread. Three weed species, cape weed *(Arctotheca calendula),* annual veldtgrass *(Ehrharta longiflora)* and bridle creeper *(Myrsiphyllum asparagoides),* are capable of

rapid establishment and major spread into natural areas. These three species, plus saffron thistle *(Carthamus lanatus),* doublegee (*Emex australis),* (both declared noxious species) and African boxthorn (*Lycium ferocissimum),* are of the highest management priority.

Cape weed is found in most of the vegetation types across the Park, while annual veldtgrass only occurs along rivers and swamps. Bridle creeper is spreading along the river flats of the Gairdner around Quaalup and Marningerup. Saffron thistle and African boxthorn are present in small numbers on the Gairdner, Phillips and West rivers. Saffron thistle is also found on farmland north-west of the junction of the latter two rivers.

A further four species are also of high management priority as they readily spread into disturbed areas and would almost certainly become established. These are flaxleaf fleabane *(Conyza bonariensis),* smooth cat's ear *(Hypochoeris glabra), common* sowthistle *(Sonchus oleraceus)* and rat's tail fescue *(Vulpia myuros).*

The worst area of weed invasion is along the Phillips River. Parts of the Fitzgerald and Gairdner Rivers also have high numbers of weeds.

PRESCRIPTIONS

1. **Liaise with the Agriculture Protection Board, adjacent landholders and local authorities regarding weed control on Park boundaries and adjacent properties.**

2. **Where possible, in fire management operations, retain a strip of bush between private property and perimeter firebreaks to slow down weed invasion.**

3. **Liaise with adjacent landholders, and local groups, to minimise fertiliser drift into the Park.**

4. **Control and, if possible, eradicate saffron thistle and doublegee (both declared noxious plants). Record treatment. Monitor to determine success or otherwise of management actions.**

5. **Accurately determine the distribution of and monitor the other eight priority weed species. If any are spreading rapidly, implement control measures. Record methods of treatment and monitor results.**

6. **Avoid unnecessary disturbance associated with management actions such as road construction and maintenance, and repeated burning.**

7. **Avoid unnaturally high nutrient build-ups by controlling rubbish and effluent disposal.**

Research and Monitoring

8. **Monitor known priority flora populations for weed invasion. Take control measures as necessary.**

9.5 REHABILITATION

The objective is to rehabilitate areas degraded by humans and their activities.

Background

The majority of the Park is relatively undisturbed. The greatest level of disturbance has occurred on or adjacent to the coast where uncontrolled access and camping on highly erodible sandy soils have led to removal of the vegetation and subsequent erosion. Camping has focused on small stands of melaleucas and many of these have become very degraded, with extensive gully erosion and tree loss.

The extensive wildfires of December 1989 have exacerbated the problems of erosion, particularly along the coast where burnt campsites were completely denuded.

In the eastern end of the Park, 2WD access has been provided to most beaches and numerous 4WD tracks have been closed and covered with brush. In some areas rehabilitation has been slow and the scars are still visible.

In the western end, a number of closed tracks in the Point Ann area and old sections of the re-aligned Pabelup Drive require brushing. Earthworks are also necessary on slopes to minimise erosion.

Several camp sites have been re-developed and the areas no longer required have been closed, ripped and brushed. Regeneration in some areas, and particularly behind part of Mylies Beach, has been slow. Soil erosion and heavy grazing of new shoots by rabbits are probably responsible.

PRESCRIPTIONS

1. **Use locally occurring native species from the same or similar sites for all rehabilitation work. This is important, not only because of the Park's biosphere status, but also because local species are adapted to local conditions and have a good chance of survival. Direct seeding is preferred. Use known dieback free nurseries if propagation is required.**

2. **Encourage members of the local community to propagate local native plants for rehabilitation, with due regard for dieback hygiene measures.**

3. **Foster and supervise volunteer programs to undertake rehabilitation work.**

4. **Rehabilitate disused tracks with appropriate techniques.**

Research and Monitoring

5. **Monitor, evaluate and record the success of rehabilitation techniques used. Experiment with a range of rehabilitation techniques.**

9.6 GRAVEL, SAND AND STONE

The objectives are:

1. *Limit the extraction of gravel, sand and stone from the Park to areas where such activity will have minimal impact on the spread of dieback, public use and the Park's flora, fauna and landscape.*
2. *Ensure that dieback is not spread by the movement of gravel, sand or stone.*

Background

Many road building and recreation site materials (ie. gravel, sand, limestone and stone) required for Park management are available from within the Park. Gravel resources, however, are limited and in many places are inaccessible, being covered by deep layers of sand. These materials may only be extracted from the Park for use within the Park.

PRESCRIPTIONS

1. **Map potential gravel and limestone sources in the Park to ensure coordinated extraction.**

2. **An up-to-date dieback hygiene map must be available before raw materials are extracted. Extraction of gravel, sand or stone will not be permitted from dieback-infected or suspected dieback-infected sites.**

3. **Limit pits supplying gravel, sand or stone to recreation and natural environment zones (see Map 3 and 5.0 Management Zones). Ensure they are not visible from roads, tracks, footpaths or other view points. Minimise pit size and the number of active pits. Develop an extraction plan for each site.**

4. **Accommodate requests for gravel, sand and stone from the Park provided that their use is necessary for the management of the Park. Issue of a lease by CALM is required.**

5. **Rehabilitate all pits as soon as material extraction is complete. Topsoil should be separately removed and stored for later rehabilitation work. Encourage excavation and stockpiling of gravel resources and immediate rehabilitation of the remainder of the pit. Locally occurring native species should be used.**

Research and Monitoring

6. **Conduct a survey prior to material extraction to ensure that no conservation values, particularly rare plants or Aboriginal sites, will be disturbed.**

9.7 DOMESTIC ANIMALS (PETS)

The objective is to continue to exclude domestic animals (pets) from the Park.

Background

Domestic animals, and particularly dogs, can create problems in national parks. Often they disturb other users. They may also create health problems by defecating in recreation areas and carrying diseases such as hydatids. While management arrangements can be made to overcome these problems, the status of this Park is such that any disturbances and potential problems should be avoided.

There are many other coastal areas near Bremer Bay and Hopetoun where domestic animals are allowed.

PRESCRIPTIONS

1. **Continue to follow a policy of prohibiting domestic animals from FRNP.**

2. **Provide Park users with information as to why domestic animals are not allowed in the Park.**

10.0 MANAGEMENT OF COMMERCIAL RESOURCE UTILISATION

10.1 MINING

The objective is to implement Government policy on exploration and mining in national parks.

Background

In accordance with current Government policy on mining, Fitzgerald River National Park is closed to exploration and mining.

Minerals known from the Park include (Geological Survey of W.A., pers. comm., 1988):

- mineral sands near Gordon and Dempster Inlets
- manganese in the gorge of the Hamersley River near the Eyre Range, along Copper Mine Creek and at Naendip
- cobalt and graphite in the gorge of the Hamersley River near the Eyre Range
- greenstone near the junction of the Phillips and West Rivers
- lead associated with manganese at the Hamersley Inlet
- kyanite 10 km west of Hopetoun
- building stone at Twertup
- lignite along the Fitzgerald River.

All of these minerals are available from deposits elsewhere, particularly mineral sands, which occur along much of the old coastline of south-west Australia. Mining in the area centres on Ravensthorpe where minerals of economic interest include copper, gold, silver and nickel.

Due to the Park's international status as a biosphere reserve and its exceptionally high conservation values, it is essential that, should a change in Government policy eventuate, applications for mineral exploration remain actively discouraged. If exploration and/or mining is ever approved, it should be subject to, and meet with, conditions which will ensure minimum impact on the biological, physical, cultural and landscape values of the Park. The prescriptions in Section 9.5 of this plan should be used as the basis for any rehabilitation program. Rehabilitation should be to CALM's specifications and at the proponent's expense using the most up-to-date techniques available.

PRESCRIPTION

1. **Follow Government policy on mining.**

10.2 COMMERCIAL FISHING

The objective is to provide for commercial fishing in a manner compatible with national park objectives.

Background

Commercial fishing associated with FRNP has been both inlet and ocean beach-based. All inlets associated with FRNP are described as intermittent fisheries. Commercial fishing is controlled by the Fisheries Act and Regulations. Limitations are placed on species caught, 69 number taken, areas that fish can be taken from and type of fishing involved as well as seasons in which catches may be taken. CALM works co-operatively with the Fisheries Department. There has been limited inlet-based commercial fishing in the Gordon, Dempster and Hamersley Inlets (Fisheries Department, pers. comm., 1987). The St Mary and Fitzgerald Inlets are not used for commercial fishing (advice from Fisheries Department).

In terms of ocean beach-based commercial fishing, some salmon netting occurred near Fitzgerald Inlet during the 1970s. However, the majority of the Park's coastline is not suitable for netting. The beaches are too exposed to safely launch a boat and use nets, while rocky headlands and offshore reefs push salmon offshore. Trigelow Beach is currently used by commercial fishermen.

Commercial fishermen basing their operations in, or transporting their catch across, national parks can lead to conflict with other Park visitors, particularly with regard to competition for space, such as campsites. This problem can be alleviated by providing separate camping facilities, or by allowing commercial fishing only when visitor numbers are low (ie. over winter). In FRNP, the former option is difficult to achieve as suitable campsites are very limited. The latter approach can only be used where inlets are accessible on 2WD roads, as all 4WD tracks in the Park are closed following rain (ie. for most of the winter). Both options require additional Park management and financial resources. Public camping is available at Hamersley Inlet Shire Reserve and on public land at the mouth of the Gordon Inlet.

PRESCRIPTIONS

1. **Inlet fishing: Allow commercial fishermen access to Gordon and Hamersley Inlets and permission to transport their catch from these two inlets across the Park, subject to the conditions given in Prescription 3 and provided that licences are held under the Fisheries Act.**

2. **Ocean beach fishing and access: Continue to allow commercial fishermen access to Trigelow Beach and use of Park roads to access the Doubtful Islands area. Permission to transport their catch across the Park is subject to the conditions given in Prescription 3. Do not issue**

permits for other beaches for one or more of the following reasons : access problems, potential conflict with other Park visitors, impact on shoreline birds.

3. **Access conditions: Issue permits to commercial fishermen for transporting their catch across the Park or using the Park as a land-base, subject to other Park values and prescriptions. The conditions associated with the permits will include:**
   - **use of designated public access**
   - **observing same road closures as general public**
   - **if necessary, introduction of a ballot system to control numbers of commercial fishermen to minimise impact on other Park users and on small recreation sites**
   - **inlet-based commercial fishing restricted to the winter months, where necessary, to minimise conflict with other Park users**
   - **ocean-based commercial fishermen restricted, where necessary, to 70**

4. **Do not issue permits for Fitzgerald, St Mary or Dempster Inlets and the river systems. The Fitzgerald Inlet is generally inaccessible over the winter months. Also the equipment associated with commercial fishing is generally incompatible with the area's designation as a natural environment zone. St Marys Inlet is part of a major recreation zone, focusing on a very limited, small site. Commercial fishing would likely conflict with recreational use. Dempster Inlet is part of the wilderness zone and is not accessible by vehicle. It is also part of a reference catchment which will not be disturbed.**

5. **Liaise with Fisheries Department to declare Fitzgerald, St Mary and Dempster Inlets closed waters (ie. closed to netting).**

6. **Based on the findings of Prescriptions 7 and 8 below, re-assess use of the area by commercial fishermen in rive years, in consultation with the South Coast Licenced Fisherman's Association and Fitzgerald River National Park Advisory Committee.**

Research and Monitoring

7. **Monitor the effect of commercial fishing on access routes and points, and other Park users.**

8. **Develop, with the Fisheries Department and the Fitzgerald Biosphere Project, a monitoring program of the impacts of commercial fishing on fish stocks, the inlet and river systems.**

Administrative Details

Two administrative courses of action are available to provide for management of these inlets by CALM and achieve the above prescriptions. The course of action depends on the current status of the inlets as defined by the Department of Land Administration.

If the inlets are regarded as being open to the sea and are, therefore, part of State internal waters, then all inlets can be proposed as marine parks to high water mark under the CALM Act (1984) and zoned accordingly. Hamersley and Gordon Inlets should include a general use zone to allow for commercial fishing. The remainder should only include recreation and sanctuary zones (ie. no commercial fishing).

If the inlets are regarded as inland waters and, therefore, vacant Crown land, then they can be added to FRNP under the Land Act (1933). This automatically precludes commercial fishing. Ile only exceptions are Hamersley and Gordon Inlets which should be reserved as marine parks to high water mark and zoned to allow for commercial fishing.

10.3 UTILITIES AND SERVICES

The objectives are to:

1. *Keep the Park free of utility corridors and assist relevant agencies to find alternatives outside the Park.*
2. *Ensure that if utility corridors are approved they are constructed and maintained so as to minimise impacts on the Park.*

Background

There are no State Energy Commission, Telecom or Water Authority service lines, highways or main roads transecting the Park. Except for road construction, the landscape is undisturbed. This is one of the great values of the Park.

The only location where State Energy Commission and Telecom lines enter the Park is the short distance required to service the ranger's residence at East Mount Barren. Provision of power or other services to Quaalup would necessitate traversing about 7 km across the National Park. Similarly, development of either of the water reserves immediately to the south of the Park may necessitate constructing water pipelines and powerlines across the FRNP.

A number of trig points, generally on the highest points in the landscape, have been established by the Department of Land Administration and Australian Survey Office. These are used on an irregular basis for mapping requirements. Given their location high in the landscape, dieback could infect large areas of the Park if introduced. Therefore, use of these points has been restricted to summer under strict hygiene conditions.

PRESCRIPTIONS

1. **In general, no utility corridors will be provided through the Park. Any proposals should be based on physical, biological, social and visual considerations, analysis of alternatives outside the Park, and alternative methods of service provision. Where they are absolutely necessary, they should follow routes with the least environmental and landscape impact.**

2. **Apply environmental assessment procedures according to the Environmental Protection Act (1986) to any proposals for utility corridors through the Park.**

3. **Any construction or maintenance of utilities or utility corridors in or adjoining the Park must be undertaken with strict dieback hygiene and an awareness of the need to minimise erosion and visual intrusion. Strict dieback hygiene procedures should be followed by the Department of Land Administration when servicing trig points, with access by helicopter or on foot preferred.**

4. **If State Energy Commission lines must traverse the Park they should be placed underground along existing access routes. Assess the feasibility of placing the East Mt Barren SEC line underground.**

10.4 BEEKEEPING

The objective is to exclude beekeeping from the Park.

Background

Much controversy exists regarding the impact of introduced honey bees on native plants and animals. There are few published data. Bell (1985) concludes that 'concentrated use by large numbers of commercial hives could have a negative effect on the continued, long-term survival of certain native bees, wasps and/or birds through competition for nectar and pollen by honeybees'. Swarms of feral bees may also affect birds such as parrots and pardalotes by occupying nest-holes which are scarce in the Park. However, it can be expected that some plant species will be unaffected and some benefitted by the impacts of bees. Hopper (1985) concluded, as did a number of other scientists, that 'it is in the interests of both the beekeeping industry and land managers to have the relevant research undertaken as soon as possible'.

Given this lack of information, and concerns about the impacts of beekeeping on native communities, beekeeping has been excluded from a number of national parks and nature reserves. The presence of a number of rare and little known plant species in FRNP makes it particularly important that

beekeeping is excluded. There are currently three apiary sites in the Park, two in the north-west of the Park near Twertup Creek and one approximately 4 km north of Mt Drummond.

PRESCRIPTIONS

1. **Liaise with the Department of Agriculture and the apiarists concerned to transfer all of the current sites out of FRNP to sites of similar value elsewhere.**

2. **Do not approve any new apiary sites in the Park.**

PART D. MANAGEMENT FOR RECREATION

GOAL:
Fulfill the nature-based recreation requirements of visitors to the extent that they are compatible with conserving the Park's flora, fauna and landscape values, wilderness qualities and cultural heritage.

11.0 RECREATION MANAGEMENT PHILOSOPHY

The continuing attraction of national parks depends on the retention of the natural vegetation and other conservation values. National parks are for people seeking different experiences to those offered elsewhere within any given region. In general, these experiences are of a low key nature and emphasise passive interaction with the natural environment (Sheppard, 1988).

The visitor survey carried out, as part of the preparation of this management plan, indicated that the features most **enjoyed about Fitzgerald River** National Park were the scenery, views, wildflowers, wildlife and unspoilt natural beauty. Management for visitor use should continue to protect these features.

The key factor in managing visitor use while maintaining the Park's values is dieback control. Any provisions for public access and use must consider dieback risk as the highest priority. Another point of relevance is the Park's very high susceptibility to erosion. This high susceptibility means that the Park has a limited capability to support recreational use without careful management. High levels of use are likely to require high levels of management. This is expensive and generally changes the features (such as "unspoilt beauty") which attracted visitors in the first place.

Therefore, the management philosophy for the Park in terms of public use is to provide low-key facilities and services which minimise changes to, and complement, the natural environment. This means low key camping facilities, a limited number of roads and extensive, untouched areas. Facilities should only be placed in areas where the soils and landform are sufficiently stable to support the facilities and their use in the longer term. Dieback should be the fundamental concern in any planning and management of public use. This philosophy is consistent with the Recreation Opportunity Spectrum of Parks as presented in the South Coast Regional Draft Management Plan (CALM, 1989).

12.0 RECREATION OPPORTUNITIES

12.1 THE REGION

The objective is to ensure that development of recreational opportunities within the Park complements rather than competes with attractions and facilities elsewhere.

Background

The CALM South Coast Region, which stretches from west of Albany to the South Australian border and up to 150 km inland in places, offers a diverse range of naturebased recreation opportunities. These include national parks, Shire reserves, other reserves and vacant Crown land.

Most places on the south coast can be reached in a day's drive or less from Perth, and within two or three hours from Albany or Esperance. Spectacular coastal scenery can be enjoyed at Cape Arid, Cape I le Grand, Torndirrup and West Cape Howe National Parks. Most of these Parks offer beaches and a range of fishing opportunities (eg. beaches, rock, estuarine/inlet). Inland parks such as the Stirling Range, Porongurup and Peak Charles offer scenery dominated by peaks and ranges, and spectacular shows of spring wildflowers.

Between them these parks offer a combination of 2WD, 4WD and foot-only access, formal and informal camping, and day-use sites (Table 12).

TABLE 12. NUMBERS OF CAMPING AND DAY USE AREAS IN MAJOR NATIONAL PARKS IN THE CALM SOUTH COAST REGION

PARK	FORMAL CAMPING			INFORMAL CAMPING			DAY USE SITES		
	2WD	4WD	TOTAL	2WD	4WD	TOTAL	2WD	4WD	TOTAL
Cape Arid	2	1	3	1	*2	3	4	2	6
Cape Le Grand	2		2	*1	*1	2	4		4
Stokes	2		2		4	4	1	3	4
Peak Charles				1	1	2	1	1	2
Frank Hann							2		2
Fitzgerald River	1	1	2	2	4	6	5	1	6
Stirling Range	1		1				8		8
Porongurup							2		2
Torndirrup							7		7
West Cape Howe				1	1	2	1	3	4
William Bay							3	1	4
TOTAL	**8**	**2**	**10**	**6**	**13**	**19**	**38**	**11**	**49**

* sporadic beach camping

Source: T. Passmore, CALM South Coast Region, pers. comm., 1988

A range of recreation sites are provided in the Shires of Jerramungup and Ravensthorpe, apart from FRNP (Table 13). There are two caravan parks in each Shire and a number of coastal sites, both with and without facilities. The Shires are responsible for the management of some of these, while the remainder lie on other reserves (either unvested or managed by another agency) or vacant Crown land.

TABLE 13. RECREATION SITES IN THE SHIRES OF RAVENSTHORPE AND JERRAMUNGUP (EXCLUDING FITZGERALD RIVER NATIONAL PARK)

RAVENSTHORPE	JERRAMUNGUP
Caravan Parks (2):	**Caravan Parks (2):**
Ravensthorpe	Jerramungup
Hopetoun	Bremer Bay
Day Use (22):	**Day Use (more than 10):**
Surf Beach	Doubtful Island beaches
Moylans	Bremer Bay beaches
Two Mile Beach	Wellstead Peninsula beaches
Look-out 2	Cape Knob beaches
Look-out 3	Point Irby beaches
Look-out 4	
Five Mile Beach	**Camping with Facilities (1):**
Six Mile Track	Miller's Point
Twelve Mile Beach	
Phillips, Jerdacuttup and Oldfield Rivers	**Camping without Facilities (more than 10):**
Dunn Swamp	Doubtful Island beaches, Four Mile Beach (east of FRNP)
Four Mile Beach (east of FRNP)	Cape Knob beaches
"Creeping Dunes"	(Fosters, Reef and Pallinup)
Castle Rock Beach	
Thirteen Mile Beach	The majority of the above sites (camping without facilities and day use) are only accessible by 4WD. All sites are within 45 Ian of Bremer Bay.
Fourteen Mile Beach	
Mullet Bay	
East of Mullet Bay	
Tuckeys Hole/Abalone Track	
Mason Point	
Camping with Facilities (4):	
Twelve Mile Beach	
Starvation Boat Harbour	
Mason Bay	
Hamersley Inlet	
All the above sites are accessible by 2WD and within 45 km of Hopetoun.	

Sources: Shires of Ravensthorpe and Jerramungup, pers. comm., 1988; Craig *et al*, 1984; DCE, 1984a; van Steveninck and Burkin 1984.

Strategy

It is most important that recreation developments in the Park complement rather than compete with other recreation opportunities on the south coast and in the Shires of Jerramungup and Ravensthorpe. This plan provides for an increase in the camping use of FRNP. Over the next 10 years there will be a doubling of the number of campsites and hence camping opportunities in FRNP. Detailed prescriptions for access, recreation sites and activities are given in Sections 13.0, 14.0 and 15.0 respectively.

12.2 THE PARK

The objectives are:

1. *Provide a range of recreational opportunities based on a range of natural settings, with minimal damage to the environment.*
2. *Direct recreational use into those areas which are suitable and can sustain the type and intensity of use they are likely to receive.*

Background

The Park provides a range of access types, from 2WD to 4WD to foot access only. Levels of development range from camping areas with toilets and marked camping bays to sites with no facilities. However, emphasis is on a natural setting with minimal development. This low key approach is strongly supported by the majority of current users (Cavana and Moore, 1988).

Current use of the Park focuses on the coast over summer and early autumn, and the inland and its wildflowers over the spring months. Visitor numbers peak in January, with 8 030 visitor days+ recorded in January 1988 (Cavana and Moore, 1988). Activities include sightseeing, bushwalking, photography, camping, swimming, fishing and nature study.

Visitor numbers are greatest where vehicle access is easiest, particularly access to 2WD vehicles. The eastern end of the Park, close to Hopetoun, is the most heavily used, particularly beaches which are accessible by 2WD. Most of this is day use, with people returning to Hopetoun or further afield for the night.

In the western end of the Park camping is more common than day use. Beaches close to Bremer Bay, rather than areas in the Park, meet the day-use needs of this population centre. At the western end, use is highest at Point Ann which is accessible to 2WDs, followed by Fitzgerald Inlet which is accessible only to 4WDs.

+ A visitor day is defined as the aggregation of time spent by persons making a recreation visit to a recreation resource or facility into units of 12 visitor hours.

A visitor survey, carried out from November 1987 to April 1988, showed most people were visiting the Park with their families (51%) or friends (27%). The majority of Park visitors came from Perth (39%) and country areas surrounding the Park (29%). Few visitors appeared to come from the Shires of Jerramungup and Ravensthorpe (14%), while 18% were from interstate and overseas. The survey did not cover the full wildflower season. Also, a number of local Park users did not fill in survey forms as they did not feel that they were visitors.

The best way to meet the needs of the different Park users is to continue to provide a range of choices, in terms of access, levels of development or facilities in particular areas, and the amount of interaction with other users. Some visitors may have a strong preference for camping opportunities providing little or no interaction with other groups, while others are more gregarious. To ensure that users know where and how to reach the recreation site most suitable for their needs, readily accessible information is essential.

Four caravan parks on the edges of the Park provide accommodation for people requiring more developed facilities. These are the most popular form of accommodation outside the National Park.

FRNP, as with many south coast areas, does not have a great capacity to support camping in natural settings. This results from an exposed coastline with unstable soils and very few areas with vegetation of sufficient height to provide shelter from the wind and sun. Those areas that have sheltering trees or shrubs are generally limited in size and can only cater for one or two groups. They are generally associated with melaleucas which are particularly susceptible to degradation (see 14.0 Recreation Sites). Small patches of mallee are potentially suitable for camping if they are of sufficient height to provide shelter, and are on stable soils.

Strategy

It is important that future management is based on the need to provide a range of low-key recreation opportunities while retaining a predominantly natural setting, and to provide for recreational use in only those areas which can sustain such use in the longer term.

PRESCRIPTIONS

Detailed management prescriptions are given in 14.0 Recreation Sites and 15.0 Recreation Activities.

Research and Monitoring

1. **Monitor visitor numbers and patterns of use, using traffic counters, site surveys and questionnaires.**
2. **Monitor visitor perceptions regarding Park management, using surveys.**

13.0 ACCESS

NOTE. Throughout this plan a "4WD track" is defined as a track which can only be used by vehicles with high clearance and where 4WD may be required in exceptional circumstances. These tracks should have a surface which has minimal dieback risk. All 4WD tracks (and other unsealed roads within the Park) are generally closed after rain.

The objectives are:

1. *Ensure that dieback control receives the highest priority in any access considerations.*
2. *Ensure that the conservation and landscape values of the Park are recognised in all access provision and changes.*
3. *Provide and/or maintain 2WD, 4WD and foot access to a variety of coastal and inland features within the Park, while ensuring that the natural environment and other Park users are not adversely affected.*
4. *Ensure that all forms of access are constructed and maintained to a standard able to safely support current and expected use levels.*

Background

The Park is accessible, via all-weather gravel roads, from Highway 1, Bremer Bay Road and Hopetoun-Ravensthorpe Road.

Two 2WD loops provide access within the Park (Map 1b). In the east, Hamersley Drive enters the Park from Hopetoun and links in the north with Old Ongerup Road. The western loop, Pabelup Drive, may be reached from the South Coast Highway via Devil's Creek Road in the west or Quiss Road in the north. 2WD roads provide access to Point Ann, West Mt Barren, Mt Maxwell, Hamersley Inlet, West Beach, West Beach Point, Mylies and East Mylies, Barrens and Four Mile Beach. The remaining roads and tracks are suitable for 4WD only. There is also an extensive network of firebreaks, particularly on the Park perimeter. All are 4WD and are for management access only.

The track system in the Park evolved from the original alignment of the transcontinental telegraph line and associated service track, constructed in 1875. Other tracks were established to provide coastal access for fishermen. Access tracks were also associated with the rabbit proof fence and the mineral boom of the late 1960s (Smith, 1977).

All tracks were in place prior to gazettal of the National Park (in 1973). Landscape design or protection of the environment were not considered in their placement. The most critical problem is the possible introduction and further spread of dieback from roads and tracks placed high in the landscape. Many tracks also traverse extensive low-lying waterlogged areas. Other problems include

safety, erosion and soil degradation, and tracks cutting across and intruding on extensive natural views or not optimising available views.

4WD tracks and sections of some 2WD roads present an added dieback risk as many have pools of water lying across them in winter, and in summer following rain. These pools provide an ideal environment for dieback spores to survive, multiply and spread. Recent "forming" of these tracks without realignment and/or sheeting or stabilisation has resulted in some sections of their surfaces becoming slippery following 20 mm or less of rain. Water also ponds in some sections of the adjacent drains.

A number of short footpaths (less than 1 day) provide access to the peaks of East and West Mt Barren and to the river valley and several low hills near Twertup. An unmarked coastal walk traverses the coast from Bremer Bay to Hopetoun. Walks up peaks present a substantial dieback risk, as they may lead to its introduction high in the landscape. Further comments on management of footpaths are given in 15.3 Bushwalking.

When full of water, some of the inlets are accessible by small boat. Boats can be launched on the Hamersley Inlet most of the year. The lower reaches of the Fitzgerald, Hamersley and Phillips Rivers can be explored by canoe. All inlets and rivers are generally too shallow to be easily or safely used by large power boats.

Some of the problems that can result from the provision and use of access, both public and management only, include the introduction of dieback and weeds, vegetation damage, soil compaction which may initiate wind and water erosion and blowouts in sensitive areas, and the impairment of scenic amenity. In addition, access may concentrate activity in areas with a limited ability to support public use or where the public is not easily safeguarded.

Much of the Park is sensitive to erosion and soil degradation (Map 4). In a number of places on the coast mobile dune-fields occur, interspersed with areas of recently consolidated wind-blown sand. The steep Barren ranges are highly susceptible to water erosion once the vegetation has been removed (eg. on footpaths). The plains suffer damage from vehicles under wet conditions. Even the more stable granite-derived soils of the northern Fitzgerald are susceptible to water erosion.

Strategy

Future access to the Park will be based on the two existing 2WD loops, Hamersley Inlet and Pabelup Drives, with 2WD spurs to Point Ann - St Marys, West Mt Barren and Mt Maxwell in the west, and Hamersley Inlet and a number of beaches between Four Mile and West Beach in the east (Map 10). The 4WD spurs to Fitzgerald Inlet and Quoin Head will also be retained, although restricted if necessary.

In the following prescriptions, dieback is the greatest management concern. Section 9.1 Disease provides further details on dieback, the extreme vulnerability of FRNP to this disease and relevant management prescriptions. If the presence of dieback is suspected or confirmed on or adjacent to the roads, tracks (including management-only) or footpaths proposed in this plan, future management of the particular access way should be carefully considered. Generally, evaluation should include consideration of further hardening of the road, track or path surface by adding gravel or limestone or, if appropriate, sealing. If required, consideration should also be given to re-assessing and altering the drainage, and realignment to reduce the area of catchments affected. Closure will also be considered.

Generally, every effort should be made to keep open the 2WD roads and 4WD tracks. All or parts of the Park may be closed following rain, using the same criteria presently applied to 4WD tracks. That is, closed when sufficient rains allow vehicles to pick up mud and soil.

Six classes of road are recognised:

Class 1. sealed through roads
Class 2. sealed spurs
Class 3. gravel through roads
Class 4. gravel spurs
Class 5. 4WD - dry weather access only
Class 6. management-only - dry weather access only.

Safety through the application of consistent standards will be a priority in all access provisions.

PRESCRIPTIONS

1. **Retain public access to most parts of the Park. The recreation and natural environment zones will be accessible by vehicle and on foot, and the special conservation and wilderness zones by foot only (except for management purposes) (Map 3).**

2. **Maintain, upgrade, realign or dose roads and tracks as indicated in Table 14. Roads and tracks will not be upgraded, except for dieback hygiene, unless resources are available to provide adequate facilities (e.g. car parks, camping areas, walkways to the beach) at the road/track end.**

3. **Road and track location and realignment must be based on selection of the best road or track corridor. The guidelines for selection are:**

a. **the corridor minimises the risk of disease spread, based on up-to-date hygiene and hazard maps, position in the landscape and landform;**
b. **the corridor is cost efficient to construct and maintain;**
c. **the corridor offers a diversity of views, including some panoramic views;**
d. **the corridor has minimal impact visually; and**
e. **the corridor allows for a given design speed.**

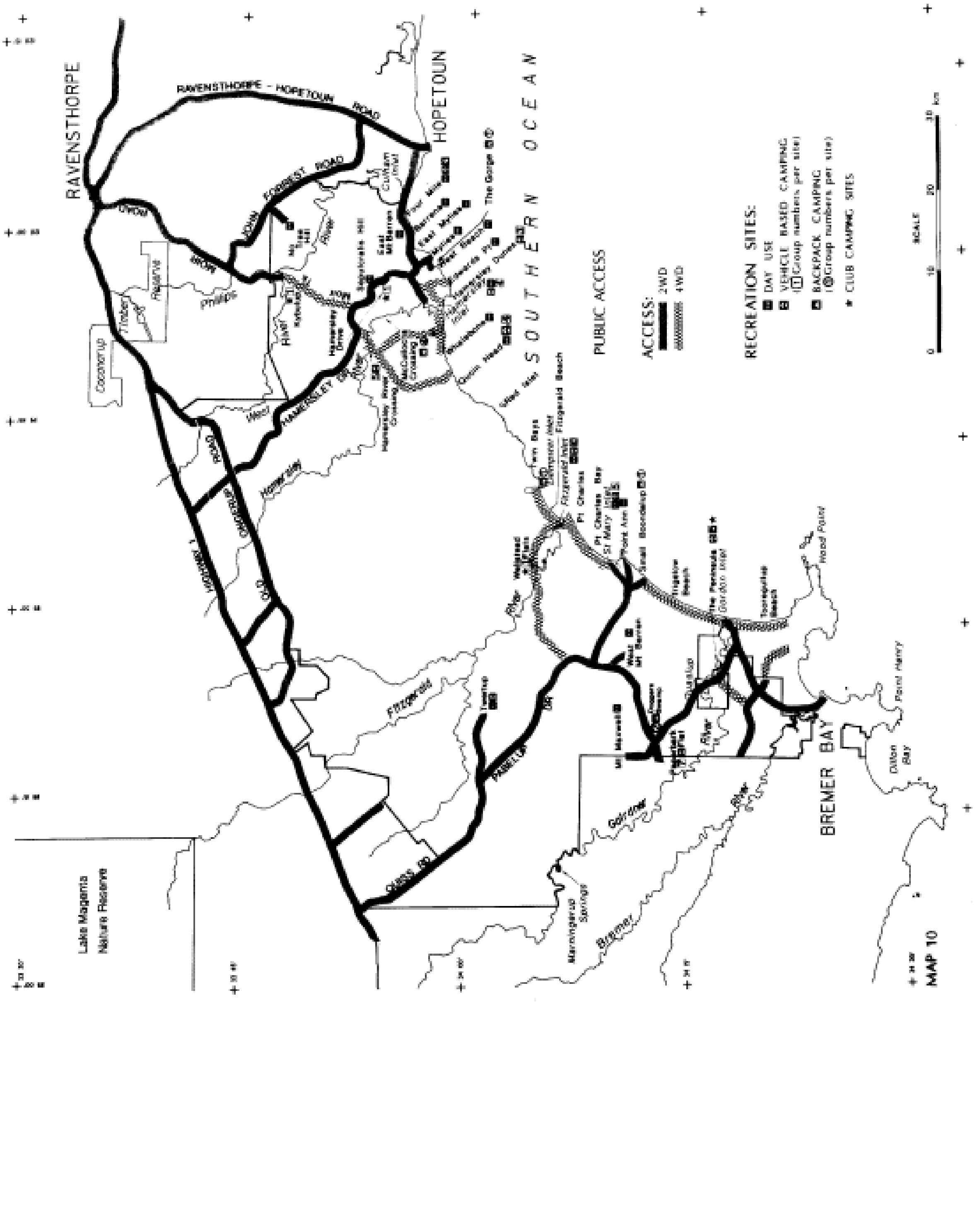
Once a corridor has been selected, the alignment of the road or track within the corridor must be designed in detail.

4. **For Class 1, 2, 3 and 4 roads (see strategy above for definition) design to provide for travelling speed of up to 60 km/hr. Provide signs at Park entrances and along roads to indicate this speed limit. Ensure safe visibility on curves and intersections.**

5. **For Class 5 and 6 tracks the most important consideration is minimising the risk of dieback introduction and disturbance. Design speed is not important.**

6. **On Class 5 tracks:**
   a. **test a range of water shedding and stabilising surfaces, such as gravel, limestone and geotextile treatments.**
   b. **continue track closures in some parts of the Park until satisfactory techniques for stabilisation. have been determined for broadscale implementation.**
   c. **once techniques are implemented, continue to closely monitor track status. d. consider dieback, landscape and erosion impacts before any technique is tested or implemented.**

7. **Exclude vehicles from the centre of the Park to reduce the risk of dieback introduction and/or spread to the lowest possible levels. Vehicle access for dieback sampling and fire management will be allowed under strict permit, subject to NPNCA approval. If a life-threatening emergency arises requiring the use of vehicles within these areas, entry will be authorised by the South Coast Regional Manager or a representative. Access for fire management purposes in the centre of the Park will be reviewed in 1995 (refer to 9.2 Fire).**



RAVENSTHORPE
HOPETOUN
RAVENSTHORPE - HOPETOUN ROAD
JOHN FORREST ROAD
HAMERSLEY DRIVE
S O U T H E R N   O C E A N
PUBLIC ACCESS
ACCESS:
2WD
4WD
RECREATION SITES:
DAY USE
VEHICLE BASED CAMPING
(Group numbers per site)
BACKPACK CAMPING
(Group numbers per site)
CLUB CAMPING SITES
SCALE
0
10
20
30 km
Lake Magenta
Nature Reserve
Fitzgerald
Bremer
Gairdner
Phillips
West
Hamersley
Twin Bays
Fitzgerald Beach
Pt Charles
Point Ann
The Gorge
East Mt Barren
West Mt Barren
Mt Maxwell
Quoin Head
Hood Point
Point Henry
Dillon Bay
BREMER BAY
MAP 10

TABLE 14. ROAD AND TRACK PRESCRIPTIONS

ROAD/TRACK	CLASS	MANAGEMENT ACTION	RECOMMENDED PRIORITY
EASTERN SECTION			
Hamersley Drive	1	Assess need for realignment. Provide "pull-overs" with inter pretive material. Seal around East Mt Barren, for dieback reasons, as highest priority. Seal to Mylies or further, if needed.	1
Moir Track	5	Assess need for realignment. Sheet where necessary.	1
Barrens Road	4	Maintain.	Ongoing
Four Mile Beach Road	4	Maintain.	Ongoing
Mylies Road	4	Maintain.	Ongoing
East Mylies Road	4	Maintain.	Ongoing
West Beach Road	4	Maintain.	Ongoing
West Beach Point Road	---	Close to vehicles, provide extended footpath to West Bch Point.	2
The Gorge Track	---	Close to vehicles, use as footpath, provide carpark at head of track.	1
Hamersley Inlet Road	2	Maintain.	Ongoing
Hamersley Dunes Track	5	Monitor. Traffic will be along a defined corridor.	Ongoing
Edwards Pt Track	5	Monitor.	Ongoing
West Hamersley Inlet Track	5	Assess need for realignment. Sheet where necessary.	1
Whalebone (Dave Niels) Tk	5	Assess need for realignment. Sheet where necessary.	1
Quoin Head Track	5	Assess need for realignment. Sheet where necessary.	1
Quoin - Whalebone Track	5	Close. Alternative access available.	1
No Tree Hill Track	4	Assess need for realignment. Provide carpark on lower slopes. Gravel.	3
WESTERN SECTION			
Pabelup Drive	1	Assess need for realignment. Seal sections for dieback reasons, if needed. Provide "pullovers" with interpretive material.	1
Colletts Road	4	Assess need for realignment.	1
Gairdner Road North	5	Assess need for realignment. Stabilise crossing. Sheet where necessary.	3
Gairdner Road- South*	4	Assess need for realignment. Liaise with Shire re joint road maintenance program.	3
Gordon Inlet Road*	4	Assess need for realignment. Upgrade to 2WD all weather. Liaise with Shire re joint road maintenance program.	3
Gordon Inlet - Quaalup Tk*	4	Assess need for realignment. Upgrade to 2WD all weather.	1
West Mt Barren Road	2	Maintain.	Ongoing
Pt Ann Road	2	Assess need for realignment.	2
Mt Maxwell Road	4	Assess need for realignment.	3
Fitzgerald Inlet Track	5	Realign to avoid 'Lake Nameless' catchment. Assess need for realignment in the remaining section. Sheet where necessary.	1
Twertup Track	4	Assess need for realignment. Sheet where necessary.	1
St Marys Track	2	Realign, upgrade to 2WD all weather. Provide stable access to Pt Charles Bay Beach.	1
Trigelow East Track	4	Realign, provide stable all weather vehicle access to northern end of Trigelow Beach.	1
Trigelow Beach Track		Close track which runs parallel to beach.	2
Trigelow Beach	---	Continue beach access, monitor.	Ongoing
"Small Boondalup" Track	---	Close to vehicles, use as footpath.	1
St Marys - Pt Charles Tk	5	Realign, keep beach open.	1
Point Charles Bay Beach	---	Continue beach access, monitor.	Ongoing
Smokehouse Landing Track	---	Close on basis of continuing access to S bank of Bremer River through Jerramungup Shire reserve.	1

ROAD/TRACK	CLASS	MANAGEMENT ACTION	RECOMMENDED PRIORITY
Fitzgerald Beach	---	Continue beach access, monitor.	Ongoing
Accesses around Quaalup	6	Review.	2
CENTRAL SECTION			
Telegraph Track (Fitzgerald Inlet - Quoin Head)	6	Close to all access except for dieback sampling and survey under strict permit. Review for fire access in 1995.	1
Drummond Track	6	Close to all access except for dieback sampling and survey under strict permit. Review for fire access in 1995.	1
Twin Bays Track	6	Close to all access except for dieback sampling and survey under strict permit. Review for fire access in 1995.	1
Bell Track South	6	Close to all access except for dieback sampling and survey under strict permit. Review for fire access in 1995.	1
Fitzgerald South Track	6	Close to all access except for dieback sampling and survey, under strict permit. Review for fire access in 1995.	1
Red Islet - Marshes Beach Track	6	Close to all access except for dieback sampling and survey under strict permit. Review for fire access in 1995.	1
Bell Track North	---	Keep closed.	1
Southern spurs off Old Ongerup Road	6	Maintain for fire (emergency) access.	2
GENERAL			
Firebreaks	6	Assess need for realignment. Minimise numbers, dieback risk and erosion. Ensure closure to public vehicles.	1

* Assess best provision of access to the Peninsula and Gordon Inlet and links with Bremer Bay and FRNP.

8. Temporarily close East Mt Barren path because of confirmed dieback at the beginning of the path. Re-locate the beginning of the path and realign the path to both avoid the infected area and to minimise the area infected if further spread associated with the footpath occurs. Clearly delineate the infected areas. Establish a sealed carpark on old gravel pit site and provide a stable walkway to the first stage of the path.

9. Because of dieback risks, prohibit access (including foot access) to the peaks of Mid Mt Barren, Woolbernup Hill and Thumb Peak, except by special permit. These peaks are proposed for closure or quarantine as they are part of the quartzite ranges which support high numbers of rare plants, many of which are susceptible to dieback. By walking on these peaks, walkers risk introducing dieback.

10. Provide parking and turning space for buses of up to 45 seats at East Mt Barren lookout, approaching from the east. Provide for buses of up to 20 seats at Point Ann, West Mt Barren and Mylies Beach and other destinations which may be approved from time to time. Elsewhere, roads should be designed and built to meet the requirements of cars, rather than those of buses or caravans.

11. Close all or parts of the Park following rain as necessary (ie. access ways where vehicles [or footwear] can pick up mud or soil). This is to minimise the risk of dieback infection and spread (see Section 9.1 Disease for explanation), damage to the track surface and to reduce safety risks to users. Use signs at all Park entrances and other media to indicate whether roads, tracks and footpaths are open or closed.

12. Realign the track on the hinterland of Point Charles Bay to ensure dieback cannot be introduced or spread to the "Lake Nameless" catchment, to reduce track visibility from Point Ann and St Marys, and to provide access to all of Point Charles Beach. Realign the Fitzgerald Inlet Track to avoid the 'Lake Nameless' catchment. The "Lake Nameless" catchment is one of the catchments from which all vehicles are being excluded to minimise the risk of dieback introduction and spread.

13. Keep Trigelow, Point Charles Bay, Fitzgerald/Dempster and Hamersley Beaches open to 4WD vehicles, with access available via the tracks indicated on Map 10. 4WD use of these four beaches has been retained on the basis that:

- **4WD access to the beach can be provided via a stable and visually acceptable alignment.**
- **these beaches are remote and, therefore, conflict with other users is minimal.**
- **a range of opportunities is available elsewhere in FRNP, firstly, for people to access the immediate hinterland of beaches in 2WD vehicles; and secondly, several remote beaches have been retained as foot access only, with no vehicle access to the immediate hinterland.**
- **users are notified of safety risks (eg. quicksand, changing beach profile).**
- **no breeding birds appear to be affected.**

If the effects on breeding birds, safety risks or damage to foredunes, particularly at access points, become unacceptable, 4WD use of the specific beach should be re-assessed. The beach of particular concern, in terms of breeding birds and safety (ie. quicksands), is Fitzgerald Beach. Any reassessment should be in consultation with users and the Fitzgerald River National Park Advisory Committee.

14. Restrict vehicles on beaches to the unvegetated beach face, generally between low and high water mark. Do not allow vehicles in foredunes.

15. Rehabilitate closed tracks to minimise erosion and encourage revegetation. Provide explanatory signs to inform users.

16. **Liaise with Shires to ensure that road standards within the Park and of adjoining roads are complementary.**

17. **Other than beach access as described, only permit the use of vehicles and machines off-road for fire control (and only in specified parts of the Park - refer to 9.2 Fire), search and rescue and other emergency circumstances. The decision will rest with the District Manager. Strict dieback hygiene must be observed and special care must be taken to avoid areas susceptible to soil erosion and degradation. Areas containing rare species or archaeological sites must also be avoided.**

18. **Subject all road and track maintenance to strict dieback hygiene measures.**

19. **A strictly limited number of management-only tracks will be maintained for the control of fire, pests, weeds and disease, and for survey, research and monitoring. These tracks will not be all-weather and may only be accessible in summer or following long dry periods. Their use will be subject to strict dieback hygiene and the approval of the District Manager. Maintenance works on these tracks should be limited to prevention of erosion and waterlogging, and should disturb the soil profile and natural drainage patterns as little as possible.**

20. **Management-only tracks will generally be open for walking but not to vehicle access by the public. They will be closed by secured gates.**

21. **New management tracks will only be established where no feasible alternatives for management exist, and only following evaluation using the Necessary Operations Checklist and obtaining the associated levels of approval. Location should be according to the principles given earlier (Prescription 3).**

22. **Liaise with local users prior to road closures, where possible.**

Research and Monitoring

23. **Monitor annually the status of roads, tracks and footpaths. If erosion gullies become greater than 10 cm deep, or if water ponds on a road or track for longer than three to four days after rain, then management action is necessary. These values are based on dieback risk, and soil degradation and erosion. They can be re-assessed and new values written if new information indicates the need.**

24. **Monitor access points to 4WD beaches. If 4WD tracks other than the designated main access point are created, management action is necessary.**

13.1 TELEGRAPH TRACK

The objective is to recognise the special wilderness values of the central part of the Fitzgerald in any access considerations associated with Telegraph Track.

Background

This 4WD track, which runs east-west through the centre of the National Park, has been closed since 1986 because of dieback risks (see 9.1 Dieback for an explanation). There are several reasons supporting continuation of this decision. These are.:

Dieback Risk

Telegraph Track traverses three catchments (Hamersley River, Quoin Head and Dempster) and provides access to a number of smaller coastal catchments. With realignment it could avoid the Quoin Head catchment. However, it would still place two major catchments at risk from dieback introduction and spread.

The Dempster is the only major catchment wholly within the National Park. This means that CALM can minimise changes in water quality and further dieback spread across the whole catchment.

Dieback risks can be overcome to some degree by upgrading access to sealed roads with comprehensive drainage. This means that dry conditions inhospitable to the survival of the dieback fungus are created. However, there is still some risk. The risk associated with gravel roads is greater, and is higher again for 4WD tracks. Construction of sealed roads is expensive and in many cases beyond the budget of land managers. In FRNP, the priorities are sealing major tourist roads such as Hamersley and Pabelup Drives. These are at greater risk given their higher levels of use.

Maximising Recreation Opportunities (Wilderness Values)

If the aim is to provide a diversity of recreational opportunities in the Park, then continued vehicle access through the central part of the Park and to the central coast means that few coastal areas are the domain of walkers only. This reduces the range of recreation and in particular wilderness opportunities.

Strategy

It is the intention at this stage that Telegraph Track (between Fitzgerald Inlet and Quoin Head Track) will remain closed to all vehicular use unless the fire management strategy for the central wilderness area, which will be reviewed by July 1995, requires it to be open for this purpose (see 9.2 Fire). The only exception is strictly controlled vehicle access approved by the NPNCA for management purposes. Recreational vehicle access will continue to be provided along Telegraph Track to Quoin Head. These decisions are necessary to protect the area from further dieback spread.

With this level of access 24% of the coastline can be considered reasonably protected, and providing for walkers only. It also provides for use of Quoin Head and Fitzgerald Inlet by 4WD-based visitors.

PRESCRIPTION

1. **Close Telegraph Track between Fitzgerald Inlet and Quoin Head Track to all vehicle access. Access for dieback and fire management purposes will only be permitted with NPNCA approval. In July 1995, future management access will be determined by the National Parks and Nature Conservation Authority on the advice of the fire advisory group.**

14.0 RECREATION SITES

NOTE: There are circumstances where certain users, for example anglers, have a genuine requirement to be on-site overnight. This plan will allow recreational fishermen to rest in their vehicles at designated 4WD sites overnight. 'Overnight resting in vehicles' is defined as sleeping in, or next to, a vehicle for one night, provided neither tents nor any other external structure is erected. This system will be periodically reviewed, time restrictions may be applied and specific sites may become unavailable.

14.1 GENERAL

The objectives are:

1. Provide a choice of recreation sites, within a range of natural settings, which can be used and maintained with minimal damage to the environment.
2. Ensure that recreation sites are located in stable landscapes where they are visually unobtrusive and where such use is sustainable in the longer term.
3. Minimise conflict between visitors by careful site location and design.
4. Consider visitors' safety at recreation sites as well *as* ensuring that the sites remain attractive.

Background

There are about 28 recreation sites currently used in the Park. Of these, 11 are used for both day use (parking and/or picnicking) and overnight camping, 13 for day use only and 4 for camping only.

The Park visitor survey (Cavana and Moore, 1988) indicated that 49% of visitors are day visitors and that the majority of campers stay 2 to 3 nights. The most frequently used campsites are Fitzgerald Inlet, Point Ann, Four Mile Beach and Mylies. With average levels of use the capacities of day use and camping areas are not exceeded. However, during peak use periods (Christmas -New Year, January and March long weekends, school holidays and Easter) the capacities of Mylies, Point Ann and Hamersley Inlet are often exceeded. The ability to camp away from other people is considered important by 81% of visitors. Many recreation sites have generally been established at the end of fishing tracks or are associated with coastal features such as beaches and headlands. The majority of sites lie on the coast. This has led to two major problems.

Firstly, many sites are located on fragile, highly erodible soils, such as recently consolidated sands. Recreational use, particularly camping, has focused on small stands of melaleucas. Many of these stands have been progressively stripped for firewood or damaged by vehicles pushing under them for shade. Once the sandy soils in these areas are exposed, they are readily damaged by water and wind erosion.

Therefore, these fragile areas cannot continue to support intensive uses such as camping. Reductions in the intensity of use can be achieved by changing the site from camping to day use (thereby reducing the length of time and the demands users place on a site), closing the area to vehicles and providing for foot access only, or by closing the area to all access. The measure chosen depends on the fragility of the area, level of degradation and availability of alternative sites.

Secondly, the majority of sites cater for both day use and camping. Using one area to cater for both demands may lead to conflict between day users and campers. To make the most efficient use of space and minimise safety risks, day use and camping sites should be physically separated where possible. The three sites which are deteriorating most rapidly are Point Ann, Mylies and Quoin Head.

Point Ann is popular because it provides a sheltered beach and small sandy terrace protected by cliffs. It has become highly degraded. The stands of melaleucas which once provided shelter and shade have been progressively removed for firewood or otherwise damaged. Erosion gullies several metres deep run from the access track to the beach. There is conflict between day visitors and their parking requirements, campers and the occasional boat trailer. An old shack also adds to the congestion.

Mylies Beach is a long beach popular for fishing and swimming. The site itself lies between a stream and mobile dunes. It is limited in size, with the melaleucas being damaged by camping. The site becomes crowded at times, with the potential for conflict between campers and day users. The site was damaged by floods in 1988, when the walkway to the beach was washed away, and by fire in 1989 when vegetation was completely removed.

Quoin Head also provides a sheltered beach. The site is on sloping sands at the foot of a steep rocky slope. The melaleucas have been extensively damaged by stripping for firewood and by vehicles pushing into stands for shelter. Exposed areas are becoming damaged by wind and water erosion with gullies 1 m deep.

Stands of mallees on stable soils provide attractive alternatives for camping in the Park. A number of potential sites relatively close to the coast (100 m - 1 km) exist in the Park.

Strategy

Reference to the Recreation Goal for the FRNP indicates that the Park should cater for recreational use in a natural setting, with minimal facilities. Within this framework there should be a choice of settings, including coastal, heathland and mallee; and development, ranging from "developed" to "less developed". This should include areas accessible to 2WDs with facilities, 4WD-accessible areas with no facilities apart from toilets, and backpack campsites with no facilities. There are currently enough

sites, albeit poorly planned, to meet demand, except over peak-use periods. It is an inefficient use of resources to plan on the basis of peak demand, which only occurs on 18-20 days per year.

Although the sites meet demand, their inherent fragility and obvious degradation mean that in a number of areas current levels of use cannot be sustained in the longer term. In terms of camping, the Park currently provides for about 21 groups in the western end and 19 groups in the east, giving a total of 40 groups spread over 18 locations.

The strategy proposed in this plan for camping is to provide attractive, additional/alternative areas which are stable and sustainable in the longer term. The number of proposed areas will cater for current demand plus a potential increase of about 100% over the next 10 years. This is based on potential sites for 43 groups in the west and 36 in the east, giving a total of 79 across 18 areas (Map 10 and Table 15). Of these 18 locations, six will be accessible to 2WD, four to 4WD, five to backpackers only and four (2 to 2WD, 2 to 4WD) for clubs or organised groups.

Only limited changes to existing camping sites, to prevent further degradation, will be made until alternatives are provided. For example, a camping area will not be changed to day use until an attractive, alternative camping area has been established.

The strategy proposed for day use areas is to separate them from camping sites. Also, most parking areas require re-assessment to maximise the space available, while at the same time minimising the area disturbed. Details on specific sites are given in Table 15, Map 10 and the following prescriptions. The development of detailed plans for all sites within the National Park is beyond the scope of this plan but will be undertaken during the life of this plan.

PRESCRIPTIONS

It is essential to read the strategy above before reading the following prescriptions.

General

1. **Carry out site modifications and management according to the prescriptions in Table 15. Carry out site developments in accordance with a site development plan. Prepare plans in consultation with CALM landscape architects.**

2. **Consult with Fitzgerald River National Park Advisory Committee regarding site development plans. All new developments should be based on an up-to-date dieback hygiene plan and an approved Seven Way Test (see 9.1 Disease for explanations).**

Camping

3. **Design campsites to cater for a range of group sizes, from one vehicle to three to four vehicle groups. Also, design to provide, where possible, good separation of camping groups, either by screening vegetation, landform and/or distance.**

4. **Provide for vehicle-based, 2WD-accessible camping at St Mary Inlet, Hamersley Inlet, Four Mile Beach, Twertup, "The Peninsula" and Paperpark Flat (at the southern end of Pabelup Drive) (Table 15, Map 10). The last two are new sites. Support the use of Hamersley Inlet Shire Reserve for camping.**

5. **Provide for vehicle-based 4WD-accessible camping at Fitzgerald Inlet, Quoin Head, Hamersley River Crossing and Hamersley Dunes (Table 15, Map 10). Investigate a possible new campsite in Whalebone Beach area.**

6. **With the exception of the wilderness zone, CALM will seek additional campsites and the upgrading and expansion of suitable existing campsites, with emphasis on those near the coast and accessible to 2WDs. Implementation will be subject to NPNCA approval.**

7. **Implement a system for booking of campsites, particularly for 4WD sites during peak demand periods, according to need.**

8. **Provide for backpack camping (foot access only) at The Gorge, McCulloch's Crossing, "Small Boondalup" River, Dogger's Swamp and the eastern end of Fitzgerald Beach (Table 15, Map 10). The Gorge, "Small Boondalup" and the Fitzgerald Beach sites are currently accessible by 4WD, but are degrading rapidly.**

9. **Provide for group camping, on a bookings basis, with a maximum group size of preferably four or rive vehicles, or 20 people or fewer, at The Peninsula, Wellstead Flats, Kybulup Pool and Hamersley Drive (Map 10). The last is a new site.**

10. **Close camping sites behind Trigelow Beach, at Point Charles, West Hamersley and Edwards Point because of degradation and erosion.**

11. **Consider the needs of commercial fishermen in the development of camping areas near Gordon and Hamersley Inlets.**

12. **Develop, as required, a campsite host system at selected campsites.**

13. **Inspect disused gravel pits with the view to rehabilitation into campsites if the need arises and if appropriate.**

14. **Change the use of Mylies and Point Ann from camping and day use to day use only. Details are given in Table 15.**

15. **Provide for day use (well separated from camping) at Quoin Head and Hamersley Inlet (National Park site).**

Day Use

16. **Re-assess and, if necessary, modify the design of carparks at Mt Maxwell, West Mt Barren, Twertup Field Study Centre, Four Mile (day use), Barrens, East Mt Barren lookout and the carpark at the foot of East Mt Barren path, East Mylies, Mylies and West Beach (Table 15, Map 10).**

17. **Close West Beach Point carpark and access road (Table 15, Map 10). Provide footpath from a new carpark on West Beach Road. This will reduce the visual scar of the existing road and carpark.**

18. **Ensure that parking areas at West Mt Barren, Point Ann and Mylies cater for 20-seater buses and that East Mt. Barren lookout carpark caters for 45-seater buses.**

19. **The highest priorities for management actions are to: a. change Pt Ann to day use and at the same time establish camping areas at St Marys and Paperbark Flat. b. change Mylies to day use and at the same time increase the capacity of Hamersley Inlet (National Park site) and Four Mile.**

Research and Monitoring

20. **Regularly photograph recreation sites from a fixed point and in a fixed direction. Use photographs to identify subtle changes over time (and between managers) at a particular site.**

21. **Record, on a regular basis, percentage canopy cover (from aerial photos), number of broken branches and depth of erosion gullies. If the canopy cover has decreased by more than 10%, number of broken branches has doubled or erosion gullies are deeper than 10 cm since the last survey, then management intervention is necessary. Change these criteria and standards if new information indicates the need. Keep a written record of any changes made.**

TABLE 15. MANAGEMENT PRESCRIPTIONS FOR RECREATION SITES*

SITE	MANAGEMENT GUIDELINES	RECOMMENDED PRIORITY
WESTERN SECTION		
Mt Maxwell lookout Current: day use Proposed: day use	Assess carpark design. Define carpark boundaries.	3
West Mt Barren Current: day use Proposed: day use	Assess carpark design. Provide seating on walktrail. Provide for access by small buses (up to 20 seats).	3
Trigelow Beach Current: day use and vehicle based camping Proposed: closure	Close and rehabilitate campsites. Close track.	2
"Small Boondalup" River Current: day use and vehicle-based camping Proposed: backpack camping	Close to vehicles, promote as a readily accessible backpack site. Provide carpark and start of the path on Trigelow East Tk. Assess need for provision of formal walkway to beach.	2
Point Ann Current: day use and vehicle-based camping Proposed: day use	Re-design for day use only. Convert shack to day use facility. Provide camping at St Marys, The Peninsula and Paperbark Flat. Use information boards to explain why changes have been made. Provide for launching of small boats, and parking for boat-trailers.	1
St Mary Inlet Current: day use and vehicle-based camping Proposed: day use and vehicle based camping	Design to provide camping for 5 groups (maximum design load 10). Ensure 4WD access to Pt Charles Bay Beach.	1
Point Charles Current: vehicle-based camping Proposed: closure	Close campsite and rehabilitate.	2
Fitzgerald Beach (E end) Current: vehicle-based camping Proposed: backpack camping	Close campsite to vehicles, tidy up and encourage use as a backpack campsite.	2
Fitzgerald Inlet Current: day use and vehicle-based camping Proposed: day use and vehicle based camping	Design to provide camping for 10 groups (maximum design load 15). Ensure 4WD access to beach.	1

SITE	MANAGEMENT GUIDELINES	RECOMMENDED PRIORITY
Twertup Current: day use and built accommodation Proposed: day use and built accommodation	Assessment of future requirements by consultation between CALM and Fitzgerald River National Park Association.	2
Paperbark Flat Current: none Proposed: vehicle-based camping	Develop for vehicle-based camping for 7 groups (maximum design load 15).	1
The Peninsula† (Pt 32666) Current: informal camping (no facilities) Proposed: vehicle-based camping	Develop for vehicle-based camping for 15 groups (maximum design load 20). Provide toilets.	2
Dogger's Swamp Current: none Proposed: backpack camping	Backpack camping, no facilities.	2
Smokehouse Landing (currently part of Jerramungup Shire Reserve) Current: day use Proposed: day use; access by boat and foot only.	Liaise with Shire to provide access to the southern part of the Shire reserve. Close to vehicles and rehabilitate access track to Smokehouse Landing.	1
EASTERN SECTION		
Four Mile - day use Current: day use Proposed: day use	Assess need to increase carpark capacity once capacity of the camping area has been increased (see below).	3
Four Mile - camping Current: vehicle-based camping Proposed: vehicle-based camping	Increase capacity for 7 groups (maximum design load 7) to give a total of 13 sites by extending existing camping area.	1
Barrens Beach Current: day use Proposed: day use	Re-design carpark to form a loop.	3
East Mt Barren lookout Current: day use Proposed: day use	Re-design parking area to reduce visual impact and erosion problems. Provide disabled access path to lookout. Provide parking for buses up to 45 seats in capacity.	2

SITE	MANAGEMENT GUIDELINES	RECOMMENDED PRIORITY
East Mt Barren path Current: day use Proposed: day use	Move and seal beginning of the path and parking area, realign path because of dieback risks to rare plants. Use carpark as a display area for information on dieback.	1
Mylies Beach Current: day use and vehicle-based camping Proposed: day use	Re-design for day use only, based on site about 200 m west of existing site. Retain existing carpark (with some re-design) for use during peak periods. Provide additional camping at Four Mile and Hamersley Inlet. Use information boards to explain why changes have been made.	2
East Mylies Current: day use Proposed: day use	Reduce road crest, use cut to fill carpark. Check that fill level doesn't make cars visually obtrusive. Monitor existing footpath for erosion.	2
The Gorge Current: vehicle-based camping Proposed: backpack camping	Close to vehicles, rehabilitate access track. Provide paths, with beginning of the path off West Beach Road. Provide for backpack camping.	2
West Beach Point Current: day use Proposed: day use	Close carpark and West Beach Point Road. Provide walktrail to West Beach Point from a new carpark on West Beach Rd.	3
West Beach Current: day use Proposed: day use	Redesign to create one-way loop within carpark.	3
Edwards Point Current: day use and vehicle-based camping Proposed: day use	Monitor track and turn around on Point. Close and rehabilitate campsite.	2
Hamersley Dunes (campsite inland of mobile dunes) Current: vehicle-based camping Proposed: vehicle-based camping	Develop nearby mallees for vehicle-based camping for 3 groups (maximum design load 6).	2
Hamersley Inlet (National Park site) Current: day use and vehicle-based camping Proposed: day use and vehicle based camping	Develop campsite for 4 groups (maximum design load 6) and day use area with access to inlet for boat launching. Provide pull-over on entrance road for views over the Inlet.	1

SITE	MANAGEMENT GUIDELINES	RECOMMENDED PRIORITY
Hamersley Inlet West Current: day use and vehicle-based camping Proposed: closure.	Close and rehabilitate. Close off the 'slide' down to Hamersley Inlet.	2
Whalebone Beach Current: day use Proposed: day use	Maintain existing access. Provide parking and turn around area at western end of beach. Close tracks along cliffs. Investigate a possible new campsite in the Whalebone Beach area.	2
Quoin Head Current: day use and vehicle-based camping Proposed: day use and vehicle-based camping	Provide for limited vehicle-based camping for 4 groups (maximum design load 4). Site of limited suitability for camping in the longer term; however, no other sites available nearby. Give high priority to monitoring. Rehabilitate degraded and eroding areas. Modify last steep section of access track to reduce erosion.	1
Hamersley River Crossing Current: informal camping (no facilities) Proposed: vehicle-based camping	Develop for vehicle-based camping for 5 groups (maximum design load 10). Realign Telegraph Track around the northern end of the yate woodland to enlarge camping area and physically separate the Track and camping area.	1
McCulloch's Crossing Current: none Proposed: backpack camping	Backpack camping, no facilities. Commence the path on Hamersley Drive.	2
Sepulcralis Hill Current: day use Proposed: day use	Maintain.	Ongoing
No Tree Hill Current: none Proposed: day use	Provide carpark on lower slopes and footpath to peak.	2
CENTRAL SECTION		
Marshes Beach to Twin Bays Current: backpack camping Proposed: backpack camping	Monitor for impacts by backpack campers.	Ongoing

† outside the existing National Park boundary * details on club/group sites not included.

14.2 RECREATION SITE MANAGEMENT (Level of development, campfires, caravans and rubbish)

The objectives are:

1. *Manage sites to protect the natural environment and maintain each site's attractiveness to visitors.*
2. *Manage sites in the most cost-effective way.*

Background

To retain the natural setting of recreation sites requires a clear definition of the acceptable levels of facility development. This is given below in the Strategy. Other points of broad relevance to site management across the Park are campfires and rubbish bins.

A major problem in the Park, and many other areas on the south coast, is the destruction of trees for firewood. Trees are a particularly limited resource in FRNP. In coastal areas their removal often leads to erosion and a reduction in shelter for campers and other visitors. Stands of melaleucas are particularly susceptible.

Most recreation sites have rubbish bins provided. These are emptied regularly by Park staff. There is a need to rationalise the provision of bins as emptying them is very time-consuming, reducing ranger time for other tasks. Most visitors only stay in the Park 2-3 days and could readily take their rubbish with them.

Strategy

A range of facilities should be provided at sites across the Park. Sites nearest the eastern and western ends of the Park and closest to the rangers (and, therefore, more rapidly accessed and maintained) should be the most developed, while those further into the Park should be more primitive.

Flushing toilets, showers and caravan parks will not be provided. Toilets will be "long drop" only, with sealed vaults accessible to sanitary trucks at the busiest sites.

Caravans should be actively discouraged because camping areas are small and not designed for caravans, and because the roads are not designed to safely accommodate them.

The facilities provided should be based on minimal maintenance to provide Park staff with more time for interpretive, educational, monitoring and research functions.

PRESCRIPTIONS

1. **Provide gas barbecues at the more intensively used areas.**

2. **Do not permit campfires on the ground within the Park, because of fire risks and impacts of firewood collection on fragile coastal vegetation. Allow fires in containers that meet with the ranger's approval on beaches and in approved campsites, provided a live fire is not left unattended and visitors supply their own fuel which is free of dirt and seeds. Brochures and general information on the Park will advise visitors to bring their own wood and fire container.**

3. **Provide toilets at all camp sites and day-use sites as required, with the exception of backpack sites. The siting of toilets must be unobtrusive.**

4. **As far as possible remove bins. Provide bulk rubbish collection sites close to exits. Provide brochures and pre-visit information which encourage visitors to "pack it in, pack it out".**

5. **Provide tables at some major day use sites.**

6. **Accept the use of generators at some remote sites (such as Fitzgerald Inlet and Quoin Head, and the club sites). If conflict arises with other users, generator-only camping areas may need to be designated.**

7. **Use of post and rails should be minimal. Their use is acceptable in the more developed sites at the eastern and western ends, but less so at the more remote sites. Use natural features where possible.**

8. **Ensure that all signs conform with the CALM Sign Manual.**

Research and Monitoring

9. **Include a sign monitoring and maintenance program in the Park's annual works program.**

15.0 RECREATION ACTIVITIES

15.1 NATURE STUDY

The objective is to encourage all visitors to appreciate, and increase their understanding of, the Park's natural and cultural environments and in particular the need to control dieback.

Background

The Park is a popular area for wildflower enthusiasts throughout the year, with interest peaking over the spring months. The attractions of FRNP's flowers are the diversity of species, the restricted distribution of many and their unusual shapes and forms. Wildflower interest presently focuses on East and West Mt Barren, Mt Maxwell and Hamersley Drive.

The Twertup Field Study Centre (refer to Section 16.0) attracts the interests of naturalists throughout the year. It provides a focal point for vertebrate, invertebrate, floral and palaeontological studies. Courses are periodically offered by members of the Fitzgerald River National Park Association.

Over the winter and spring months, increasing numbers of people are visiting Point Ann and Four Mile Beach to watch whales.

PRESCRIPTIONS

Prescriptions for Nature Study are given under Section 16.0 Information, Interpretation and Education.

15.2 SIGHTSEEING

The objective is to foster an appreciation of the natural environment by vehicle-based sightseers.

Background

FRNP is visited by many people who enjoy the scenery, wildflowers and "naturalness" without leaving their car, or only leaving it briefly. Sightseeing is the most popular activity undertaken in the Park (68% of visitors; Cavana and Moore, 1988). The eastern and western loop roads provide attractive tourist routes, with Hamersley Drive, in particular, offering constantly changing views and spectacular wildflowers for much of the year. A number of people are satisfied driving the short distance from Hopetoun to East Mt Barren or West Beach and then returning to Hopetoun. They may only stop briefly, but the scenery and flowers viewed from the car are worth the trip.

PRESCRIPTIONS

1. **Provide several "pull-overs" and associated information on Hamersley and Pabelup Drives.**

2. **Provide safe, comfortable access for 2WD vehicles along Hamersley and Pabelup Drives (13.0 Access provides further details).**

3. **Assess potential "pull-overs", associated information requirements and possible interpretive footpaths along Old Ongerup Road, in consultation with the Shire of Ravensthorpe and interest groups. Implement findings of assessment, with guidance from CALM landscape architects.**

Further prescriptions are given under 16.0 Information, Interpretation and Education.

15.3 BUSHWALKING

The objectives are:

1. *Provide a variety of bushwalking opportunities in the Park, ranging from short scenic and interpretive paths into each major natural community in the Park to extended walks of several days duration, sometimes into remote areas.*
2. *Ensure that footpaths are developed in locations which are capable of sustaining them, where maintenance is feasible and where Park values will not be adversely affected.*

Background

The second most popular activity in the Park is walking (46% of visitors; Cavana and Moore, 1988). It is an activity which is enjoyed by people of all ages, interests and levels of fitness. A range of opportunities is necessary to meet the needs of this diverse user group. Walks may be short self-guided circuit paths developed in conjunction with other facilities, such as campgrounds or picnic sites, long distance walking tracks, or cross-country tracks.

The Park offers a wealth of bushwalking opportunities. Currently, walks range from a 15 minute walk at Twertup, through 1-2 hour walks up East and West Mt Barren, to a weeklong coastal walk from Bremer Bay to Hopetoun. The "coastal walk" is currently unmarked and in a number of places there is a bewildering number of paths converging and diverging. In some sections the path is nonexistent. 'It could be tremendous walk, ... however at the moment only experienced walkers can use it' (L. Sandiford, pers. comm., 1988).

Other opportunities are available for development. Short footpaths of less than one day duration could be provided on the sandplains and river valleys as well as the peaks. Short walks associated with recreation sites such as Point Ann and Quoin Head also provide additional walking opportunities. Overnight walks could be developed along the Hamersley and Fitzgerald Valley, the rabbit proof fence and inland tracks. Places such as the Eyre Range should be left for experienced walkers.

The impact of bushwalking on the physical environment, while generally low, is variable depending on soil conditions, vegetation type and intensity of use. Where use levels are high, walking can lead to the loss of vegetation as well as localised soil compaction and erosion problems. Other imp-acts such as the spread of dieback disease, the introduction of weeds, or the escape of fires from overnight campfires may also occur. Usually these problems can be minimised effectively through the sensitive location and design of paths, the careful selection of campsites and suitable education. Access for bushwalkers may need to be altered from time to time depending on the dieback situation.

Of similar concern is the potential safety problem associated with long distance walks through remote areas. In the event of a walker becoming lost or injured, search and rescue operations could lead to substantial environmental impacts. Such problems can be largely offset through visitor information programs designed to ensure walkers are adequately informed about, and equipped to handle, the conditions they will encounter.

Guidelines for footpath development

- paths should be placed low in the landscape, wherever possible, to minimise the risk of disease introduction or spread.
- paths should be circuits or loops rather than commencing and ending at widely divergent points.
- beginning of the paths should be relatively accessible to vehicles to facilitate visitor use and management and provide information on the associated path.
- paths should provide views; that is, paths should be placed in a position in the landscape where this can be achieved without jeopardising Park values, particularly by creating dieback risks.
- path alignments or routes should be located along or near the boundaries of different landforms, soil types or plant communities to provide maximum visual diversity.
- longer walks (routes) should enable the walker to experience the remoteness and solitude of the Park.

Strategy

Walks in the Park were selected to provide a range of opportunities. Such opportunities cover both ends and the centre of the Park, a combination of the valleys, coast, mountains and northern upland and include a range of walk lengths.

Three footpath "standards" are used in this plan: walk, track and route. A **walk** is the easiest and is relatively short and well formed. It is constructed to "shoe" standard and is suitable for people of all ages and fitness levels. A **track** is more difficult, requiring some skill or experience. However, it is generally well designed, marked and suitable for people of average fitness. It is designed to "boot" standard. A **route** is most difficult, being lightly marked to unmarked and requiring a high degree of experience. It is only suitable for well-equipped walkers.

The Strategy section in 13.0 Access outlines contingency measures in the case of possible or confirmed dieback infections associated with footpaths.

PRESCRIPTIONS

1. **Develop the paths detailed in Table 16. Development may range from the construction of a gravelled surface with gentle grades (a walk) to the provision of only a sign at the beginning of the path, pamphlets and/or route markers as required (a route).**

2. **Provide self-registration points for walkers using remote areas (for safety reasons and to evaluate the effects of users on remote areas).**

3. **Produce information for walkers on the dieback risks associated with the Park, how to protect Park values, and ensure their own safety.**

4. **Place signs at the beginning of paths regarding dieback, requesting walkers to scrape any earth off their boots into the waterproof rubbish bin provided before they start walking.**

5. **Close Mid Mt Barren, Woolbernup Hill and Thumb Peak to walkers because of the potential dieback risk and their botanical importance. Prescription 9 in 13.0 Access gives a more detailed explanation. Place signs at appropriate points to explain why.**

6. **Require walkers to carry their own cooking fuel and not to light wood fires. The fire risks are too great and wood is a scarce commodity in the Park. Require walkers to carry their rubbish out. Promote minimum impact bushwalking.**

7. **Produce individual brochures for most walks. Leave a number of routes unmarked for those who enjoy a high degree of challenge.**

8. **Develop some walks for interpretation.**

9. As unobtrusively as possible, and based on the best possible alignment, mark sections of the coastal route which are currently confusing.

10. On the longer walks, provide designated camping sites with no facilities at attractive places capable of supporting such use in the longer term. Several proposed backpack campsites are given in Section 14.0 Recreation Sites (Table 15, Map 10).

11. Retain the water tank at Twin Bays.

Research and Monitoring

12. Monitor the effects of bushwalking in remote areas.

TABLE 16. WALKS

PATH	DURATION	STANDARD
Less Than 1 Day		
1. Twertup Short Loop	1/2 hr	walk
2. Pt Ann - St Marys	1/2 hr	walk/track
3. West Beach Point	1-2 hrs	walk
4. Twertup Long Loop	1 1/2 hrs	walk
5. The Gorge	1 hr	track
6. Horrie & Dorrie (Twertup)	1 1/2 hrs,	track
7. Dogger's Swamp	1-2 hrs	track
8. West Mt Barren	2 hrs	track
9. East Mt Barren	2-3 hrs	track
10. Pt Ann Heritage Trail	1-2 hrs	track
11. W edge of Culham Inlet	1 1/2 hrs	track
12. No Tree Hill	1-2 hrs	track
13. Boondalup River	3-4 hrs	route
1 Day or Longer		
14. Roe's Rock Pool	1 day	track
15. McCulloch's Crossing	1-2 days	track/route
16. Parwoonup	1-2 days	track/route
17. Mt Drummond	1 day	track
18. Dempster Inlet	1-2 days	route
19. Quoin Hd - Marshes	1-2 days	route
20. Fitzgerald Inlet - Twin Bays	1-2 days	route
21. Eyre Range	2-3 days	route
22. Quoin Hd - Twin Bays	1-3 days	route
23. Fitzgerald Valley	2-3 days	route
24. Hopetoun - Bremer Bay	7-10 days	route

15.4 CAMPING

Objectives, background information and detailed prescriptions for camping are given under 14.0 Recreation Sites, and in Table 15 and Map 10.

15.5 RECREATIONAL FISHING

The objective is to allow vehicle access for recreational fishing to those sections of the coast, including beaches and cliffs, which are able to support use with minimal damage to the natural environment.

Background

The FRNP coastline has long been a destination for fishermen. For at least 100 years farmers and other local residents have been using the beaches and cliffs. Fishing is controlled by the Fisheries Act and Regulations. Limitations are placed on species caught, number taken, areas that fish can be taken from and type of fishing involved as well as seasons in which catches may be taken. CALM and the Fisheries Department work cooperatively.

Beach fishing is popular, with species caught including herring, shark, skipjack and tailor. During late summer and early autumn, salmon can be caught from Hamersley Beach. Rock fishing generally concentrates on groper, while inlet fishing generally produces black bream.

Vehicle access to fishing spots may have adverse impacts on the environment. If vehicles leave existing roads and tracks it encourages other vehicles to follow, leading to a profusion of tracks. This is becoming an increasing problem as more people buy 4WDs and explore the more remote parks of the south-west. Continuing 4WD use of sandy soils and steep rocky slopes leads to rapid gully erosion.

Camping in areas with no facilities, as is the case in more remote fishing spots, can create problems if firewood is not carried in and rubbish carried out. Past use has led to minimal impact in remote sites; however, all sites are becoming increasingly accessible as numbers of 4WDs, and people's interest in exploring remoter areas increases. Adverse impacts are already high at readily accessible sites (refer to 14.0 Recreation Sites).

PRESCRIPTIONS

1. **Continue to allow vehicle access for recreational fishing, to those points accessible by 2WD roads and public 4WD tracks (Map 10). Following addition of the inlets to the Park (refer**

to prescriptions in Section 3.3) continue to permit fishing in all waters of the Park, subject to the Fisheries Regulations. The only exception is the Dempster Inlet which should be closed to fishing and retained as a biological reference area.

2. **"Overnight resting" in vehicles will be permitted on beaches designated as 4WD accessible and at some 4WD sites in the Park (refer to 14.0 Recreation Sites). "Overnight resting" is defined as sleeping in, or next to, a vehicle provided neither tents nor any other external structure is erected.**

3. **Encourage fishermen using the Park to join fishing dubs. This helps people become aware of their responsibilities and increases the social and educational aspects of fishing. CALM will liaise closely with fishing clubs and provide information.**

4. **Allow for foot access along paths to remote fishing spots in the natural environment and wilderness zones (refer to 5.0 Management Zones).**

5. **Encourage the Fisheries Department to monitor and research fish stocks in inland waterways.**

15.6 BOATING

The objective is to provide for boat launching where the natural environment is stable enough to support such use in the longer term, and where such activities do not unduly impinge upon other recreational activities or the landscape.

Background

Use of boats in the Park is closely associated with fishing. Small boats less than 3 m long are generally used. They are occasionally launched at Point Ann and used for fishing in Point Charles Bay. Small boats are also occasionally launched at Hamersley Inlet.

Opportunities for boat use are limited in FRNP. Much of the coastline is exposed and there are few calm bays for launching or fishing from a boat. Although the inlets are protected, most are too shallow for boating. The Hamersley is an exception with several suitable launching sites.

PRESCRIPTIONS

1. **Allow car-top boats on all inlets and rivers of the Park, except the Dempster, which is part of the wilderness zone and has non-motorised access only.**

2. **Provide vehicle access to the water for launching small boats and off-beach parking for boats and trailers at The Peninsula (Gordon Inlet), Point Ann and Hamersley Inlet (old National Park site).**

3. **Support the Ravensthorpe Shire in providing for boat launching and associated parking requirements at the Hamersley Inlet Shire Reserve.**

Research and Monitoring

4. **Monitor boat launching sites. If tracks to the water, other than at the launching area, become obvious additional management actions are necessary.**

15.7 HORSE RIDING

The objective is to exclude horse riding from the Park except for search and rescue.

Background

There is no horse riding in the existing Park. Horse riding can adversely affect the natural environment. The major concerns in FRNP are the spread of weeds, erosion and damage to vegetation. Horses may also spread dieback. Because of the very high values of FRNP, risks should be minimised. Park roads are not open to horses and many alternative areas for horse riding exist in the region.

PRESCRIPTIONS

1. **Continue to exclude recreational horse riding from the FRNP.**

2. **Allow use of horses in search and rescue if:**
   a. **approval has been granted by the CALM District Manager;**
   b. **soil conditions are dry, minimising the risk of dieback introduction and spread;**
   c. **the horses' hooves have been thoroughly cleaned before entering the Park; and**
   d. **there is no other viable alternative by 4WD, air or boat access, on foot or some combination of these.**

15.8 GROUP AND CLUB-BASED ACTIVITIES

The objective is to accommodate use by groups and clubs to the extent that it is compatible with the Park's natural values and the aspirations of other users.

Background

The Park is used by naturalist, 4WD, bushwalking and fishing clubs, plus community groups. Use concentrates over the summer months, peaking over Christmas-New Year, January and March long week-ends and Easter.

A number of these groups are Perth-based. Some stay in caravan parks nearby, while others camp in the National Park. 4WD clubs drive to destinations in the Park, set up camp and remain in the one place for three to seven days (S. Wilke, W.A. Association of 4WD Clubs, pers. comm., 1988).

School groups generally come from Albany, and to a lesser extent from Perth, to walk the coastal route.

Party sizes of most groups are generally four to 10 vehicles. Groups of greater than four to five vehicles can lead to damage of camping and day use sites as excess vehicles are forced to drive over or into surrounding areas to remain with the group. Conflict with other users due to crowding and pressure on facilities, such as* toilets, is also a problem.

Proposed club and group campsites are marked on Map 10. The Marningerup area (on western edge of the Park) is a possible future site for group camping.

PRESCRIPTIONS

1. **Liaise with clubs and organisations to keep group sizes to approximately 20 people or fewer, in four or rive vehicles.**

2. **Make suitable campsites available for club and group use on a bookings basis (Map 10).**

3. **Review and consider limitations on bushwalking groups only if backpack campsites become degraded or the enjoyment of other walkers is being affected.**

4. **Provide publications for groups and organisations regarding the values of the Park, how group members can help protect these values, camp-sites available to groups and the benefits of booking ahead.**

15.9 COMMERCIAL OPERATORS

The objective is to allow use of parts of the FRNP by a limited number of commercial operators, while ensuring that the Park environment and other users are not adversely affected.

Background

A number of commercial operators visit the Park, principally over the spring months, with wildflower tours. The Park roads are generally not suitable for large vehicles.

The road and recreation site proposals in this plan will provide suitable facilities for small buses. However, the roads and facilities, such as toilets, will not meet the requirements of larger buses and associated larger numbers of people. Also, the numbers of people in larger buses may adversely affect the enjoyment of the Park by other users.

The Park is only rarely used by "wilderness-walking" tour operators. This is probably a result of its distance from Perth and lack of readily available water. The Park does, however, provide good opportunities for extended walks.

PRESCRIPTIONS

1. **Liaise with the Shires to ensure provision of facilities in nearby towns for tour members. This encourages visitors to spend money locally, and also means that large ablution blocks do not need to be provided in the Park.**

2. **Provide parking and turning space for buses of up to 45 seats at East Mt Barren lookout, approaching from the east. Provide for buses of up to 20 seats at Point Ann, Mylies Beach and West Mt Barren and at other destinations which may be approved from time to time.**

3. **Continue to ensure that tour operators contact rangers before entering the Park and have correct entry permits. Encourage tour operators to obtain interpretive information.**

4. **Should road standards be upgraded to a level accepted as safe for 45 seater buses during the period of this plan, the NPNCA may allow this commercial use to occur subject to appropriate conditions.**

PART E. MANAGEMENT FOR EDUCATION

GOAL: Foster a sense of stewardship for the Park by the community at all levels - local, State, national and international - emphasising its special conservation, landscape, recreation, cultural and historic values.

16.0 INFORMATION, INTERPRETATION AND EDUCATION

The objectives are:

1. *Develop and maintain a Park information program which interprets the Park's values, natural systems, and management concerns, particularly dieback, fire, flora, fauna and geology; and which addresses visitor needs and public safety.*
2. *Emphasise, in any information program, the Park's international biosphere reserve designation and, in particular, the values of the Park to the broader community and the community's role in the Park's future.*
3. *Encourage use of the Park for educational purposes.*
4. *Enrich the visitor's understanding and appreciation of the Park's natural and cultural values through on-site interpretation.*

Background

Nature study is one of the most popular activities in the Park (32% of visitors). The majority of visitors also noted that it was important to learn more about nature, particularly from information displays and publications (Cavana and Moore, 1988).

The Park is particularly rich in terms of interpretive features. Its geologic history ranges from the ancient Archaean Shield to the more recent Eocene spongolite and siltstone and even younger limestone shoreline. The Proterozoic Barrens and associated ranges add to this diversity. The wealth of plant species, a number found nowhere else, and the Park's rare birds and mammals are also features of interest. To this can be added a number of Aboriginal sites and features of European history dating back more than 100 years.

There is a significant level of involvement by community groups in public education and interpretation. The Fitzgerald River National Park Association and CALM have jointly established a number of walks and produced associated publications. The Association run courses from the Twertup Field Study Centre.

The Fitzgerald Biosphere Project Committee (FBP) is also interested in education and research in the broader context of the Park and adjacent lands. They are actively seeking funds to promote the biosphere concept and better land management practices, particularly on agricultural lands.

Field Study Centre

Twertup Field Study Centre is run on a volunteer basis by the Fitzgerald River National Park Association. It is located in the north-western part of the Park, in an old house on the edge of a disused spongolite quarry. The building was originally occupied by the quarry operator (Horace Worth) and was restored and established as a Study Centre in 1981. It is used on a bookings basis

through the Association. There is currently no tenancy agreement. The Association uses Twertup on a "permissive occupancy" basis.

The Study Centre has education, information and interpretation functions. Courses run by the Fitzgerald River National Park Association include botany, geology, ornithology, palaeontology, entomology, arachneology and photography. Information and interpretation resources include a library, herbarium, maps and other publications. Other features include its use as a venue for meetings (Fitzgerald River National Park Association, Agriculture Protection Board), art camps, University extension courses and school camps. It is also a base for survey and research in the western end of the Park, a starting and wayside point for bushwalkers, and a place for day visits and quiet family camping.

Strategy

Adopt an integrated approach to the provision of information, interpretation and education regarding FRNP. This will involve close liaison with community groups, Government departments (such as the Tourism Commission), and the tourism industry.

Interpretation and education programs should explore the ecosystem functions of the Park, the Park's role in the broader region, and individual values (scenery, rare plants and animals).

PRESCRIPTIONS

Prior to implementation of the following programs, Park facilities and services should be of a sufficient standard to support the anticipated and resultant increase in demand.

General

1. **Provide Park information, interpretation and education as part of a regional and local community approach. This will involve liaison with community groups, other Government departments and local government. The Fitzgerald River National Park Advisory Committee will provide a useful forum (see 20.0 Liaison).**

2. **Ensure that FRNP information, intepretation and education programs complement other CALM programs, particularly those in the CALM South Coast and Goldfields Regions.**

Information

3. **Update and maintain supplies of a basic Park brochure, including a detailed map. The brochure should contain a general description of the Park and Biosphere Reserve, and details of recreation sites.**

4. **Provide information bays at Park entrances with details of recreation sites, dieback and other management concerns and specific points of interest. They should be regularly monitored, maintained and updated by regional staff in accordance with CALM standards for interpretive facilities. The information symbol "i" should be erected I km either side of the Quiss Road turn-off indicating the CALM information bay.**

5. **Provide interpretive signs at key sites, based on particular themes relevant to the management objectives for that area. For example, East Mt Barren: dieback; Pt Ann: whales; Quoin Head: campsite degradation; Quiss Road: fire. Information should be regularly updated.**

6. **Warning signs (eg. coast risk) should be placed in potentially hazardous areas which receive moderate to high levels of use (eg. 2WD accessible beaches with known rips or some cliffs).**

7. a. **Once works have been completed on Pabelup and Hamersley Drives (see Section 13.0 Access) and at associated fa**cilities, place Main Roads Dept **approved signs to the Park on appropriate turn-offs from Highway 1.**
   b. **Sign-post all 2WD accessible points and give distances at turn-offs.**
   c. **Turn-offs to 4WD tracks (eg. Fitzgerald Inlet and Quoin Head) should not be sign-posted at turn-offs, rather small, distance signs should be placed several hundred metres down the track. This will help to keep use levels low, thereby minimising track and recreation site degradation.**

8. **Provide simply designed pamphlets emphasising a "code of the coast" to shops and service stations in Bremer Bay, Jerramungup, Ravensthorpe and Hopetoun. The pamphlets should include safety details, plus information on dieback and fire, the standard of various roads and tracks, and current Park management.**

Interpretation

9. **Produce publications which promote FRNP as an ecosystem and part of larger ecosystems, and on specific themes relevant to particular parts of the Park. Themes could include biosphere status, early exploration. and settlement, Aboriginal use, plants known only from FRNP, geology, whales, banksias, orchids, honeyeaters and waterbirds. These pamphlets could also include management information.**

10. **Provide interpretive information (publications, signs, displays) for a number of walks (Table 16). Use these walks to interpret distinctive features within the Park.**

11. **Establish seasonal interpretive activities and programs, including children's programs. Evening talks and activities could also be established. The emphasis could initially be in the Hopetoun area as it currently receives the majority of Park visitors. Hopetoun Caravan Park (only 4-5 km away from the Park) could be included as part of the regional approach in Park communication programs. Local expertise should be employed where possible.**

12. **Promote and maintain the vehicle-based Heritage Trail which follows Hamersley Drive. Provide pull-overs to encourage people to get out of their vehicles and enjoy the Park. Develop a similar publication and approach for Pabelup Drive.**

13. **Develop the interpretive potential of Old Ongerup Road, in association with the Shire of Ravensthorpe and interest groups. Development could include information bays, picnic areas, publications and short walks. Planning and implementation should be in consultation with CALM landscape architects.**

Education

14. **Continue to support and encourage educational activities by groups and individuals associated with FRNP.**

Field Study Centre

15. **Establish a lease agreement with Fitzgerald River National Park Association regarding Twertup Field Study Centre. Provide year-round 2WD access. Support the Association in their ongoing use of Twertup.**

16. **Co-operate with, and provide assistance to, the FRNPA in the provision of Park information, education and interpretation.**

PART F. RESEARCH AND MONITORING

GOALS:

1. Promote and undertake the scientific study and monitoring of those physical, biological and social values and natural processes special to the Park.

2. Measure and control impacts of management activities and human use on the Park environment.

17. 0 RESEARCH AND MONITORING

The objectives are:

1. Promote and undertake research on the flora, fauna, ecosystem processes, physical environment and archaeology of the Park, with special emphasis on endangered and endemic species, and on processes/activities that threaten *or enhance conservation values.*
2. Develop and implement a monitoring program to determine: a. the impacts of management and human use on the Park; and b. changes in the natural environment and other natural processes.

Background

The Park has particularly high potential for research, in terms of both research for Park management and as part of a world-wide network of biosphere reserves.

In physical terms, the Park has a diversity of landforms subject to a range of physical processes, particularly ongoing erosion by water and wind. Biologically, the area is large (328 026 ha), relatively undisturbed and contains a wealth of plant and animal species, a number of these rare. In social terms, the Park provides a good opportunity to evaluate the impacts of various levels and types of recreation use and management activities. Research in all areas is enhanced by the availability of good baseline data on the area's biological values (Chapman and Newbey, in prep.) and visitor use (Cavana and Moore, 1988).

Research is an integral part of the international biosphere reserve (IBR) concept (Section 4.0). In FRNP, which is regarded as the core of the Fitzgerald Biosphere Reserve, emphasis should be on non-manipulative research.

Topics researched to date include honey possums and pygmy possums, geology, honeyeater pollination, eucalypts, fire and floral/faunal succession, inlets, Aboriginal occupation, water levels and water quality in the Fitzgerald River, Ground Parrots, Western Bristlebirds, a comprehensive two-year biological survey and a visitor survey. A number of these projects are ongoing.

Other work currently underway includes surveys to establish the status of the chuditch in the Park, surveys and radio-tracking of Ground Parrots, and monitoring of regrowth following the 1989 fires. Proposed research includes determination of the effects and management of fox predation.

Monitoring is necessary to determine changes over time, particularly changes in response to disturbance. Causes of disturbance may be as varied as dieback introduction and spread, weed or pest invasion, fire, public use, and/or management activities.

Monitoring is also a fundamental component of IBRs, both in terms of "benchmark" areas which can be used to monitor broadscale changes in the environment, and buffer areas where more localised changes can be followed. About 60 fixed monitoring points have been established across the Park as part of the FRNP Association two-year biological survey. These, plus other baseline data already collected, provide a starting point for regular monitoring.

Monitoring water quality and flow is essential to the Fitzgerald Biosphere Project to determine the effectiveness of various catchment management programs. A Water Authority gauging station exists within the National Park on the Fitzgerald River, and samples have been taken regularly from the Fitzgerald and other major rivers.

Social monitoring, or determination of visitor satisfaction and impacts of visitors, is receiving increasing attention from park management agencies throughout Australia. There is also a need to monitor the impact of recreation on the natural environment so management action can be taken in time to prevent degradation.

The impact of management activities, such as buffer burning, pest control and re-planting needs to be monitored. This is the only way that the success, or otherwise, of management actions can be evaluated.

The level of research and monitoring undertaken will be influenced by the level of funding. The prescriptions in Table 17 represent a list of desirable activities recognised to date. It may be a number of years before all high priority research programs can be funded.

PRESCRIPTIONS

1. **Implement an integrated program of survey, research and monitoring based on the summary given in Table 17. Staff from the CALM Research Division, South Coast Region and FRNP, and the Fitzgerald Biosphere Project Committee should be involved in integrating the program, and should facilitate its implementation.**

2. **Assess potential locations, and acquire funds, for the establishment of a CALM research station to service the Park. Factors to be considered are: closeness to species/communities being studied, closeness to rangers for security and servicing, and establishment and maintenance expenses. Jacup is a potential site.**

3. **Continue to require all research workers to follow dieback hygiene procedures whether travelling by vehicle or on foot. Provide research workers with a publication explaining these procedures.**

4. **Continue to require all research workers to make their findings readily available, with copies of their findings being kept at the CALM South Coast Regional Office and made known to the Ranger-In-Charge.**

Research and Monitoring

5. **Encourage non-manipulative research in the Park. However, some manipulative research is required, such as determining the most effective ways of eradicating dieback and of establishing fire buffers, feral animal control and 4WD track stabilisation techniques.**

6. **Encourage and support other groups, agencies, institutions and individuals to carry out research and monitoring projects relevant to the conservation and management of the Park.**

TABLE 17. SUMMARY OF SURVEY, RESEARCH AND MONITORING PRESCRIPTIONS FOR THE FITZGERALD RIVER NATIONAL PARK (Implementation dependent on availability of funding)

SECTION No.	PRESC. No.	PRESCRIPTION
HIGH PRIORITY		
C7.2	6	Survey areas proposed for management activities for rare flora prior to the activity commencing.
C7.2	7	Carry out detailed surveys within the Park and adjacent areas to locate other populations of the priority rare flora. Give priority to the Barren Ranges and areas likely to be disturbed.
C7.2	8	Research the response to disturbance (such as dieback, fire, soil disturbance, weeds and grazing), reproductive biology and taxonomy of the priority rare flora.
C7.3	8	Investigate habitat requirements and ecology of rare fauna species by: a) conducting comprehensive surveys to determine broader distribution b) studying individuals of each species to determine which habitats, including vegetation structures, compositions and fire ages, are used c) studying life history characteristics of each species d) determining appropriate fire regimes for each species.
C7.3	9	Investigate the impacts of predation by introduced carnivores by baiting foxes in part of the Park for 3-4 years. Monitor small mammal and fox populations in both baited and unbaited parts of the Park to determine the effects of baiting. Identify prey species from fox stomach and gut analyses. Determine effective control mechanisms. Use the research findings to guide future management.
C7.3	10	Update existing data on the Park's invertebrates. Subject to resource availability, carry out invertebrate surveys, investigate the effects of fire and dieback on invertebrate communities.
C9.1	16	Continue developing techniques which will enable the rapid confirmation of the presence or otherwise of Phytophthora species in plant communities on the south coast.
C9.1	17	Accurately determine boundaries of, and regularly monitor, known dieback infections. Continue using aerial photography, landsat and thermal enhanced imagery for monitoring disease distribution.
C9.1	19	Continue to survey and sample roads, tracks (including management-only) and footpaths within the Park for signs of dieback disease.
C9.1	20	Quantify the impact of each Phytophthora sp. This information is necessary in order to assign and predict hazard ratings for all vegetation associations in the Park.

SECTION No.	PRESC. No.	PRESCRIPTION
C9.1	21	Investigate control and eradication procedures while ensuring that they do not place other areas or values at risk. Eradication or isolation of all the infections should be of the highest priority.
C9.1	22	Focus research effort on determining practical methods for preventing dieback introduction and spread and accurately identifying high hazard locations. Effort should also be directed towards developing effective ways of controlling soil and water movement, particularly in relation to roadworks and facilities development and maintenance. This work, although focusing on FRNP, should complement similar research across the CALM South Coast Region.
C9.2	20	Continue to investigate the practicality of using aerially ignited wind-driven buffers.
C9.2	21	Record and analyse details of all fires, including available fire behaviour information.
C9.2	22	Instigate a research and monitoring program to determine the level of environmental impact resulting from the prescribed fire regimes, fuel modification and wildfire suppression activities, and wildfires; and to examine the effectiveness of prescribed burning and wildfire suppression procedures.
C9.2	23	Continue to strongly support the need for a geographic information system for the recording and analysis of information on fire in the Park.
C9.6	7	Conduct a survey, prior to material extraction, to ensure that no conservation values, particularly rare plants or Aboriginal sites, will be disturbed.
D12.2	1	Monitor visitor numbers and patterns of use, using traffic counters, site surveys and questionnaires.
D13.0	23	Monitor annually the status of roads, tracks and footpaths. If erosion gullies become greater than 10cm deep or water ponds on a road or track for longer than 3-4 days after rain then management action is necessary. These values are based on dieback risk and soil degradation and erosion. They can be re-assessed and new values written if new information indicates the need.
D14.1	20	Record on a regular basis percentage canopy cover (from aerial photos), number of broken branches and depth of erosion gullies. If the canopy cover has decreased by more than 10%, number of broken branches has doubled or erosion gullies are deeper than 10 cm since the last survey, then management intervention is necessary. Change these criteria and standards if new information indicates the need. Keep a written record of any changes made.
F17.0	6	Encourage and support other groups, agencies, institutions and individuals to carry out research and monitoring projects relevant to the conservation and management of the Park.

SECTION No.	PRESC. No.	PRESCRIPTION
MEDIUM PRIORITY		
C6.2	5	Monitor beach access points, both footpaths and vehicle access points, and take remedial actions as required.
C6.3	8	Support continued monitoring of river flow and quality, with particular emphasis on the Fitzgerald River. Continue to provide access, for monitoring, to the gauging station on the Fitzgerald River in the northern part of the Park.
C7.1	6	Carry out research into management regimes (especially fire) required to maintain vegetation communities and fauna habitat.
C7.2	9	Encourage surveys of the distribution, and research into the taxonomy, of the 250 important species identified by Chapman and Newbey (in prep.).
C7.3	3	Identify and research keystone species to develop knowledge of community response to disturbances such as dieback, fire, recreation use and management actions, and knowledge of general community changes over time.
C8.1	5	Encourage the W.A. Museum and other professional archeologists to further study Aboriginal occupation and use of the Park.
C9.1	18	Develop a comprehensive description, including information on species affected, vegetation association, infection area, rate of spread, soil profile, topography and threat to ground and surface waters.
C9.3	7	Record the general extent and location of pest animals, control measures implemented and an evaluation of their success. Request the Agriculture Protection Board to do likewise.
C9.4	8	Monitor known priority flora populations for weed invasion. Take control measures as necessary.
C9.5	5	Monitor, evaluate and record the success of rehabilitation techniques used. Experiment with a range of rehabilitation techniques.
D12.2	2	Using surveys, monitor visitor perceptions regarding Park management.
D13.0	24	Monitor access points to 4WD beaches. If 4WD tracks other than the designated main access points are created, management action is necessary.
D14.1	19	Regularly photograph recreation sites from a fixed point and in a fixed direction. Use photographs to identify subtle changes over time (and between managers) at a particular site.
D14.2	9	Include a sign monitoring and maintenance program in the Parks annual works program.
D15.3	12	Monitor the effects of bushwalking in remote areas.
D15.6	4	Monitor boat launching sites. If tracks to the water other than at the boat launching area become obvious additional management actions are necessary.

SECTION No.	PRESC. No.	PRESCRIPTION
F17.0	5	Encourage non-manipulative research in the Park. However, some manipulative research is required, such as determining the most effective ways of eradicating dieback and of establishing fire buffers, feral animal control and 4WD track stabilisation techniques.
LOW PRIORITY		
C6.2	4	Use fixed points and aerial photography to monitor the movement of sand inland from unstable dunes, eg. Hamersley Inlet, Gordon Inlet.
C6.3	9	Encourage, in consultation with the Environmental Protection Authority, longer term research and monitoring of inlet dynamics, such as opening and closing of bars, water levels and rate of sediment accumulation. Use the Dempster Inlet as an undisturbed reference.
C8.1	4	Continue to investigate the traditional Aboriginal knowledge of the area.
C9.2	24	Continue to investigate the use of computer modelling to aid fire management.
C10.2	7	Monitor the effect of commercial fishing on access routes and points, and other Park users.
C10.2	8	Develop with the Fisheries Department and the Fitzgerald Biosphere Project, a monitoring program on the impacts of commercial fishing on fish stocks, the inlets and river systems.

PART G. IMPLEMENTATION OF THE PLAN

18.0 MANAGEMENT PRIORITIES

Strategy

The following list provides a general overview of priorities. Only the six highest priorities are listed. These are:

1. Determining practical procedures for dieback control to protect the Park's flora, particularly the priority rare and endemic species (7.2 Flora).

2. Realigning and/or treating where necessary roads, tracks (including managementonly) and footpaths designated in this plan, primarily to reduce dieback risks (13.0 Access).

3. Relocating where necessary and establishing boundary fire buffers (9.2 Fire).

4. Changing Pt Ann and Mylies from camping and day use to day use only and providing attractive alternatives; re-designing Quoin Head to separate day use and camping and to stabilise erosion. (14.0 Recreation Sites).

5. Providing up-to-date Park publications, displays and signs (16.0 Information, Interpretation and Education).

6. Conducting research into habitat requirements of rare species such as the Ground Parrot, Western Bristlebird and heath rat (7.3 Fauna).

19.0 STAFF

Background

The Park currently has a staff of three: a ranger-in-charge at Jacup, and two rangers, one at East Mt Barren and the other at Quaalup. Over the summer months, mobile rangers assist by servicing popular areas, particularly at the eastern end of the Park. There is a need for seasonal staff for the western end of the Park, in areas such as Pt Ann and The Peninsula.

Specialist staff from the CALM Albany regional and district offices and Perth also provide assistance, however the travel time involved reduces their effective operating time. If research, and particularly monitoring, and the proposed site works are to be undertaken, staff numbers and funding will need to be increased.

Housing

Facilities at Jacup include a house, workshop and storage shed and wash-down pad. Mains electricity and the dam water supply are adequate. Additional land for further housing or facilities is available.

Facilities at East Mt Barren include a house, workshop, storage shed and washdown pad. Mains electricity and rainwater supply are used. The existing water supply is inadequate and additional sources are required, primarily for firefighting and the washdown facility. These facilities could not be readily expanded without an adverse effect on the views from East Mt Barren.

The Quaalup residence is privately owned and a government-owned facility will be required when the current ranger retires. Its location should be based on the point of greatest access to the Park, on cost-effectiveness in terms of closeness of services (eg. mains electricity) and recreation sites requiring frequent servicing.

PRESCRIPTIONS

1. **Actively seek an increase in the number of staff in order to successfully implement this plan. Resources are required to:**
   - **develop proposed recreation sites and paths.**
   - **assist in implementing research and monitoring programs.**
   - **assist in general implemention of the management plan prescriptions.**
   - **assist in Park maintenance.**
2. **Locate the residence for the ranger servicing the south-western part of FRNP in or adjacent to the south-western part of the Park.**
3. **Assess the feasibility of re-locating the East Mt Barren ranger's residence to the east side of Culham Inlet.**

20.0 LIAISON

20.1 COMMUNITY LIAISON

Background

Several methods of communication between the local community and CALM exist. The first of these is the presence of three Park rangers as members of the local community. Each is involved to different degrees in local community groups such as the FRNP Association and the South Coast Recreation Association. The rangers, plus other CALM staff, also become involved in firefighting on lands adjacent to the Park. CALM regional and district staff based in Albany maintain regular contact with the Ravensthorpe and Jerramungup Shire Councils. The Fitzgerald River National Park Advisory Committee and community - CALM link also provide excellent fora for information exchange.

Ongoing liaison with local community groups and associations is essential, as is liaison with interests further afield.

Community Involvement in Implementation

There is tremendous potential for public involvement in the implementation of this plan. This involvement may range from monitoring, research and interpretation to laying brush and re-planting. The best mix would be a combination of paid and voluntary contributions.

PRESCRIPTIONS

1. **Revise the structure and membership of the existing Fitzgerald River National Park Advisory Committee, to create a Committee to provide advice to the CALM South Coast Regional Manager regarding implementation of this management plan and other management issues which arise. Any revisions to the structure and membership should be made in consultation with the existing Committee.**

2. **Hold regular meetings in the Fitzgerald area to discuss aspects of management of the Park with the local community and, relevant Government departments.**

3. **Ensure ongoing CALM involvement in the Fitzgerald Biosphere Project Committee.**

4. **Liaise with the Ravensthorpe and Jerramungup Shire Councils, State Emergency Services and local Counter Disaster Advisory Committees regarding emergency situations which could occur in the Park.**

20.2 GOVERNMENT AGENCY LIAISON

Liaison with the two Shires is essential for a number of reasons:

a. integrated fire management
b. integrated management of the two Shire reserves and the National Park
c. provision of a valuable recreation resource to the local community
d. potential benefits to the local community of educational and research uses of the Park.

The Tourism Commission and Great Southern Tourism Directorate should also be aware of the values and management issues associated with FRNP in their planning for tourism development in the south-east region. Ongoing liaison with the Bush Fires Board, local Bush Fire Control Officers and volunteer brigades regarding fire protection of areas adjacent to the Park is also essential. The Main Roads Department and Department of Agriculture are also key players in achieving good land management in the Fitzgerald area.

PRESCRIPTION

1. **Continue, and seek ways to improve, liaison established between CALM and other Government agencies and departments.**

21.0 FUNDING

Background

Management of FRNP is funded by CALM. External funding has also been provided to the FRNP Association for research and the Fitzgerald Biosphere Project Committee for educational and interpretive projects. This has included international funding from World Wide Fund for Wildlife, and Commonwealth funding from the Australian Heritage Commission. The biosphere reserve status of the Park represents a significant opportunity to attract funding.

PRESCRIPTIONS

1. **Actively seek sufficient funds during the first 2 to 3 years of this plan to ensure essential works are carried out, ie. to upgrade, realign or close the nominated roads and tracks, establish perimeter low fuel buffers and carry out the works necessary to manage, establish and rehabilitate recreation sites.**

2. **Seek funding from the Main Roads Department for proposed works on roads and tracks.**

3. **Actively seek funding both within and outside Government to implement this plan.**

4. **Support community groups in their efforts to seek funds for projects associated with the Park.**

22.0 EVALUATION AND REVIEW

The results from the research and monitoring programs detailed in this plan will be an integral part of the yearly and 10-year evaluation and review process outlined below. There is provision under Section 61 of the CALM Act for the plan to be amended, as required. If there are major changes to the plan, the revised plan will be released for public comment.

PRESCRIPTIONS

1. **CALM and Fitzgerald River National Park Advisory Committee should review plan implementation each year, prior to CALM preparing the works program for the Park for the following year. The highest priorities for this program are given in 18.0 Management Priorities. The review should identify which prescriptions have been implemented and to what degree, and any new information which may affect management.**

2. **The fire advisory group, representing the two local bush fire organisations, Shires, Bush Fires Board, Fitzgerald River National Park Association and CALM, should meet annually to review implementation of the fire master plan, and priorities and programs for the next year. The group should report to the Shires, National Park and Nature Conservation Authority, Bush Fires Board and CALM.**

3. **A major review by the fire advisory group of fire access requirements, particularly in the central Park, should be completed by July 1995. The review should include consideration of aerially ignited mosaic burning.**

4. **The National Parks and Nature Conservation Authority will monitor the implementation of the FRNP management plan as required under Section 22 (1)(e) of the Conservation and Land Management Act.**

5. **Review the plan in the final year of its 10-year term. This review should identify the extent to which the objectives have been achieved and prescriptions implemented, the reasons for lack of achievement or implementation, and a summary of information which may affect future management.**

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APPLICATION TO THE CONSERVATION COMMISSION FOR MECHANISED ACCESS WITHIN THE FITZGERALD RIVER NATIONAL PARK FOR ESSENTIAL MANAGEMENT OR RESEARCH OPERATIONS

1. **Location of the proposed access**
   Core Wilderness Area: Mt Drummond, Thumb Peak, Woolbemup, Mid Mt Barren, south Drummond Track, Twin Bays Track and Telegraph Track.

2. **Relationship of the proposal to any existing relevant documents or plans (e.g. management plans, interim management guidelines, policies, recovery plans).**

   The *Fitzgerald River National Park Management Plan 1999 — 2001* Section 3 Prescription 2 states:
   Vehicle access within the centre of Fitzgerald River National Park (FRNP) requires approval by the NPNCA (now the Conservation Commission) as a requirement of the Management Plan. Specifically the most relevant provision (13 Access — Prescription 7) states:

   > *Exclude vehicles from the centre of the Park to reduce the risk of phytophthora) dieback introduction and/or spread to the lowest possible levels. Vehicle access for dieback sampling and fire management will be allowed under strict permit, subject to NPNCA approval. if a life-threatening emergency arises requiring the use of vehicles within these areas, entry will be authorised by the South Coast Regional Manager or a representative. Access for fire management purposes in the centre of the Park will be reviewed in 1995 (refer to 9.2 Fire).*

   The '1995 review' was significantly delayed due to major fires in the wilderness zone requiring the development of new fire management strategies but it was eventually gazetted on 18 January 2000 as an amendment to the Management Plan. It included clauses stating:

   > *All vehicle entries, environmental checklists and dieback hygiene evaluations are to be endorsed by the Directors of National Parks and Nature Conservation.*

   In direction relation to the proposed survey the *Fitzgerald River National Park Management Plan 1999 — 2001* Section 7.3 Prescription 7 states

   > *Investigate habitat requirements and ecology of rare species by: a. conducting comprehensive surveys to determine broader distribution and b. studying each species to determine which habitats, including vegetation structures, compositions and fire ages, are used.*

   The proposed survey addresses this prescription for specific survey of threatened fauna taxa (Western Ground Parrot). Surveys for Western Ground Parrots were conducted in Spring 2007, and only one individual was confirmed present in the area. A follow-up survey in Autumn 2008 detected at least two individuals present. However, an accurate estimate was difficult because calling was unreliable and the birds appeared to be quite mobile. Further surveys are required to establish the status of this population.

   The *South Coast Threatened Birds Recovery Plan* details recovery actions for the Critically Endangered Western Ground Parrot *Pezoporus wallicus flaviventris.* Monitoring known Western Ground Parrot populations is a key action in this plan.

3. Purpose and objectives of the proposed access

Project title: Survey of threatened fauna populations, namely Western Ground Parrot.

Objective/Goal: To follow-up the autumn 2008 surveys of the known Western Ground Parrot (CR) population in the Wilderness area.

Brief Outline of works proposed: A team of five staff and volunteers will complete this project work within the Wilderness area, minimising vehicle access, disturbance and time required in the area. The proposed survey work will be conducted in the Wilderness Zone of the Fitzgerald River National Park in autumn 2009, with survey timing dependent on access conditions. It is proposed to spend up to 10 days surveying areas previously known to support a small population of Western Ground Parrots.
The proposed project team comprises Abby Berryman, Jeff Pinder, and three volunteers. A vehicle are necessary to transport field equipment and camping gear (existing track network).

4. Timing of proposed access

A ten day period of access is proposed dependent on dry soil access conditions, with work to be completed in autumn 2009.

Commencement date: 23 March 2009 Completion date: 20 April 2009

5. Mechanised access proposed

Vehicle/Machine Type	Number of Vehicles/Machines	Number of Entries	Est'd Duration (days)
Toyota Hilux 4x4 (1QBF651) with trailer	1 (plus trailer)	1	10

6. Consideration of alternatives to mechanised access

In order to complete this survey work a period of ten days is required. It is not considered practicable to walk in on a daily basis to complete survey work given the distances involved, and equipment necessary for this survey effort. For example Ground Parrot survey work necessitates being in situ for listening sessions an hour before sunrise and an hour after sunset.

7. Likely environmental impacts of access and how these impacts can be minimised and/or rehabilitated, such as: - soil erosion/damage

Under dry soil conditions no impacts of access are anticipated. All mechanised vehicle movement will be on existing tracks, namely Drummond Track, Telegraph Track, Fitzgerald Track and Twin Bays track. Impacts from camping will be minimised by establishing camp on an existing track junction. Human waste will be maintained by use of a single pit toilet.

8. ***Phytophthora cinnamomi*** **hygiene plan for vehicular access for project works in FRNP wilderness area**

Hygiene Tactics	To be applied (Tick where appropriate)	Person Accountable
All staff and volunteers involved to receive dieback hygiene training prior to undertaking works	✓	Regional Manager
No entry or works under wet soil conditions	✓	Regional Manager
Vehicle wash down prior to entry	✓	Senior Operations Officer or District Manager
No movement within survey area in event of rainfall	✓	Senior Operations Officer or District Manager
Ensure all staff follow appropriate root hygiene protocols for any off-track work	✓	Senior Operations Officer or District Manager
Local vehicle permit issue custodian	✓	Senior Operations Officer or District Manager

9. **Endorsement and Approvals**

Endorsed by Regional Manager, South Coast Region

Bruce Bone. ..... Date 23 /03/2009

Endorsed by Director of Nature Conservation

Gordon Wyre. ..... Date 22/03/2009

Approved by Chairman or Director of CCWA

John Bailey. ..... Date /03/2009

Gordon Graham. ..... Date /03/2009

ADDITIONAL BACKGROUND TO SURVEY PROPOSAL

The Western Ground Parrot is endemic to Western Australia, and is declared threatened. It is currently Critically Endangered. The total population size in 2008 was estimated to number less than 140 individuals, occurring only in Fitzgerald River and Cape Arid National Parks. Fitzgerald River NP was previously considered the stronghold of this bird. However, the population there has declined alarmingly in recent years and now numbers fewer than 16 individuals. Additionally, the number of subpopulations in Fitzgerald River NP has declined. The Wilderness Area now contains one of only two known sub-populations remaining in Fitzgerald River NP.

This small sub-small population was found in the Wilderness Area in 2005, and it was hoped that this population was still extant, but surveys conducted in Spring 2007 only detected a single bird in the area previously occupied. A further survey in Autumn 2008 detected at least two birds, possibly even three or four.. However, these birds were calling unreliably and seemed to be quite mobile, so an accurate estimate of numbers was difficult. Actions specified in the South Coast Threatened Birds Recovery Plan, which is overseen by the WA South Coast Threatened Birds Recovery Team, include monitoring sub-populations of this species to determine status and trends.

Environmental Protection Authority

Guidance for the Assessment of Environmental Factors

(in accordance with the Environmental Protection Act 1986)

Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia

No. 56

June 2004

Western Australia

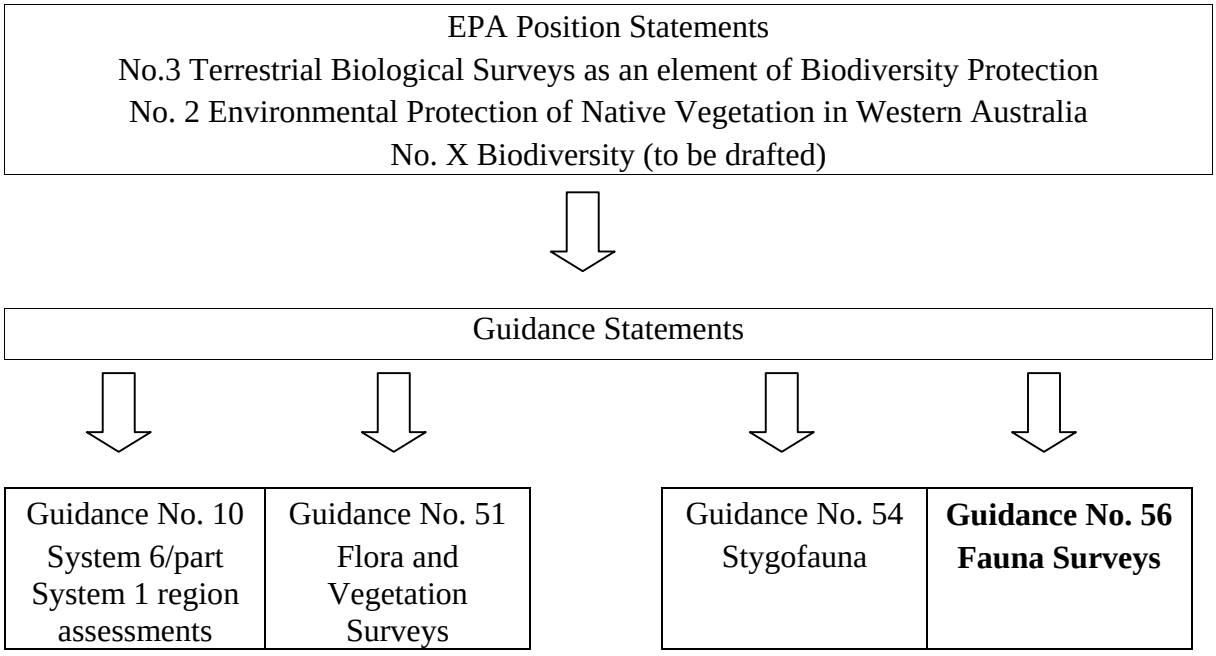
FOREWORD

The Environmental Protection Authority (EPA) is an independent statutory authority and is the key provider of independent environmental advice to Government.

The EPA's objectives are to protect the environment and to prevent, control and abate pollution and environmental harm. The EPA aims to achieve some of this through the development of environmental protection Guidance Statements for the environmental impact assessment (EIA) of proposals.

This document is one in a series being issued by the EPA to assist proponents, consultants and the public generally to gain additional information about the EPA's thinking in relation to aspects of the EIA process. The series provides the basis for the EPA's evaluation of, and advice on, development proposals subject to EIA. The Guidance Statements are intended to assist proponents in achieving an environmentally acceptable proposal. Consistent with the notion of continuous environmental improvement and adaptive environmental management, the EPA expects proponents to take all reasonable and practicable measures to protect the environment and to view the requirements of this Guidance as representing the minimum standards necessary to achieve an appropriate level of fauna survey for the assessment of environmental factors.

This Statement provides guidance on the standard of survey required to assist in collecting the appropriate data for decision-making associated with the protection of Western Australia's terrestrial faunal biodiversity and its habitat. The flowchart below shows the relationship between Position Statements and this and other Guidance Statements.



While the EPA has provided this guidance to encourage best practice in fauna and faunal assemblage survey and reporting, it is conscious that the process has also highlighted the need for complementary measures to promote such goals. In short, it is clear that the wider scientific community has a role to play in fostering skills and expertise. Firstly, the universities have a role to play in developing graduate skills in the areas of zoology, taxonomy, biogeography, ecology and statistics, which are amongst the basic prerequisites in this line of endeavour. It is evident that there has been a shift away from these areas as society places more emphasis on areas such as biotechnology. Secondly, practising zoologists and ecologists have a role to play, by mentoring recent graduates, and, perhaps most importantly, providing them with the opportunity to experience the breadth of the diversity at first hand. Thirdly, all practitioners have a role in developing a progressively improved synthesis of the fauna and zoogeography of the State. These matters are not specifically covered in this guidance.

While guidance is provided specifically in relation to the Western Australian *Environmental Protection Act, 1986*, proponents are reminded to ascertain any responsibilities they may have in regard to this issue under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

This Guidance Statement has the status of '**Final**' which means it has been reviewed by stakeholders and the public. The EPA has signed off the Guidance Statement and published it although it will be updated regularly.

I am pleased to release this document that now supersedes the draft version.

Walter Cox
CHAIRMAN
ENVIRONMENTAL PROTECTION AUTHORITY

June 2004

Contents

Guidance Statement No. 56

Guidance Statement for Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia

Key Words: **animal species assemblages, biodiversity, biological surveys, IBRA, terrestrial fauna, faunal assemblages, Priority fauna, short-range endemics, Specially Protected Fauna**

1 INTRODUCTION

1.1 Purpose

The primary purpose of this Guidance Statement is to provide direction and information on general standards and protocols for terrestrial fauna surveys to environmental consultants and proponents engaged in EIA activities. The generic process for the writing of Guidance Statements is set out in Appendix 1.

This guidance should be used when preparing documentation for referral of proposals, planning schemes and their amendments to the EPA, as well as for formal assessment and audit.

This Guidance Statement:

- addresses the general standards and a common framework for terrestrial fauna and fauna assemblages for EIA in Western Australia, the quality and quantity of information derived from these surveys, and the consequent analysis, interpretation and reporting; and
- is primarily directed at the subset of biodiversity contained in all terrestrial faunal groups.

This guidance will assist in the interpretation and application of the general principles outlined in the EPA's Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (Environmental Protection Authority 2002). It should be read in conjunction with Guidance 51 when planning for biological surveys for EIA and when practical fauna and vegetation surveys should be coordinated.

This Guidance also aims to promote survey work of sufficient rigour to contribute to a more systematic inventory of the State's biota. A more uniform approach to biodiversity appraisal is intended to provide a progressively better collective inventory of biodiversity and ecosystems. Such an approach is compatible with a

consolidated, unified and readily accessible system of environmental information.

1.2 Policy context

1.2.1 State legislation

A range of legislation is relevant to biodiversity conservation in Western Australia. This includes the *Environmental Protection Act 1986* (EP Act), the *Conservation and Land Management Act 1984*, and, in particular, the *Wildlife Conservation Act 1950*.

The Government proposes to replace the *Wildlife Conservation Act 1950* with a new Biodiversity Conservation Act. The new Act will provide for the protection and restoration of biodiversity, and the sustainable use of native plants, animals and other organisms.

1.2.2 Requirements for assessments which are accredited under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) proposed actions which have the potential to have a significant impact on a matter of national environmental significance must be referred to the Commonwealth Minister for the Environment for a decision as to whether assessment is required under the provisions of that Act.

Provision has been made within the EPBC Act, for State authorities to be accredited to undertake environmental assessments, either jointly with or on behalf of the Commonwealth, so as to meet the requirements for assessment under that Act. The related requirements and arrangements for this are discussed in the EPBC Act itself and in the provisions of bilateral agreements being negotiated between State and Commonwealth governments. A bilateral agreement between Western Australia and the Commonwealth has been signed and came into effect on 20 October 2003, the date on which accommodating EP Act amendments were assented to in the Western Australian Parliament.

Assessments must adequately address the potential impacts on matters of national environmental significance in order to comply with the provisions of the EP Act and be accredited under the EPBC Act.

1.2.3 International and National policy context

A number of International policies and agreements are part of the framework for the protection of biodiversity:

- Wetlands of International Importance
  - 1971 – *The Convention on Wetlands of International Importance* (Ramsar Convention);
- Agreements covering migratory birds
  - 1974 – the *Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment* (Japan-Australia Migratory Bird Agreement – JAMBA published as "Australian Treaty Series 1981 No. 6" by the Australian Government Publishing Service, Canberra, 1995);
  - 1979 – *Convention on the Conservation of Migratory Species of Wild Animals* (held in Bonn, Germany); and
  - 1986 – the *Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment* (China-Australia Migratory Bird Agreement – CAMBA published as "Australian Treaty Series 1981 No. 22" by the Australian Government Publishing Service, Canberra, 1995).

The State has committed to an agreed framework, principles and objectives for the protection of biodiversity with the adoption of the *National Strategy for Ecologically Sustainable Development* (Commonwealth of Australia 1992) and the subsequent *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia 1996). Western Australia was the first State to become a signatory to the latter, which followed from Australia's ratification of the United Nations Convention on Biological Diversity. In 2001 Western Australia endorsed the *National Objectives and Targets for Biodiversity Conservation 2001-2005* (Commonwealth of Australia 2001).

The EPA intends to ensure that, as far as possible, development proposals in Western Australia are consistent with, or do not conflict with, these principles, objectives and targets.

State of the Environment (SoE) reporting is now a legislative requirement at the Commonwealth level and has been adopted by Western Australia. SoE reporting aids environmental decision-making and enables assessment of progress towards ecological sustainability. It is important that environmental impact assessment reflects and reports on the 'core' environmental indicators developed for SoE reporting, some of which are biodiversity indicators (ANZECC 2000).

Accordingly, the EPA is seeking to improve the consistency and the standard of fauna surveys to ensure that decisions relating to protection of biodiversity are based on appropriate information that accords with agreements between the State and the Commonwealth.

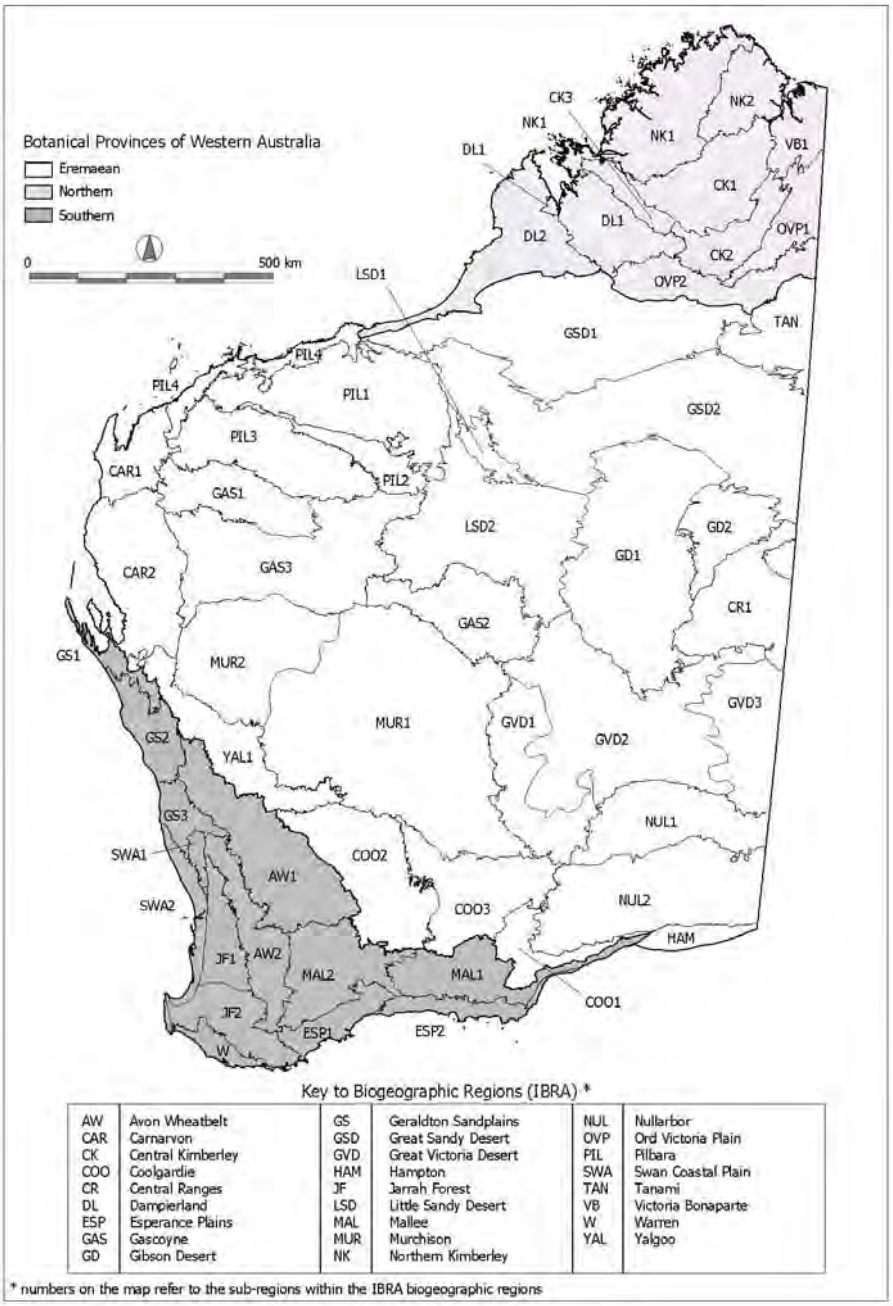


Figure 1: A Map of Western Australia showing the Botanical Provinces[1] (after Beard 1980), the IBRA bioregions (Environment Australia 2000) and the IBRA subregions (McKenzie et al. 2000).

[1] The Coolgardie and Yalgoo bioregions are here placed in the Eremaean Botanical Province (see Section 2.3 in Guidance 51). However, while their biotic composition is intermediate between the Eremaean and the South-West Provinces they are more closely allied with the South-West Province (GJ Keighery pers. comm. 2004).

1.2.4 Related policies of the Environmental Protection Authority

1.2.4.1 Position Statement No.3 on terrestrial biological surveys

In March 2002, the EPA published Position Statement No. 3 entitled *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (Environmental Protection Authority 2002). In that document the EPA discussed the range of International, National and State agreements and policies currently influencing the future protection of biodiversity in Western Australia and the need to review and improve the quality and quantity of information required for EIA.

Position Statement No. 3 indicated that the EPA adopted the definition of Biological Diversity and the Principles as defined in the *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia 1996); that the quality of information and scope of field surveys should meet standards, requirements and protocols as determined and published by the EPA; and the Interim Biogeographic Regionalisation of Australia (IBRA) should be used as the largest unit for EIA decision-making in relation to the conservation of biodiversity. The IBRA has identified 26 bioregions in the State (Figure 1) that are affected by a range of different threatening processes and have varying levels of sensitivity to impact. Terrestrial biological surveys should provide sufficient information to address both biodiversity conservation and ecological function values within the context of proposals and the results of surveys should be publicly available.

Following a workshop in July 2000 on the draft Position Statement No. 3, the EPA decided that because of the diversity of ecosystems, separate guidance statements were warranted to address the range and complexity of issues pertaining to biological surveys.

Issues and survey types under consideration for incorporation in a series of guidance statements related to terrestrial biological surveys include:

- terrestrial fauna and faunal assemblage surveys (this Guidance);
- flora and vegetation surveys (Guidance 51);
- subterranean fauna in groundwater and caves (Guidance 54);
- karst environments;
- data acquisition and submission; and
- threatening processes.

Therefore this Guidance Statement forms part of a series in response to Position Statement No. 3, and is intended to be read in conjunction with that document and Guidance Statement No. 51 (Environmental Protection Authority 2004) as well as others that may be published in the series.

For projects located in the System 6 Region or the southern Swan Coastal Plain this Guidance Statement should also be read in conjunction with Guidance

Statement No. 10, *Guidance Statement for Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1 region* (Environmental Protection Authority 2003a).

1.3 Limitations of this Guidance

This Guidance Statement is:

- confined to matters relating to terrestrial fauna and faunal assemblage surveys, and the treatment of associated data, and does not address more proposal-specific issues, which are the preserve of proposal-specific guidelines or approved scoping documents. Accordingly, it does not provide prescriptive guidelines for survey methodology. A useful reference for survey methodology is that adopted in South Australia to collect data for the Environmental Data Base of South Australia (Government of South Australia 2000);
- the contemporary view of the EPA until such time as this document is subject to review;
- not an instrument for predicting outcomes of deliberations by the EPA; and
- intended to apply to proposals yet to come before the EPA.

2 DIVERSITY OF THE FAUNA AND FAUNAL ASSEMBLAGES

2.1 The high diversity and endemism of the fauna

Australia's biota is recognised as one of the 12 most diverse in the world (Common and Norton 1992; Mummery and Hardy 1994). The faunal biota of Western Australia is diverse but incompletely documented (Hopper *et al*. 1996). The vertebrate groups are the best documented with an estimated 3,168 species (see Table 2 in Hopper *et al*. 1996). However, in some groups, especially fishes, frogs and reptiles, entirely new species are described almost every year (Aplin *et al*. 2001). The 1,900 species of fishes referred to by Hopper *et al*. (1996) has been increased to 3,127 species Hutchins (2001).

Figure 2 shows the increase in named species among the terrestrial vertebrate groups over time since the early exploration of Western Australia. This reflects the continuing growth of knowledge of the State's biodiversity as more areas are surveyed.

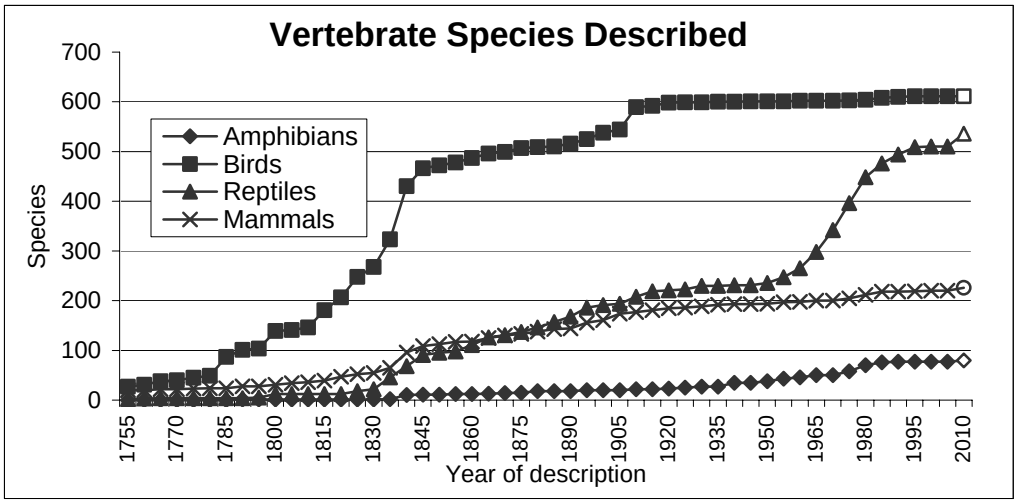


Figure 2: Number of species of Western Australian vertebrates described over time and the potential numbers for 2010 based on known yet to be described taxa.

Some faunal groups have a high level of endemism to Western Australia. For example, Horwitz (1994) commented on endemism patterns in the freshwater fauna and Hopper *et al*. (1996) noted that 49% of amphibians, 60% of reptiles, 18% of mammals but only 3% of birds were endemic to Western Australia. They estimated that 60% of the estimated 10,000 species of Chelicerata (spiders), 75% of the estimated 1,000 species of Myriapoda (millipedes and centipedes), and 55% of the estimated 30,000 species of Crustacea were endemic to Western Australia. However they were not able to estimate what percentage of the estimated 50,000 species of Insecta were endemic to Western Australia.

2.2 Short-range endemics

Comprehensive systematic reviews of different faunal groups often reveal the presence of short-range endemic species (Harvey 2002). Among the terrestrial fauna there are numerous regions that possess short-range endemics. Mountainous terrains and freshwater habitats often harbour short-range endemics, but the widespread aridification and forest contraction that has occurred since the Miocene has resulted in the fragmentation of populations and the evolution of many new species. Particular attention should be given to these types of species in environmental impact assessment because habitat loss and degradation will further decrease their prospects for long-term survival.

Harvey (2002) considered that although there were occasional short-range endemics among the vertebrates and insects, there were much higher numbers among the molluscs, earthworms, some spider groups (especially the mygalomorphs), millipedes, and some groups of crustaceans. Short-range endemics generally possessed similar ecological and life history characteristics,

especially poor powers of dispersal, confinement to discontinuous habitats, slow growth and low fecundity.

Some better known short-range endemic species have been listed as threatened or endangered under State or Commonwealth legislation but the majority have not. Often the lack of knowledge about these species precludes their consideration for listing as threatened or endangered. Listing under legislation should therefore not be the only conservation consideration in environmental impact assessment.

The State is committed to the principles and objectives for the protection of biodiversity as outlined in *The National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia 1996). The EPA expects that environmental impact assessment will consider impacts on conservation of short-range endemics in accordance with these principles and objectives.

3 THE GUIDANCE

3.1 EPA's objectives and their application to environmental impact assessment

3.1.1 The environmental objectives

This Guidance Statement provides information to proponents, consultants and the general public on the EPA's requirements for terrestrial fauna and faunal assemblage surveys and resulting survey reports. It details the minimum requirements for when a survey is required, what type and extent of survey is required and the minimum standard of interpretation of survey data which is required in the fauna and faunal assemblage survey report and related environmental assessment and evaluation (see definitions).

The objectives of this Guidance are to ensure that:

- there is clarity for proponents on the scale of fauna and faunal assemblage survey appropriate for different areas;
- the fauna and faunal assemblage survey, analysis, interpretation and reporting undertaken for EIA is of a suitable quality and of consistent methodology to enable the EPA to judge the impacts of proposals on fauna and faunal assemblages;
- the environment, in particular significant fauna and faunal assemblages, is identified and protected through best practice in the conduct and reporting of fauna and faunal assemblage surveys for EIA;
- Western Australia's knowledge base of fauna and faunal assemblages and biogeography are developed and enhanced over time at both the local and regional scale to the benefit of future decision making; and

- survey data are capable of underpinning long-term observation and measurement for later compliance and audit purposes (especially as this pertains to completion criteria for projects).

3.1.2 Environmental factors and EPA objectives for each factor

Section 44 of the EP Act requires the EPA to report to the Minister for the Environment on the environmental factors relevant to proposals and planning schemes that it formally assesses under Part IV of the Act. The environmental factors are described in the scoping document (for proposals under Section 38) or instructions (for Schemes and their amendments under Section 48A) for the required environmental review document. The EPA's objective for each environmental factor and the investigations that will be undertaken by the proponent (proposals) or is required of the responsible authority (schemes and their amendments) to evaluate whether these objectives can be achieved is also defined in the scoping document or instructions.

The initial identification of factors should be undertaken by the proponent during the preparation of referral and scoping documents (see Section 3.1.3).

3.1.3 Application of the guidance to environmental impact assessment

This Guidance will apply when preparing documentation for referral of proposals, planning schemes and their amendments to the EPA for formal assessment and audit where fauna and faunal assemblages are likely to be impacted as a result of implementation. Additional or special requirements for individual projects may be identified in the scoping document or instructions or in other advice provided via correspondence with the proponent or the responsible authority. Scoping documents or instructions should normally be consistent with this Guidance. However, in certain circumstances there may be a need to vary requirements to suit the particular case, and this would be set out in the scoping document or instructions.

3.2 Planning and design of fauna and faunal assemblage surveys

All proposals, planning schemes and their amendments where fauna and faunal assemblages will be impacted as a result of implementation of the proposal, scheme or amendment should report fully on natural values, potential impacts, cumulative impacts, and options to minimise impacts. Documentation should identify the degree to which the advice and approach provided in this Guidance Statement has been followed. Divergence from these standards should be highlighted in sections dedicated to limitations (see Section 3.3.1).

The EPA has provided below, guidance on what needs to be considered when surveys are being undertaken to provide information about fauna and faunal assemblages relevant to a proposal.

3.2.1 Approaches, resources and standards required

The State's fauna is highly diverse and only partially known, and appraisal of it is a highly technical and skilled process. Therefore it is expected that for fauna and faunal assemblage surveys:

- there will be adequate provision of resources for the survey and documentation of the fauna and faunal assemblages:
    - the intensity of sampling will reflect the likely faunal diversity due to the complexity of the vegetation and habitats of the proposal area;
    - adequate resources are directed to fauna sampling and identification, specimen processing and subsequent lodgement of specimens in the Western Australian Museum. This should include allowance for a possible species verification lag due to other commitments by taxonomists and the lack of availability of some taxonomic specialists; and
    - adequate resources are directed to data analysis and interpretation;
- there will be a high degree of rigour in reporting not only to describe current fauna and faunal assemblages but also to facilitate subsequent EPA assessment and auditing; and
- there will be a requirement for standardisation of techniques and terminology. It is important that survey methods are given minimum standards so that future work on the fauna and faunal assemblages is comparable.

3.2.2 Stage of proposal when surveys should be commissioned

For any proposal, the timing of fieldwork is critical to the whole process of survey and reporting on fauna and faunal assemblages. It is the first part of a process, and the natural fluctuation in rainfall may delay fieldwork. For example, heavy rainfall may cause delays with trapping and consultants need to comply with animal welfare requirements. A significant lead-time is required as it may be necessary to undertake surveys at various times of the year depending on the nature of the assemblages and species in the subject area. Survey over multiple years may be required where a single year's data is not adequate to determine the faunal assemblage (see How 1998, How *et al*. 1991) or to address the environmental factors.

There may also be a lag time due to appropriate faunistic expertise being unavailable. Proponents should make allowance for this lag when project planning, as it is a consequence of best practice. Consequently the EPA urges proponents to commission fauna and faunal assemblage surveys as early as practicable in the planning/site selection phase of a development or scheme to avoid potential for delays in project approvals.

For environmental monitoring and management, it is essential that fauna and faunal assemblage surveys have been conducted before the project area is cleared or otherwise modified.

3.2.3 Who should lead and undertake fauna and faunal assemblage surveys

Fauna and faunal assemblage surveys should be coordinated and led by fauna specialists who have had:
a) training, experience and mentoring in the area of fauna identification/fauna and faunal assemblage surveys and/or specific training in elements of survey or sampling theory and Australian fauna identification and zoogeography; and
b) would normally have had a wide exposure to WA's fauna and faunal assemblages, preferably with knowledge and experience in the region being surveyed.

It is recognized that the survey team will often include assessors who are less experienced. However, these team members should be supervised at all times by experienced and suitably qualified supervisors. The latter will enable the skill development of all zoologists involved in the work, which will assist in the development of professional skills within the wider industry. The universities also have a key role in developing graduate skills; in recent years there has been a tendency to shift away from the classical aspects of taxonomy and statistics, even though these are critical to fauna surveys.

Fauna and faunal assemblage survey reports should acknowledge all persons involved in the survey and their role in the survey. This includes acknowledging all specialists involved with specimen identification or species verification. The report should state who was responsible for its compilation.

These are specialist scientific and technical reports that should appropriately acknowledge authorship and contributions. The EPA sees this as part of the process of properly valuing this work and promoting good standards.

3.2.4 When fauna and faunal assemblage surveys should be conducted

The EPA expects that the design of fauna and faunal assemblage surveys, including sampling methods, duration and timing, will be appropriate to the faunal group being sampled and will use methods appropriate to the region of the State. In many cases the timing of a fauna and faunal assemblage survey will be critical in terms of the results of the survey providing adequate information and certainty levels with respect to whether the EPA's relevant environmental factors can be met. It is therefore essential that the timing of fauna and faunal assemblage surveys be such that the survey objective/s can be met.

The appropriate timing of fauna and faunal assemblage surveys will therefore need to be considered early in the planning phase of a development proposal or scheme. Environmental and planning consultants, staff of government authorities and the

EPA all have a role in bringing these requirements to the attention of development proponents as early as possible in the planning process for proposed developments or schemes (or their amendment).

In general fauna and faunal assemblage surveys conducted for baseline information (i.e. the first detailed survey of the area prior to development) should be multiple surveys conducted in each season appropriate to the bioregion and the faunal group. The most important seasonal activity times for many faunal groups are related to rainfall and temperature. Thus, a survey in the season that follows the season of maximum rainfall is generally the most productive and important survey time. However, in some cases there may also be a need to time surveys according to the seasonal activity patterns of particularly important species (such as Specially Protected Fauna or Priority species) or particular assemblages (e.g. molluscs or amphibians). In the case of surveys conducted for formal EPA assessments, the EPA's proposal-specific guidelines may specify these species and/or assemblages. In other cases (such as where the survey is carried out prior to referral of a proposal) advice on which are likely to be important species or assemblages may be sought from the Department of Environment (DoE) and (particularly with respect to proposals in current or proposed conservation reserves) the Department of Conservation and Land Management (CALM).

3.2.5 Determining the extent and level of survey required

The scale and nature of impact and the sensitivity of the receiving environment will govern the indicative levels of faunal survey expected by the EPA. These were outlined in EPA's Position Statement No. 3 (Environmental Protection Authority 2002) and are presented in Appendix 2.

Aspects of the environmental factors and objectives and the scope of the required survey may be set out by the EPA in proposal-specific Guidelines (in the case of environmental assessments by the EPA). In this case, the specific direction provided in the EIA Scoping Document or Instructions will take precedence within the context of the approach and expectations set out in this document. However in the absence of specific direction in these documents, the scope will be determined by the objectives of the survey consistent with expectations established in this Guidance Statement. Resource considerations are also relevant, provided that the survey will provide sufficient information for the EPA to determine whether or not the objectives for specified relevant environmental factors can be met.

3.2.6 Determining survey sampling design and intensity

Factors likely to influence sampling design include :

- bioregion – level of existing survey/knowledge of the region and associated ability to predict accurately;
- landform special characteristics/specific fauna/specific context of the landform characteristics and their distribution and rarity in the region;

- lifeforms, life cycles, types of assemblages and seasonality (e.g. migration) of species likely to be present;
- level of existing knowledge and results of previous regional sampling (e.g. species accumulation curves, species/area curves;
- number of different habitats or degree of similarity between habitats within a survey area;
- climatic constraints, e.g. temperature or rainfall that preclude certain sampling methods;
- sensitivity of the environment to the proposed activities;
- size, shape and location of the proposed activities; and
- scale and impact of the proposal.

During the planning stage before fauna and faunal assemblage surveys are conducted, the EPA expects that proponents will consider the methods, including any constraints, of other surveys in the region. Useful references in this context include Biological Surveys Committee of WA (1984), Burbidge *et al.* (2000a), How *et al*. (1984, 1991) and papers in Burbidge *et al.* (2000b). A useful manual for vertebrate survey methodology is that used in South Australia to collect data for the Environmental Data Base of South Australia (Government of South Australia 2000). The sampling design should be adequately explained and justified in the survey report.

The duration and spatial scale of fauna sampling are pivotal in environmental impact assessment and the methodology design and intensity of the survey needs careful consideration and will vary regionally and take into account local conditions. For example, studies (e.g. How 1998, How *et al*. 1991, Rolfe and McKenzie 2000) have shown that extensive sampling effort is required in both a temporal and spatial scale before the composition of a herpetofaunal assemblage (including its rarer species) can be adequately determined. At Bold Park on the Swan Coastal Plain, How (1998) showed that 80% of the reptile assemblage was recorded only after 40 days of systematic trapping, but in specific habitats the mean effort expended to record 80% of the assemblage was over 75 days. In the east Pilbara, a study by How *et al*. (1991), which extended over 58 days of pitfall trapping over nine trapping periods over three years over eight discrete habitats, revealed that 25 trapping days elapsed before 80% of the pitfall trapped assemblage was recorded. However, the assemblage revealed by pitfall trapping represented only 58% of the 67 reptile species recorded by all means during the survey.

Survey methodology, duration and timing will vary according to the faunal group being surveyed. For example, the timing of molluscan surveys is crucial. An apparent paucity of molluscs may be due to the relative humidity or time of day, rainfall and temperature on the day of the survey, over the preceding weeks or even in the previous year when conditions were not advantageous for breeding and survival of the young. For mollusc surveys for example, surveyors need to be skilled in assessing habitat diversity as it pertains to snails, and in using the

various techniques (dismantling rock piles, excavating burrows, sieving for micro-molluscs, etc.) that are appropriate for searching for snails (live or dead, active or aestivating).

The relative efficacy of sampling methods for terrestrial vertebrates has been analysed (e.g. How *et al*. 1984, 1991 and Rolfe and McKenzie 2000) for different parts of Western Australia. The EPA expects that analysis of faunal assemblage data will take cognisance of sampling bias in favour of some groups while under sampling others.

3.3 Presentation and reporting

3.3.1 Identifying the limitations of the survey

It is essential that every fauna and faunal assemblage survey report contains a section describing the methods used and the limitations of these methods. This is particularly important as it will enable assessment officers to determine whether the survey is adequate to address particular issues. The survey techniques for each of the faunal groups sampled should be detailed including person/hours and number of traps/area.

Detailing survey limitations are important as they fulfil three functions:

- they are a discipline that requires the author of the fauna and faunal assemblage survey report to consider any factors which may have limited or compromised the results, or omissions from the survey, and any issues which could not be addressed within the survey scope;
- in the spirit of transparency they clearly signpost such compromising factors in a way that should indicate the capacity of the survey and the report to address issues; and
- they may act as insurance to the practitioner against being perceived by others to have made false claims.

Limitations may cover constraints such as:

- competency/experience of the consultant carrying out the survey;
- scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions, e.g. pitfall trapping in waterlogged soils or inability to use pitfall traps because of rocky terrain or impenetrable subsoil);
- proportion of fauna identified, recorded and/or collected ;
- sources of information e.g. previously available information (whether historic or recent) as distinct from new data;
- the proportion of the task achieved and further work which might be needed;
- timing/weather/season/cycle;
- disturbances (e.g. fire, flood, accidental human intervention etc.) which affected results of survey;

- intensity (in retrospect, was the intensity adequate);
- completeness (e.g. was relevant area fully surveyed);
- resources (e.g. degree of expertise available in animal identification to taxon level);
- remoteness and/or access problems; and
- availability of contextual (e.g. biogeographic) information on the region.

3.3.2 Requirements for data presentation

As far as possible, data collected for fauna and faunal assemblage surveys being conducted for EIA or for other consideration by the EPA should be gathered and presented in quantitative form. Results presented within fauna and faunal assemblage survey reports can be used to interpret data or make qualitative observations, but the information to support the key results should be presented in a form that would allow an appropriately qualified third party to evaluate.

Nomenclature
The EPA is seeking to ensure comparability between different EIA reports, both in project methodologies and especially in the nomenclature of species involved. Agencies with the primary responsibility for compiling the State's species listing are the Western Australian Museum in the case of the fauna and the Herbarium (CALM) in the case of the flora. EIA reports will be expected to use current listings from these agencies.

In the case of vertebrate species the acceptable nomenclature will be that determined by the Western Australian Museum as provided in the original or current (including electronic) versions of *Checklist of the vertebrates of Western Australia*. EIA reports will quote the appropriate authorities for the nomenclature used for each vertebrate group, e.g. Hutchins (2001) for fish, Aplin and Smith (2001) for amphibians and reptiles, Johnstone (2001) for birds, and How *et al*. (2001) for mammals. For non-vertebrate groups for which there are no current comprehensive species listings it is expected that EIA reports will use the most recently available names and the appropriate departments in the Museum should be consulted for advice.

3.3.3 Preparation of fauna and faunal assemblage survey reports

Generally the person/s involved in the planning and implementation of the relevant fauna and faunal assemblage survey should be responsible for preparing these reports. In some cases there may be a need for quality endorsement by more experienced persons. However these persons should also be qualified to undertake surveys as set out in Section 3.2.3.

3.3.4 Setting the context for survey design and reporting

The key policy reference dealing with the environmental significance of impacts on fauna and faunal assemblages in Western Australia is Position Statement No. 3 (Environmental Protection Authority 2002). Position Statement No. 3 outlines the policy context for the protection of biodiversity throughout Western Australia, and in particular regions. In Position Statement No. 3 the EPA sets out key elements that are relevant to its consideration of proposals which impact on biodiversity. These elements provide the general framework for the objectives and design of fauna and faunal assemblage surveys because, in order to properly assess the environmental significance (and acceptability) of proposals, the EPA needs to be able to answer specific questions based on the elements identified. These questions also relate to any specific objectives that the EPA has identified as being relevant to a particular project, via the process of providing proposal-specific assessment guidelines, and to the requirements of the Commonwealth for matters of national environmental significance.

As Western Australia is a very large State with considerable local and regional environmental variation, the nature, scope and intensity of the fauna and faunal assemblage survey required may vary according to the region, in response to regional characteristics such as spatial heterogeneity and geographic distribution. These requirements need to be considered on a region-specific basis and are described in Appendix 2.

Aspects of 'context ' will generally include, but not be limited to:

- objective of the survey (foreshadowing the contribution of the work);
- review of background (literature search, metadata search including appropriate search of specimen databases, e.g. W.A. Museum *Faunabase*);
- characteristics of the fauna of the site at the international, national, State, regional, local level as appropriate;
- appraisal of current knowledge base/framework;
- what specific areas of information will be investigated (e.g. regional and local biogeographical significance, biodiversity, species richness, conservation status, threatening processes); and
- review of other environmental work carried out in the area and relevant to the proposal.

3.3.5 Format of survey reports and data

The findings of the fauna and faunal assemblage survey should be submitted in two ways:

1) As a stand-alone report, which may also appear whole as an appendix of an environmental review document:

- To the EPA

  In both hard copy (including any original habitat or other maps) and electronic form (with mapped data in a digital format). (Note: the EPA intends to develop guidance in the near future on the requirements for submission of data from biological surveys.)

- To the public

Available in hard copy from the proponent at a cost no greater than that of the main environmental review document; and

2) As an overview within the environmental review document

The environmental review document should include, within its text, a clear overview of the findings on the biodiversity and conservation values of the fauna and associated impacts. It is imperative that the overview accurately and directly represents the discussion, conclusions, recommendations, summary and limitations of the base survey report. The conclusions, summary and limitations of the base survey report should also be evident in the summary and conclusions of the environmental review document. The authors of the fauna survey report should be responsible for preparing the conclusion, summary and limitations, or at least vet these sections, and should sign the reports to indicate their agreement with the material presented.

3.3.6 Public availability of fauna survey reports submitted for EIA

The EP Act stipulates that the EPA [Section 39(1)(a)(b) and 39(5)] and proponents [Section 40 (2)(a)(4)(a)(b)] make information publicly available as part of the environmental review process.

The EPA considers that:

- the public availability of information on biodiversity is fundamental to the environmental review process and good decision-making;
- all survey work on fauna and faunal assemblages should contribute to the sum total of knowledge for the State; and
- any disclaimer within an environmental review or survey document must recognise that the work is primarily for the purposes of environmental impact assessment under the EP Act, is consequently publicly available, and is subject to the limitations outlined in the methods of the survey document.

The EP Act provides for particular and limited protections on confidential information [Section 39(2)(3)(a)(b)(4) and Section 120]. The *Freedom of Information Act 1992* also applies.

3.3.7 Use of terminology

Terminology should be clear and standardised, preferably using those terms listed in Section 6 of this Guidance.

3.3.8 Acknowledgement of contributors and attribution of all sources of data

Scientific and technical documents should appropriately acknowledge all contributions and authorship (this includes Environmental Review documents). This is important to the process of properly valuing all work and promoting basic standards.

Fauna and faunal assemblage survey reports should list the names of all persons involved in both the survey and the preparation of the report and briefly state their role. Acknowledgements should also extend to any other contributors including external expertise sought.

Other sources of data should be fully attributed and referenced to the original source. This includes metadata (including GIS), maps, figures and tables copied or adapted from other sources.

3.3.9 Record keeping for the purpose of audit

The EPA's requirement for information provided in fauna and faunal assemblage surveys is for the source data from surveys to be readily available for a reasonable period (7 years) following the survey so that:

- subsequent supplementary or time-sequence surveys can be adequately designed;
- survey limitations are transparent to data users; and
- the surveys themselves are verifiable and auditable by a third party.

Accordingly, the base data collected in surveys (including details of sample dates, precise location, habitat details, etc.) should be retained in the form originally collected for a minimum of 7 years after the survey was completed.

The EPA advises that from time to time there will be random and opportunistic audits of fauna and faunal assemblage surveys (and/or related reports). In some cases (usually for major projects in sensitive areas) fauna and faunal assemblage survey reports (and related data) may be subject to peer review by an independent faunal survey practitioner.

As outlined in Position Statement No. 3, the EPA expects that information obtained as part of environmental impact assessment should be made permanently available to the public. To achieve this, the EPA intends to encourage the coordinated development of a statewide database for EIA-related biological surveys in consultation with environmental practitioners and Western Australian natural resource management agencies and authorities. To achieve this end, it is desirable that an electronic version of the fauna data is provided to the EPA, so that it can be used to consolidate knowledge of the State's biota and progressively add to the knowledge base of the biodiversity of Western Australia and provide an improved basis for future decision-making.

The EPA proposes to work with survey practitioners and officers of the Western Australian Museum and CALM to develop an appropriate set of protocols for the presentation, storage, acknowledgement and accessibility of faunal information.

3.4 The role of the surveyor in increasing biodiversity knowledge

As a result of the limited amount of detailed fauna and faunal assemblage survey data available for most regions of Western Australia, much of the fauna survey work conducted is of an exploratory nature and there is significant potential for new discoveries or findings. This may significantly challenge or revise conventional understanding of the distribution or abundance of fauna and faunal assemblages.

This leads to a need for persons engaged in fauna and faunal assemblage surveys to act as scientific advocates and bring to the scientific, government, and public arenas, new information gathered in the course of the survey. This contributes to an increase in collective knowledge and ensures that decisions on biodiversity protection are based on the best available information.

For example, the EPA would expect that animal specimens collected and not readily identifiable as common, would be vouchered to the Western Australian Museum and that specimens which reflect taxonomic anomalies or which are found to occur beyond the previously known range of a taxon would be highlighted in the fauna and faunal assemblage survey report and brought to the attention of relevant authorities (e.g. Western Australian Museum, CALM, the EPA etc.).

Additionally, fauna and faunal assemblage survey reports should identify whether any animal taxa or assemblages present are restricted or whether the survey area is an outlier or known extremity of the range of those taxa/assemblages.

3.5 Auditing or peer reviewing surveys

The EPA does not have the resources to undertake systematic review of all fauna and faunal assemblage surveys or reports. To ensure that the methods and standards applied in surveys are of a standard that is adequate to ensure quality environmental assessment by the EPA, a proportion of projects may be selected at random for the audit process. In such cases, selected parts of the survey and the related report (i.e. a sample of the work) may be audited.

Peer review may be warranted for some EIA surveys, particularly where the EPA or the practitioner conducting the main fauna and faunal assemblage survey considers that the survey is in an area or bioregion which is poorly known or in which a limited range of specialists may be qualified or experienced. Such review must be undertaken by experienced and suitably qualified professionals (Section 3.2.3). Unless there are matters in dispute, the peer review would normally be conducted at the expense of the proponent. The EPA will normally seek to inform the proponent

of the likely requirement for a peer review in the project-specific guidelines or approved scoping documents.

Core elements of the peer review process in science are that:

a) the choice of reviewer/s is made by a body independent of the author and the report commissioners (in this case, the EPA is the independent body);
b) the reviewers are qualified and experienced professionals, with levels of relevant experience and expertise at least equivalent to those of the people they are reviewing;
c) the reviewers are clear as to the scope and the limitations of the review (general limitations are considered);
d) the reviewers can remain anonymous; and
e) there is an opportunity to re-submit work after revision.

4 APPLICATION

4.1 Area

This Guidance Statement applies throughout the State of Western Australia and will apply to all new proposals, planning schemes and amendments to schemes.

Position Statement No. 3 indicates that the EPA intends to use IBRA as the largest unit for decision-making in relation to maintenance of biodiversity. Proponents will, as a minimum, be required to demonstrate that their proposal can meet objectives which are framed in the context of conservation within the applicable bioregion/s. In some areas, such as the Swan Coastal Plain, the developing framework of biogeographical knowledge and policy may provide a more detailed context (EPA Guidance Statement No. 10 and Government of Western Australia 2000a and b).

4.2 Duration and Review

The duration of this Guidance Statement is for five years, unless circumstances require it to be reviewed earlier.

5 RESPONSIBILITIES

5.1 Environmental Protection Authority responsibilities

The EPA will apply this Guidance Statement when assessing any proposals, planning schemes or amendments where fauna and/or faunal assemblages are identified as relevant factors prior to, or during, the assessment.

5.2 Department of Environment responsibilities

The DoE, through the EPA Service Unit (EPASU), will assist the EPA in applying this Guidance Statement in environmental impact assessment and in conducting its functions under Part IV of the EP Act.

The DoE, through the EPASU, will provide more specific advice to proponents and environmental consultants, as required, in relation to detailed interpretation of aspects of this Guidance or in relation to specific assessments, within available resources.

5.3 Proponent responsibilities

Assessment is likely to be assisted if proponents demonstrate to the EPA that the requirements of this Guidance Statement are incorporated into proposals.

As outlined in Section 3.3.5, the EPA expects that proponents will ensure that the findings of the original survey report/s appear in an unaltered form in the main text of any review document, and that a copy of the whole survey report will appear as an appendix of the review document.

5.4 Environmental practitioner (including fauna consultant) responsibilities

The EPA expects that the design of fauna and faunal assemblage surveys will take account of current fauna protection legislation and that survey practitioners will have appropriate CALM administered licences and will comply with current animal ethics requirements.

Environmental practitioners are expected to exercise due professional diligence in the conduct of fauna and faunal assemblage surveys and the authorship of fauna and faunal assemblage survey reports. Environmental review documents and fauna and faunal assemblage survey reports should contain an acknowledgment that the EPA's EIA process is one of the specific purposes for which the document or report has been prepared and that the document is suitable for this purpose. Documents and/or reports that do not do so will not be accepted by the EPA for the purposes of EIA.

It is essential that the standards for survey outlined here are met or exceeded. The EPA urges practitioners to ensure that they fully understand the inherent context and level of meaning of terms before they apply them. Particular use should be made of definitions in this Guidance.

A full and frank statement of impacts is expected at all levels of survey and environmental assessment documentation.

6 DEFINITIONS AND ACRONYMS

6.1 Definitions

Biological diversity/biodiversity – is the variety of all life forms - the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part. It is not static, but constantly changing; it is increased by genetic change and evolutionary processes and reduced by processes such as habitat degradation, population decline, and extinction (Commonwealth of Australia 1996).

Biodiversity has two key aspects:

- its intrinsic value at the genetic, individual species, and species assemblages levels; and
- its functional value at the ecosystem level.

Two different species assemblages may have different *intrinsic* values but may still have the same *functional* value in terms of the part they play in maintaining ecosystem processes.

o **Genetic diversity** – is the variety of genetic information contained in all of the individual plants, animals and micro-organisms that inhabit the earth (Commonwealth of Australia 1996). Genetic Diversity represents the heritable variation within and between populations of organisms. In any given area it is the variety of genetic material contained in all organisms.

Genetic diversity occurs within and between the populations of organisms that comprise individual species as well as among species (Commonwealth of Australia 1996).

Due to a lack of research regarding the genetic range of endemic species, there has been, and will continue to be, difficulty in addressing protection of biodiversity specifically at the genetic level.

However for many species some information is available on the phenotypic expression of genetic variation through the recognition of different taxa at the sub-species or variety level. These may be significant in terms of exhibiting varying distribution and levels of rarity. The protection of species throughout their range and on the variety of sites may therefore serve as a surrogate for protection of genetic diversity in the absence of specific information. This issue needs to be considered in the design/collection and interpretation of data obtained in fauna and faunal assemblage surveys.

o **Species diversity** – this can be considered as the variety of individual species within a given area, such as a region. While such diversity can be

measured in many ways, the number of species (species richness) is most often used, but a more precise measurement taxonomic diversity, also considers the relationship of species to each other. The more different a species is from other species the greater its contribution to any overall measure of biological diversity. The ecological importance of a species can have a direct effect on community structure, and thus on overall biodiversity. The variety of species increases with genetic change and evolutionary processes.

Species diversity is conceptually different from genetic diversity because:

- in general, the recognition of species is based on physical features (a taxonomic approach of recognising, describing, naming and classifying); and
- a species is a concept, rather than a clear unit in nature. This can mean that the amount of genetic variation within one species may be markedly different from another species. To accommodate such inconsistencies, sub-divisions such as sub-species and hybrids may be recognised.

EIA in WA to date has typically considered fauna at the species and species assemblage levels. For example, environmental assessment work presented to the EPA typically includes fauna inventory lists with an emphasis on the presence or absence of rare, Threatened and Priority species (as determined by CALM databases or other relevant data sources).

Threatened and Priority fauna are only one subset of species diversity. The scope of formal listings is limited by the extent and intensity of sampling in any area, by how well a surveyor recognises all different organisms in an area, by whether all known occurrences are registered, and by the current progress in naming species groups. Since these processes are ongoing, it is clear that survey for environmental impact assessment has a role in extending knowledge. Consequently, consultants are encouraged to check specimens that have no known match, or appear anomalous, and which may be new.

o **Ecosystem diversity** – in any given area, the variety of habitats, biotic communities and ecological processes (Commonwealth of Australia 1996).

Ecosystems are the basic functional ecological units. They comprise the diversity of all-living organisms and non-living components and their relationships within a given area. They can be defined at almost any nominated scale. Ecosystems include abiotic components, which include physical factors such as radiation, gases, the water cycle, geology, land and soil forming processes, and climate.

Ecological processes are the interactions, and changes or development processes, of the ecosystem over time.

Ecosystem diversity is harder to measure than species or genetic diversity because the boundaries of ecosystems (or component habitats and communities) are a matter of definition within a matrix. Provided a consistent set of criteria is used to define ecosystems, their number and distribution can be measured. It is therefore essential

that scale/s and the basis for differentiation are defined and understood in any treatment of ecosystem diversity.

o **Other expressions of biodiversity** - Other expressions of biodiversity can be important. These include the relative abundance of species, the age structure of populations, the pattern of communities in a region, changes in community composition and structure over time, and ecological processes such as predation, parasitism and mutualism. It is often important to examine diversity in ecosystem structure and function as well as compositional diversity of genes, species and ecosystems (Environmental Protection Authority 2002).

Environmental assessment and evaluation document (sometimes referred to as an **environmental review document**) – An environmental assessment and evaluation document is the information presented in an environmental assessment or review document submitted to the EPA. Environmental assessment or review documents may include:

- a referral document (prior to the EPA determining the level of environmental assessment required for a proposal);
- an environmental review document (as required by the EPA for formal assessments of some proposals and schemes, under Part IV of the Environmental Protection Act); or
- a post-approval report (i.e. prepared subsequent to environmental approval being granted) such as reports on fauna and faunal assemblage surveys conducted to fulfil proponent commitments or environmental conditions.

The information provided in an environmental assessment and evaluation may (where relevant) make reference to one or more fauna and faunal assemblage survey reports (as well as information relevant to other impacts of the proposal). It may also include an evaluation of the impacts of a proposal, drawing information from the fauna and faunal assemblage survey (and other) report/s that should always be made available to the DoE and the EPA either separately or as an appendix to the environmental review document.

Faunal assemblage - A collection of animal species inhabiting a particular area.

Fauna and faunal assemblage survey - For the purposes of EIA or environmental management, a fauna and faunal assemblage survey is the primary office and field based investigation (including a review of established literature) of the characteristics of the faunal biodiversity of a proposal or scheme area or any other area relevant to the consideration or assessment of a proposal or scheme by the EPA or the management of a proposal or scheme.

Fauna and faunal assemblage survey report - A fauna and faunal assemblage survey report describes the objectives, methods, data results, analysis and conclusions of a fauna and faunal assemblage survey. The primary author/s of this document should be the person/s conducting the fauna and faunal assemblage

survey. This report should be separate from an environmental assessment and evaluation report (described above).

Habitat - The natural environment of an organism or a community, including all biotic and abiotic elements; a suitable place for it to live (after Gilpin 1996; Jones *et al.* 1990; Lewis 1977; Onions 1978; Commonwealth of Australia 1996). The term 'habitat' has been applied at a range of scales in general use (as have community and vegetation). Vegetation can become a reasonable surrogate for outlining habitat when its main components, structure and the associated landform are also described.

Natural Areas - naturally vegetated area or non-vegetated areas such as water bodies (generally rivers, lakes and estuaries), bare ground (generally sand or mud) and rock outcrops (Environmental Protection Authority 2003b).

Priority Fauna - Conservation significant animal species listed by CALM's Threatened Species Consultative Committee but which are not currently listed under Section 14 (2) (ba) of the Wildlife Conservation Act 1950 as Specially Protected Fauna.

Proposal area - Any area or portion of the environment including aquatic areas and affected portions of the atmosphere potentially impacted upon by a proposal or scheme area being considered by the EPA.

Short-range endemics - A species with a naturally small distribution covering less than 10,000 km^2, although the actual area of occupancy may be far less (Harvey 2002).

Significant fauna - Species may be significant for a range of reasons other than those protected by international agreement or treaty, Specially Protected or Priority Fauna. Significant fauna may include short-range endemic species, species that have declining populations or declining distributions, species at the extremes of their range, or isolated outlying populations, or species which may be undescribed.

Significant fauna assemblage – Relatively intact examples of naturally occurring fauna assemblages or large populations representing a significant proportion of the local to regional total population of a species. [Note: significant fauna values are distinct from values for significant fauna species].

Species - A group of biological entities that interbreed to produce fertile offspring or possess common characteristics derived from a common gene pool. *(EPBC Act).*

Specially Protected Fauna - Animal species listed under Section 14 (2) (ba) of the Wildlife Conservation Act 1950. The latest listing is Wildlife Conservation (Specially Protected Fauna) Notice 2002 (Government of Western Australia

2002).

System 6 areas - Those specific localities as listed in The Darling System - System 6 Part II Recommendations for Specific Localities Report 13 Conservation Reserves for Western Australia as recommended by the Environmental Protection Authority (Department of Conservation and Environment 1983).

Taxa (singular **Taxon)** - A taxonomic group. Depending on context this may be a subspecies, species, genus or higher taxonomic grouping.

Terrestrial fauna - Animal species living in or on land. For the purpose of this Guidance Statement freshwater vertebrates including fish and amphibians and aerial species are included. (Note: marine and subterranean fauna (troglodytic and stygofauna, see Section 1.2.4.2) are not included in this Guidance Statement.)

Vegetation (compare with flora; and see significant vegetation) - The various combinations that all populations of all vascular plant species form within a given area, and the nature and extent of each combination (after Mueller-Dombois and Ellenberg 1974; Collocott and Dobson 1975; Lewis 1977; Onions 1978; Delbridge 1987). Note that this is a biodiversity approach, and that other approaches may be based on structure or appearance - approaches that describe lesser subsets of plant diversity. The term vegetation has been applied at a range of scales in general use (as have community and habitat). The joint influence of different approaches and levels that can be applied to vegetation has led to a range of terms which describe vegetation, with resulting confusion.

6.2 Acronyms

ANZECC	Australian New Zealand Environment and Conservation Council
CALM	Department of Conservation and Land Management
CAMBA	China-Australia Migratory Bird Agreement (the Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment)
DoE	Department of Environment (formerly Department of Environmental Protection
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPA SU	Environmental Protection Authority Service Unit
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GIS	Geographic Information System
IBRA	Interim Biogeographic Regionalisation of Australia

JAMBA	Japan-Australia Migratory Bird Agreement (the Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment)
SoE	State of the Environment

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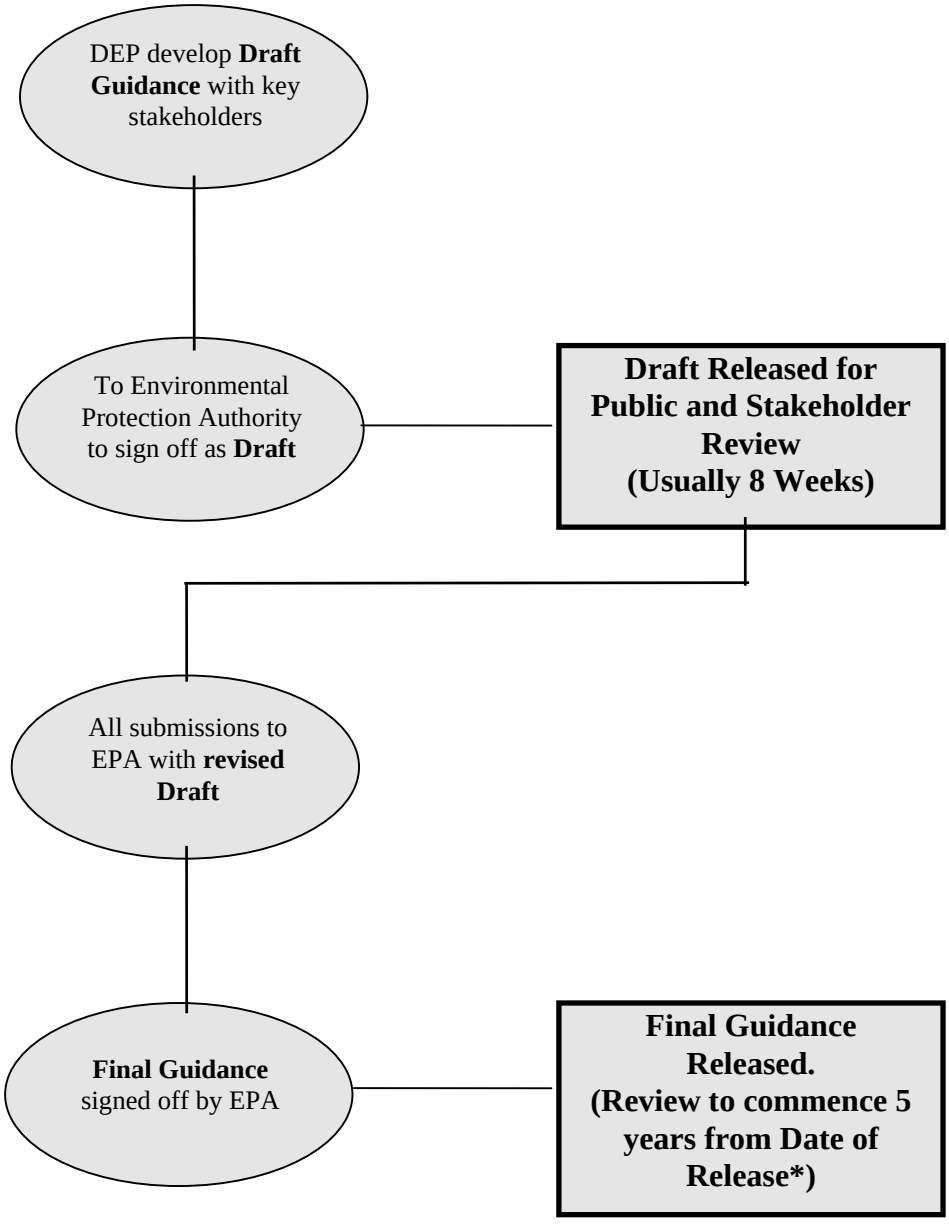
Appendix 1

GENERIC FLOW DIAGRAM FOR THE GUIDANCE STATEMENT PROCESS



* Guidance may be reviewed earlier if circumstances require it.

Appendix 2
GUIDE TO LEVELS OF TERRESTRIAL FAUNA AND FAUNA ASSEMBLAGE SURVEY

Table 1: Levels of Terrestrial Fauna and Faunal Assemblage survey
(adapted from EPA Position Statement No. 3)

Survey levels differ in the capacity of the survey work to provide detail of the conservation and functional values of the target area and its immediate context.	
Level 1 Surveys	**Background research or 'desktop' study** The purpose is to gather background information on the target area (usually at the locality scale). This involves a search of all sources for literature, data and map-based information. **Reconnaissance survey** The purposes are: i) to verify the accuracy of the background study; ii) to further delineate and characterise the fauna and faunal assemblages present in the target area; and iii) to identify potential impacts. This involves a target area visit by suitably qualified personnel to undertake selective, low intensity sampling of the fauna and faunal assemblages, and to provide habitat descriptions and habitat maps of the project area.
Level 2 Surveys	Incorporates **Background research** and **Reconnaissance survey** as preparation for more intensive survey that may range in form between detailed and comprehensive survey. **Detailed survey** The purpose is to enhance the level of knowledge at the locality scale. This applies where the general context is better known. This involves: i) one or more visit/s in each season appropriate to the bioregion and the faunal group being surveyed. Generally maximum survey will be the season that follows the season of maximum rainfall but there will be need to time surveys according to seasonal activity patterns of some faunal groups (e.g. molluscs or amphibians). **Comprehensive survey** The purpose is to enhance the level of knowledge at the locality scale and the context at the local scale. In some cases sub-region survey may be required to provide wider context. This applies where there is only broad general context. This involves survey, at the intensity applied in detailed survey, of both the locality and parts of the local area. Such work is likely to be more structured with longer-term study and multiple visits.

Table 2: Indicative levels of terrestrial fauna and faunal assemblage survey expected by the EPA in relation to the scale and nature of impact of proposals and the sensitivity of the receiving environment

(adapted from EPA Position Statement No. 3)

The bioregions have been grouped in Table 2 according to the existing degree of regional modification or loss of biodiversity, degree of threat and sensitivity to further loss. As a guide to the use of this table, it is very important to note that there will be areas of greater sensitivity within each bioregion that will require special consideration (e.g. wetlands, threatened ecological communities, restricted geomorphological/soil type areas with the likelihood of presence of short-range endemic species including unnamed species, areas with Specially Protected Fauna or Priority species, etc.). Conversely, for areas with a high degree of pre-existing modification and reduced native fauna species (such as cleared agricultural land) the investigation effort expected is likely to be reduced in comparison to areas that are likely to support fauna in native vegetation.

Sensitivity of Environment (Bioregion Groups)	**Numbers indicate level of terrestrial fauna and faunal assemblage survey expected (as defined in Table 1)**		
	Scale and Nature of Impact		
	High	**Moderate**	**Low**
Group 1	2	2	1
Groups 2 and 3	2	1 or 2	1
Group 4	2	1	1

Bioregion Groups

- **Group 1: Warren, Avon Wheatbelt, Geraldton Sandplains, Esperance Plains, Mallee, Swan Coastal Plain** (bioregions of the South-West Botanical Province that are extensively cleared for agriculture).
- **Group 2: Gascoyne, Carnarvon, Yalgoo, Pilbara, Coolgardie, Murchison, Nullarbor, Hampton,** (bioregions of the Eremaean Botanical Province, native vegetation is largely contiguous but used for commercial grazing) **and Jarrah Forest** (this South-West Botanical Province bioregion is included here because the native vegetation remains extensive and largely contiguous but is used as a commercial forestry resource).
- **Group 3: Dampierland, Northern Kimberley, Central Kimberley, Ord-Victoria Plains, Victoria-Bonaparte** (bioregions of the Northern Botanical Province, native vegetation is largely contiguous but is used for commercial grazing).
- **Group 4: Great Sandy Desert, Gibson Desert, Great-Victoria Desert, Little Sandy Desert, Central Ranges, Tanami** (bioregions of the Eremaean Botanical Province, native vegetation is largely contiguous but is generally not used for commercial grazing).

Table 3: Consideration of the characteristics of proposal areas in defining the scale and nature of impacts on biodiversity

(to be used in conjunction with Tables 1 and 2 to provide guidance on the level of fauna and faunal assemblage survey required for a proposal)

SITUATION I: The area and its immediate surrounds are unlikely to support populations of native fauna.	
The area of the proposal and adjacent areas that could be impacted by off site impacts from the proposal **do not** support native faunal populations in natural areas.	**This Guidance Statement is not applicable** It is not expected that the proposal will need to address fauna or faunal assemblage factors. Any proposal submitted to the EPA for assessment of other environmental factors should include comprehensive photographs of the area suitable for identifying the nature and condition of any vegetation and habitats in the area. Depending on the area and nature of the development it may be appropriate to consider some strategic habitat revegetation or landscaping to enhance faunal linkages with local provenance native plant species to re-establish them in the area.

SITUATION II: The area and/or its immediate surrounds are likely to support populations of native fauna.	
If there is native fauna in habitats in or adjacent to the proposal area that could be impacted then background research and reconnaissance survey is required as a minimum. Areas that could be impacted support native fauna in vegetation that is not completely degraded. **Note: if the area supports native vegetation within a national park, nature reserve, conservation park, or other reserve formally protected or recommended for protection for a conservation purpose a comprehensive survey is required as a minimum.**	**This Guidance Statement is applicable.** This Table provides guidance as to the level of fauna and faunal assemblage survey expected.

AREA CHARACTERISTICS	EXPLANATION OF SIGNIFICANCE	SCALE AND NATURE OF IMPACT		
		HIGH	MODERATE	LOW
Degree of habitat degradation or clearing within region				
Determine the level of alteration of the original vegetation. The extent of clearing in the district and bioregion is the simplest measure of change and of sensitivity to further change. However, less obvious factors can be measured that have also altered the vegetation and consequently the fauna habitat. Examples in the Eremaean Province include change in faunal assemblages as a consequence of vegetation degradation resulting from grazing, and associated invasion of introduced species, especially predators and competitors.	This is a background factor in any region, with some regions having significantly higher cumulative degradation than others.	In either the local area or region: i) in fragmented ecosystems with less than 30% native vegetation or natural areas remaining; or ii) in more extensive ecosystems with less than 30% of vegetation in better condition.	In either the local area or region: i) in fragmented ecosystems with between 30-50% native vegetation or natural areas remaining; or ii) in more extensive ecosystems with between 30-50% of vegetation in better condition.	In either the local area or region: i) in fragmented ecosystems with more than 50% native vegetation or natural areas remaining; or ii) in more extensive ecosystems with more than 50% of vegetation in better condition.
Size/scale of proposal/impact				
The size of impact is important in determining the environmental significance of the proposal. This characteristic is not intended to imply relative natural values of bioregions. Rather it reflects the relative degree of disturbance in each group of bioregions.	Area of clearing/loss of habitat and native fauna as a result of the proposal.	>10 ha - Bioregion Group 1 >50 ha - Bioregion Groups 2-3 >75 ha - Bioregion Group 4	1-10ha - Bioregion Group 1 10-50ha - Bioregion Groups 2-3 20-75ha - Bioregion Group 4	<1ha - Bioregion Group 1 <10ha - Bioregion Groups 2-3 <20ha - Bioregion Group 4

AREA CHARACTERISTICS	EXPLANATION OF SIGNIFICANCE	SCALE AND NATURE OF IMPACT		
		HIGH	MODERATE	LOW
Rarity of vegetation and landforms				
Consider whether the proposal impacts on habitats in vegetation or landform units that are restricted or rare either naturally or as a result of clearing. Threatened Ecological Communities (TEC's) may fit either of these categories.	Impact on **any** naturally rare or restricted habitat and its component fauna is considered a high to moderate impact. Restricted distribution landform units such as Banded Ironstone Hills, areas with granite outcrops (e.g. in the Coolgardie/Yalgoo Bioregion), or areas with specialised faunal habitats such as Salmon Gum/York Gum woodlands that provide breeding resources for obligate tree hollow breeding species (in the Avon Wheatbelt Bioregion) and regionally rare wetlands may be important rare habitats.	Vegetation and landforms that: i) naturally comprises less than 5% in the local area (15 km radius) or the bioregion; or ii) is a Threatened Ecological Community.	Vegetation and landforms that naturally occupy from 5 to 10% of the local area (15 km radius) or the bioregion.	Vegetation and landforms that are naturally more widespread than 10% of local area (15 km radius) and the bioregion.
Significant Habitats				
Consider whether the area supports habitats that have particular significance for ecological reasons. For example, important feeding or breeding areas or habitats for species protected under international agreements or treaties (e.g. RAMSAR wetlands, migrating birds), Specially Protected and/or Priority Fauna, and habitats for short-range endemic species.	Sites that provide important habitats supporting populations of species that are specially protected by law.	Significant habitats are known in the area or are found in the area during reconnaissance survey.	The vegetation and area characteristics indicate that significant habitats are likely to occur.	Significant habitats are not known from the area or found by reconnaissance survey.

AREA CHARACTERISTICS	EXPLANATION OF SIGNIFICANCE	SCALE AND NATURE OF IMPACT		
		HIGH	MODERATE	LOW
Refugia				
Consider whether the area serves as an ecological refuge for fauna species. These are more restricted environments that have been isolated for extended periods of time, or are the last remnants of such areas. They may be of high significance for fauna species or faunal assemblages with very restricted distributions, or support fauna species well outside their normal range. Examples include isolated hills (e.g. Banded Ironstone or Greenstone Formations or granite outcrops) which are remnants of an ancient eroding surface, islands, permanent wetlands in arid areas, permanent damplands in wetter regions which may retain Gondwanic elements, patches of ancient paleodrainage which have habitat that is not yet affected by secondary salinity as a result of clearing (especially in agricultural areas), mound springs, etc.	For Gondwanic values see Main 1996, Hopper *et al.* 1996, and Horwitz 1994. For short-range endemic values see Harvey (2002). Refuges may include taxa with preferences for stability/low seasonality, seclusion from fire, or for permanent water,or rainforest elements, with mesic features , or other derivatives that are now isolated (e.g. specific soil types).	Isolated, or disjunct fauna populations or faunal assemblages are known or are likely to be present. The presence of refuges indicates the potential impact is high.	The characteristics of the area indicate that it could serve as a refuge for some faunal groups.	Refugia are not known from the area or are not found by reconnaissance survey.

AREA CHARACTERISTICS	EXPLANATION OF SIGNIFICANCE	SCALE AND NATURE OF IMPACT		
		HIGH	MODERATE	LOW
Fauna protected under international agreements or treaties, Specially Protected or Priority Fauna				
Consider whether the area supports species protected by international agreement or treaty (JAMBA/CAMBA), Specially Protected and/or Priority Fauna.	Areas support populations of statutory protected species.	i) Species protected by international agreement or treaty (JAMBA/CAMBA), or Specially Protected Fauna are found in the area or in similar habitats in its immediate vicinity during reconnaissance survey; and/or ii) habitat characteristics indicate that species protected by international agreement or treaty (JAMBA/CAMBA), or Specially Protected Fauna species may occur. The presence of several Priority Fauna species may also raise the impact to high.	i) Priority Fauna species are found in the area or in similar habitats in its immediate vicinity during reconnaissance survey; and/or ii) the habitat and area characteristics indicate that Priority Fauna species may occur. Cumulative impact on the total number of populations should be considered.	Specially Protected and/or Priority Fauna species are not found by reconnaissance survey, and are not likely to be found in the area or its immediate vicinity, on the basis of existing information. Generally the area would be well known from one, and ideally more than one, well-timed and structured survey.

AREA CHARACTERISTICS	EXPLANATION OF SIGNIFICANCE	SCALE AND NATURE OF IMPACT		
		HIGH	MODERATE	LOW
Other significant fauna or fauna assemblages				
Consider whether the area supports fauna or fauna assemblages that have particular significance for ecological reasons and/or large populations/ seasonal concentrations of particular species. N.B. If the area is known to support large populations from previous adequate surveys this could be used to assess the significance of the portion of the habitat within the proposal area.	The faunal assemblage may be relatively intact compared to other assemblages in the region and may contain species that have declining populations or declining distributions. The area may support species at the extremes of their range, or isolated outlying populations; or species with anomalous features, which may be undescribed.	Relatively intact faunal assemblages are known or are highly likely to be present. The area is known to support a large population/seasonal concentration of species.	Significant species or taxa are found or likely to be found in the area or in similar habitat in its immediate vicinity.	Significant species or taxa are not found or likely to be found in the area or in similar habitat in its immediate vicinity.
Size of remnant and condition/intactness of habitat and faunal assemblage				
Determine whether the proposal impacts on a relatively large more or less intact remnant (e.g. Bioregion Group 1) or is an area of more or less intact habitat in areas of extensively degraded landscapes (e.g. Bioregion Groups 2 and 3) and is likely to support a relatively intact faunal assemblage.	Large intact remnants are key biodiversity reservoirs in fragmented environments. In some cases even small, but intact, remnants may be highly significant because they support a relatively intact faunal assemblage. Areas of relatively intact habitat in regions/districts where the habitat is generally in poorer condition are also important for retention of biodiversity. Desktop study should seek to determine the size of remnants and/or habitat condition relative to those in the local surrounds (≥15km radius).	Area is a relatively large compact remnant, or part of a large compact remnant in a district where habitats are fragmented by clearing and/or other degradation; or an area of habitat, which is more intact than typical for the local district or bioregion.	Area supports a remnant of less than average size and degree of intactness in the district; or the habitat and faunal assemblage is not more intact than that in the district.	Area is not in a fragmented environment or an environment with extensive areas of otherwise degraded habitats or faunal assemblages, such as some rangeland environments.

AREA CHARACTERISTICS	EXPLANATION OF SIGNIFICANCE	SCALE AND NATURE OF IMPACT		
		HIGH	MODERATE	LOW
Ecological Linkage				
Determine the ecological linkage role of the area in the local and regional context.	Ecological linkages have important biodiversity conservation roles, therefore the values of these roles are highly sensitive to change.	The area is part of an ecological linkage at the regional or local scale. Should also survey the bushland areas connected by the linkage to determine fauna species and populations maintained by the linkage.	The area is not directly connected to adjoining areas but is part of a minor ecological linkage.	The area is isolated with no ecological linkages.
Heterogeneity or complexity of the habitat and faunal assemblage				
Determine the characteristics of habitats relative to those in the local surrounds through desktop and reconnaissance surveys.	The relative complexity of the area is expressed by the range of landforms/habitats/ecotones offering a diversity of seasonal resources for fauna populations and faunal assemblages.	The area and/or its immediate surrounds are complex, with a wider range of habitats and ecotones and faunal assemblages relative to the character of the local and regional surrounds.	The area and/or its immediate surrounds have a similar range of habitats and faunal assemblages relative to the characteristics at the local and regional scale.	The area and its immediate surrounds are less complex relative to the characteristics of the local and regional scale.

Environmental Protection Authority

Guidance for the Assessment of Environmental Factors

(in accordance with the Environmental Protection Act 1986)

Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia

No. 51

June 2004

Western Australia

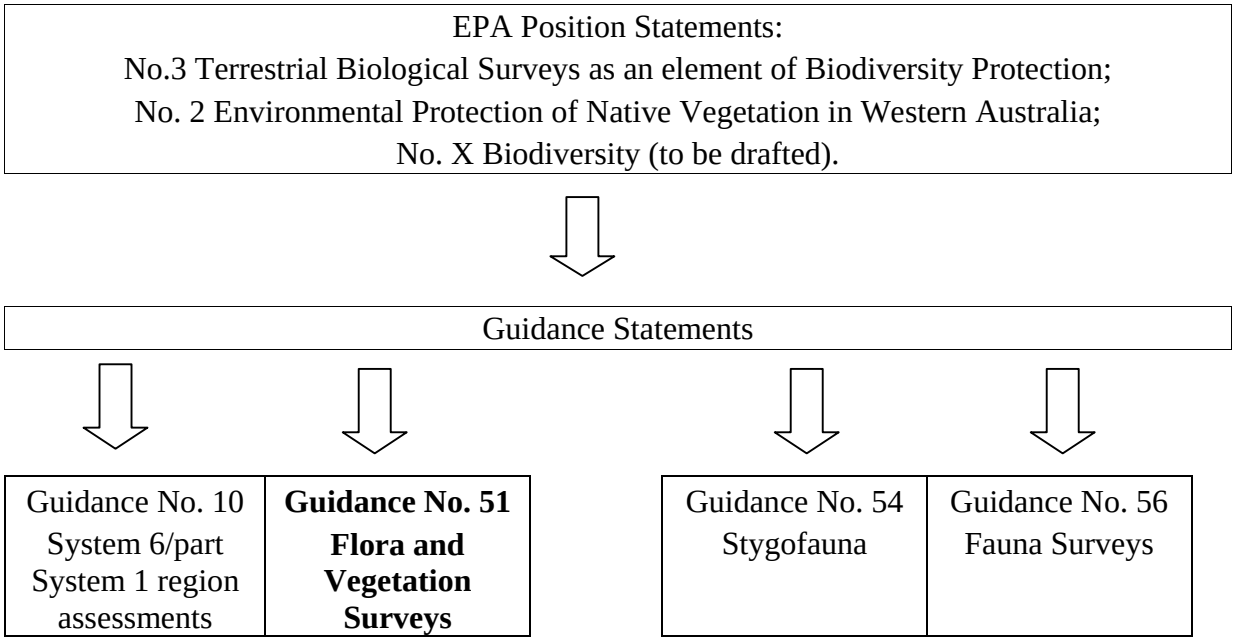
FOREWORD

The Environmental Protection Authority (EPA) is an independent statutory authority and is the key provider of independent environmental advice to Government.

The EPA's objectives are to protect the environment and to prevent, control and abate pollution and environmental harm. The EPA aims to achieve some of this through the development of environmental protection Guidance Statements for the environmental impact assessment (EIA) of proposals.

This document is one in a series being issued by the EPA to assist proponents, consultants and the public generally to gain additional information about the EPA's thinking in relation to aspects of the EIA process. The series provides the basis for EPA's evaluation of, and advice on, development proposals subject to EIA. The Guidance Statements are one part of assisting proponents in achieving an environmentally acceptable proposal. Consistent with the notion of continuous environmental improvement and adaptive environmental management, the EPA expects proponents to take all reasonable and practicable measures to protect the environment and to view the requirements of this Guidance as representing the minimum standards necessary to achieve an appropriate level of flora and vegetation survey for the assessment of environmental factors.

This Statement provides guidance on the standard of survey required to assist in collecting the appropriate data for decision-making associated with the protection of Western Australia's terrestrial flora and vegetation and their ecosystems. The flowchart below shows the relationship between Position Statements and this and other Guidance Statements.

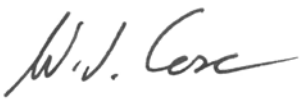


Whilst the EPA has provided this guidance to encourage best practice in flora and vegetation survey and reporting, it is conscious that the process has highlighted the need for complementary measures to promote such goals. In short, it is clear that the wider scientific community has a role to play in fostering skills and expertise. Firstly, the universities have a role to play in developing graduate skills in the areas of botany, taxonomy, biogeography, ecology and statistics, which are amongst the basic prerequisites in this line of endeavour. It is evident that there has been a shift away from these areas as society places more emphasis on areas such as biotechnology. Secondly, practising botanists and ecologists have a role to play, by mentoring recent graduates, and, perhaps most importantly, providing them with the opportunity to experience the breadth of the diversity at first hand. Thirdly, all practitioners have a role in developing a progressively better synthesis of the botany and ecology of the State. These matters are not specifically covered in this guidance.

While guidance is provided specifically in relation to the Western Australian *Environmental Protection Act, 1986*, proponents are reminded to ascertain any responsibilities they may have in regard to this issue under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

This Guidance Statement has the status of "**Final**" which means it has been reviewed by stakeholders and the public. The EPA has signed off the Guidance Statement and published it although it will be updated regularly as new documents come to hand.

I am pleased to release this document which now supersedes the draft version.



Walter Cox
CHAIRMAN
ENVIRONMENTAL PROTECTION AUTHORITY

June 2004

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Guidance Statement No. 51

Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia

Key Words: biodiversity, biological diversity, biological surveys, IBRA, terrestrial flora, vegetation, plant species assemblages, Declared Rare and Priority Flora, significant flora

1 INTRODUCTION

1.1 Purpose

The primary purpose of this Statement is to provide guidance and information on expected standards and protocols for terrestrial flora and vegetation surveys to environmental consultants and proponents. The generic process for the writing of Guidance Statements is set out in Appendix 1.

This Guidance should be used when preparing documentation for referral of proposals, planning schemes and their amendments to the EPA, as well as for formal assessment and audit.

This Guidance Statement:

- provides the general standards and a common framework for terrestrial flora and vegetation surveys for environmental impact assessment (EIA) in Western Australia, the quality and quantity of information that should be derived from these surveys, and the consequent analysis, interpretation and reporting; and
- is primarily directed at the subset of biodiversity contained in all terrestrial vascular plants.

This Guidance will assist in the interpretation and application of the general principles outlined in the EPA's Position Statement No. 3, *Terrestrial Biological Surveys as an Element of Biodiversity Protection,* and Position Statement No. 2, *Environmental Protection of Native Vegetation in Western Australia.*

The EPA aims to promote survey work that is uniform and of sufficient rigour to contribute to a more systematic inventory of the State's biodiversity. This will result in a consolidated and readily accessible system of environmental information.

1.2 Policy context

1.2.1 State legislation

1.2.1.1 Environmental Protection Amendment Act 2003

Clearing of native vegetation on all land, except for exempt purposes, will soon be subject to the permit process defined under the *Environmental Protection Amendment Act 2003* (Government of Western Australia 2003a) and administered by the Department of Environment (DoE). The Act was assented to by the Governor on 20 October 2003. However, the clearing provisions cannot be proclaimed until regulations are tabled in the Legislative Assembly. These regulations have undergone extensive consultation with stakeholders and it is anticipated that they will be tabled in Parliament in the autumn session of 2004. All clearing of native vegetation in the State will require a permit, unless it is for an exempt purpose (detailed in Schedule 6 of the Act and in regulations).

Permit applications will be assessed against principles contained in the Act which consider impacts on: biodiversity, fauna habitat, rare flora, threatened ecological communities, level of remnant vegetation representation, watercourses and wetlands, land degradation, conservation areas, surface water quality, groundwater quality, and potential for flooding.

1.2.1.2 Other legislation in Western Australia

A range of other legislation is relevant to biodiversity conservation in Western Australia. This includes the *Environmental Protection Act 1986* (EP Act), the *Conservation and Land Management Act 1984*, and, in particular, the *Wildlife Conservation Act 1950*.

The Government proposes to replace the *Wildlife Conservation Act 1950* with a new Biodiversity Conservation Act. The new Act will provide for the protection and restoration of biodiversity, and the sustainable use of native plants, animals and other organisms.

1.2.2 Requirements for assessments which are accredited under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), proposed actions which have the potential to have a significant impact on a matter of national environmental significance must be referred to the Commonwealth Minister for the Environment for a decision as to whether assessment is required under the provisions of that Act.

Provision has been made within the EPBC Act for State authorities to be accredited to undertake environmental assessments, either jointly with or on behalf of the Commonwealth, so as to meet the requirements for assessment under that Act. The

related requirements and arrangements for this are discussed in the EPBC Act itself and in the provisions of bilateral agreements being negotiated between State and Commonwealth governments. A bilateral agreement between Western Australia and the Commonwealth has been signed and came into effect on 20 October 2003, the date the EP Act amendments were assented to in the Western Australian Parliament.

Assessments must adequately address the potential impact on matters of national environmental significance in order to comply with the provisions of the EP Act and be accredited under the EPBC Act.

1.2.3 National policy context

The State has committed to an agreed framework, principles and objectives for the protection of biodiversity with the adoption of the *National Strategy for Ecologically Sustainable Development* (Commonwealth of Australia 1992) and subsequently *The National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia 1996). Western Australia was the first State to become a signatory to the latter, which followed from Australia's ratification of the United Nations Convention on Biological Diversity. In 2001 Western Australia endorsed the *National Objectives and Targets for Biodiversity Conservation 2001-2005* (Commonwealth of Australia 2001).

The EPA intends to ensure that, as far as possible, development proposals in Western Australia are consistent with, or do not conflict with, these principles, objectives and targets.

State of the Environment (SoE) reporting is now a legislative requirement at the Commonwealth level and has been adopted by Western Australia. SoE reporting aids environmental decision-making and enables assessment of progress towards ecological sustainability. It is important that environmental impact assessment reflects and reports on the "core" environmental indicators developed for SoE reporting, some of which are biodiversity indicators (ANZECC 2000).

Accordingly, the EPA is seeking to improve the consistency and the standard of flora and vegetation surveys to ensure that decisions relating to protection of biodiversity are based on appropriate information that accords with agreements between the State and the Commonwealth. These include:

- an increased level of emphasis placed on the protection of native biodiversity;
- some changes to nomenclature and definition; and
- an increase in the quality and quantity of information that the EPA needs for EIA, in order to report and make recommendations that are based on clear and meaningful information.

1.2.4 Related policies of the Environmental Protection Authority

1.2.4.1 Position Statement No. 2 on the protection of native vegetation

Position Statement No. 2, *Environmental Protection of Native Vegetation in Western Australia* (EPA 2000), outlined EPA policy on the protection of native vegetation in Western Australia, particularly in the agricultural area. It identified basic elements that the EPA should consider when assessing proposals that impact on biological diversity. These include the following: comparison of all proposal options; avoidance of species and community extinctions; an expectation that implementing the proposal will not take a vegetation type below the "threshold level" of 30%; and that proponents should demonstrate that on- and off-site impacts can be managed.

1.2.4.2 Position Statement No. 3 on terrestrial biological surveys

In March 2002, the EPA published Position Statement No. 3 entitled *Terrestrial Biological Surveys as an Element of Biodiversity Protection*. In that document the EPA discussed the range of International, National and State agreements and policies currently influencing the future protection of biodiversity in Western Australia and the need to review and improve the quality and quantity of information required for EIA.

Position Statement No. 3 indicated that the EPA adopted the definition of Biological Diversity and the Principles as defined in the *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia 1996); that the quality of information and scope of field surveys should meet standards, requirements and protocols as determined and published by the EPA; and the Interim Biogeographic Regionalisation of Australia (IBRA) should be used as the largest unit for EIA decision-making in relation to the conservation of biodiversity. The IBRA has identified 26 bioregions in the State (Figure 1) which are affected by a range of different threatening processes and have varying levels of sensitivity to impact. Terrestrial biological surveys should provide sufficient information to address both biodiversity conservation and ecological function values within the context of proposals and the results of surveys should be publicly available.

Following a workshop in July 2000 on the draft Position Statement No. 3, the EPA decided that because of the diversity of ecosystems, separate guidance statements were warranted to address the range and complexity of issues pertaining to biological surveys.

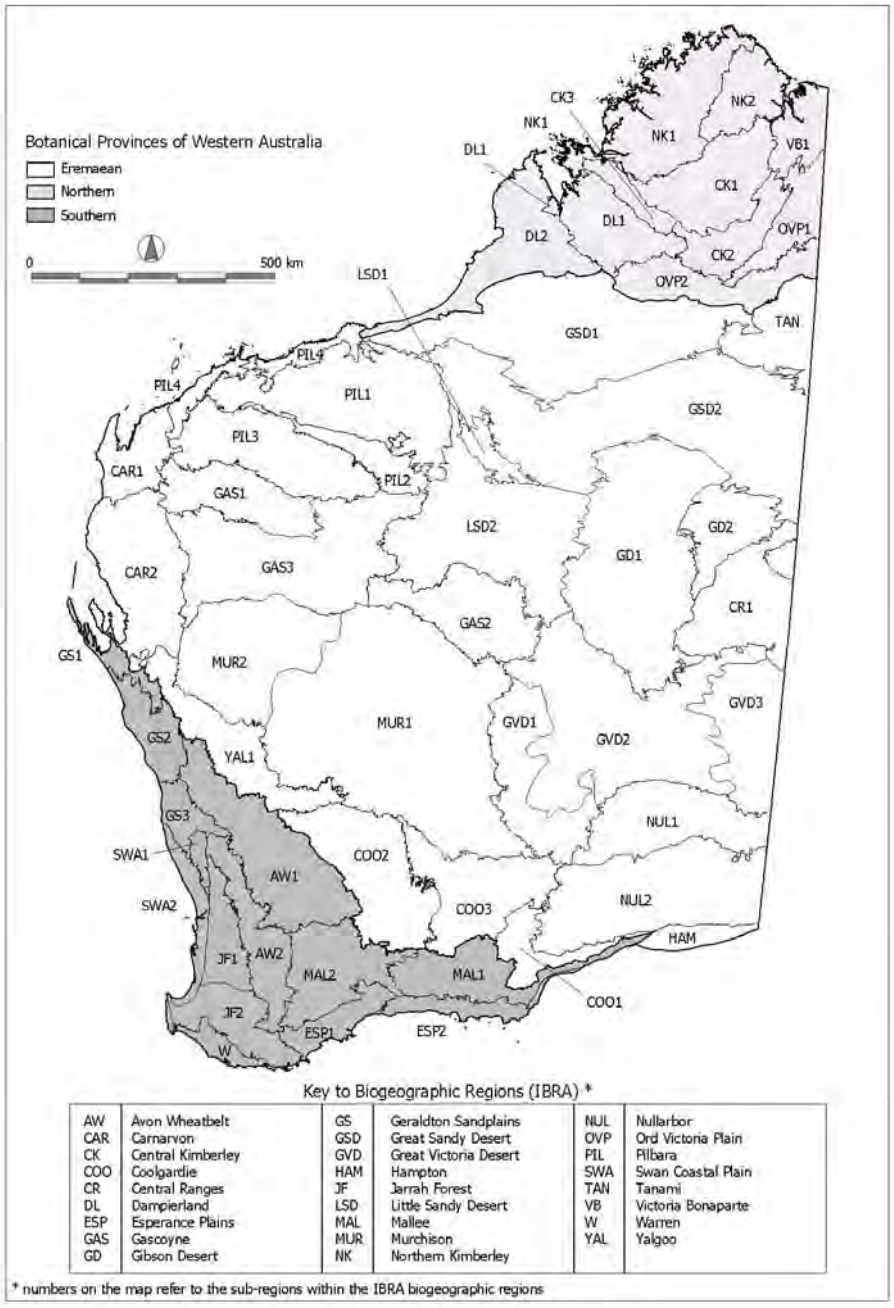

Figure 1: A Map of Western Australia showing the Botanical Provinces[1] (after Beard 1980), the IBRA bioregions (Environment Australia 2000) and the IBRA subregions (McKenzie et al. 2000).

[1] The Coolgardie and Yalgoo bioregions are here placed in the Eremaean Botanical Province (see Section 2.3). However, while their biotic composition is intermediate between the Eremaean and the South-West Provinces they are more closely allied with the South-West Province (GJ Keighery pers. comm. 2004).

Issues and survey types under consideration for incorporation in a series of guidance statements related to terrestrial biological surveys include:

- terrestrial flora and vegetation surveys (this Guidance);
- terrestrial fauna surveys (Guidance 56);
- subterranean fauna in groundwater and caves (Guidance 54);
- karst environments;
- data acquisition and submission; and
- threatening processes.

Therefore this Guidance Statement forms part of a series in response to Position Statement No. 3, and is intended to be read in conjunction with that document and other guidance statements that form part of the series.

1.3 Limitations of this guidance

This Guidance Statement is:

- confined to matters relating to flora and vegetation survey for EIA, and the treatment of associated data, and does not address more proposal-specific issues, which is the preserve of proposal-specific guidelines or approved scoping documents;
- the contemporary view of the EPA until such time as this document is subject to review;
- not an instrument for predicting outcomes of deliberations by the EPA; and
- intended to apply to proposals yet to come before the EPA.

2 DIVERSITY OF THE FLORA AND VEGETATION

2.1 The high diversity and endemism of the flora and vegetation

Flora

Australia's biota is one of the top 12 most diverse in the world (Common and Norton 1992, Mummery and Hardy 1994). One of the key parts of this diversity is the terrestrial flora of the South-West (Myers 1990).

Western Australia has high diversity and endemism of vascular plants. The progressive total of known species was 9803 in the year 2000 (Table 3 in Paczkowska and Chapman 2000); this was nearly half the national total (Hopper 1996). Overall, about 62% of plant species are endemic to the State, particularly the South-West (Paczkowska and Chapman 2000). The South-West, for example, holds 75% of the world's triggerplants (James 1979), and all *Actinostrobus* species (Marchant *et al.* 1987). In the wider part of the State endemism is less, at about 30% (Hopper 1996).

Vegetation

The high flora diversity is reflected in the vegetation. The State's 26 IBRA bioregions have been divided into 52 natural sub-regions which contain many vegetation units. This reflects the large number of different plants in each sub-region, which may occur together in a range of distinct combinations and habitats (e.g. Lyons *et al.* 2000, Gibson *et al.* 1994 and Keighery *et al.* 2000).

Other patterns that are evident with respect to the diversity of the flora, and particularly the vegetation, include:

- marked change in species complement from place to place; most intense in species rich areas (Griffin *et al.* 1990);
- patchiness or mosaic patterns of distribution, which are linked to the ancient, decayed, landscape (Hopper *et al.* 1996);
- refuges, or outposts, where organisms that are poorly suited to the current environment persist in isolated pockets of still suitable habitat (Hopper *et al.* 1996).

2.2 Developing the state of knowledge of the flora and vegetation

Due to the high diversity and the large size of the State, the short history of investigation, and limits to investigative resources, knowledge of the flora and vegetation of the State is still developing. Knowledge of species and their distribution is still in an exploratory phase. Thus frameworks to help understand patterns in vegetation are also still being developed.

There has been a steady increase in the number of taxa collected, examined and placed into their family groups (Paczkowska and Chapman 2000). A major rise since the 1970's probably reflects more systematic flora and vegetation survey, and taxonomic study (Figure 2). As this trend has not yet plateaued, it is clear that all future surveys, including those for EIA, can play a role in improving our knowledge of plant diversity.

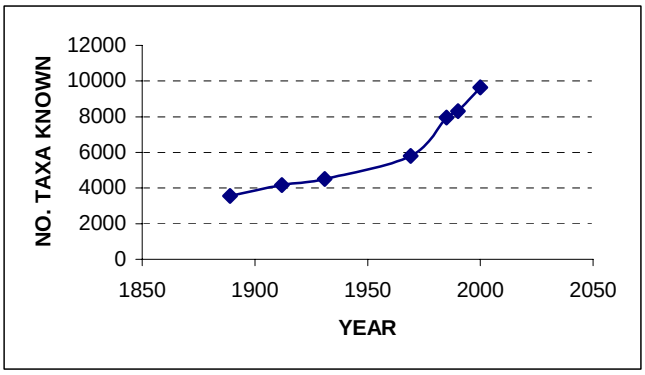

Figure 2: ***Historic rise in the number of vascular plant species found and recognized in Western Australia*** (from Paczkowska and Chapman 2000).
Note: Naturalised alien species are not part of the 1969 values.

The knowledge of the flora within bioregions is variable, and every bioregion (even the most studied) still has a suite of poorly known or recently found taxa.

2.3 Vegetation classification and mapping

The regionalisation of Western Australia based on vegetation and flora dates back to the 1860's with the recognition of south-western Australia's unique diversity and endemism by von Mueller 1867. In 1944 the state botanist, C. A. Gardner, used von Mueller's work, together with work by another German botanist (Diels 1906), to delineate three Botanical Provinces in Western Australia:

- the South-West Province, that is, south-western Australia;
- the Eremaean Province of the dry interior and coast; and
- the Northern Province in the tropical and semi-tropical north.

While both Diels and Gardner recognised districts within the provinces, subdivisions of the provinces are generally based on mapped vegetation types after Beard (1974-1981). Beard traversed the State to produce a series of maps, amalgamated at a broadscale (1:1 000 000). These mapping categories have been subdivided into sub-categories with associated text. Apart from the coarse scale of this mapping, there are other constraints in some sections of the State such as:

- there is generally only a summarised description of vegetation; and
- there have been changes to many plant names since Beard's publications.

Beard's mapping has remained the basis for the more recent regional maps: the National Land and Water Resources Audit (1998) vegetation maps and the natural regions identified in the IBRA project. Much of the base data set of the National Land and Water Resources Audit (1998) is at the broadscale, with some reference to a 1:250 000 scale for the South-West. This mapping, modified to reflect more recent information and unified across State borders, used the same underlying data as was utilised for delineating the IBRA natural regions in WA. However, the IBRA natural regions took into account geology, vegetation, flora and fauna.

The extent to which vegetation has been examined and categorised and/or mapped at finer scales in each of the three Botanical Provinces and/or regions is highly variable. In general, the most detailed approaches are linked to specific projects, and have very localised, scattered and limited coverage. In a few areas, such as regions in the South-West Province, there is better coverage at intermediate to broad levels of detail.

For example, mapping at scales in the vicinity of 1:250 000 to 1:100 000 are Heddle *et al.* (1980) and Mattiske and Havel (1998). Examples of vegetation plot based classification include Gibson *et al*. (1994), Department of Environmental Protection (1996), Markey (1997) and Keighery *et al.* (2000).

At State and regional levels there has been a mixed application of approaches to vegetation classification and mapping based on landform, species composition and vegetation structure. This mix of approaches has been recognised across Australia with the development of the National Vegetation Information System (NVIS) framework (Executive Steering Committee for Australian Vegetation Information 2003). NVIS has been developed to work towards providing Australia-wide comparable and consistent data. Consultants should be aware of this and, where possible, information should be collected so that it is compatible with NVIS protocols. There have also been various approaches to vegetation classification and mapping at the site/locality scale. This variation consequently means that all work does not systematically contribute to the development of regional frameworks.

For the purposes of this Guidance, the Provinces, regions and subregions, as delineated in Figure 1, are recognised as the basis for regional comparisons. The limitations of the knowledge base in these regions, broadly outlined above, should be noted.

2.4 Diversity and ecological function

A broad consideration of the ecological processes that influence sites and their ecological functions is required; statutory lists of Declared Rare and Priority Flora are only a small sub-set of biodiversity. Proponents should ensure that flora and vegetation surveys provide sufficient information to address both biodiversity conservation and ecological function values within the context of the type of proposal being considered and the relevant EPA objectives for protection of the environment (Environmental Protection Authority 2002a). This will enable an assessment of impacts on the conservation values and status of the site in a regional and local context.

This will help ensure that components and interactions of ecosystems are more effectively considered, leading to improvements in decision making and outcomes that are more ecologically sustainable.

3 THE GUIDANCE

3.1 EPA's objectives and their application to environmental impact assessment

3.1.1 The environmental objectives

The objectives of this Guidance Statement are to ensure that:

- there is clarity for proponents on the scale of flora and vegetation survey appropriate for different areas (see 3.2.5);

- the flora and vegetation survey, analysis, interpretation and reporting undertaken for EIA is of a suitable quality and consistent methodology to enable the EPA to judge the impacts of proposals on flora and vegetation;
- the environment, in particular significant flora and vegetation biodiversity, is identified and protected;
- WA's knowledge base of flora and vegetation biodiversity and biogeography is developed and enhanced over time, (particularly at the local scale) to the benefit of future decision-making; and
- survey data are capable of underpinning long-term observation and measurement for later compliance and audit purposes (especially as this pertains to completion criteria for projects).

3.1.2 Environmental factors and EPA objectives for each factor

Section 44 of the EP Act requires the EPA to report to the Minister for the Environment on the environmental factors relevant to proposals and planning schemes which it formally assesses under Part IV of the Act. The environmental factors are described in the scoping document (for proposals under Section 38) or instructions (for Schemes and their amendments under Section 48A) for the required environmental review document. The EPA's objective for each environmental factor and the investigations that will be undertaken by the proponent (proposals) or is required of the responsible authority (schemes and their amendments) to evaluate whether these objectives can be achieved is also defined in the scoping document or instructions.

The initial identification of factors should be undertaken by the proponent during the preparation of referral and scoping documents, see Section 3.1.3.

3.1.3 Application of the guidance to environmental impact assessment

This Guidance will apply when preparing documentation for referral of proposals, planning schemes and their amendments to the EPA for formal assessment and audit where vegetation is likely to be impacted as a result of implementation. Additional or special requirements for individual projects may be identified in the scoping document or instructions or in other advice provided via correspondence with the proponent or the responsible authority. Scoping documents or instructions should normally be consistent with this Guidance. However, in certain circumstances there may be a need to vary requirements to suit the particular case, and this would be set out in the scoping document or instructions.

3.2 Planning and design of flora and vegetation surveys

All proposals, planning schemes and their amendments where vegetation will be impacted as a result of implementation of the proposal, scheme or amendment should report fully on natural values, potential impacts, cumulative impacts, and options to minimise impacts. Documentation should identify the degree to which

the advice and approach provided in this Guidance Statement has been followed. Divergence from these standards should be highlighted in sections dedicated to limitations, see Section 3.3.1.

The EPA has provided below, guidance on what needs to be considered when surveys are being undertaken to provide information about flora and vegetation surveys relevant to a proposal.

3.2.1 Approaches, resources and standards required

The State's flora and vegetation is vast, complex and only partially known, and appraisal of it is a highly technical and skilled process. Therefore it is expected that for flora and vegetation survey:

- there will be adequate provision of resources for the survey and documentation of the flora and vegetation. It is anticipated that resources will be commensurate with the complex nature of the subject and the scope of the task being undertaken. For the process as a whole it is expected that:
  - the intensity of sampling (the number of sites, their spacing, and their area) is attuned to the complexity of the flora and vegetation of the proposal;
  - adequate resources are directed to plant specimen processing, identification, and subsequent lodgement (including allowance for a possible lag due to demand on botanists from multiple surveys and the availability of taxonomic specialists); and
  - adequate resources are directed to data analysis, mapping and interpretation (including allowance for a lag due to demand on surveyors from multiple surveys);
- there will be a high degree of rigour in reporting, not only to describe current vegetation and flora, but also to facilitate subsequent EPA assessment and auditing; and
- there will be a requirement for standardisation of techniques and terminology. It is important that the survey methods are given minimum standards so that future work on the flora and vegetation is comparable.

3.2.2 Stage of proposal when surveys should be commissioned

For any proposal, the timing of fieldwork is critical to the whole process of survey and reporting on flora and vegetation. It is the first part of a process, and the natural fluctuation in seasonal rainfall often delays fieldwork. A significant lead-time is required as it may be necessary to undertake surveys at various times of the year depending on the nature of the communities and species in the subject area. Survey over multiple years may be required where a single year's data is not adequate to address the environmental factors.

There may also be a lag time due to appropriate botanical expertise being unavailable. Botanists who meet demands for surveys at optimal times from more than one source, are likely to generate a lag due to having to sequentially process sample material and data from each survey. Proponents should make allowance for

this lag in project planning, as it is a consequence of best practice. Consequently, the EPA urges proponents to commission flora and vegetation surveys as early as practicable in the planning/site selection phase of a development or scheme to avoid potential for delays in project approvals.

For environmental management, it is essential that flora and vegetation surveys have been conducted before monitoring or completion criteria are decided prior to topsoil movement, and before local seed provenance determination and collection are undertaken.

3.2.3 Who should lead and undertake flora and vegetation surveys

Flora and vegetation surveys should be coordinated and led by botanists who have had training, mentoring and experience in flora and vegetation survey. It is expected that they will have specific training and/or experience in ecology and taxonomy of the Australian flora and would normally have had a wide exposure to WA's flora and vegetation, preferably with knowledge and experience in the region being surveyed.

It is recognised that some surveys may be done by survey teams that include members with less experience. These members should be supervised and mentored by the specialists mentioned above. This is seen as useful in training new practitioners.

3.2.4 When flora and vegetation surveys should be conducted

In most cases, the timing of a flora and vegetation survey is the key to providing the EPA with adequate information so that it can effectively assess the related environmental factors. Appropriate timing ensures that the majority of the plant species in an area are flowering, fruiting and have foliage that allows identification. This is particularly important where ephemeral or cryptic species of interest may occur (e.g. geophytes, orchids).

In general, the primary flora and vegetation survey should be conducted following the season which normally contributes the most rainfall in the bioregion. The relevant windows of time for sampling are dictated by the bioregion and can be ascertained from the growth and reproductive responses of all species to climate.

Northern Province	Eremaean Province	South-West Province
Main rain in summer	Main rain sporadic	Main rain in winter

In order to sample the majority of the flora and vegetation, it will be necessary to time additional surveys:

- according to secondary peaks in rainfall and/or the flowering period for additional suites of species or significant flora or plant communities; and

- to take into account short-term climatic fluctuation (such as drought or deluge) on the number of species present at the time of sampling. In periods of below average rainfall, there may also be justification for supplementary sampling in succeeding years to compensate for low diversity recorded during a survey (especially of ephemerals). This will be highly desirable in cases where drought is prolonged, or there are unusual circumstances such as possible pockets of significant flora and vegetation, or in the absence of a range of species or significant flora that might normally be expected in the environment.

If the initial botanical survey is undertaken in non-optimal times, e.g. drought, supplementary surveys must be undertaken at optimal times.

For surveys conducted for formal environmental assessments, the scoping document or instructions may specify survey requirements. In other cases (such as where the survey is carried out prior to referral of a proposal) advice on significant flora or communities may be sought from relevant conservation agencies.

3.2.5 Determining the extent and level of survey required

The extent and level of flora and vegetation survey must ensure the information is sufficient for the EPA to assess potential impacts.

The scope of flora and vegetation survey may be set out in the EPA's scoping document or instructions. The scoping document or instructions should be consistent with this Guidance. In the absence of specific direction, the following steps should be addressed.

1) Extent
   The EPA encourages the early and comprehensive definition of the boundaries of the proposal. In terms of impacts this means considering the potential:
   a) zone of direct impacts which only affect the site or locality (e.g. clearing);
   b) zone of indirect impacts which spread from the site or locality (e.g. drainage, hydrological change, dust, weeds and pathogens); and
   c) zone of wider interest (e.g. alternative sites, the extent of vegetation).

   Each proposal will be expected to consider the following aspects of flora and vegetation.

   - Flora
     Significant taxa (usually species or their sub-divisions) should be considered at all scales. It is expected that advice will be sought from CALM and the relevant experts on significant taxa in the study area and the appropriate region. To adequately address significant taxa a comprehensive listing of flora is necessary.

- Vegetation
  Vegetation should be addressed below the regional to sub-regional scale, e.g. vegetation complexes, alliances and formations, and land systems. Mapping at the population or community level is preferable. However, in larger areas this may not be feasible.

The level of detail required for information on vegetation and flora for the wider zones of influence, under (b) and (c) above, will vary on a case by case basis. Much will depend on what information is already available and the level of risk and potential consequences of indirect impacts. However, in general, it is likely that information will be required at a similar scale as that for the locality, but at a decreasing level of intensity for zones (b) and (c). This information and mapping is particularly important where the zone of direct impact is a narrow linear shape, for example, a road, rail, powerline or pipeline easement.

When flora of interest are found, it is essential that surveys for these taxa extend on a local or regional basis (if data is not available) to facilitate a conservation assessment of the taxa and the potential impact of the proposal.

2) Level of Survey
A simplified outline indicating the levels of flora and vegetation survey expected is given in Appendix 2. Table 3 in Appendix 2 provides guidance on a range of characteristics that will influence the scale and nature of the impact. Appendix 2 is also intended to indicate issues that need to be considered during survey and reporting. It is not exhaustive, and practitioners may well find other ecological values that need to be assessed.

3) Review of Extent and Scope
In some cases the objective and scope of the flora and vegetation survey may need to be reviewed as a response to the findings of the initial stages of the investigation.

3.2.6 Determining survey sampling design and intensity

Sampling design and intensity needs to be considered at two levels: regional and area specific.

The EPA considers the IBRA regions or sub-regions as the most appropriate level for assessing regional significance. At times, these may be subdivided to take into account other natural and/or administrative boundaries.

In determining sampling design and intensity, the following need to be addressed:
- landform - scale, heterogeneity, rarity;
- habitat - scale, heterogeneity, rarity;
- vegetation structure, diversity and seasonality;

- potential for Declared Rare, Priority and other significant flora to occur, based on habitat analysis;
- results of reconnaissance investigations and preliminary sampling for the specific investigation (e.g. species/area curves, species and ecosystem diversity and heterogeneity); and
- information on adjacent areas, including herbarium records and previous surveys.

Some general trends evident in each of the three botanical provinces in Western Australia, which influence survey methodology, are illustrated here:

Northern Province	Eremaean Province	South-West Province
Main rain in summer	Main rain sporadic	Main rain in winter
Plant species at low/moderate densities	Plant species at low densities	Plant species at moderate/high densities

Survey methodology that includes point based sampling is preferable as the sample sites can be located on a map and used over time for standard locatable reference points. The minimum number of sample sites that would be expected per vegetation unit would be two (unless the unit is confined to a small area of about sample site size). Where a unit is widespread, there would need to be sampling at representative points throughout its range. Stratified transects and targeted sampling may also be appropriate.

Most importantly, the sampling design should be adequately explained and justified in the methods.

3.3 Presentation and reporting

3.3.1 Identifying the limitations of the survey

Every flora and vegetation survey report should contain a section describing the methods used and a sub-section identifying the limitations of these methods. The survey limitations are important and their influence on findings should be incorporated into the conclusions.

Listing survey limitations assists by:

- promoting consideration by the author of any:
  - factors which may have compromised results;
  - omissions from the survey; and
  - issues which could not be addressed within the survey scope;
- clearly signposting any compromising factors in a way that should indicate the capacity of the survey and its report to address issues; and
- providing insurance to the practitioner against being perceived to have made false claims.

Limitations may cover constraints such as:

- sources of information and availability of contextual information (i.e. pre-existing background versus new material);
- the scope (i.e. what life forms, etc., were sampled);
- proportion of flora collected and identified (based on sampling, timing and intensity);
- completeness and further work which might be needed (e.g. was the relevant area fully surveyed);
- mapping reliability;
- timing, weather, season, cycle;
- disturbances (fire, flood, accidental human intervention etc.);
- intensity (in retrospect, was the intensity adequate);
- resources;
- access problems; and
- experience levels (e.g. degree of expertise in plant identification to taxon level).

3.3.2 Requirements for data presentation

As far as possible, data collected should be presented in quantitative form. The information to support the key results should be in a stand-alone format, which would allow an appropriately qualified third party to evaluate them. Once these components are in place, the discussion and conclusions can be used to make more qualitative statements.

Requirements for data presentation include:

- location map/s which place the project in the regional and local context;
- Vegetation
  - a description of the vegetation units and their key component species referenced to specific sites described in a standardised format with a key to any codes used. GPS coordinates should be given for the sampling sites;
  - a map showing the vegetation units, preferably orthogonally corrected and with a scale bar. The map should show roads and tracks, the location of sampling sites and/or the degree to which the area was traversed;
  - a map of the vegetation condition (the condition rating should be referenced); and
  - data on each site location, characteristics, (e.g. landform, soil, geology) vegetation layer/s cover and height, dominant species cover and height and list of all species present.
- Flora
  - a species list by Family using the nomenclature of the WA Herbarium for known taxa. It is preferable that the list is in the form of a table indicating presence in vegetation types/plots. Conservation significant and introduced species should be indicated;
  - an estimate of what proportion of the total flora was found (given the coverage and the timing of sampling);

  - a description of Declared Rare and Priority Flora and/or significant flora, with an estimate of their numbers at the survey site, regional abundance and distribution. The data should be presented in a standard CALM Rare Flora Report Form to facilitate entry into the computerised database maintained by CALM;
  - the collection numbers of specimens vouchered in the WA Herbarium as part of the survey should be included in an appendix;
- consideration of disturbance, focussing on the number of native species compared to weed species, the proportion of native species present compared with that expected in an intact plant community of the same type and on the condition of the described units of vegetation;
- to define vegetation categories where the scope is large, in terms of number of vegetation types, area, and/or multiple locations, a form of multivariate analysis of the data is likely to be warranted. At intermediate scales, or in the absence of the resources for such analysis, a site/species matrix may be used to group sites on the basis of like suites of the most common/indicator species;
- multivariate analysis should include, as a minimum, presence/absence data, and perennial species;
- a table of the area of each vegetation type, the percentage affected by the project area (both at the locality and in the region), the categories of vegetation and their environmental values (which may include near pristine, unique, limited extent, extensively cleared, significant flora present); and
- general observations and other qualitative information on the site.

Data presented should be interpreted in a regional and local context. Biodiversity conservation includes all ecosystem components (biotic and abiotic) and their relationships. Understanding biotic and abiotic relationships is integral to the appraisal of ecosystem function.

3.3.3 Preparation of flora and vegetation survey reports

The person/s involved in planning and conducting the flora and vegetation survey should be responsible for preparing these reports. In some cases, there may be a need for quality endorsement by more experienced persons. However, as set out in Section 3.2.3, these persons should also be qualified to undertake surveys.

3.3.4 Setting the context for survey design and reporting

Aspects of ‘context’ will include, but not be limited to:

- review and appraisal of existing knowledge (including literature search, metadata search, CALM database searches to identify Threatened Ecological Communities, Declared Rare, Priority and significant flora that are known to occur in the vicinity);
- characteristics of the site at the international, national, State, regional, local level as appropriate;
- objective of the survey; and

- what specific areas of information will be investigated (e.g. biogeographical, landform, conservation status, threatening processes).

3.3.5 Format of survey reports and data

The findings of the survey should be submitted in two ways:

1) As a stand-alone report, which may also appear whole as an appendix of an environmental review document:
   - To the EPA
     In hard copy (including any original colour maps) and electronic form (with mapped data in a digital format)
   - To the public
     Available in hard copy from the proponent at a cost no greater than that of the main environmental review document (the specific location of Threatened and Priority flora may need to be removed from public documents. Such information disclosure is exempted under Freedom of Information legislation).
2) As an overview within the environmental review document
   A clear overview of survey findings on biodiversity, conservation values, and associated impacts should be included in the review document. It is imperative that the overview accurately and directly represents the discussion, conclusions, recommendations, summary and limitations of the survey report. The findings and impacts should also be evident in the summary and conclusions of the review document. The parts of the review document which refer to flora and vegetation should be an accurate representation of the survey report. Ensuring that this occurs is the responsibility of the review document author.

   The EPA encourages the flora and vegetation survey report author to present their results, discussion, conclusions, recommendations, summary and limitations in a form that can be transferred intact into the overview document.

3.3.6 Public availability of flora and vegetation survey reports submitted for EIA

The EP Act stipulates that the EPA [Section 39(1)(a)(b) and 39(5)] and proponents [Section 40 (2)(a)(4)(a)(b)] make information publicly available as part of the environmental review process.

The EPA considers that:

- the public availability of information on biodiversity is fundamental to the environmental review process and good decision making;
- all survey work on flora and vegetation should contribute to the sum total of knowledge for the State; and
- any disclaimer within an environmental review or survey document must recognise that the work is primarily for the purposes of environmental impact

assessment under the EP Act, is consequently publicly available, and is subject to the limitations outlined in the methods of the survey document.

The EP Act provides for particular and limited protections on confidential information [Section 39(2)(3)(a)(b)(4) and Section 120]. The *Freedom of Information Act 1992* also applies.

3.3.7 Use of terminology

Terminology should be clear and standardised, preferably using those terms listed in Section 6 of this Guidance. Vegetation categorisation tends to be the most variable area of terminology. When there is doubt about the application of vegetation terms, it is recommended that reference be made to absolute scales, densities, and extent of vegetation. When using the generic term "vegetation unit" it should be qualified to indicate whether each unit is fine-scale (intra-locality), intermediate-scale (locality or inter-locality) or broad-scale (local to region).

3.3.8 Acknowledgement of contributors and attribution of all sources of data

Scientific and technical documents should appropriately acknowledge all contributions and authorship (this includes Environmental Review documents). This is important to the process of properly valuing all work and promoting basic standards.

Flora and vegetation survey reports should list the names of all persons involved in the survey and the preparation of the report and briefly state their role. Acknowledgements should also extend to any other contributors including external expertise sought.

Other sources of data should be fully attributed and referenced to the original source. This includes metadata (including GIS), maps, figures and tables copied or adapted from other sources.

3.3.9 Record keeping for the purpose of audit

It is highly desirable that the source data from flora and vegetation surveys be maintained by the proponent (or the consultant on behalf of the proponent, but the responsibility for this is with the proponent) in a readily available format for a minimum period (7 years) following the survey so that:

- subsequent supplementary, time-sequence or monitoring surveys can be adequately designed;
- survey limitations are transparent to data users; and
- the surveys themselves are verifiable and auditable by a third party.

Accordingly, the base data collected in surveys (including details of sample timing, precise location, etc.) should be retained in the form originally collected, and electronically, for a minimum of 7 years after the survey is completed.

The EPA advises that there may be random audits of flora and vegetation surveys (and/or related reports). In some cases flora and vegetation survey reports (and related data) may be subject to peer review by an independent botanist.

3.4 The role of the surveyor in increasing biodiversity knowledge

As a result of the limited amount of detailed flora and vegetation survey data available for Western Australia, much of the flora survey work conducted is of an exploratory nature and there is significant potential for new discoveries or findings which may challenge conventional understanding of the distribution or abundance of flora and vegetation.

The EPA would expect that persons engaged in flora and vegetation surveys will act as scientific advocates and bring to the scientific, government and public arenas, new information arising from surveys.

In addition to Threatened and Priority Flora, other significant taxa should be highlighted in the survey report, vouchered in the State Herbarium and brought to the attention of relevant authorities (CALM, the EPA, etc.). These include plant specimens which are collected and not readily identifiable as common, or reflect taxonomic anomalies (new species, sub-species, varieties, hybrids), or are found to occur at the limit of, or beyond, the previously known range of a taxon. It is recommended that proponents consult with the staff of the State Herbarium and other experts, prior to the survey, for guidance on these significant taxa and whether the locality of the planned survey has been subject to previous survey and therefore whether vouchering of more common taxa may also be warranted.

Local-scale vegetation categories which may be scarce, unknown, refugia, key habitat or at extremes of distribution, should also be noted.

3.5 Auditing or peer reviewing surveys

The EPA does not have the resources to undertake systematic review of all flora and vegetation surveys or reports. To ensure that the methods and standards applied in surveys are of a standard that is adequate to ensure quality environmental assessment by the EPA, a proportion of projects may be selected at random for the audit process. In such cases, selected parts of the survey and the related report (i.e. a sample of the work) may be audited.

Peer review may be warranted for some EIA surveys. Such review must be undertaken by experienced and suitably qualified professionals (Section 3.2.3). Unless there are matters in dispute, the peer review would normally be conducted at the expense of the proponent. The EPA will normally seek to inform the proponent

of the likely requirement for a peer review in the project-specific guidelines or approved scoping document.

Core elements of the peer review process in science are that:

a) the choice of reviewer/s is made by a body independent of the author and the report commissioners (in this case, the EPA is the independent body);
b) the reviewers are qualified and experienced professionals, with levels of relevant experience and expertise at least equivalent to those of the people they are reviewing;
c) the reviewers are clear as to the scope and the limitations of the review (general limitations are considered);
d) the reviewers can remain anonymous; and
e) there is an opportunity to re-submit work after revision.

4 APPLICATION

4.1 Area

This Guidance Statement applies throughout the State of Western Australia and will apply to all new proposals, planning schemes and amendments to schemes.

Position Statement No. 3 indicates that the EPA intends to use IBRA as the largest unit for decision making in relation to maintenance of biodiversity. Proponents will, as a minimum, be required to demonstrate that their proposal can meet objectives which are framed in the context of conservation within the applicable bioregion/s. In some areas, such as the Swan Coastal Plain, the developing framework of biogeographical knowledge and policy may provide a more detailed context (EPA Guidance Statement No. 10 and Government of Western Australia 2000a and b).

4.2 Duration and Review

The duration of this Guidance Statement is for five years, unless circumstances require it to be reviewed earlier.

5 RESPONSIBILITIES

5.1 Environmental Protection Authority responsibilities

The EPA will apply this Guidance Statement when assessing any proposals, planning schemes or amendments where flora and/or vegetation are identified, as relevant factors, prior to or during the assessment.

5.2 Department of Environment responsibilities

The DoE, through the EPA Service Unit (EPASU), will assist the EPA in applying this Guidance Statement in environmental impact assessment and in conducting its functions under Part IV of the EP Act.

The DoE, through the EPASU, will provide more specific advice to proponents and environmental consultants, as required, in relation to detailed interpretation of aspects of this guidance and in relation to specific assessments, within available resources.

5.3 Proponent responsibilities

Assessment is likely to be assisted if proponents demonstrate to the EPA that the requirements of this Guidance Statement are incorporated into proposals.

As outlined in Section 3.3.5 the EPA expects that proponents will ensure that the findings of the original survey report/s appear in an unaltered form in the main text of any review document, and that a copy of the whole survey report will appear as an appendix of the review document.

5.4 Environmental practitioner (including botanical consultant) responsibilities

Environmental practitioners should exercise due professional diligence in the conduct of flora and vegetation surveys and the authorship of flora and vegetation survey reports. Environmental review documents and flora and vegetation survey reports should contain an acknowledgment that the EPA's EIA process is one of the specific purposes for which the document or report has been prepared and that the document is suitable for this purpose. Documents and/or reports that do not do so will not be accepted by the EPA for the purposes of EIA.

It is essential that the standards for survey outlined here are met or exceeded. The EPA urges practitioners to ensure that they fully understand the inherent context and level of meaning of terms before they apply them. Particular use should be made of this document in this regard.

A full and frank statement of impacts is expected at all levels of survey and environmental assessment documentation.

6 DEFINITIONS AND ACRONYMS

6.1 Definitions

Assemblage (compare with community, which is similar) - A collection of co-occurring populations (Lewis 1977).

Biological diversity/biodiversity – is the variety of all life forms - the different plants, animals and microorganisms, the genes they contain, and the ecosystems of which they form a part. It is not static, but constantly changing; it is increased by genetic change and evolutionary processes and reduced by processes such as habitat degradation, population decline, and extinction (Commonwealth of Australia 1996).

Biodiversity has two key aspects:

- its intrinsic value at the genetic, individual species, and species assemblages levels; and
- its functional value at the ecosystem level.

Two different species assemblages may have different *intrinsic* values but may still have the same *functional* value in terms of the part they play in maintaining ecosystem processes.

o **Genetic diversity** – is the variety of genetic information contained in all of the individual plants, animals and microorganisms that inhabit the earth (Commonwealth of Australia 1996). In any given area it is the variety of genetic material contained in all organisms.

Genetic diversity occurs within and between the populations of organisms that comprise individual species as well as among species (Commonwealth of Australia 1996).

Due to a lack of research regarding the genetic range of endemic species, there has been, and will continue to be, difficulty in addressing protection of biodiversity specifically at the genetic level.

However for many species some information is available on the phenotypic expression of genetic variation through the recognition of different taxa at the sub-species or variety level. These may be significant in terms of exhibiting varying distribution and levels of rarity. The protection of species throughout their range and on the variety of sites may therefore serve as a surrogate for protection of genetic diversity in the absence of specific information. This issue needs to be considered in the design/collection and interpretation of data obtained in flora and vegetation surveys.

o **Species diversity** – the variety of species on the earth (Commonwealth of Australia 1996). In any given area it is the variety of species, or a measure of that variety (Lewis 1977; Jones *et al.* 1990).

While diversity can be measured in many ways, *Most simply it is measured as the species richness of ... an area, though it provides a more useful measure ... when it is combined with an assessment of the relative abundance of species present. Diversity within ecosystems has been equated classically with stability and climax communities* (Allaby 1992).

Species diversity is conceptually different from genetic diversity because:

- in general, the recognition of species is based on physical features (a taxonomic approach of recognising, describing, naming and classifying);
- a species is a concept, rather than a clear unit in nature. This can mean that the amount of genetic variation within one species may be markedly different from another species. To accommodate such inconsistencies, sub-divisions such as sub-species, varieties and hybrids may be recognised.

Species diversity is usually the default in biodiversity assessment, which means it becomes a surrogate for the underlying genetic diversity. Species diversity becomes a progressively better estimate of the full range of genetic diversity when it considers the range of variation within a species (including sub-species, varieties, and hybrids), a species' entire range, and the range of habitat in which a species occurs.

Declared Rare and Priority flora are only one subset of species diversity. The scope of formal listings is limited by the extent and intensity of sampling in any area, by how well a surveyor recognises all different organisms in an area, by whether all known occurrences are registered (i.e. whether specimens were submitted), and by the current progress in naming species groups. Since these processes are ongoing, it is clear that survey for environmental impact assessment has a role in extending knowledge. Consequently, consultants are encouraged to check specimens which have no known match, or appear anomalous, and which may be new.

In natural systems, species diversity varies from area to area and so is not a complete measure of the significance of a vegetation unit. Many communities with relatively few species, such as estuaries and mangrove forests, are highly productive and have an abundance of life but not a great variety of species. Similarly, for any species, its significance may come from values other than scarcity, or because it may be under threat. For example, a prolific species may be a key part of an ecosystem (e.g. in terms of bulk, productivity, or the provision of resources such as nest sites or nectar).

o **Ecosystem diversity** – in any given area, the variety of habitats, biotic communities and ecological processes (Commonwealth of Australia 1996).

Ecosystems are the basic functional ecological units. They comprise the diversity of all-living organisms and non-living components and their relationships within a given area. They can be defined at almost any nominated scale. Ecosystems include abiotic components, which include physical factors such as radiation, gases, the water cycle, geology, land and soil forming processes, and climate.

Ecological processes are the interactions, and changes or development processes, of the ecosystem over time.

Ecosystem diversity is harder to measure than species or genetic diversity because the boundaries of ecosystems (or component habitats and communities) are a matter of definition within a matrix. Provided a consistent set of criteria is used to define ecosystems, their number and distribution can be measured. It is therefore essential that scale/s and the basis for differentiation are defined and understood in any treatment of ecosystem diversity.

- **Other expressions of biodiversity** - Other expressions of biodiversity can be important. These include the relative abundance of species, the age structure of populations, the pattern of communities in a region, changes in community composition and structure over time, and ecological processes such as predation, parasitism and mutualism. It is often important to examine diversity in ecosystem structure and function as well as compositional diversity of genes, species and ecosystems (Environmental Protection Authority 2002a).

Community (compare with assemblage and ecological community) - A general term applied to any grouping of populations of different organisms found living together in a particular environment (Allaby 1992). Plant community - an assemblage of plants at any given locality Beard (1990).

The term ‘community’ has been applied at a range of scales in general use (as have ecosystem, habitat and vegetation). In this document ‘community’ is usually used to refer to all populations of all plant species at a locality. This is a detailed approach to plant diversity, with good resolution of the make-up of vegetation. Beard’s regional vegetation mapping was several levels coarser than this.

Completion criteria - Completion criteria apply to the required state of an area at the end of the natural life of a proposal that impacts on that area. Completion criteria are used to stipulate the natural values that should be rehabilitated or, preferably, restored (adapted from Tongway and Hindley 1995 and Tongway *et al.* 1997).

Declared Rare Flora - Species specially protected under the *Wildlife Conservation Act 1950*, as identified in the current listing. At time of printing the listing is Wildlife Conservation (Rare Flora) Notice 2003 (Government of Western Australia 2003b).

Ecological community - Naturally occurring biological assemblage that occurs in a particular type of habitat. Note that the scale at which ecological communities are

defined will often depend on the level of detail in the information source. Therefore no particular scale is specified (English and Blyth 1999).

An assemblage of native species that: a) inhabits a particular natural area; and b) meets the additional criteria specified in the regulations made for the purposes of this definition (EPBC Act 1999).

Ecosystem - A dynamic complex of plant, animal, fungal, and microorganism communities and the associated non-living environment interacting as an ecological unit (Commonwealth of Australia 1996). (That is, all living and non-living parts of a system and their interaction. Non-living factors include climate, atmosphere, and the geosphere.)

Ecosystem function/processes (compare to threatening processes) - Interconnected processes that sustain the biodiversity typical of a given ecosystem, and drive the self-directed development of that ecosystem. Such processes involve all components of ecosystems, living and non-living. One-off biological survey tends to reveal little about ecosystem processes without complementary investigations over time.

Environmental Impact Assessment (EIA) - an orderly and systematic process for evaluating a proposal, including its alternatives and its effect on the environment, and the mitigation and management of those effects. The process extends from the initial concept of the proposal through implementation to commissioning and operation and, where appropriate, decommissioning (Environmental Protection Authority 2002b).

Environmental review document – a document (used in environmental impact assessment) which describes a proposal or plan for human development activity, the pre-existing environment of the area to be affected and the potential environmental impacts of the proposal or plan (including impacts on flora and vegetation). The preparation of an environmental review document may precede or be required as a component of the formal EIA process under the EP Act.

Environmental Indicators of Biodiversity - Applied to State of the Environment (SoE) reporting at a national level (Saunders *et al.* 1998). Indicators most relevant to flora and vegetation survey reporting are listed below, with those of lesser relevance in brackets [thus]:

1 Pressure Indicators (SoE sense)
- extent and rate of clearing or major modification of natural vegetation ... (No. 2.1)
- location and configuration or fragmentation of remnant vegetation ... (No. 2.2)

2 Condition Indicators (SoE sense)
- number of sub-specific taxa (No. 9.1); applies to the number of distinct entities (such as sub-species; ecotypes; geographical, morphological, physiological, behavioural or chromosomal races) readily recognisable

within a species. Attention to the amount of variation within a species is applied as a surrogate means of estimating the genetic variation and monitoring any decline. It is not a perfect substitute. This indicator is more useful for widely distributed species, particularly if they are rich in such variation, cover a number of biogeographic regions or habitats, and have populations with a disjunct or fragmented distribution.

- population size, numbers and physical isolation (No. 9.2)
- number of species (No. 10.1)
- [estimated number of species] (No. 10.2)
- number of species formally described (No. 10.3)
- number of subspecies as a percentage of species (No. 10.5)
- number of endemic species (No. 10.6)
- conservation status of species (No. 10.7)
- [percentage of species changing in distribution] (No. 10.9)
- demographic characteristics of target taxa (No. 10.11)
- ecosystem diversity (No. 11.1)
- number and extent of ecological communities of high conservation potential (No. 11.2)

3 Response Indicators (SoE sense)

- Extent of vegetation type (No. 13.1)
- Proportions of bioregions covered by biological surveys (No. 14)

Factor - This word has two meanings in the contexts of EIA and ecology

1 environmental factor - [ecological definition]
Any component or aspect of the environment that may influence the observed state. Since these factors arise from the environment, they are revealed by impartial observation. They are not imposed. Rather, they are labelled as they manifest themselves. (In ecology, multi-variate analysis is employed in order to account for the influence of all factors other than the one in question, so that its influence clearly stands out).

2 environmental factor - [EPA definition]
Usually broad working divisions used to compartmentalise the environment for administrative purposes. Some of these definitions may have broad similarities with the ecological definitions at higher levels. Since these factors arise from an administrative need to compartmentalise, they are imposed *a priori* (before study). At lower levels, they may more closely approach environmental factors, such as within proposal-specific guidelines or approved scoping documents.

Flora (compare with vegetation) - All the vascular plant taxa (including species, subspecies, varieties, hybrids, and ecotypes) in a given area or epoch (after Collocott and Dobson 1975; Onions 1978; Lewis 1977; Delbridge 1987; Mueller-Dombois and Ellenberg 1974).

Flora and vegetation survey - A field-based investigation (including a review of established literature) of the biodiversity inherent in the flora and vegetation of an area. In terms of EIA or environmental management, the area is usually that of a

proposal or scheme to be reviewed by the EPA. Survey may also include sufficient surrounding areas to place the proposal or plan into local area and/or regional context.

Flora and vegetation survey report - A document describing the objectives, methods, limitations, data results and conclusions of a flora and vegetation survey.

Habitat - The natural environment of an organism or a community, including all biotic and abiotic elements; a suitable place for it to live (after Gilpin 1996; Jones *et al.* 1990; Lewis 1977; Onions 1978; Commonwealth of Australia 1996). The term 'habitat' has been applied at a range of scales in general use (as have community and vegetation). Vegetation can become a reasonable surrogate for outlining habitat when its main components, structure and the associated landform are also described.

Heterogeneity - Diverse in character, varied in content (Onions 1978).

Interim Biogeographic Regionalisation of Australia (IBRA) - the scheme for the division of the continent into natural regions.

- It is based on the assumption that it is the physical processes which drive ecological processes, which in turn are responsible for driving the observed patterns of biological productivity and the associated patterns of biodiversity (Thackway and Cresswell 1995).
- IBRA regions represent a landscape-based approach to classifying the land surface. Specialist ecological knowledge, combined with regional and continental scale data on climate, geomorphology, landform, lithology and characteristic flora and fauna were interpreted to describe these patterns.
- The resulting integrated regions were ascribed the term biogeographic regions. The developers of the IBRA acknowledged that, given the paucity of biophysical data in some parts of the continent, new information through time would modify our understanding of the regions, hence the term interim was used in the title of the IBRA.
- Currently the number has been revised from the original 80 to 85 regions. In addition, 354 **IBRA sub-regions** have been developed (Environment Australia 2000).

Natural Areas - naturally vegetated area or non-vegetated areas such as water bodies (generally rivers, lakes and estuaries), bare ground (generally sand or mud) and rock outcrops (EPA 2003).

Precautionary principle - Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

- careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and

- an assessment of the risk-weighted consequences of various options.

(Intergovernmental Agreement on the Environment 1992).

This provides an approach for considering the environmental impacts of a proposal on biodiversity values where there is a lack of knowledge and lack of scientific certainty. A useful methodology for applying the precautionary principle is that of Deville and Harding (1997).

Priority Flora - Lists of plant taxa, maintained by the Department of Conservation and Land Management (Atkins 2003), that are either under consideration as threatened flora but are in need of further survey to adequately determine their status, or are adequately known but require monitoring to ensure that their security does not decline.

Proposal specific guidelines - See scoping documents.

Scoping document - A document prepared as part of the referral to the EPA of a Public Environmental Review or Environmental Review and Management Program. Scoping documents are used to outline the environmental factors to be examined as part of environmental impact assessment of a proposal. Scoping documents have replaced proposal-specific guidelines that formerly filled a similar role. This is outlined in the EP Act under Section 6.1 of the *Environmental Impact Assessment (Part IV Division 1) Administrative Procedures 2002.*

The EPA intends that this flora and vegetation guidance will apply to assessments where project-specific guidelines or approved scoping documents cover flora and vegetation survey, and that it will provide the context, standards and principles. Additional or special requirements for individual projects may be specified by the EPA in the proposal-specific guidelines or approved scoping documents or in other advice provided via correspondence with the proponent or consultant. Scoping documents should normally be consistent with this guidance. However, in certain circumstances, there may be a need to vary requirements to suit the particular case, and this would be laid out in the scoping document.

Significant flora – Species, subspecies, varieties, hybrids, and ecotypes may be significant for a range of reasons, other than as Declared Rare Flora or Priority flora, and may include the following:

- a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species;
- relic status;
- anomalous features that indicate a potential new discovery;
- being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- the presence of restricted subspecies, varieties, or naturally occurring hybrids;
- local endemism/a restricted distribution;

- being poorly reserved.

Significant vegetation - Vegetation may be significant for a range of reasons, other than a statutory listing as Threatened Ecological Communities or because the extent is below a threshold level, which may include the following:

- scarcity;
- unusual species;
- novel combinations of species;
- a role as a refuge;
- a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species;
- being representative of the range of a unit (particularly, a good local and/or regional example of a unit in 'prime' habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- a restricted distribution.

This may apply at a number of levels, so the unit may be significant when considered at the fine-scale (~intra-locality), intermediate-scale (~locality or inter-locality) or broad-scale (~local to region)

Species/area curve - Number of species versus area (Lewis 1977); usually depicted as a graph.

State of the Environment (SoE) reporting (see Environmental Indicators of Biodiversity)

Taxa (singular **Taxon) –** A taxonomic group. Depending on context, this may be a species or their subdivisions (subspecies, varieties etc), genus or higher group.

Threatened Ecological Community - Ecological communities that have been assessed through a procedure (co-ordinated by CALM) and assigned to one of the following categories related to the status of the threat to the community.

The categories are:

1 **Presumed Totally Destroyed;**
2 **Critically Endangered:** <10% of pre-European extent remains in an intact condition in the bioregion;
3 **Endangered:** 10 to 30% of pre-European extent remains;
4 **Vulnerable:** declining and/or has declined in distribution and/or condition, and whose ultimate security is not yet assured (it could move into a category of higher threat in the near future if threatening processes continue) (English and Blyth 1997, 1999).

One of the criteria used to determine the categories of threatened ecological community is an estimate of the geographic range and/or the total area occupied and/or the number of discrete occurrences reduced since European settlement.

Threatening Processes (compare ecosystem function/processes) - Any process or activity that threatens to destroy or significantly modify the ecological community and/or effect the continuing evolutionary processes within any ecological community (English and Blyth 1999). A process that threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community (ANZECC 2000).

Vegetation (compare with flora; and see significant vegetation) - The various combinations that all populations of all vascular plant species form within a given area, and the nature and extent of each combination (after Mueller-Dombois and Ellenberg 1974; Collocott and Dobson 1975; Lewis 1977; Onions 1978; Delbridge 1987). Note that this is a biodiversity approach, and that other approaches may be based on structure or appearance - approaches that describe lesser subsets of plant diversity. The term vegetation has been applied at a range of scales in general use (as have community and habitat). The joint influence of different approaches and levels that can be applied to vegetation has led to a range of terms which describe vegetation, with resulting confusion.

Vegetation unit - A general purpose term to apply to vegetation categories regardless of level, and with no level implied.

This is required because the most variable area of terminology is to do with vegetation and its categorisation at various levels of meaning. If practitioners have any doubt about the application of vegetation terms, it is recommended that they:

- refer to absolute scales, densities, and extent of vegetation as much as possible; and
- use only the generic term "vegetation unit" and qualify whether each unit is fine-scale (~intra-locality), intermediate-scale (~locality or inter-locality) or broad-scale (~local to region).

6.2 Acronyms

ANZECC	Australian and New Zealand Environment and Conservation Council
CALM	Department of Conservation and Land Management
DEP	Department of Environmental Protection
DoE	Department of Environment
DRF	Declared Rare Flora
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
EP Act	*Environmental Protection Act 1986*
EPASU	Environmental Protection Authority Service Unit
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GIS	Geographic Information System
IBRA	Interim Biogeographic Regionalisation of Australia

NVIS	National Vegetation Information System
SoE	State of the Environment
TEC	Threatened Ecological Community

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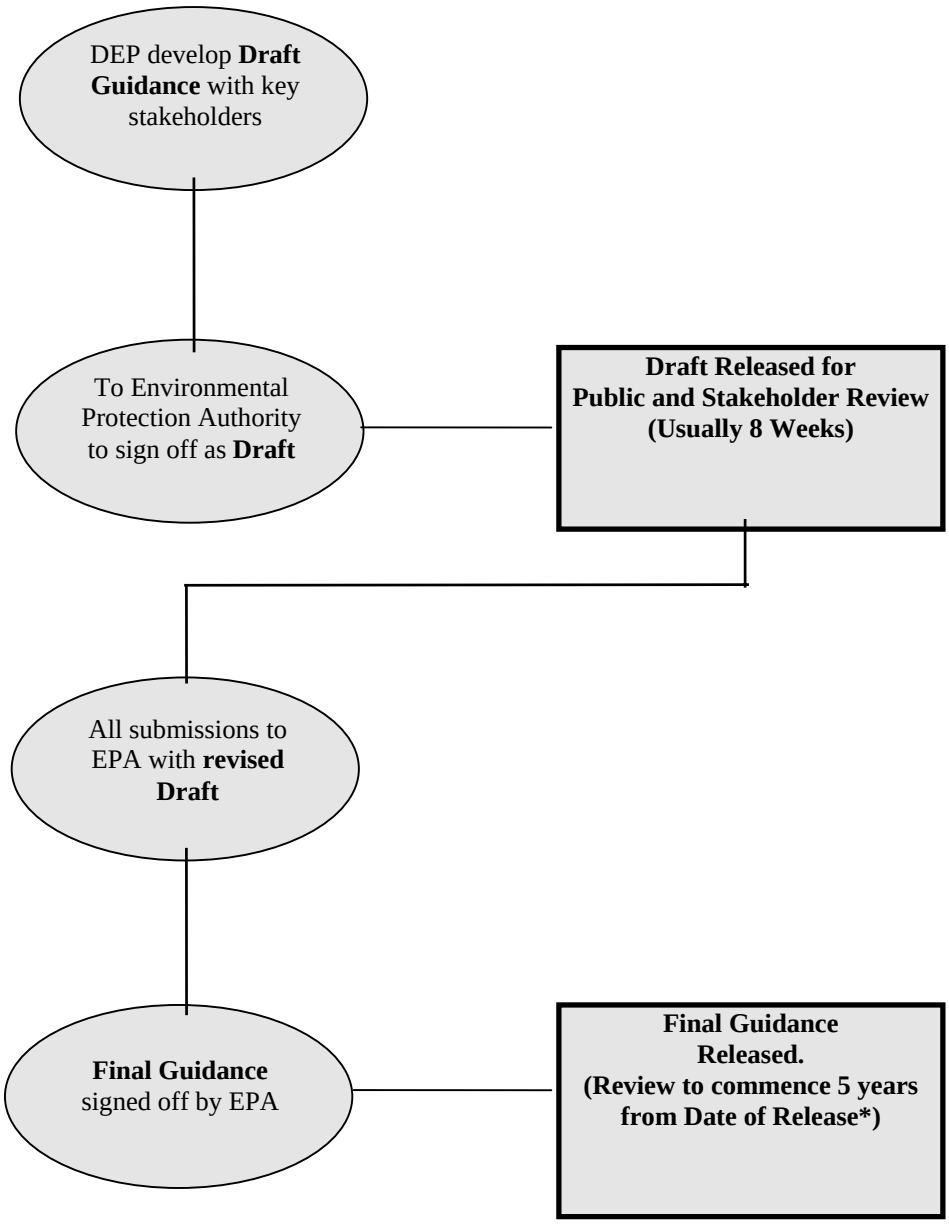
Appendix 1

GENERIC FLOW DIAGRAM FOR THE GUIDANCE STATEMENT PROCESS



* Guidance may be reviewed earlier if circumstances require it.

Appendix 2
GUIDE TO LEVELS OF FLORA AND VEGETATION SURVEY

Table 1: Levels of Flora and Vegetation survey
(adapted from EPA Position Statement No. 3)

Survey levels differ in the capacity of the survey work to provide detail of the conservation and functional values of the target area and its immediate context.	
Level 1 Surveys	**Background research or 'desktop' study** The purpose is to gather background information on the target area (usually at the locality scale). This involves a search of all sources of literature, data and map-based information. **Reconnaissance survey** The purposes are: i) to verify the accuracy of the background study; ii) to further delineate and characterise the flora and the range of vegetation units present in the target area; and iii) to identify potential impacts. This involves a target area visit by suitably qualified personnel to undertake selective, low intensity sampling of the flora and vegetation, and to produce maps of vegetation units and vegetation condition at an appropriate scale.
Level 2 Surveys	Incorporates **Background research** and **Reconnaissance survey** as preparation for more intensive survey that may range in form between detailed and comprehensive survey. **Detailed survey** The purpose is to enhance the level of knowledge at the locality scale. This applies where the general context is better known. This involves: i) one or more visit/s in the main flowering season and visit/s in other seasons; and ii) replication of plots in vegetation units, and greater coverage and displacement of plots over the target area. **Comprehensive survey** The purpose is to enhance the level of knowledge at the locality scale and the context at the local scale. In some cases sub-region survey may be required to provide wider context. This applies where there is only broad general context. This involves survey, at the intensity applied in detailed survey, of both the locality and parts of the local area. Such work is likely to be more structured with longer-term study and multiple visits.

Table 2: Indicative levels of flora and vegetation survey expected by the EPA in relation to the scale and nature of impact of proposals and the sensitivity of the receiving environment

(adapted from EPA Position Statement No. 3)

The bioregions have been grouped in Table 2 according to the existing degree of regional modification or loss of biodiversity, degree of threat and sensitivity to further loss. As a guide to the use of this table, it is very important to note that there will be areas of greater sensitivity within each bioregion that will require special consideration (e.g. wetlands, threatened ecological communities, heritage, geomorphological values, etc). Conversely, for areas with a high degree of pre-existing modification (such as cleared agricultural land) the investigation effort expected is likely to be reduced in comparison with areas supporting native vegetation.

Sensitivity of Environment (Bioregion Groups)	**Numbers indicate level of flora and vegetation survey expected (as defined in Table 1)**		
	Scale and Nature of Impact		
	High	**Moderate**	**Low**
Group 1	2	2	1
Groups 2 and 3	2	1 or 2*	1
Group 4	2	1	1

Bioregion Groups

- **Group 1: Warren, Avon Wheatbelt, Geraldton Sandplains, Esperance Plains, Mallee, Swan Coastal Plain** (bioregions of the South-West Botanical Province that are extensively cleared for agriculture).
- **Group 2: Gascoyne, Carnarvon, Yalgoo, Pilbara, Coolgardie, Murchison, Nullarbor, Hampton,** (bioregions of the Eremaean Botanical Province, native vegetation is largely contiguous but used for commercial grazing) **and Jarrah Forest** (this South-West Botanical Province bioregion is included here because the native vegetation remains extensive and largely contiguous but is used as a commercial forestry resource).
- **Group 3: Dampierland, Northern Kimberley, Central Kimberley, Ord-Victoria Plains, Victoria-Bonaparte** (bioregions of the Northern Botanical Province, native vegetation is largely contiguous but is used for commercial grazing).
- **Group 4: Great Sandy Desert, Gibson Desert, Great-Victoria Desert, Little Sandy Desert, Central Ranges, Tanami** (bioregions of the Eremaean Botanical Province, native vegetation is largely contiguous but is generally not used for commercial grazing).

Table 3: Consideration of the characteristics of proposal areas in defining the scale and nature of impacts on biodiversity (to be used in conjunction with Tables 1 and 2 to provide guidance on the level of flora and vegetation survey required for a proposal)

SITUATION I: The area and its immediate surrounds do not support native vegetation	
The area of the proposal and adjacent areas that could be impacted by off-site impacts from the proposal **do not** support native vegetation (see Keighery 1994). Areas that could be impacted are in a completely degraded condition (Keighery 1994).	**This Guidance Statement is not applicable** It is not expected that the proposal will need to address flora or vegetation factors. Any proposal submitted to the EPA for assessment of other environmental factors should include comprehensive photographs of the area which identify the nature and condition of any vegetation in the area. Depending on the area and nature of the development, it may be appropriate to consider some strategic revegetation or landscaping with local provenance native plant species to re-establish them in the area.

SITUATION II: The area and/or its immediate surrounds supports native vegetation	
If there is native vegetation in or adjacent to the proposal area that could be impacted, and that vegetation is not completely degraded, then background research and reconnaissance survey is required as a minimum. **Note: If the area supports native vegetation within a national park, nature reserve, conservation park, or other reserve formally protected or recommended for protection for a conservation purpose a comprehensive survey is required as a minimum.**	**This Guidance Statement is applicable** The following sections of this Table provide guidance as to the level of flora and vegetation survey expected.

AREA CHARACTERISTICS	EXPLANATION OF SIGNIFICANCE	SCALE AND NATURE OF IMPACT		
		HIGH	MODERATE	LOW
Degree of degradation or clearing within region				
Determine the level of alteration of the original vegetation. The extent of clearing in the district and bioregion is the simplest measure of change and of sensitivity to further change. However, less obvious factors can be measured that have also altered the vegetation and flora. Examples in the Eremaean Province include change in the balance of species under grazing, and associated invasion of introduced species (especially grasses). This is usually referred to as a change in vegetation condition.	This is a background factor in any region, with some regions having significantly higher cumulative degradation than others.	In either the local area or region: i) in fragmented ecosystems with less than 30% native vegetation or natural areas remaining; or ii) in more extensive ecosystems with less than 30% of vegetation in better condition.	In either the local area or region: i) in fragmented ecosystems with between 30-50% native vegetation or natural areas remaining; or ii) in more extensive ecosystems with between 30-50% of vegetation in better condition.	In either the local area or region: i) in fragmented ecosystems with more than 50% native vegetation or natural areas remaining; or ii) in more extensive ecosystems with more than 50% of vegetation in better condition.
Size/scale of proposal/impact				
The size of impact is important in determining the environmental significance of the proposal. This characteristic is not intended to imply relative natural values of bioregions. Rather it reflects the relative degree of disturbance in each group of bioregions.	Area of clearing/loss of native vegetation or habitat expected to result from the proposal.	>10 ha - Bioregion Group 1 >50 ha - Bioregion Groups 2-3 >75 ha - Bioregion Group 4	1-10ha - Bioregion Group 1 10-50ha - Bioregion Groups 2-3 20-75ha - Bioregion Group 4	< 1ha - Bioregion Group 1 <10ha - Bioregion Groups 2-3 <20ha - Bioregion Group 4
Rarity of vegetation				
Consider whether the proposal impacts on vegetation that is restricted or rare, either naturally or as a result of clearing. Threatened Ecological Communities (TEC's) may fit either of these categories. This may include vegetation unit/s, habitat type/s, or landform units.	Impact on **any** naturally rare or restricted vegetation unit or TEC is considered a high to moderate impact.	Vegetation that: i) naturally comprises less than **5%** in the local area (15 km radius) or the bioregion; or ii) is a Threatened Ecological Community.	Vegetation that naturally occupies from **5 to 10%** of the local area (15 km radius) or the bioregion.	Vegetation that is naturally more widespread than **10%** of local area (15 km radius) and the bioregion.

AREA CHARACTERISTICS	EXPLANATION OF SIGNIFICANCE	SCALE AND NATURE OF IMPACT		
		HIGH	MODERATE	LOW
Significant vegetation unit				
Consider whether the area supports vegetation units that have particular significance for ecological reasons; (in addition to Threatened Ecological Communties).	See Section 6 for definition of significance.	Significant vegetation units are known in the area or are found in the area during reconnaissance survey.	i) There are anomalous vegetation units in the area; and/or ii) the vegetation and area characteristics indicate that significant units may occur.	Significant vegetation units are not known from the area or found by reconnaissance survey.
Refugia				
Consider whether the area serves as an ecological refuge. These are more restricted environments that have been isolated for extended periods of time, or are the last remnants of such areas. They may be of high significance for plant taxa or vegetation units with very restricted distributions. Examples include isolated hills which are remnants of an ancient eroding surface, islands, permanent wetlands in arid areas, permanent damplands in wetter regions which may retain Gondwanic elements, patches of ancient palaeodrainage which have vegetation that is not yet affected by secondary salinity as a result of clearing (especially in agricultural areas), mound springs, etc.	For Gondwanic values see Main 1996, Hopper *et al.* 1996, and Horwitz 1994. Arid zone refuges may include taxa with preferences for stability/low seasonality, seclusion from fire, or for permanent water (e.g. Nix 1982); or rainforest elements, with mesic features (Truswell and Harrris 1982); or other derivatives that are now isolated (e.g. Keighery and Gibson 1993, Gibson and Lyons 1997).	Isolated, or disjunct populations and communities are known or are likely to be present. The presence of refuges indicates the potential impact is high.	The characteristics of the area indicate that it could serve as a refuge for some taxa.	Refugia are not known from the area or are not found by reconnaissance survey.

AREA CHARACTERISTICS	EXPLANATION OF SIGNIFICANCE	SCALE AND NATURE OF IMPACT		
		HIGH	MODERATE	LOW
Rare or Priority flora				
Consider whether statutory significant and Priority flora occur or may occur in the area.	Declared Rare Flora (DRF) and Priority flora.	i) DRF species are found in the area or in similar vegetation in its immediate vicinity during reconnaissance survey; and/or ii) the vegetation and area characteristics indicate that DRF species may occur. The presence of several Priority species may also raise the impact to high.	i) Priority species are found in the area or in similar vegetation in its immediate vicinity during reconnaissance survey; and/or ii) the vegetation and area characteristics indicate that Priority species may occur. Cumulative impact on the total number of populations should be considered.	DRF and Priority flora species are not found by reconnaissance survey, and are not likely to be found in the area or its immediate vicinity, on the basis of existing information. Generally, the area would be well known from one, and ideally more than one, well timed and structured survey.
Other significant flora				
Consider whether the area supports taxa that have particular significance for ecological reasons.	Taxa at the extremes of their range, or isolated outlying populations; taxa with anomalous features which may be new. See Section 6 for definitions of significance.	-	Significant species or taxa are found in the area or in similar vegetation in its immediate vicinity during reconnaissance survey.	Significant species or taxa are not found in the area or in similar vegetation in its immediate vicinity during reconnaissance survey.

AREA CHARACTERISTICS	EXPLANATION OF SIGNIFICANCE	SCALE AND NATURE OF IMPACT		
		HIGH	MODERATE	LOW
Size of remnant and condition/intactness of vegetation				
Determine whether the proposal impacts on a relatively large more or less intact remnant (e.g. Bioregion Group 1), or is an area of more or less intact vegetation in areas of extensively degraded landscapes (e.g. Bioregion Groups 2 and 3).	Large intact remnants are key biodiversity reservoirs in fragmented environments. In some cases even small, but intact, remnants may be highly significant. Areas of relatively intact vegetation in regions/districts where the vegetation is generally in poorer condition are also important for retention of biodiversity. Desktop study should seek to determine the size of remnants and/or vegetation condition relative to those in the local surrounds (≥15km radius).	Area is a relatively large compact remnant, or part of a large compact remnant in a district where native vegetation is fragmented by clearing and/or other degradation; or an area of native vegetation, which is more intact than typical for the local district or bioregion.	Area supports a remnant of less than average size and degree of intactness in the district; or the vegetation is not more intact than that in the district.	Area is not in a fragmented environment or an environment with extensive areas of otherwise degraded vegetation, such as some rangeland environments.
Ecological Linkage				
Determine the ecological linkage role of the area in the local and regional context.	Ecological linkages have important biodiversity conservation roles, therefore the values of these roles are highly sensitive to change.	The area is part of an ecological linkage at the regional or local scale.	The area is not directly connected to adjoining areas but is part of a minor ecological linkage.	The area is isolated with no ecological linkages.
Heterogeneity or complexity of the vegetation				
Determine the characteristics of remnants relative to those in the local surrounds through desktop and reconnaissance surveys.	The relative complexity of the area is expressed by the range of landforms/habitats/vegetation units and associated ecotones.	The area and/or its immediate surrounds are complex, with a wider range of component units relative to the character of the local and regional surrounds.	The area and/or its immediate surrounds have a similar range of component units relative to the characteristics at the local and regional scale.	The area and its immediate surrounds are less complex relative to the characteristics of the local and regional scale.

Phytophthora Disease Action Plan (*P*-DAP)

Objective: To eliminate any risk of transportation of phytophthora from known infected sites to known *Phytophthora* Free "protectable" areas.
Risk: Vehicle movement, foot traffic, and equipment movement. **Vector**: Soil, organic material
Mitigation of Risk: Total removal of all organic material known to transport or with the potential of transporting Phytophthora.

MOVEMENT

Weather conditions must be considered to determine soil moisture condition before any movement is planned, and reassessed at time of movement. Close consultation with Park Ranger must occur at all times.

1.0 Movement between areas

1.1 Movement from Known Infected (or unknown) to *Phytophthora* Free areas
- 1.1.1 Under **Dry** Soil Conditions
  - **All** *vehicles/equipment/shoes* **must** be **cleaned thoroughly**
  - Clean vehicle movement acceptable
- 1.1.2 Under **Wet** Soil Conditions
  - **No movement** acceptable

1.2 Movement from *Phytophthora* Free to Known Infected areas
- 1.2.1 Under **Dry** Soil Conditions
  - Vehicle movement acceptable without cleaning
- 1.2.2 Under **Wet** Soil Conditions
  - Movement acceptable up to a certain moister threshold
  - **Boundary** must have been previously demarcated
  - Care must be taken to not affect track condition/surface

2.0 Movement within Areas

2.1 Movement within Known Infected area
- 2.1.1 Under **Dry** Soil Conditions
  - Vehicle movement acceptable
  - Knowledge of infested (and suspected) areas/boundaries essential
- 2.1.2 Under **Wet** Soil Conditions
  - **No movement** acceptable unless boundary has been demarcated
  - Wash down should be implemented upon departure (refer 1.1)
  - Care must be taken to not affect track condition/surface

2.2 Movement within *Phytophthora* Free areas
- 2.2.1 Under **Dry** Soil Conditions
  - **Clean vehicle** movement acceptable
  - Knowledge of infested (and suspected) areas/ boundaries essential
- 2.2.2 Under **Wet** Soil Conditions
  - Movement acceptable up to a certain moister threshold
  - Knowledge of infested (and suspected) areas essential
  - Threshold to be advised by ranger (moist soil - no soil movement)
  - Care must be taken to not affect track condition/surface

Appendix H - Aboriginal Heritage Monitor Daily Report

APPENDIX H – ABORIGINAL HERITAGE MONITORS DAILY REPORT

Cultural Heritage Monitors' Responsibilities:

- To work in accordance with the Environmental Management Plan and as directed by the Project Manager
- To ensure a safe working environment, cultural heritage monitors must:
  - Comply with personal protective equipment requirements (steel capped boots and long sleeved shirt, high visibility vest to be provided)
  - Comply with all safety instructions and directions
  - Be under the management of the Main Roads Construction Manager while on site
  - On issues of concern, only liaise with the Main Roads Construction Manager (that is, not directly with the construction work teams).
- Cultural Heritage Monitors must attend the Main Roads site office by 6:30am. Failure to attend by 6:30am (by any of the Cultural Heritage Monitors) will not prevent Main Roads from undertaking ground disturbing activities on that day
- Provide advice to Main Roads as required in regard to any material that may have cultural heritage value
- Cultural Heritage Monitors are to sign in and out as visitors on arrival at and departure from the site, and are to complete and sign this daily report
- NOTE: Main Roads may continue ground disturbing activities even if the Cultural Heritage Monitors choose to leave the site before works have ended for the day.

Activities observed:

……
……
……
……
……

Issues raised:

……
……
……
……
……

Date:……

Time arrived: …… Time departed:……

Signed: Cultural Heritage Monitor …….

Construction Manager: …….

Appendix I - Environmental Incident Form

ENVIRONMENTAL INCIDENT AND INVESTIGATION REPORT

CONTRACT NUMBER	CONTRACTOR	REGION	INCIDENT REPORT NUMBER

PART A – INCIDENT DETAILS

1. OBSERVATION DETAILS

Name: Position:

Company: **Select**

2. DETAILS OF INCIDENT

Location: Time: **Select** Date: / /

INCIDENT CATEGORY (Refer Environmental Incident Category Attached): **Select**

3. MANAGEMENT NOTIFIED *(Refer Environmental Incident Notification Process attached)*

Select

4. DETAILS OF INCIDENT *(i.e. Where did the incident occur, What happened, How the incident happened?)*

5. IMMEDIATE REMEDIAL ACTION TAKEN *(To Stop, Control or Contain the Incident)*

6. DESCRIPTION OF ENVIRONMENTAL IMPACT *(Size, Duration)*

PART B – INCIDENT INVESTIGATION

7. DESCRIPTION OF EVENTS LEADING UP TO THE INCIDENT

8. CONTRIBUTING FACTORS / IMMEDIATE CAUSES

9. LIKELY UNDERLYING CAUSES

10. CORRECTIVE AND PREVENTIVE ACTION

DESCRIPTION	Responsible Person	Target Completion	Date Completion

11. TEAM INVESTIGATION

NAME	POSITION	SIGNATURE
	(Investigation Leader)	
	(Team Member)	
	(Team Member)	
	(Team Member)	

12. COMMENTS *(Contractor's Representative)*

	Signature & Date

13. COMMENTS *(Contract Manager)*

	Signature & Date

14. COMMENTS *(Main Roads Environment Manager – Significant Incident Only)*

	Signature & Date

ENVIRONMENTAL INCIDENT CATEGORY

Incident Category	Definition	Examples
MINOR ENVIRONMENTAL INCIDENT	Where the environmental impact is limited and is confined within the work site. Environmental impacts are readily addressed through clean up or changes to work practices. Breach of project or contract EMP. NB: Minor incidents that have a high frequency of recurrence are indicative of underlying issues associated with work practices. This in turn increases the potential for these minor incidents developing into significant incidents.	Uncontained hydrocarbon spillage <200 L. Dust suppression spray failure without causing off site impact.
SIGNIFICANT ENVIRONMENTAL INCIDENT	Incident involving off site environmental impacts that requires significant resources to address. Non-compliance with statutory requirements or environmental criteria requiring reporting to authorities.	Clearing outside of approved area (<100m^2) Over spray of herbicides damaging nearby crops or native vegetation. Dust monitoring results exceed statutory criteria. Failure to submit compliance report to DEC within the timeframe.
	Non-conformance with Contractor's EMP occurring within the work site where the environmental impact is significant and has the potential for an offsite environmental impact.	Uncontained hydrocarbon spillage >200 L. Dust suppression spray failure causing actual off-site impact. Unauthorised clearing of rare flora.
MAJOR ENVIRONMENTAL INCIDENT	Any on site or off-site environmental incident resulting in significant long term environmental harm. An incident resulting in prosecution under environmental laws.	Unauthorised clearing of a large area (>100 m^2). Actual pollution of waterways (eg. by on-site or off-site fuel spills). Land disturbance resulting in damage to public infrastructure (power line or water pipes) which impact on a group of people.

ENVIRONMENTAL INCIDENT NOTIFICATION PROCESS

Incident Category	Personnel to be Notified by Whom	Timing of Notification
MINOR	▪ Observer(s) notifies the relevant Supervisor	▪ By the end of the working day.
SIGNIFICANT	▪ Observer(s) notifies the relevant Supervisor ▪ Contractor's Supervisor notifies the Contractor's Representative and Contract Manager ▪ Contract Manager/Main Roads' Supervisor notifies Manager Environment and DEC if the incident is a non-compliance with statutory requirements or has resulted in pollution or environmental harm.	▪ Upon completion of remediation actions. ▪ Upon completion of initial incident assessment. ▪ Upon completion of initial incident assessment.
MAJOR	▪ Observer(s) notifies the relevant Supervisor. ▪ Contractor's Supervisor notifies Contractor's Representative and Contract Manager. ▪ Contract Manager/Main Roads' Supervisor notifies DEC, Manager Environment and relevant Executive Directors.	▪ Immediately. ▪ Immediately. ▪ Upon completion of initial incident assessment and/or site emergency response procedure.

Appendix J – Aboriginal Heritage Surveys

REPORT OF AN ETHNOGRAPHIC ABORIGINAL HERITAGE SURVEY OF THE HAMERSLEY DRIVE UPGRADE AND MATERIALS EXTRACTION PITS WITHIN THE FITZGERALD RIVER NATIONAL PARK AND HOPETOUN, WESTERN AUSTRALIA

A report prepared for GHD Pty Ltd upon behalf of Main Roads Western Australia.

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Report submitted February 2010 to:

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Great Southern Region
ALBANY WA 6330

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HERITAGE SURVEY

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- Brad Goode and Associates Pty Ltd - Angela Tarbotton
- Brad Goode and Associates Pty Ltd - Colin (Floyd) Irvine
- Brad Goode and Associates (SWALSC working party member) - Vernice Gillies.
- Applied Archaeology Australia -David Guilfoyle & staff -

Wagyl Kaip (WC98/070) and Southern Noongar (WC96/109) Native Title Claim group representatives

Ethnographic survey informants:

- Aden Eades
- Alwyn Coyne
- Sandra Woods (nee Inel)
- Bill Woods
- Lynette Knapp
- Graham Miniter
- Errol Williams
- Geoff Wynne
- John Penny
- Johno Woods
- Elaine Miniter

DISCLAIMER

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EXECUTIVE SUMMARY

Main Roads Western Australia ('Main Roads') is proposing to upgrade a section of Hamersley Drive and extract gravel from adjacent materials pits within the Fitzgerald National Park and on private property near Hopetoun. Main Roads wish to determine whether any sites of significance to Aboriginal people will be affected by this proposed work thereby fulfilling their obligations under the Western Australian Aboriginal Heritage Act (1972).

Specifically the scope of the survey includes:

- A 20m wide survey corridor either side of Hamersley Drive where the road would be widened by up to 2m meters and then sealed, inclusive of the three beach access roads between the Culham and Hamersley Inlets within the Fitzgerald National Park (see fig 1, location page).

- Three gravel extraction pits, located along Hamersley Drive within the Fitzgerald National Park that have been previously used and partially rehabilitated (see fig 1, location page).

- A further three gravel pits and one sand extraction pit located outside of the national park on private property within Lot 6382 Steeredale Road and Lot 95 Hamersley Drive at Hopetoun (see fig 2 & 3, location page).

A search of the DIA Sites Register has revealed **no previously recorded ethnographic Aboriginal heritage sites** to be located within the survey areas.

It is the view of the authors of this report that the lack of previously recorded ethnographic sites in the survey area is due to two factors. Firstly the areas in question have not be subject to rigorous ethnographic enquiry as there has only been a small and limited number of commercially driven Aboriginal heritage surveys conducted in the region in recent years. Secondly, due the events at Cocanarup late last century, there has been a considerable attenuation of traditional religious knowledge lost to the descendants of the areas traditional Aborigines (see ethnographic background).

What knowledge that does exist is generally associated with the importance of the coastal inlets to Noongar people's traditional economies for fishing, and for mythological associations with waterways in terms in the belief that the '*Marchant'*, a mythic snake that is said to have created and is the guardian of water. Subsequently areas around the Culham and Hamersley Inlets are likely to be places of ethnographic importance.

Two previously recorded archaeological sites have been identified to be located within the survey area, Site ID 4934 West Beach and Site ID 19596 Location G Gnamma Hole (see Appendix: 1, for sites register searches).

Site ID 4934 West Beach's DIA coordinate locates the site 65m south east of the car park at West Beach. The site will be potentially affected by the proposed upgrade to the car park should the car park be widened.

Site ID 19596 Location G Gnamma Hole DIA coordinate locates the site 630m west of the south west corner of proposed gravel pit B and 560m southeast of the southeast corner of proposed gravel pit C and will not be affected by the materials extraction proposal at Lot 6382 Steeredale Road (see Appendix :3 for maps of archaeological sites).

As these sites are archaeological a full analysis of these sites nature and extent is contained in the separate archaeological report by Guilfoyle 2010.

As a result of consultations conducted with representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups **no new sites of ethnographic significance** as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) were identified to be located within the Hamersley Drive designated survey area, or within the materials extraction pits located on Lot 6382 Steeredale Road and Lot 95 Hamersley Drive.

In regards to the archaeological site, **'Kurda Gorge Site',** identified and recorded by Applied Archaeology Australia, representatives of the above Native Title Claim groups have assigned this site as a place of high cultural significance and have recommended that the site should be **preserved in situ** and that **a heritage management plan** should be formulated to protect the site, should work to seal the existing road be conducted within the area.

At present there is **no support** within the group for Main Roads to implement a plan to widen the road to the west of West Beach Road turn off to the Hamersley Inlet. In the opinion of the Native Title Claim groups consulted this would likely affect the 'Kurda Gorge Site' to an unacceptable level.

In regards to the previously recorded archaeological site, **ID 4934 West Beach,** representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups could not determine a cultural significance assessment for the site as they were unable to relocate the site during the survey and did not have sufficient information regards the nature and extent of the site upon which to base a decision.

The group stated that at present the site was under no threat from simply sealing the existing road and were happy for this to take place. However should the car park at the beach require substantial modification to accommodate tour busses then the group would wish an archaeologist to determine the effect that these plans would have on the integrity of this site before being re-consulted with a request to support disturbance to the area under an application for ministerial consent. The group stated that if the site was small and not scientifically significant then the group would consider salvaging the site with Noongar participation as long as no artefacts are taken away from the area.

In regards to the materials extraction pits within the national park the Noongar community were **not supportive** of plans to extract gravel as the issue of the spreading dieback through an iconic national park was a paramount concern. It was also stated that the areas were likely to be problematic in terms of disturbance to sub surface archaeological material and the clearing of culturally significant plant species used for food and medicine.

The new material extraction pits located on private property on Lot 6382 Steeredale Road and Lot 95 Hamersley Drive were identified by the group to be clear of any heritage issues and environmental concerns.

As a result of the ethnographic survey the following recommendations area made:

As no sites of ethnographic significance as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) were identified to be located within the survey areas, **it is recommended** that the work can proceed without any risk of affecting ethnographic sites of significance.

During the consultations representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups identified a number of issues of cultural concern within the general survey areas.

As a result of the issues raised, the following recommendations area made:

- **It is recommended** that Main Roads avoid extracting gravel from the proposed materials extraction pits located within the Fitzgerald River National Park along Hamersley Drive as the Noongar community are concerned about the spread of dieback fungus and disturbance to culturally significant archaeological material and flora.

- **It is recommended** that Main Roads give due consideration to the Noongar communities request to monitor all ground disturbing works at creek crossings, along the margins of water courses and areas where archaeologists have determined to have high potential for cultural material to be unearthed.

- **It is recommended** that Main Roads inform DEC of the need to conduct further consultations with regards to any future plans to expand car parks at the end of all three beach access roads and at the Hamersley Inlet as these plans were not known to the community and the consultants during this survey.

In regards to the archaeological site , **'Kurda Gorge Site',** representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups have identified this sites to be off high cultural significance and as such;

- **It is recommended** that Main Roads does not widen the road from the West Beach Turn off west to the Hamersley Inlet.

- **It is recommended** that the sites should be **preserved in situ** and that **a heritage management plan** should be formulated to protect the site should work to seal the existing road be conducted within the area.

If this is not be possible then Main Roads **will be required** to make application under the terms set out by Section 18 Western Australian Aboriginal Heritage Act (1972) for consent to use the land that may contain an Aboriginal site.

As representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups have clearly articulated that they are at present **not supportive** of such an application until further and more detailed archaeological assessments are conducted **it is further recommended** that Main Roads conduct further and detailed archaeological investigation of the road works potential for affects upon the integrity of this site followed by further consultations with the above representatives should this course of action become necessary.

In regards to the previously recorded archaeological site, **ID 4934 West Beach,** representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups could not determine a cultural significance assessment for the site as they were unable to relocate the site and did not have sufficient information regarding the nature and extent of the site upon which to base a decision during this initial survey.

Should Main Roads determine that the site is likely to be affected by any future plans to expand the car park at West Beach **it recommended** that once a full archaeological analysis of the site is completed and that Main Roads conduct further consultations with representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim group prior to lodging notice pursuant to an application under Section 18 Western Australian Aboriginal Heritage Act (1972) for consent to use the land that may contain an Aboriginal site.

Should consent be given as a result of this application **it is then recommended** that members of the above claim groups be engaged to assist archaeologists to fully record and salvage the site and then to redeposit the artefacts in a safe area in line with the wishes of the elders expressed during these consultations.

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LIST OF FIGURES

REPORT

Report of an Ethnographic Aboriginal Heritage Survey of the Hamersley Drive Upgrade and Materials Extraction Pits within the Fitzgerald River National Park and Hopetoun, Western Australia

ISSUE

Main Roads Western Australia ('Main Roads') is proposing to upgrade a section of Hamersley Drive and extract gravel from adjacent materials pits within the Fitzgerald National Park and on private property near Hopetoun. Main Roads wish to determine whether any sites of significance to Aboriginal people will be affected by this proposed work thereby fulfilling their obligations under the Western Australian Aboriginal Heritage Act (1972) ['AHA'].

REPORT OBJECTIVES

To report on archival research in order to determine if any previously recorded ethnographic Aboriginal heritage sites as defined by Section 5 of the 'AHA' will be affected by the above project proposal.

To report on consultations held with representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups in order to determine if any new ethnographic Aboriginal heritage sites will be affected by this project proposal.

BACKGROUND

On the 9th of November Ms Melissa O'Toole, from the Great Southern Region of Main Roads Western Australia, made contact with Mr Brad Goode, anthropologist from Brad Goode & Associates Pty Ltd, and requested a fee proposal to conduct 'a site identification' Aboriginal Heritage Survey for the proposed Hamersley Road up grade and associated materials extraction pits.

The survey was required in order that the project could proceed with this work remaining compliant with the terms of the 'AHA'.

Further to this request Ms O'Toole advised that the fee proposal should be provided to Mr Neil McCarthy at GHD Pty Ltd in Bunbury who would manage the project upon behalf of Main Roads.

Mr McCarthy provided the consultants with a scope of service request which outlined that the survey should consider;

- A 20m wide survey corridor either side of Hamersley Drive where the road would be widened by up to 2m meters and then sealed, inclusive of the three beach access roads between the Culham and Hamersley Inlets within the Fitzgerald National Park (see fig 1, location page)

- Three gravel extraction pits, located along Hamersley Drive within the Fitzgerald National Park that have been previously used and partially rehabilitated (see fig 1, location page)

- A further three gravel and one sand extraction pits located outside of the national park on private property on Lot 6382 Steeredale Road and Lot 95 Hamersley Drive at Hopetoun (see fig 2 & 3, location page).

These extra gravel and sand pits were added to the brief following the initial survey which had identified that gravel extraction within the national park may be problematic due to 'Die Back' risks.

Resulting from the above brief Mr Brad Goode (Anthropologist), Mr Colin [Floyd] Irvine (Ethnographic Assistant) and Ms Vernice Gillies (Aboriginal Liaison Consultant) conducted the ethnographic consultations for the Hamersley Drive work on the 15th of November 2009 with 9 members representing Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups. Further consultations regards to materials extraction pits near Hopetoun were conducted on the 31th January 2010 by Mr Brad Goode and Ms Vernice Gillies.

David Guilfoyle from Applied Archaeology Australia conducted a separate archaeological assessment of the Hamersley Road project area between the 14 and the 16th of November 2009, and a site inspection of the Hopetoun materials extraction pits on the 29 & 30th January 2010. During the initial field work at Hamersley Road, Applied Archaeology was assisted by four members of the above Native Title Claim groups. The results of the Guilfoyle survey are reported separately.

LOCATION

Figure 1: Location of the Hamersley Drive upgrade and materials extraction pits.

Figure 2: Location of the Proposed Gravel Extraction Pits on Lot 6382, accessed via Steeredale Rd, Hopetoun

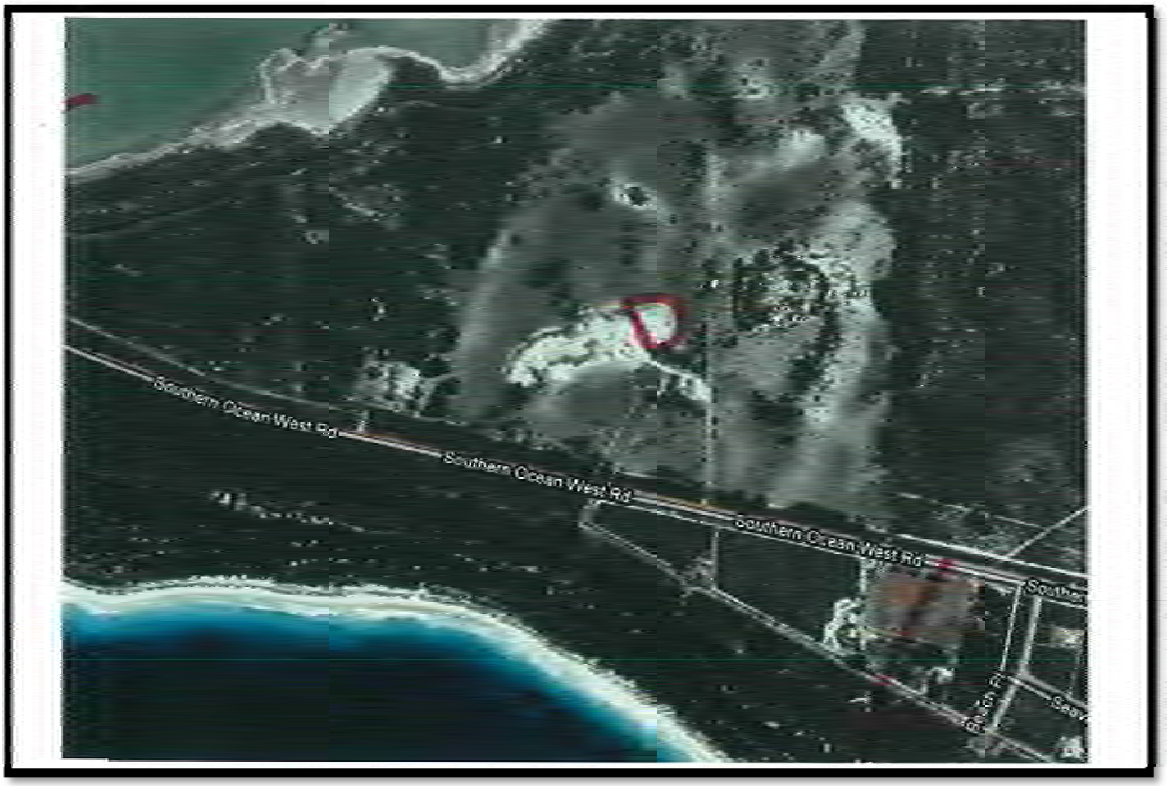

Figure 3: Location of the Culham Inlet Sandpit Lot 95 Hamersley Drive (also named Southern Ocean West Rd).

ETHNOGRAPHIC & HISTORICAL BACKGROUND

The Southwest of Western Australia is considered to form a distinct cultural bloc defined by the distribution of the Noongar language groups. Before the term Noongar was used as a group name or linguistic term the southwest people recognized themselves, their language and culture, as 'Bibbulmun' (Bates 1985). Daisy Bates writes that the Bibbulmun people were the largest homogenous group in Aboriginal Australia. Their land took in everything to the west of a line drawn from Jurien Bay on the west coast to Esperance on the south coast (Bates 1966).

> "The inland tribes were distinguished by the character of the country they occupied. They were either *Bilgur* (river people, beel or bil-river), *Darbalung* (estuary people), or *Buyun-gur* (hill people – buya-rock, stone, hill), but all were *Bibbulmum* [*Nyungar*]" (Bates 1985).

Tindale (1974) identified thirteen Noongar groups in the southwest cultural block and based their distribution on socio-linguistic boundaries and minor dialect differences. The Noongar or Bibbulmun people of the southwest were a distinct group in that their initiation practices varied markedly from their desert and semi-desert dwelling neighbours. Unlike the desert people, the Noongars did not practice circumcision or sub-incision, but rather practiced a ritual of nasal septum piercing and scarring of the upper body (Bates 1985, Tindale 1974). The people who followed these socio-religious practices have been described in Berndt and Berndt (1979) as being of the 'Old Australian tradition'.

Tindale's (1974) map of Noongar group's distribution has identified that the Ravensthorpe area was occupied by *Wudjari Noongar* with the *Koreng* bordering to the west and the *Njunga* to the east. Tindale (1974) identified that the *Njunga* people's, who did practice both circumcision and sub-incision, country extended to the Young River to the east of Ravensthorpe and suggests that the initiation rite of circumcision did diffuse into some groups in the Ravensthorpe area. Tindale (1974) also suggests that between Ravensthorpe and the Young River, the *Wudjari* and the *Njunga* groups overlapped and intermarried.

Bates (1985) recorded the Noongar group around the Albany area as belonging to the *Minung Bibbulmun* and that their country went east to Ravensthorpe. Bates identified the people around the Esperance region as the *Kurin* section of the *Minung Bibbulman* (Bates 1985). Their country was identified to be located between Cape Arid and the Lort River.

Dortch and Dortch (1993) state that very little has been recorded about the *Wudjari* group, although Ethel Hassel, the young wife of the first pastoralist to settle Jerramungup in 1849, recorded some aspects of their traditional life in the Jerramungup district during the late 1870's and early 1880's (Hassel 1975). Ethel Hassel recorded the Noongar group in Jerramungup to be the *Wheelman*. To the east of the Wheelman, she suggests that the *Kar-Kar* occupied the coastal lands from Hopetoun to Ravensthorpe. Inland of these areas, and east to Eucla was occupied by the *Barteck* (or *Bardocks, Pardooks*), some of whom were recorded to bear six fingers and toes on each hand (Hassel 1975; Gallant no date). Helms' account of the *Njunga* people describes the areas of the Young and the Lort Rivers emptying into the Stokes Inlet in the west, to the Thomas River in the east, as 'one country' and noted that there were four family groups or clans living in this region (Helms 1986).

Within the Bibbulmun, two primary moiety divisions existed, the *Manichmat* or 'fair people of the white cockatoo' and *Wordungmat* or 'dark people of the crow', which were the basis of marriage between a further four class subdivisions (Bates 1985). Bates describes the only lawful marriage between the groups to be "the cross-cousin marriage of paternal aunts' children to the maternal uncles' children", and states that the four clan groups and relationships, under different names, are "identical in every tribe in Western Australia, east, north, south and southwest…" (1966:24-25).The four subdivisions of the *Wudjari* people have been recorded to be: *Yonga* – the kangaroo; *Gnow* – the mallee fowl; *Waitch* – the emu; and *Coudda* – the long-tailed goanna (Anon 1995).

The Noongar people along the west coast followed a matrilineal system of descent whereas those of the south coast 'below Augusta and the Donnelly River' observed patrilineal descent. All along the borderline where the two lines of descent met, the tribes were friendly with each other, intermarrying and adjusting their 'in-law' relationships to suit the form of descent obtaining. This did not prevent marriage or other interactions taking place between the two systems and it is also unclear as to the exact boundary (Bates 1985). Noongar people were observed to marry outside of their immediate vicinity, and it seems likely that this served to reinforce alliances with neighbouring groups. Inherent in the marriage relationship was a reciprocity, which transferred rights and privileges between groups (Le Souef 1993).

Ethel Hassel recorded that the Jerramungup area was a borderline between several local groups, and noted that many Noongars came and camped at her Jerramungup pastoral property for various social events including the important *Yardies* when marriage arrangements between the neighbouring groups were made (Hassel 1975). In marriage, the tribal elders, the old men, were given preference (Hassel 1975). The young men, when initiated into manhood had to be content with old wives, so that as a man grew older, his wives became younger. Most of the female babies were promised at birth to elders, so when the girl reached puberty at 12 or 14 years of age, she would marry an elderly man.

Each socio-linguistic group consisted of a number of smaller groups. Each of these smaller groups was made up of around 12 to 30 persons, related men, their wives and children and at times visiting relatives from other groups. These subgroups could be described as a family, a band or a horde. For every subgroup there was a tract of land with which they most closely identified them-selves with. An individual or a group's land was called their *Kalla* or fireplace (Moore 1884). This referred to an area of land which was used by the group and over which the members of the group exercised the greatest rights to its resources. It was also the area for which the group would act as custodians of. Other groups would also have some rights of access and use gained through marriage.

> "Ownership rights to land were held by groups of people linked through common descent; there was definite ownership of land in both social and personal ways. As well as belonging to a local descent group by birth each individual simultaneously belonged to an economic or food gathering group" (Le Souef 1993)

There are two forms of socially organised relationships to the land, a spiritual association and an economic one. Stanner (1965) uses the terms 'estate' and 'range' to distinguish these two different associations. He writes that the 'range' was that land in which the group 'ordinarily hunted and foraged to maintain life'. The 'estate' refers to the spiritual country which may be 'owned' by either an individual, group, or part of a group. The relationship to 'estate' is mostly religious; however there is also an economic benefit. The estate can be considered the country or home of a group. It is sometimes referred to as the 'Dreaming place' and as such includes all religious sites, myths and rituals that occur on or about that land. In this way 'estate' forms part of the Aboriginal ties to Dreaming and place (Stanner 1965).

> "There is a clear relationship between the individual and the land, which is expressed in a number of ways. There is a direct link between the mythic heroes and spirits of the dreaming and the land. Relationships with these beings, which are transmitted through birth, descent and marriage (to a lesser extent), are a reciprocal arrangement of rights and obligations and they are vital for claiming rights to the land" (Silberbauer 1994).

The link between the individual and the land comes from the conception site, where the animating spirit enters the mother and thus there is a direct connection between the land, spirit and the identity of the individual (Machin 1996). The spiritual ties with the land strengthened economic rights and land usage involved both ritual and social connections (McDonald et al. 1994).

Land use or ownership in traditional Aboriginal Australia is based on a religious view of the world and the position of people in it. This religious view is most often referred to as the Dreaming. The Dreaming is an ideological and philosophical basis for a close emotional connection between Aboriginals and their land (Machin 1996). The Dreaming refers to a distant past when the world had yet to be fully created. Dreamtime stories refer to mythic beings that roamed the earth creating plant and animal species. During the struggles of these mythic beings many landforms such as hills and rivers were created. *Njunga* Noongars today relate such a story with regards to the creation of the rivers, hill and wetlands of the region,

> "Long ago the Norrun (tiger snake) awoke from its sleep up north and began his journey towards the coast. The land was bare and desolate. As it moved along, its body pushed up the hills/dunes and went under the ground and back up again all the way along the coast. When the rains came it started to fill up the gullies and the flat areas that then became our creeks/rivers and lakes/swamp areas that today make up 'kepwari' (Doc Reynolds per com 2005).

The landscape bears testimony to the struggles of creation and is studded with sacred sites recalling the Dreamtime. These sites are owned by or belong to either one or more groups, and so such sites have a shared significance amongst the local population. The shared spiritual significance of these sites had a function of bringing together different groups. Another function of these shared sites is that knowledge of the local myths created rights of use to the land.

> "Rights are recognised through active social relations, a process symbolized through the possession of knowledge. That is, knowledge is only gained through participation in social relations and rights to the land are reliant on the possession of relevant religious knowledge" (Machin 1996:11).

Traditional subsistence practices of Noongar people in the Ravensthorpe and Esperance regions consisted of a pattern of seasonal migration. In summer the coastal inlets were utilised for fishing, and then in winter inland regions were used by groups who dispersed to hunt game and fish along the pools in the rivers. The major river valleys of the Jerdacuttup, Oldfield, Lort and Young Rivers also served as protection and solace from the more extreme weather of the coastal regions in winter and offered and provided the focal points of traditional subsistence activities. Numerous archaeological sites which are recorded upon the Department of Indigenous affairs Aboriginal sites register attest to the importance of these valleys as places of prehistoric occupation.

Historical records show that Esperance was settled by European's in the mid 1860's by the Dempsters family (Rintoul 1986) and that from this time onward there was a noticeable decline in the Aboriginal population due to the infectious diseases brought with white settlement which typhoid, diphtheria, influenza, cholera and other diseases that had a detrimental effect on the traditional Aboriginal way of life.

As a result of disruption to the traditional Aboriginal way of life, the Esperance population of Aboriginal people became increasingly inter-mixed with other South West Aboriginal populations. Records show that the early pioneers such as the Dempsters and the Moirs received numbers of Aboriginal people that were sent to the area as prisoners or brought in as shepherds to work on these early stations. Aboriginal shepherds were used until the 1940's in the region as the local economy consisted of wool production and relied on the cheap labour that had been used in the past.

The Ravensthorpe area was first surveyed by the Western Australia Surveyor General John Septimus Roe in 1848. It was Roe who named many of the features in the area. From the summit of Mount Madden Roe named Mount Short after the Bishop of South and Western Australia and Ravensthorpe after the bishop's old parish in England. He also named the Phillips and Young Rivers and Mount Desmond.

The Ravensthorpe area was first explored by John Hassel who used Noongar guides to find good grazing country 100 miles east in Jerramungup, where he took up another 20,000 acres of land. In 1850 he extended his lease to 44,000 acres. The site of the Hassel's Jerramungup homestead is the exact place that his Noongar guides had told him was an important corroboree ground, alongside a fresh water creek (Eades & Roberts 1984).

In 1861, the Hassel's shepherd Storey was fatally speared by natives when tending his flock near Jerramungup (Forrest and Crowe 1996). Apparently, Storey was a ticket-of leave man who could not bear arms. Thus he was easily overpowered by the Noongars who claimed to have rights to the sheep being grazed on their traditional lands.

At this time, in the south coastal areas, the pattern of settlement was reminiscent of the large pastoral holdings of the northwest, rather that the south western agricultural districts. In 1864, the colonial administration instituted land regulations which explicitly applied to all Crown Lands within a defined area, south of the Murchison and west of line drawn between Hopetoun and Esperance, which effectively denied the traditional relationships of Noongars to the land in the area (Forrest and Crowe 1996). Outside of this area, the regulations '...recognised the Noongars' right to enter, at all times, the unenclosed or enclosed but otherwise unimproved parts of the pastoral lease, for the purposed of seeking sustenance in their traditional manner' (Biskup cited in Forrest and Crowe 1996:37).

In 1868, John Dunn took up a lease of 28,000 acres in the hills to the northwest of the current Ravensthorpe town site (Archer 1979). John Dunn selected a block about 20 miles up the stream 'Cocanarup' where the Noongars said that the water was always fresh (Eliza Dunn, John's sister in a letter written in 1882 or 1883, reproduced in Archer 1979:185). With the help of Noongar shepherds, John Dunn and his brothers cleared their land, and three years later, they brought the first flocks to 'Cocanarup '(Archer 1979). Their wagon track from Jerramungup (the Hassel's station) to Cocanarup became the road, and with a few alterations, is still the main road to Albany and Broomehill (Archer 1979). The Dunn brothers had their goods and stores brought by boat to a place called Mary Anne Haven and Mary Anne Point, which is the area now known as Hopetoun (Archer 1979). Around 1875, after the previous year's attempts to cart the wool by tracks to Albany had failed, the Dunn brothers built a stone hut and shearing shed about 2 miles from the harbour so that the wool could be sent to Albany by boat (Archer 1979).

In 1872, at the same time that Dunn's settled 'Cocanarup', John Moir settled Fanny's Cove to the east of Hopetoun. It was not long before Moir was experiencing difficulties with the Noongars who were stealing his sheep and robbing his camps, and in 1876 he was fatally stabbed with half a hand blade shear after disputes over his sheep (Archer 1979, Eades and Roberts 1984).

In February 1880, John Dunn was fatally speared by Aboriginals on his property 'Cocanarup'. Various news reports of the time, together with information relayed by his sister some two or three years later, suggests that Dunn was speared through the neck by a small party of Noongars alone in the bush not far from his homestead (Archer, 1979; Eades and Roberts, 1984). Oral histories of the event held by the Noongar community suggest that the spearing was necessary according to tribal law, as John Dunn had been having inappropriate sexual relations with young Noongar women when the men were away droving (Eades and Roberts 1984, Forrest and

Crowe 1996). Other accounts from settlers say that the spearing was due to trouble with sheep stealing (Archer 1979, Anon 1995).

Some two or three years later, John Dunn's brother James was speared, although not fatally, when relations between the Noongars and the settlers had deteriorated, again due to the continued appropriation of sheep (Eliza Dunn, cited in Archer 1979:187). In retaliation for one or possibly both of these attacks, it appears that the remaining Dunn brothers, together with other settlers from the district and possibly police also, led a reprisal attack on the local Noongar population, killing many men, women and children (Eades and Roberts 1984, Forrest and Crowe 1996, Anon, 1995). The site of this massacre was on the Phillips River not far from the Cocanarup Homestead. Locals such as Mr Rodney Daw say that when the Phillips River is in flood skeletal remains are often uncovered from this event (R Daw per com 2001).

Despite the virtual absence of published historical accounts of the reprisal attack known as the Cocanarup Massacre, there is a substantial body of oral tradition held by descendants of the survivors of the massacre that supports the actual existence of the massacre (Eades and Roberts 1984).

One account of the massacre that reportedly comes directly from James Dunn says that the massacre did not occur until 1883, following James' spearing by Noongars. According to this version:

> "His brother, Walter was enraged by this, packed two horses and rode around the property shooting men, women and children, anything that was black and moved. Altogether he shot at least 17 people on the property itself. The local Nyungars took to the hills. They moved eastward towards the Bremer Range or the Dundas Lakes, which is very dry country. Walter Dunn pursued them and went as far as he could before his water supply ran low. On the way back, he poisoned with strychnine all the water holes. The Nyungars on returning died agonising deaths after drinking the water, and made signs on the ground so that the others would not drink the water. According to this version of the story, half of the Aboriginal population of the area was wiped out by this one event. Thence the area became taboo and the Nyungars moved out, never to return" (Eades and Roberts 1984:5).

Another version of the massacre provided by Eades and Roberts (1984:5) suggests that:

> "...following the murder of John Dunn, a police officer was sent out from Albany. He was empowered, or took upon himself the power to declare what was known in the region as an 'open season'. The settlers had discussed the situation and decided to teach the blacks a lesson. For a month or so, the police would agree to turn a blind eye to any violence. Dunn's, Hassel's and Moir's were all involved and were more or less free to shoot or punish any Aboriginal in any way they chose...many Nyungars are said to have been killed, men, women and children. A vigilante group consisting of members and white employees of the three families is said to have pursued the remnants of the 'trouble-makers' out to the Dundas Lakes, north of Esperance, and killed them there."

According to Eades and Roberts (1984), the Dunn's were known to have spoken out about 'solving the native problem at the local level'. A third account of the massacre is probably the most common. This account says that the massacre occurred following the death of John Dunn, when many of the local Noongars were returning from station work on the coast or on other properties:

> "...when the men and boys were returning from their labours to the south and south-west of Cocanarup they were ambushed by a group of settlers who included members of all three families (the Dunn, Moir and Hassel families). They were slaughtered at a place just south of the creek and their bodies thrown into a mass grave about 100m from (John) Dunn's resting place. Other dead may have been dumped in a laterite cave south of the creek." (Eades and Roberts 1984:6)

Although the accounts of the massacre differ in some aspects, it is clear that the massacre did occur, with some killings occurring on the property 'Cocanarup', and some killings occurring further east. Following the massacre, all of the remaining Aboriginals are said to have fled from the district to surrounding areas and pastoral properties, never to return to the Ravensthorpe area (Eades and Roberts 1984, Forrest and Crowe 1996, Gallant, Gray 1992). The Ravensthorpe area has been regarded as a '*Wara*' area by Noongar's ever since.

According to Eades and Roberts (1984:7):

> "Many Nyungars today speak with deep feeling about this wild, windswept country. They tell stories of the old folk that they lost in the massacre and recall how their mothers warned them to stay out of that area. ...The whole region has bad associations and an unwelcoming aura for them."

ARCHIVAL RESEARCH

Archival research involved an examination of the Department of Indigenous Affairs (DIA) Sites Register, a review of any relevant site files, and a review of any unpublished ethnographic reports that relate to the Hopetoun area.

SITES REGISTER SEARCH

A search of the DIA Sites Register was conducted, prior to the field survey taking place in November 2009, by auto download onto a cadastral base by Arch GIS from the Department of Indigenous Affairs (DIA) FPT site.

A further sites register search was conducted at the online division at the Heritage and Culture section of the DIA prior to finalising the survey report to ensure no new sites had been recorded within the designated survey areas (See Appendix: 1).

The above searches revealed **no previously recorded ethnographic Aboriginal heritage** sites to be located within the Hamersley Drive and materials pits survey area within the Fitzgerald National Park.

The above searches revealed **no previously recorded ethnographic Aboriginal heritage** sites to be located within the proposed gravel extraction pits on Lot 6382, accessed via Steeredale Road.

The above searches revealed **no previously recorded ethnographic Aboriginal heritage** sites on the Culham Inlet sandpit Lot 95 Hamersley Drive.

The nearest previously recorded Aboriginal Heritage Sites are sites ID 4934 West Beach and site ID 19596 Location G Gnamma Hole.

Site ID 4934 West Beach's DIA coordinate locates the site 65m south east of the car park at West Beach. The site will be potentially affected by the proposed upgrade to the car park should the car park be widened.

Site ID 19596 Location G Gnamma Hole DIA coordinate locates the site 630m west of the south west corner of proposed gravel pit B and 560 southeast of the southeast corner of proposed gravel pit C and will not be affected by the materials extraction proposal at Lot 6382 Steeredale Road (see Appendix :3 for maps of archaeological sites).

As these sites are archaeological a full analysis of these sites nature and extent is contained in the separate archaeological report by Guilfoyle 2010.

REVIEW OF RELEVANT SITE FILES

As there are **no previously recorded ethnographic sites** located within the study area, there are not any site files to review.

For a full summary of the location, nature and extent of DIA sites ID 4934 West Beach and site ID 19596 Location G Gnamma Hole see Guilfoyle 2010 in the accompanying report.

REVIEW OF RELEVANT ETHNOGRAPHIC REPORTS

Gallant, H, No date, *Research of Aboriginal History along the South Coast Region of Western Australia.* Unpublished report prepared for Greenstone Resources.

This report compiles many different historical sources relating to the Aboriginal history of the south coast region, including the Jerramungup and Hopetoun areas. The report includes reproductions of explorer's journals, station ledger books, police records, Native Welfare Department records, Mission records, letters to magistrates, and newspaper articles. The report documents information relating to the 'Cocanarup Massacre'. In support of suggestions that Aboriginals have avoided the Ravensthorpe area since the massacre occurred in the 1880's, a 1902 report on the Aboriginals of Ravensthorpe by the Native Welfare Department's travelling Inspector G.S. Olivey states 'There were no natives at town when Olivey arrived. They had all gone to the coast. Police here informed Olivey that there were never many Aboriginals around Ravensthorpe'.

Eades, A, and Roberts, P, 1984, *Report on Documentation of Research into Aboriginal Involvement in the Land in the Southwest Region of Western Australia,* An unpublished report on community consultations for the Seaman Land Inquiry.

This report, undertaken as part of the 1984 Seaman Land Inquiry, discusses the reasons for the apparent absence of Noongar people in the areas between Jerramungup and Ravensthorpe. In particular, the report provides a historical profile from a Noongar perspective, of Noongar involvement in the establishment of pastoralists in the area from the 1850's to the 1880's. The report provides several accounts of the little documented 'Cocanarup Massacre', which is thought to have occurred as a reprisal for the spearing of John Dunn, one of the area's white pioneers, by a local Aboriginal in 1880. There are no published historical accounts of the massacre, and this report provides various versions of the massacre which have been maintained by oral tradition passed down by the survivors of the massacre, which may number as few as three. The report presents three commonly known versions of how the massacre occurred, and although the accounts differ slightly in details and location, it is suggested that there is a baseline of information which indicates that the massacre actually occurred. The report suggests that although the exact location and extent of the massacre is unknown, it is clear that some killings occurred on the property 'Cocanarup' whereas other killings took place further east, possibly as far as the Dundas Lakes, to the south of Norseman. The report suggests that several discoveries, over the years, of human skeletons near Ravensthorpe on the Phillips River, have been acknowledged to be remnants of the massacre. The report concluded that Noongar people still avoid the Ravensthorpe area because of the Cocanarup Massacre.

Dortch, C, 1987, *Search for Aboriginal sites in proposed gravel reserves, Ravensthorpe District.* Unpublished report prepared for the Shire of Ravensthorpe Department, Albany.

This survey examines six gravel reserves (borrow pits) in upland areas of the Ravensthorpe Shire. The survey failed to find any Aboriginal heritage sites, but suggested that the lack of sites does not mean that the district was not used by Aboriginals during the traditional or historic period. Rather, the report noted that stone artefacts are present on disturbed ground in the vicinity of Cordinup Soak (2 km ESE of the Ravensthorpe town site), and suggested that numerous other open-air sites, mostly the remains of camping places, are present likely to be in the wooded sandy valleys in the district along creeks. The report concluded that the river valleys were most probably the focal points of Aboriginal occupation and movement throughout the district, and suggested that the most important sites are probably open-air campsites in the alluvium along the Jerdacuttup River, 8 – 12 km east of the town site.

Gray, R, 1992, *Ethnographic study of portions of the Shire of Jerramungup including the Fitzgerald National Park.* Unpublished report prepared by the Department of Aboriginal Sites.

This report documents Aboriginal heritage sites in parts of the Shires of Jerramungup and Ravensthorpe, including parts of the Fitzgerald National Park. The report does not record any Aboriginal heritage sites in the vicinity of the Ravensthorpe town site and discusses oral tradition relating to the Cocanarup Massacre. The report suggests that Aboriginal people have generally avoided the Ravensthorpe area since the massacre in 1880.

Dortch, C, and Dortch, J, 1993, *Search for Aboriginal Sites in Proposed Dam Catchment Extension and Gravel Source, Ravensthorpe Shire, Western Australia.* Unpublished report prepared for the Water Authority of Western Australia.

This survey searched for Aboriginal heritage sites within the Water Authority's proposed 2ha dam extension and 4 ha gravel pit located 6-8 km south of Ravensthorpe, on the upper reaches of the Manyutup Creek, a tributary of the Phillips River. The survey discovered one archaeological site, a partially destroyed diorite artefact quarry-flaking floor, within the area of the proposed dam extension. The report highlighted the paucity of ethnographic information about the Ravensthorpe area, and suggested that the more barren and upland habitats around Ravensthorpe 'have an exceptionally low priority in terms of their cultural significance to present-day Noongar communities'. The report concluded that the archaeological value of the upland divides (as opposed to the river valleys) appears to be equally low, although 'finds of stone arrangements are a real possibility in future investigations'.

Chown, B, 1997, *An Ethnographic Survey of the Rav 8 Nickel Mine.* Unpublished report prepared by Tamora Consultants upon behalf of Tectonic Resources NL Ravensthorpe.

This survey was conducted in an area identified for the Rav 8 Nickel Mine Leases. These leases are located on the north side of the South Coast Highway approximately 25km east of Ravensthorpe, with the eastern extremity of the leases adjacent to Bandalup Creek. During this survey a number of potential burial sites were identified in this eastern portion of the leases, on the west side of Bandalup Creek at GPS coordinates 250351mE 6278751mN. The Aboriginal informants requested that the mining company conduct archaeological investigations of these potential burial mounds to establish if they were in fact a burial ground and if so, for the mining operations to avoid impacting upon the area. No other issues were identified during this survey.

Parker, R, 1998, *Ethnographic Report: Comet Resources NL Ravensthorpe Nickel Project.* Unpublished report for Kaiser Engineers prepared on behalf of Australian Interaction Consultants.

This ethnographic survey examined five tenements proposed for nickel mining to the south and east of Ravensthorpe and Hopetoun. On-site consultations were held with representatives of several, but not all, groups with current Native Title Claims over the project area. No ethnographic sites were reported within the area of the tenements, and the report provided no ethnographic information relating to the Ravensthorpe area.

Parker, R, and Corsini, S, 1998, *Work Clearance Survey of the Ravensthorpe Nickel Project for Kaiser Engineers PTY LTD and Comet Resources NL*, an unpublished report prepared for Kaiser Engineers PTY LTD on behalf of Australian Interaction Consultants.

This survey for archaeological sites was conducted within three areas proposed for nickel mining, Bandalup North, Bandalup Central and Bandalup South project areas, located to the south and east of Ravensthorpe and Hopetoun. During this survey the archaeological site Jerdacuttup 1 & 2 Site ID 2032 was located. The site is an artefact scatter .No ethnographic sites were located at the time of this survey.

Goode, B, 1999, *Desktop Aboriginal Heritage Survey for an Optic Fibre Cable Route between Hopetoun and the South Coast Highway, Shire of Ravensthorpe, Western Australia.* Unpublished report prepared for Telstra Corporation, Stirling Street Perth WA.

This report was prepared by Mr Brad Goode, Consulting Anthropologist, for proposed Optic Fibre cable that was to be installed by Telstra that transverse the Hopetoun Ravensthorpe area beginning at the intersect at the Hopetoun Ravensthorpe Road and Lee Road travelling north-east along North Jerdacuttup Road and finishing within a pit on the South Coast Highway opposite Rockhole Road east of Ravensthorpe. The purpose of the study was to identify any known and previously recorded Aboriginal heritage sites that may be impacted by the installation of the Optic Fibre cable. The study identified Site ID 2032 'North Jerdacuttup River 1 & 2', Site ID 1780 'Jerdacuttup River', Site ID 15148 'Bandalup Rock Pool', Site ID 15150 'Bandalup Rockhole' and Site ID 18950 'Gnamma Hole' was located within the vicinity of the Optic Fibre path. None of these sites would be impacted upon by the Telstra proposal.

Goode, B, 2004a, *A report of an Aboriginal Heritage Survey, for a Road Upgrade Project in the Ravensthorpe Shire of Western Australia.* An unpublished report prepared for the Shire of Ravensthorpe.

This survey was commissioned by the Ravensthorpe Shire who planned to upgrade three roads in anticipation of the BHP Ravensthorpe Nickel Mine proceeding. It was necessary to upgrade Lee Road between the Hopetoun Ravensthorpe Road and Jerdacuttup North Road, Jerdacuttup Road between Lee Road and the mine and Tamarin Road from Jerdacuttup Road to Middle Road, from Middle Road along Jerdacuttup Road to the South Coast Highway. Most of the road works involved the adding of gravel to the existing road and then sealing the road. Several areas involved more significant road works. These road works included improving two curves on Lee Road, lowering of a crest on Jerdacuttup Road and the realignment of the intersection of Lee Road and Jerdacuttup Road near the Jerdacuttup River crossing. During this survey the Jerdacuttup River was identified to be a site of mythological significance in association with Waugal beliefs (Marchant beliefs). The upgrade of the river crossing on the Jerdacuttup River could proceed with community support under a Section 18 clearance of the Western Australian Aboriginal Heritage Act (1972). No other issues were identified during this survey.

Goode, B, 2004b, *An Aboriginal Heritage Survey, Kundip Haul Road, Shire of Ravensthorpe, Western Australia.* Unpublished report prepared for Tectonic Resources NL.

This survey was conducted as a result of Tectonic Resources NL need to build a mine haul road between their mine at Kundip and their proposed processing plant located on the South Coast Highway. The route of the proposed haul road follows Hatfield Road and then an unnamed road easement that has been gazetted since 1930. The proposed haul road was to be 17.125 kilometres long with gravel surface and was to be 6 to 10 meters wide including the shoulders and drainage. The width of the gazetted road easement is between 20 and 40 meters. Hatfield Road was an existing gravel road that was to be upgraded. The survey identified that the road would impact upon Site ID 2032 'Jerdacuttup River' a mythological site in association with Waugal beliefs (Marchant beliefs) and would require clearance under Section 18 of the Aboriginal Heritage Act (1972). The survey also discussed the fact that archaeological sites were most likely to be found along the riverine valleys that were used as the focal points and highways for traditional Aboriginal people in the area. The survey discussed the lack of historical association with the Ravensthorpe area by Aboriginal people due to the 'Cocanarup Massacre'. The survey also identified an ochre site adjacent to the road easement on a south facing slope in the vicinity of the Jerdacuttup river crossing. This site was recorded and reported in Greenfeld (2004).

No other issues were identified.

Goode, B, & Harris, J, 2005, *An Aboriginal Heritage Survey for Road Upgrades South Coast Highway SLK 290-415 And Hopetoun Ravensthorpe Road SLK 0-15, Western Australia.* A report prepared for GHD Consultants on behalf of Main Roads Western Australia.

This survey was conducted on behalf of Main Roads who were proposing to upgrade sections of the South Coast Highway and the Hopetoun Ravensthorpe Road over a five year period. The works proposed were to enhance safety concerns and allow a continual flow of traffic due to heavy haulage vehicles by widening the road and creating overtaking lanes. It was identified that the Jerdacuttup River (Site ID 21378) a site of mythological significance bisects the South Coast Highway, however the proposed works would not impact upon the site. Numerous other previously recorded sites were also located within the project area, however were all determined to not be affected by the proposed works (Site ID 15151 Bandalup Burials, Site ID 18950 Gnamma Hole, Site ID 1414 Young River Bridge Camp, Site ID 1415 Young River Burials, Site ID 1416 Lort River Burials and Site ID 17798 Coomalbidgup Swamp).

During the survey the three main river systems that ran through the project area, including the Jerdacuttup River, Oldfield River and the Young/Lort River systems were identified as sites of mythological and domestic significance. Specific stories were reported with regards to the Young/Lort River system:

> "*Walitj benerwenerup*" – The Young River
> The Noongar people camped along the banks of the Young River, because the Eagle chased them all away from the fresh water. He wanted to keep it for all himself and not share with anyone. One day all the fresh water dried up. The eye of the Crows which were the people had all turned white because they were forced to drink salty water. The Crow and the Eagle then had a big fight and the Crow speared the Eagle and killed him. The Eagles wife, the Mallee hen dragged his body way down to the estuary of the river and buried his body on the east side. Because of the Mallee hens scratching up of all the sand to bury her husband, her foot markings can still be seen today. The hill on the east side looks like a Mallee hen's nest, where the Walitj is buried."(pg 32)

The river systems were also reported to be associated with the mythological snake called the '*Marchant'* in the Ravensthorpe area. The Aboriginal consultants advised that it is the general belief of Aboriginal people that water courses are of significance due to their association with serpent creators. Mr Reynolds stated that the Jerdacuttup River was significant in relation to a dream time story about its creation that involved a bird, possibly an eagle. Mr Reynolds said that '*Jerda*' meant bird and '*cuttup*' means head, therefore '*Jerdacuttup*' translates birds head.

During this survey Ms Lynette Knapp also reported a Ceremonial site reported to be located east of the Ravensthorpe town site south of the South Coast Highway 500 metres east of Elston Street at 226945mE 6280706mN .Ms Knapp reported that whilst travelling through the area her parents and larger extended family would often stop and camp north of the highway while her uncle, Mr Albert Knapp would attend the ceremonies. Ms Knapp stated that her father told her about these events which she believed occurred around 1914.

It was recommended to Main Roads that if any sites of significance as identified during the survey were to be impacted upon by the proposed works, that approval under Section 18 of the Western Australian Aboriginal Heritage Act (1972) would be required prior to work commencing. As a condition of a Section 18 being applied for it was also recommended that any disturbance works would need to be monitored by the Aboriginal community.

Cue K, Goode B, Greenfeld P, & Irvine C, 2008, *An Aboriginal Heritage Survey of the Mt Cattlin Project area, Ravensthorpe, South Western Australia*, Prepared for Galaxy Resources Limited.

In November 2008 Galaxy Resources commissioned Deep Woods Survey's Pty Ltd to conduct a 'site identification' Aboriginal Heritage Survey of mining leases M74-197, M74-196, M74-155, M74-182, M74-012 and M74-159 at Mt Cattlin in Ravensthorpe. During the survey 4 artefact sites were recorded along the margins of a creek line that ran centrally through the survey area. Noongar consultants advised that should development proceed that the material should be fully recorded, salvaged and stored in a repository on site until the material can be reinstated as a part of the environmental rehabilitation post mining.

During the survey one Noongar consultant reported the existence of a ceremonial area located adjacent to the South Coast highway just to the east of the town. From the information given and research conducted the veracity of the report could not be substantiated and as such the consultants recommended that this report site be accessioned as stored data. While no ethnographic sites were identified during the survey members of the Noongar community determined that the creek lines that ran through the area were likely to have been traditional migration paths where people migrated to the coast from the ranges to the north via the Jerdacuttup River valley to the south east of the survey area.

OUTCOMES OF ARCHIVAL RESEARCH

As a result of research conducted for this project **no** previously recorded DIA ethnographic Aboriginal Heritage sites were identified to be located within the three designated survey areas.

It is the view of the authors of this report that this is due to two factors. Firstly the areas in question have not be subject to rigorous ethnographic enquiry as there has only been a small and limited number of commercial heritage surveys conducted in the region in recent years. Secondly, due the events at Cocanarup late last century, there has been a considerable attenuation of traditional religious knowledge lost to the descendants of the areas traditional Aborigines.

What knowledge that does exist is generally associated with the importance of the coastal inlets to Noongar people's traditional economies for fishing, and for mythological associations with waterways in terms in the belief that the '*Marchant'*, a local variant of the Rainbow Serpent, a mythic snake that is said to have created and is the guardian of water.

While it is unlikely that contemporary Noongar consultants will have specific traditional stories about these waterways per say it is likely that they will hold contemporary values in regards to their importance as defined above.

As such **it is recommended** that Main Roads makes all efforts to minimize any affects to waterways during this project. '

IDENTIFICATION OF SPOKESPEOPLE

THE RIGHT TO SPEAK ON HERITAGE ISSUES

Various authors have discussed the contemporary problem of who in the Aboriginal Community has the authority to speak on heritage issues within an area. O'Connor et al. (1989:51) suggest that when this question is posed to people in Aboriginal Australia, answers are usually framed by such terms as 'the traditional owners', i.e., those people who are defined by place of birth i.e. descent. Meyers presents a broader and more contemporary view of 'ownership' based upon descent and association:

> "An estate, commonly a sacred site, has a number of individuals who may identify with it and control it. They constitute a group solely in relationship to this estate. Identification refers to a whole set of relationships a person can claim or assert between himself or herself and a place. Because of this multiplicity of claims, land holding groups take essentially the form of bilateral, descending kindred. Membership as a recognised owner is widely extended" (cited in Machin 1993:22).

Meyers then goes on to further clarify the current perception of 'ownership' when he states:

> "....such rights exist only when they are accepted by others. The movement of the political process follows a graduated series of links or claims of increasing substantiality, from mere identification and residual interest in a place to actual control of its sacred association. The possession of such rights as recognised by others, called 'holding' (kanyininpa) a country, is the product of negotiation" (Ibid.).

While the notion of descent is clearly an important criterion within Meyer's analysis, it must be seen in terms of the contemporary Nyungar situation. Nyungar tradition in the south west has been seriously eroded since colonisation, lines of descent have been broken and previously forbidden and mixed marriages have interconnected many Nyungar groups who would not have traditionally had a close association (Ibid.). Consequently, in contemporary times the criteria of historical 'association' seem to be important in regards to the 'right to speak' on heritage issues within an area.

> "Traditional subsistence no longer sufficed to support Aboriginals so they combined this with menial work on farms and over time new relationships to land developed. As a consequence, the more recent history associated with their involvement with European agriculture and labour patterns is often more relevant than the pre-contact mode of attachment to an old way of life and the roots of the identity as original owners of the land. Biographical associations are often tied to post-settlement labour patterns and identification. These can predominate. This is part of a dynamic process of ethnicity, identity and tradition" (Machin 1995:11)

O'Connor, et al. (1989) identified several criteria for determining contemporary community spokes people. A spokesperson must have a long-term association with an area, usually as a young person, and had extensive contact with a member or members of the 'pivotal generation of the culture transmitters'; those people whom, as children themselves, had contact with people who could pass on their traditional knowledge. A spokesperson must also demonstrate knowledge of the region's natural resources, its hunting, fishing and camping grounds, its local water sources, and the flora. This is important because a person without this knowledge is unlikely to be seen by their fellow Nyungars as truly being from that country, despite having been born or lived in that area. In some cases, people from outside a specific region have established themselves by political activism. They are accepted by their fellow Nyungar because they may have participated in mainstream white pursuits, such as advanced education, or legal and political careers, that have empowered them within the broader community. As such, these people are a valuable resource to the local Aboriginal Community. The people consulted in this survey fulfil at least one of these criteria.

NATIVE TITLE CLAIMS OVER THE SURVEY AREA

Currently, there are two registered Native Title applications and one unregistered application that overlays the project area, lodged with the Register of Native Title Claims and the Schedule of Applications held by the Commonwealth Native Title Tribunal. The Schedule of Applications includes registered applications, unregistered applications, and applications still undergoing the registration test.

- **Southern Noongar WC96/109**

  Applicants:
  Mr. Aden Eades, Mr. Allan Bolton, Mr. Cedric Roberts, Mr. Dallas Coyne, Mr. Glen Colbung, Ms. Joyce Winsley and Ms. Rita Dempster.

- **Wagyl Kaip WC 98/070**

  Applicants: Mr. Allan Bolton, Mr. Cedric Roberts, Mr. Glen Colbung, Mr. Ken Colbung, Mr. Kevin Miller, Mr. Mark Smith, Mr. Sam Miller, Ms. Hazel Brown, Ms. Marlene Ware, Ms. Mingli Wanjurri-Nungala, Ms. Rita Dempster and Ms. Rose Pickett.

- **Single Noongar Claim (Area 1) WC03/006 (unregistered)**

  Applicants:
  Anthony Bennell, Alan Blurton, Alan Bolton, Martha Borinelli, Robert Bropho, Glen Colbung, Donald Collard, Clarrie Collard-Ugle, Albert Corunna, Shawn Councillor, Dallas Coyne, Dianna Coyne, Margaret Colbung, Edith De Giambattista, Rita Dempster, Aden Eades, Trevor Eades, Doolan-Leisha Eattes, Essard Flowers, Greg Garlett, John Garlett, Ted Hart, George Hayden, Reg Hayden, John Hayden, Val Headland, Eric Hayward, Jack Hill, Oswald Humphries, Robert Isaacs, Allan Jones, James Khan, Justin Kickett, Eric Krakouer, Barry McGuire, Wally McGuire, Winnie McHenry, Peter Michael, Theodore Michael, Samuel Miller, Diane Mippy, Fred Mogridge, Harry Narkle, Doug Nelson, Joe Northover, Clive Parfitt, John Pell, Kathleen Penny, Carol Petterson, Fred Pickett, Rosemary Pickett, Phillip Prosser, Bill Reidy, Robert Riley, Lomas Roberts, Mal Ryder, Ruby Ryder, Charlie Shaw, Iris Slater, Barbara Stamner-Corbett, Harry Thorne, Angus Wallam, Charmaine Walley, Joseph Walley, Richard Walley, Trevor Walley, William Webb, Beryl Weston, Bertram Williams, Gerald Williams, Richard Wilkes, Andrew Woodley, Humphrey Woods, Dianne Yappo, Reg Yarran, Saul Yarran, Myrtle Yarran, Ken Colbung.

SELECTION OF SPOKESPEOPLE FOR THIS SURVEY

The selection of spokespeople for this survey was based on advice given by the South West Aboriginal Land and Sea Council (SWALSC), the Albany Office of the DIA and a number of prominent Noongar working party members of the Southern Noongar WC96/109 and Wagyl Kaip WC 98/070 Native Title Claim groups in the region.

In terms of organizing the survey Mr Vernice Gillies (nee Coyne), a prominent working party member at SWALSC and former DIA officer, was tasked with making contact with the Noongar community and arranging the participation of those who the above organizations had advised were appropriate to speak for the region. Ms Gillies in consultation with the above agencies provided the consultants with a list of people to be consulted for the survey. This list was verified by research from previous reports in the area and by reference to the consultants own knowledge of the areas Noongar associations gained by in excess of 10 years working in the region.

As a result of this pre-consultation process, the following Noongar people were selected to participate in the survey:

Mr Bill Woods was born in Borden to parents Mr Jack Woods (born in Jerramungup) and Sara Clara James or '*Yettung'* (born in Kendenup). Mr Bill Wood's grandmother on his mother's side was *Kitty Nordy* or '*Yirabirnan*' who was born in Ravensthorpe and married a man of Chinese decent. Mr Bill Wood's grandmother on his father's side was Rachel Brotheridge-Toovey (Jerramungup) who married Peter Royal Woods an Englishman. Mr Bill Woods Noongar ancestry on his father's side can be traced back a number of generations to European settlement on his father's mothers side with his great grandfather being '*Ngurabirding'* (Jerramungup) and great grandmother being '*Waiaman'* (Yauangup near Kattaning), and even further to *Ngurabirding's* parents, who were *Yajan* (of Balerongin) and *Gebaritch* (of Jerramungup). Mr Woods attended school in Mt Barker and has since worked as a contractor for farmers in Ravensthorpe and the Great Southern as a shearer. Mr Bill Woods was selected to participate in the survey by nomination from Mr Dallas Coyne, Mr Aden Eades, and the Albany DIA in recognition of his family's descent and association with the Ravensthorpe/Jerramungup area.

Ms Lynette Knapp was born in Perth but has lived most of her life in Albany. Ms Knapp's Minang bloodline comes through her great grandmother on her father's, father's wife's side. Ms Knapp's father was Alfred Knapp who was born in Albany; her grandfather was Johnny Knapp who was born at the Thomas River at Cape Arid but who spent many years travelling the South Coast region doing farm work. Johnny Knapp helped with the construction of the Palace Hotel in Ravensthorpe. Ms Knapp's great grandfather was *Wural* who was from the *Bibul* moiety; his parents were *Djinidjanan* and *Midan* from the Warren River. *Wural's* wife, and Ms Knapp's great grandmother was *Jacburn* daughter of *Melagan* or *Nilgin* and *Barnangain*, who were from the Minang Moiety and was born at *Kurabilup*. Ms Knapp's mother's lineage is from the Frazer Range near Balladonia. Ms Knapp is a member of the Wagyl Kaip Native Title claim group. Ms Knapp's was nominated by other working party members to participate in this survey in recognition of her family's descent and association with the Ravensthorpe/Esperance area.

Mr Graeme Miniter was born at the Gnowangerup Mission to parents Mr Roy Miniter (Borden) and Ms Elaine Miniter nee Brown (Borden). Mr Miniter's grandparents on his father's side are Roy Miniter an Irishman and Esther Woods from Ongerup. Mr Miniter's grandparents on his mother's side are Hazel Brown (nee Roberts) and Harry Brown. Mr Miniter is connected to the apical ancestors Bob '*Peerup*' Roberts and '*Monkey'* on the Wagyl Kaip and Southern Noongar Native Title claims. The Roberts families' grandmother Emilie Dab was one of the few surviving witnesses of the Cocanarup Massacre which occurred near Ravensthorpe in the 1880's. Mr Miniter attended primary school in Borden, Mt Lockyer and Spencer Park and high school in Albany. Upon leaving school Mr Miniter has worked for the Education Department as an Aboriginal Liaison Officer, Department of Indigenous Affairs and the Southern Aboriginal Corporation as a program manager. Mr Miniter is the Chairperson of the Executive Board at SWALSC and a working party member of the Wagyl Kaip Native Title Claim group. Mr Miniter was nominated by other working party members to participate in this survey in recognition of his family's descent and association with the Ravensthorpe area.

Mr Aden Eades was born at the Gnowangerup Mission to parents Mr Fred Eades (Woodanilling) and Ms Ayplin Penny (Borden). Mr Eades grandparents on his mother's side are Agnes Woods (Jerramungup) and Chris Penny (Kojonup). Mr Eades grandparents on his father's side are Ethel Cornwall (Arthur River) and Alfred Eades. Mr Eades great great grandmother on his father's side was Alice Williams or *'Ilung'* (nee Davidson born at Bremer Bay) sister to Margaret Davidson from Ravensthorpe. Mr Aden Eades is connected to the apical ancestors Johnny Penny and Maggie Pickett/ Piggot/Starlight on the Wagyl Kaip and Southern Noongar Native Title Claims. Mr Eades grew up and went to school at the Gnowangerup Mission. Mr Eades has lived and worked in the Jerramungup region as a contractor for farmers shearing sheep and clearing farmland throughout his life and currently resides in Albany. Mr Eades also has held positions at the Southern Aboriginal Corporation as a project officer. Mr Eades is a working party member and an applicant to the Southern Noongar Native Title Claim.

Mr Aden Eades was nominated by the DIA and other working party members to participate in this survey in recognition of his family's descent and association with the Ravensthorpe area.

Mr Errol Williams was born in Albany. Mr Errol William's mother is Ms Jane Williams from Gnowangerup. Mr Williams grandparents on his mother's side are Jack *Wibbin* (Jerramungup) and Fanny Williams or '*Nainyan'* (Chillinup). Mr William's great grandparents on his mother's side are Jimmy Williams or '*Kagaritch*' from Ravensthorpe and Rose Williams or '*Mungoe'*. Mr Williams attended primary and high school in Katanning and is currently working as an ALO for Great Southern GP network. Mr Errol Williams was nominated by the DIA and other working party members to participate in this survey in recognition of his family's descent and association with the Ravensthorpe area.

Mr Alwyn Coyne was born in Albany to parents *Jessie Wandagee* (Carnarvon) and Sydney Coyne from Borden. Mr Alwyn Coyne's grandparents on his father's side were Edward James Coyne and Mary Anne Woods from Bremer Bay. Mr Alwyn Coyne traces his descent to apical ancestors on the Wagyl Kaip and Southern Noongar claims to Margaret Davidson (born Ravensthorpe died and buried in Ravensthorpe) and Fred Coyne. Margaret Davidson was the daughter of a Noongar woman named '*Jinny*' (Esperance) and an Englishman named Davidson. Mr Alwyn Coyne and went to school in Albany before embarking on a career with the public service as a councillor. Mr Coyne was nominated by the Coyne family to participate in this survey in recognition of his family's descent and association with the Ravensthorpe/Hopetoun area.

Ms Sandra Woods (nee Inel) was born in Albany to parents Mr John Woods and Alma Inel born in Borden. Ms Woods's grandfather was on her mother's side was Charles Inel born east of Gnowangerup at a place known as 'Little Jerramungup'. His father Jimmy Inel was born at Fanny's Cove on the Young River near Ravensthorpe. Ms Woods currently lives in Albany and was selected to represent the Inel family by her uncle Mr Stan Loo who at the last minute had to attend a family emergency and could not participate in the survey. Other members of the group supported Ms Woods's late inclusion in the survey team.

Mr Geoff Wynne was born in Albany to parents Keith Wynne (senior) and Mary Narrier. Mr Wynne's grandfather on his father's side was Fred Wynne, born in Jerramungup. Fred's parents were Jimmy Wynne and Kitty Nightly. Mr Wynne's grandmother on his father's side was Eileen Penny, born in Katanning. Eileen's parents were John Penny and Maggie Pickett. Mr Wynne's grandparents on his mother's side came from north east Goldfields. Mr Wynne completed his schooling to year ten in Albany in which time he was a very keen sportsperson. Mr Wynne was nominated by the Albany DIA to participate in the survey.

Mr John Penny was born in Narrogin and also attended schools there. His parents are Kelvin Penny and Elizabeth Penny. Mr Penny's grandmother on his mother's side is Marjory Woods, born at Borden. Marjory's parents were Jim Woods and Florae Colbung. Mr Penny's grandfather on his mother's side is Humphrey Smith, born in Kojonup. Humphrey's parents were Tommy Smith and Lilly Hough. On his father's side Mr Penny's grandparents are Laura Woods, from Gnowangerup, and Walter Penny, from Katanning. Mr Penney was nominated by the Albany DIA to participate in the survey.

Mrs Elaine Miniter **(nee Brown)** was born in Borden, the daughter of Mr Harry Brown and Ms Hazel Roberts. Mrs Elaine Miniter went to school in Borden and then later at Roelands Mission near Bunbury. Upon leaving school Ms Elaine Miniter worked in domestic services prior to being married and becoming a preschool teacher. Ms Miniter worked for 38 years in preschools in Albany and is a member of the Wagyl Kaip Native Title Claim group. Ms Elaine Miniter was selected to represent the Roberts family and invited to participate in the survey in place of her mother Ms Hazel Brown (named applicant) whose health precluded her from participation.

Mr Johno Woods was born in Albany to parents John Woods Senior and Alma Inel. Mr Johno Woods uncle is Bill Woods Senior a participant in this survey, Mr Woods traces his ancestors on the Woods side as the same bloodlines as described for Bill Woods. Mr Johno Woods's grandfather on his mother's side was Charles (Bullfrog) Inel born east of Gnowangerup at a place known as 'Little Jerramungup'. His father Jimmy Inel was born at Fanny's Cove on the Young River near Ravensthorpe. Mr Johno Woods's went to school in Gnowangerup and Borden and currently works in Horticulture in Albany. Mr Johno Woods's was nominated by the Albany DIA to participate in the survey.

COMMUNITY CONSULTATION

AIMS

- To establish contact with Aboriginal people who retain traditional or current knowledge pertaining to the region.
- To determine if there are any sites of significance as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) within the project area.
- To record any ethnographic information provided about identified sites.
- To generate consensual recommendations from the Aboriginal community representatives in regards to any Section 18 requests and to record management strategies for identified ethnographic and archaeological sites.

METHOD

Those selected to participate in the survey were contacted by phone, briefed as to the requirements for the survey and arrangements were made for the informants to be driven to the survey area with the consultants.

The survey began with a detailed briefing in Hopetoun aided by viewing the project plans on a large scale air photo map in relation to any previously recorded Aboriginal heritage sites. The survey participants were then driven along Hamersley Drive stoping at locations of interest such as beach access sites and creek crossings.

During the survey the group also meet the team from Applied Archaeology Australia and were then shown the artefact sites that they had recorded. The group made a through pedestrian inspection of these areas before giving the consultants there advice which was recorded in a note book, by voice recording and by photograph.

The survey teams also made a through pedestrian inspection of the materials extraction pits along Hamersley Drive, keeping out of Dia Back affected areas and then on a second site visit inspected all the materials extraction pits located at Lot 6382 Steeredale Road and lot 95 Hamersley Drive

COMMUNITY CONSULTATION PROCESS

On Friday the 15th of November 2009 the consultants; Mr Brad Goode (Anthropologist), Mr Colin Floyd Irvine (Assistant) and Mrs Vernice Gillies (ALO) met with representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups; Mr Bill Woods, Mr Aden Eades, Mr John Penny, Mr Alwyn Coyne, Ms Lynette Knapp, Mrs Sandra Woods (representing the Inel side of her family), Mr Geoff Wynne, Mr Errol Williams and Mr Graham Miniter in Albany and then drove to Hopetoun.

At Hopetoun Mr Brad Goode explained the details of the Main Roads development proposal. Mr Goode explained that as a result of funding for the 'Royalties for Regions' program, an initiative by the state government to provide funding for infrastructure in regional areas, it had been identified that a road upgrade to Hamersley Drive would be necessary to assist in the development of tourism in the area. The injection of funds was seen as necessary as the recent closure of the BHP Nickel Mine at Ravensthorpe had caused considerable economic hardship in the area and such a project was now necessary to stimulate the local economy providing much needed employment opportunities.

Mr Goode stated that the road upgrade would involve a 20m wide survey corridor either side of Hamersley Drive where the road would be widened by up to 2m meters and then sealed,

inclusive of the three beach access roads between the Culham and Hamersley Inlets within the Fitzgerald National Park (see fig 1, location page).

In order to source the materials to upgrade this road three gravel extraction pits, located along Hamersley Drive within the Fitzgerald National Park that have been previously used and partially rehabilitated, were required. With regards to the sites Mr Goode advised that these gravel extraction pits did have some areas where Die Back fungus was present however Main Roads would manage this issue in regards to compliance with environmental laws and would avoid these portions of the pits with the fungus to extract gravel.

Figure 4: Mr Colin (Floyd) Irvine, Mr Graham Miniter, Mrs Vernice Gillies and Mr Errol Williams viewing the project plans for the Hamersley Road upgrade. Location near the materials extraction pits

After this briefing the survey team drove to the Ranger's house on Hamersley Drive where the vehicles were washed down for contamination. The group then decided that a slow drive along the road corridor would be conducted and that the group would stop at each beach access road car park and inspect the area. The group also wished to walk the material extraction pit areas and stop at creek crossings to inspect any culvert locations.

The group then drove west along Hamersley Drive to the turn off to East Myilies Beach and then to Myilies Beach. Each of these spur roads were checked and the area around the car parks that would possibly be enlarged to cater for tourist busses were inspected on foot.

No heritage issues were identified during these inspections.

The group then continued west to the West Beach turn off and drove to the beach car park. Some of the group attempted to walk to the location of a previously recorded archaeological site (Sites ID 4934 West Beach) that lies adjacent to the car park but were unable to re-locate the site due to the thick scrub.

In regards to this site the group **recommended** that if the car park and turning area at West Beach needed to be enlarged and that if work proposed would affect the site then once the detailed plans were known then the group should be re-consulted regards the proposal.

In the interim the group requested that the archaeologists report detailing the nature, extent and significance of the site should be provided to the group so that they could make an informed decision if ministerial consent to disturb the area was required. If consent is sought, and approved the group said that Noongar monitors should be on site to assist the archaeologists with salvage and recording. At this stage the group could not determine a significance assessment of the site as they had little information upon which to base their views.

The group then stopped at the location of the first gravel extraction pit located to the west of the intersection with West Beach Road and Hamersley Drive. The group inspected the area and did not identify any ethnographic Aboriginal heritage issues; however they all stated that gravel should be sourced from an already cleared area and that they did not think it sensible to clear an area for gravel. The group pointed out that the area contained bush foods important to Noongar people and that the archaeologist had found some cultural material in the area.

In regards to the presents of isolated artefacts the group said that they provided evidence that their ancestors had used the area for hunting and camping and as such suggested that more material would be found if the area was cleared. The group stated that despite their objection if Main Roads continued with the proposal that Noongar people would need to assist archaeologists to monitor the clearing. The Noongar people present would then be able to provide a cultural interpretation of the material as opposed to a purely scientific analysis. Once the recording was complete the Noongar monitors could then advise the archaeologist where to redeposit the material in line with cultural beliefs. Artefacts are seen by Noongar people to be imbibed with spirits and removal of such material from the area in which it is found is considered dangerous; ‘things can follow you’ being a common comment made by Noongar people in this regard.

Figure 5: The survey team with Archaeologist Mr David Guilfoyle inspecting the second planed gravel extraction pit adjacent to Hamersley Drive to the west of the West Beach turn off; view west.

The group then continued a short distance (270m) west along Hamersley Drive to the second gravel extraction site. Here the group meet the team from Applied Archaeology Australia who were surveying the proposed gravel extraction area. The group assisted with this inspection being careful to keep away from the area marked upon the plan to contain dieback.

The group questioned why Main Roads would propose to take gravel from an area so close to a place already known to contain dieback. The group were not convinced that Main Roads could maintain an adequate quarantine during extraction operations and were concerned that dieback could be spread throughout the park. The group said they objected to any plan which would risk spreading of dieback in the park. The group explained that Noongar people rely upon a healthy ecology to maintain their cultural practices such as the collection of bush foods and that if the environment is harmed then so is Noongar culture.

The group then examined the third proposed gravel extraction pit. Here the same concerns were expressed. The group resolved that Main Roads should seek another solution to source gravel from an already cleared and clean area outside of the park. The group said that the vegetation in this park is internationally iconic and as such any risk should not be considered.

The group then drove to the Hamersley Inlet where they had lunch and discussed their knowledge of the area and potential heritage issues.

Figure 6: Members of the ethnographic survey team at the Hamersley Inlet. View to the northwest near the entrance to the sea.

Mr Alwyn Coyne said that it was his opinion that most Noongar people did not know of any specific traditional creation stories relating to this part of the coast as many of the traditional people had been massacred at Cocanarup and that this knowledge had not been passed on. Mr Alwyn Coyne said some of the survivors of the Cocanarup massacre were believed to have followed the Phillips River to the coast and dispersed into the Fitzgerald National Park and were then killed along the shores of the Culham Inlet.

Subsequently for many years following the Cocanarup massacre the entire area had been avoided by Noongar people and became '*Warra;* an avoidance area'.

Mrs Lynette Knapp reported that it was her belief that the location of Hamersley Drive followed the approximate location of the *bidi* or footpath used by the traditional Noongar people on their travels to places as far to the west as Ongerup.

Ms Knapp said that her family had told her that the traditional name for the hills near the Hamersley inlet was *Djuckarah*, Ms Knapp could not detail the meaning of the name or could not define the actual peak that the name referred to.

Mrs Knapp also reported a creation story that relates to the Hamersley inlet area:

> The *Younger* people from the Stirling Ranges organised a marriage with a young man from the *Waitch* people near Balladonia. When the young man travelled to the Stirling Ranges he found that he did not want to marry the girl as she was already pregnant The *Waitch* man tried to run away to return to Balladonia but was chased by the *Younger* people for breaking the arranged marriage. Clay pans along the Pallinup River are places where blood fell from him as the *Younger* people threw spears at him as he ran away. The people from Balladonia heard what was happening to the young man and they came to the area of the Fitzgerald River. There is a place where the *Waitch* people and the *Younger* people met and the *Younger* people threw their spears and the *Waitch* people crouched down and were turned to stone and are represented as stones at this place, this location is called *Nolla Waitch* (Emu Back). The spears thrown by the *Younger* people are also represented by the trees that grow alongside the road at Sculpture Hill. These trees are a strange spindly tree that grows in this area and is reminiscent of a spear. The young man was killed by the spears and can be seen in the hills to the north west of the Hamersley Inlet (*Whoogarup* Range).

The others in the group had no knowledge of these names or this myth. Ms Knapp could not determine any specific places within the survey area that relate to this myth.

In regards to issues with the road construction the group said that the creeks that are crossed over by the road were believed to have been used as access ways to the coast and the group believed there would be archaeology in those locations and that culvert installation would require monitors.

The group also said that the areas within the national park were still regularly used by Noongar people as places to camp and fish with their family groups. The group were concerned that increased visitation in the area may have adverse affects upon the cultural resources in the area and as such suggested that DEC should also consult with Noongar people regards management of this impact if the road upgrade goes ahead.

In regards to the road upgrade the group stated that they had no knowledge of any ethnographic sites in the area that would be affected by the work and were happy for the road to be widened and sealed as proposed, provided that any significant archaeological sites were avoided and that isolated the archaeological material was recorded and managed appropriately during construction.

During lunch and after this discussion the archaeologists joined the group and advised that they had now located a large archaeological site that contained numerous artefacts with a diverse array of lithologies and tool types. The archaeologists reported that the site had been located just to the west, of the turn off to West Beach, and extended to the west past the third gravel pit for an undetermined distance. The site followed an east west running canyon and river draining into the Hamersley Inlet (Guilfoyle 2010; 19).

The concentrations of archaeological material at the site, while generally some distance from the road, extended to the road on both sides and as such any plans to widen the road along this section would directly affect the site.

The archaeologists requested that the ethnographic survey team inspect the area in order to give a significance assessment and to provide cultural advice regards the affect that this discovery would have upon the development proposal.

Figure 7: Ms Vernice Gillie (nee Coyne) and Archaeologist Mr David Guilfoyle in the fore ground with the other members of the survey team in the background inspecting archaeological site 'Kurda Gorge Site'. View to the east

The group identified the site as being of **high cultural significance** and requested the site be recorded as a closed site with the group listed as the custodians of the site. Closing the site file was seen as necessary in order to disguise the location of the area so that the public will not be able to locate the site from the DIA web site and then souvenir artefacts. The group stated that they **did not wish the area to be disturbed by Main Roads** as the material at the site is extensive with many of the artefact clusters looking to be where it was left by the traditional people thousands of years ago. The group said that it is not often you see sites where there is so much archaeological material and formal tools just laying there as they were left by our ancestors. The group suggested that the site was of elevated importance due to the undisturbed context in which it is located and its proximity to a large inlet.

In terms of the sites cultural associations the group stated that the site was believed to represented a strong link with their traditional past and the nature of the artefacts suggested that some of the stones had been carried for great distances to be made into tools at this location. This indicates that this ridge was a major path or *bidi* of the type that Mrs Knapp had earlier reported to run through the area. The site indicated to the group that the Hamersley Inlet to the west was an important gathering place for large groups of Noongar to exploit the abundance of foods available in the area and as such may have been associated with ceremonies and ritual exchange between groups who were known to congregate in this area.

The group made these statements from reading the country as opposed to having any first hand ethnographic knowledge of this usage; however all stated that archaeological sites such as this confirm these types of conclusions.

The group said that if the road is to be upgraded (sealed) near the site then the area would need to be managed appropriately so as to avoid the site being accidently disturbed.

The group **recommended** that the area should be subject to **a compressive heritage management** plan. In this plan it should be made known to the supervisors of the road works and all workers are to be kept out of the bush where the site is located. The group also suggested that there should be cultural awareness training for the workers involved in the road works to ensure they were aware of the value of the site and the landscape to Noongar people.

In regard to the road work proposed that will affect the 'Kurda Gorge Site' the group were not prepared to support a Section 18 application to disturb the area to widen the road. The group **recommended** that any road works to the west of the West Beach turnoff is restricted to only sealing the existing road. The group stated that this would include the DEC car parks at the Hamersley Inlet.

Should this not be possible then the group **recommended** that once a full archaeological analysis of the site and the area around the Hamersley Inlet car park is conducted then the Noongar community should be re-consulted with the findings so as to be able to make an informed decision regards any levels of acceptable disturbance that may be considered.

Figure 8: Mr Errol Williams showing a large chert flake fragment found at 'Kurda Gorge Site'. View to the north east.

On Friday the 30th of January 2010, Ms Melissa O'Toole and Mrs Vernice Gillies (ALO) met with representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups; Mr Bill Woods, Mr Aden Eades, Mr John Penny, Mr Alwyn Coyne, Ms Lynette Knapp, Mr Johno Woods (representing the Inel side of her family), Mr Geoff Wynne, and Mr Elaine Miniter in Albany and then drove to Hopetoun where they met the consultant.

A briefing was conducted in the park at Hopetoun with the aid of an air photo map showing the location of the three gravel pits and one sand extraction pit on private property on Lot 6382 Steeredale Road and Lot 95 Hamersley Drive respectively. As a result of the previous site inspection and the issues that related to the materials extraction pits in the national park Main Roads have decided to source materials elsewhere for road works proposed for Hamersley Drive.

During the briefing the consultant advised the Noongar community that no previously recorded Aboriginal heritage sites were identified at the actual pit sites, but that a Gnamma Hole (Site ID 19596) had been recorded in the vicinity of pit B on Lot 6382 Steeredale Road.

In terms of the archaeological inspection Applied Archaeology Australia had also located one isolated quartz flake at this pit site and another quartz flake at the sand pit site on Lot 95 Hamersley Drive. The archaeologists recommended that the area has archaeological potential in particular pit B due to its proximity to the Culham Inlet and resulting from this and low visibility **recommended** that the clearing should be monitored.

Following this briefing the group proceeded to Lot 6382 Steeredale Road to inspect the material pit areas A and C. This site was accessed via a track through private property of the Ravensthorpe/Hopetoun Road. The group made a vehicle reconnaissance of pits A and C and then walked each pit site.

Figure 9: Ms Vernice Gillies (nee Coyne) and Mr Aden Eades inspecting a marsupial skeleton found at pit site A on Lot 6382 Steeredale Road. View to the north east with an existing quarry in the background.

During this inspection no ethnographic issues were recorded and the group had no issue with the proposal.

The group then proceeded to pit B. The area was viewed from an adjoining track. No one identified any ethnographic issues. Mr Johno Woods asked if the area would be rehabilitated when the quarrying was completed. Ms O'Toole stated that as the land was privately owned and as the land owner had development plans after the quarry was finished that she did not believe that this would be considered.

Figure 10: Ms Melissa O'Toole from Main Roads and members of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim survey team at proposed gravel extraction pit B. View looking to the north west towards the Culham Inlet.

The group accepted this explanation and stated that there were no issues with the proposal. Following this the group drove to the sand pit site on Lot 95 Hamersley Drive. Here people had lunch and then inspected the area which was currently being farmed.

No issues were identified with this location for sand extraction. Everybody in the survey team stated that by moving the extraction pits away from the national park that the issues that they had raised during the previous consultation had been addressed and as such **recommended** that Main Roads proceed as now planned.

COMMUNITY CONSULTATION OUTCOMES

As a result of the above consultations **no sites of ethnographic significance** as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) were identified to be located within the survey areas along Hamersley Drive or within material extraction pit sites on Lot 6382 Steeredale Road and Lot 95 Hamersley Drive.

In regards to the **identified archaeological site denoted as 'Kurda Gorge Site** recorded by Applied Archaeology Australia, representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups assigned this sites as a place of high cultural

significance stating that the site represented a long term migration path where permanent camps would have existed that were likely to be associated with seasonal gatherings that would have traditionally occurred at the nearby Hamersley Inlet.

In terms of the management of this site it was the preference of the Noongar representatives that the sites should be **preserved in situ** and that **a heritage management plan** is formulated to protect the site should work to **seal the existing road** be conducted within the area.

At present there is **no support** within the group for Main Roads to implement a plan to widen the road to the west of West Beach Road to the Hamersley Inlet. In the opinion of the group this would likely affect the **'Kurda Gorge Site** to an unacceptable level.

In regards to the **previously recorded archaeological site denoted as Sites ID 4934 West Beach** representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups could not determine a cultural significance assessment for the site as they were unable to relocate the site and did not have sufficient information regards the nature of the site upon which to base a decision.

The group stated that at present the site was under no threat from simply sealing the existing road and were happy for this to take place. However should the car park at the beach require substantial modification to accommodate tour busses then the group would wish an archaeologist to determine the effect that these plans would have on the integrity of this site before being re-consulted with a request to support disturbance under ministerial consent.

The group stated that if the site was small and not scientifically significant then the group would consider salvaging the site with Noongar participation. All salvaged material once recorded would be redeposited at the site after the work was completed. Archaeological material taken from an area where it is originally located is believed to cause spiritual problems for contemporary Noongar custodians and as such material should always remain where or near to where it was found.

In regards to the **materials extraction pits** the Noongar community were not supportive of plans to extract gravel from the old pits along Hamersley Road. The issue of the spreading of dieback through an iconic national park was a paramount concern. However it was also stated that the areas were likely to be problematic in terms of disturbance to sub surface archaeological material and the clearing of culturally significant plant species used for food and medicine.

As Main Roads have now determined alternative arrangements to source this material the issue raised above will now not affect the project as now proposed.

The new material extraction pits located on private property on Lot 6382 Steeredale Road and Lot 95 Hamersley Drive were identified by the group to **be clear of any heritage issues**.

During the survey the Noongar representatives requested that Noongar people should be engaged to assist archaeologists to monitor all areas where archaeological material and or potential exists, inclusive of all water course crossings

RECOMMENDATIONS

As no sites of ethnographic significance as defined by Section 5 of the Western Australian Aboriginal Heritage Act (1972) were identified to be located within the survey areas, **it is recommended** that the work can proceed without any risk of affecting ethnographic sites of significance.

During the consultations representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups identified a number of issues of cultural concern within the general survey areas.

As a result of the issues raised the following recommendations area made:

- **It is recommended** that Main Roads avoid extracting gravel from the proposed materials extraction pits located within the Fitzgerald River National Park along Hamersley Drive as the Noongar community are concerned about the spread of dieback fungus and disturbance to culturally significant archaeological material and flora.

- **It is recommended** that Main Roads give due consideration to the Noongar communities request to monitor all ground disturbing works at creek crossings, along the margins of water courses and areas where archaeologists have determined to have high potential for cultural material to be unearthed.

- **It is recommended** that Main Roads inform DEC of the need to conduct further consultations with regards to any future plans to expand car parks at the end of all three beach access roads and at the Hamersley Inlet as these plans were not known to the community and the consultants during this survey.

In regards to the archaeological site , **'Kurda Gorge Site',** representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups have identified this sites to be off high cultural significance and as such;

- **It is recommended** that Main Roads does not widen the road from the West Beach Turn off west to the Hamersley Inlet.

- **It is recommended** that the sites should be **preserved in situ** and that **a heritage management plan** should be formulated to protect the site should work to seal the existing road be conducted within the area.

If this is not be possible then Main Roads **will be required** to make application under the terms set out by Section 18 Western Australian Aboriginal Heritage Act (1972) for consent to use the land that may contain an Aboriginal site.

As representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups have clearly articulated that they are at present **not supportive** of such an application until further and more detailed archaeological assessments are conducted **it is further recommended** that Main Roads conduct further and detailed archaeological investigation of the road works potential for affects upon the integrity of this site followed by further consultations with the above representatives should this course of action become necessary.

In regards to the previously recorded archaeological site, **ID 4934 West Beach,** representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim groups could not determine a cultural significance assessment for the site as they were unable to relocate the site and did not have sufficient information regarding the nature and extent of the site upon which to base a decision during this initial survey.

Should Main Roads determine that the site is likely to be affected by any future plans to expand the car park at West Beach **it recommended** that once a full archaeological analysis of the site is completed and that Main Roads conduct further consultations with representatives of the Wagyl Kaip WC98/070 and Southern Noongar WC96/109 Native Title Claim group prior to lodging notice pursuant to an application under Section 18 Western Australian Aboriginal Heritage Act (1972) for consent to use the land that may contain an Aboriginal site.

Should consent be given as a result of this application **it is then recommended** that members of the above claim groups be engaged to assist archaeologists to fully record and salvage the site and then to redeposit the artefacts in a safe area in line with the wishes of the elders expressed during consultations.

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APPENDIX 1: SITES REGISTER SEARCHES

As the PDA exists across two geographic zones (GDA 50 and GDA 51) it was necessary to conduct separate site register searches, as the current DIA database does not allow one search over two geographic zones.

Search Criteria

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

MGA Zone 51	
Northing	Easting
6246528	231635
6244742	235997
6241116	234476
6242171	229090

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.

Copyright

Legend

Restriction

N	No restriction
M	Male access only
F	Female access

Access

C	Closed
O	Open
V	Vulnerable

Coordinate Accuracy

Accuracy is shown as a code in brackets following the site coordinates.

[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
[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.

Status

L	Lodged	IR	Insufficient Information (as assessed by Site Assessment Group)
I	Insufficient Information	PR	Permanent register (as assessed by Site Assessment Group)
P	Permanent register	SR	Stored data (as assessed by Site Assessment Group)
S	Stored data		

Site Assessment Group (SAG)

Sites lodged with the Department are assessed under the direction of the Registrar of Aboriginal Sites. These are not to be considered the final assessment.

Final assessment will be determined by the Aboriginal Cultural Material Committee (ACMC).

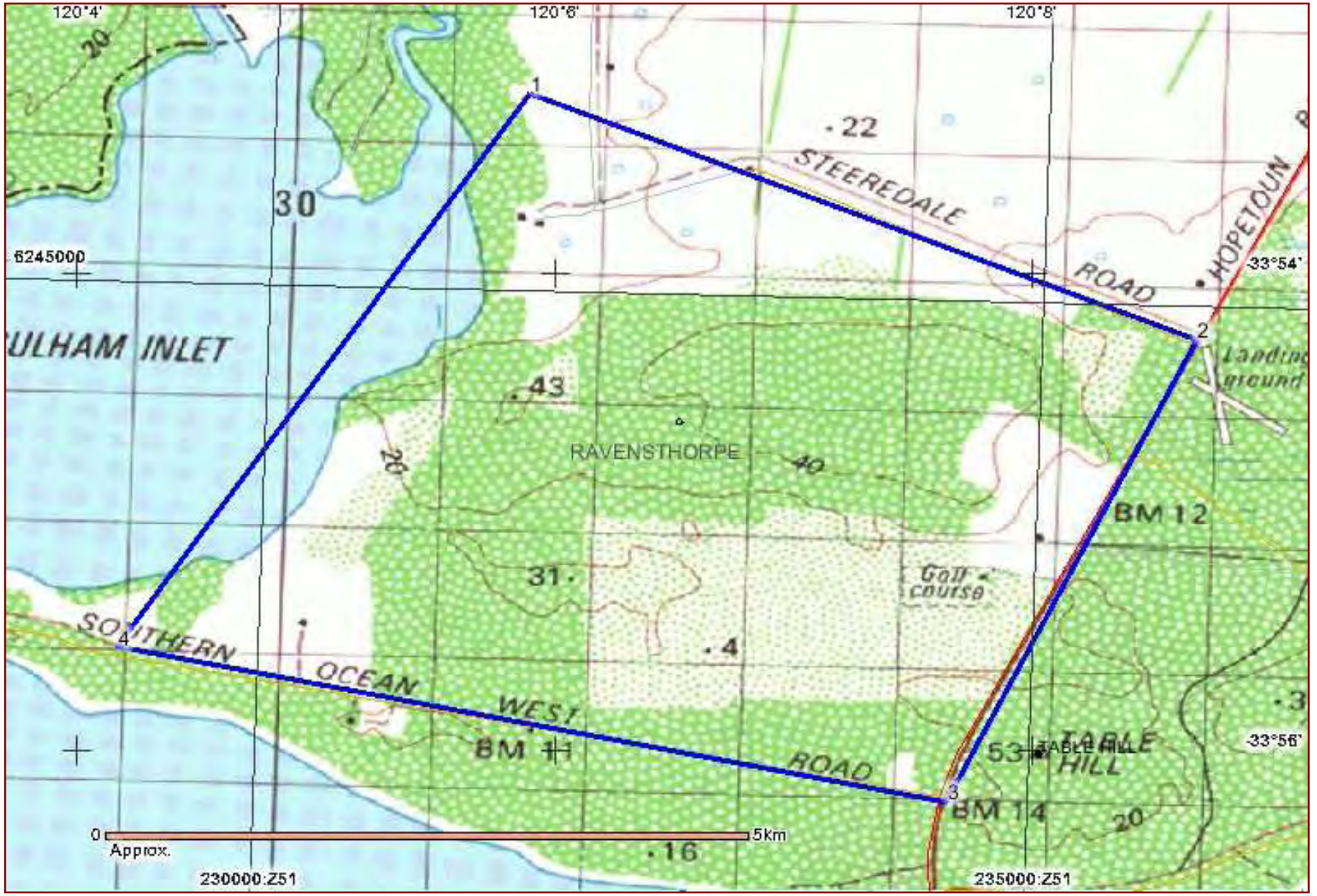
Spatial Accuracy

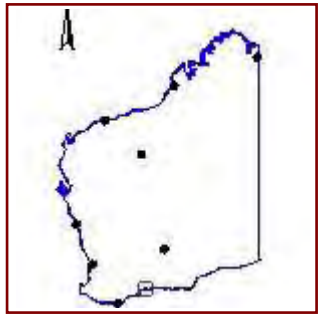
Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code “closed” or “vulnerable”. Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more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

Aboriginal Heritage Inquiry System

Register of Aboriginal Sites

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
19596	L	O	N	Location G Gnamma Hole		Water Source	*Registered Informant names available from DIA.	232672mE 6244015mN Zone 51 [Reliable]	





Legend

- Highlighted Area
- Town
- Map Area
- Search Area

Aboriginal Heritage Inquiry System

Register of Aboriginal Sites

Search Criteria

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

MGA Zone 51	
Northing	Easting
6240283	222797
6243055	222731
6243415	226876
6240933	226950

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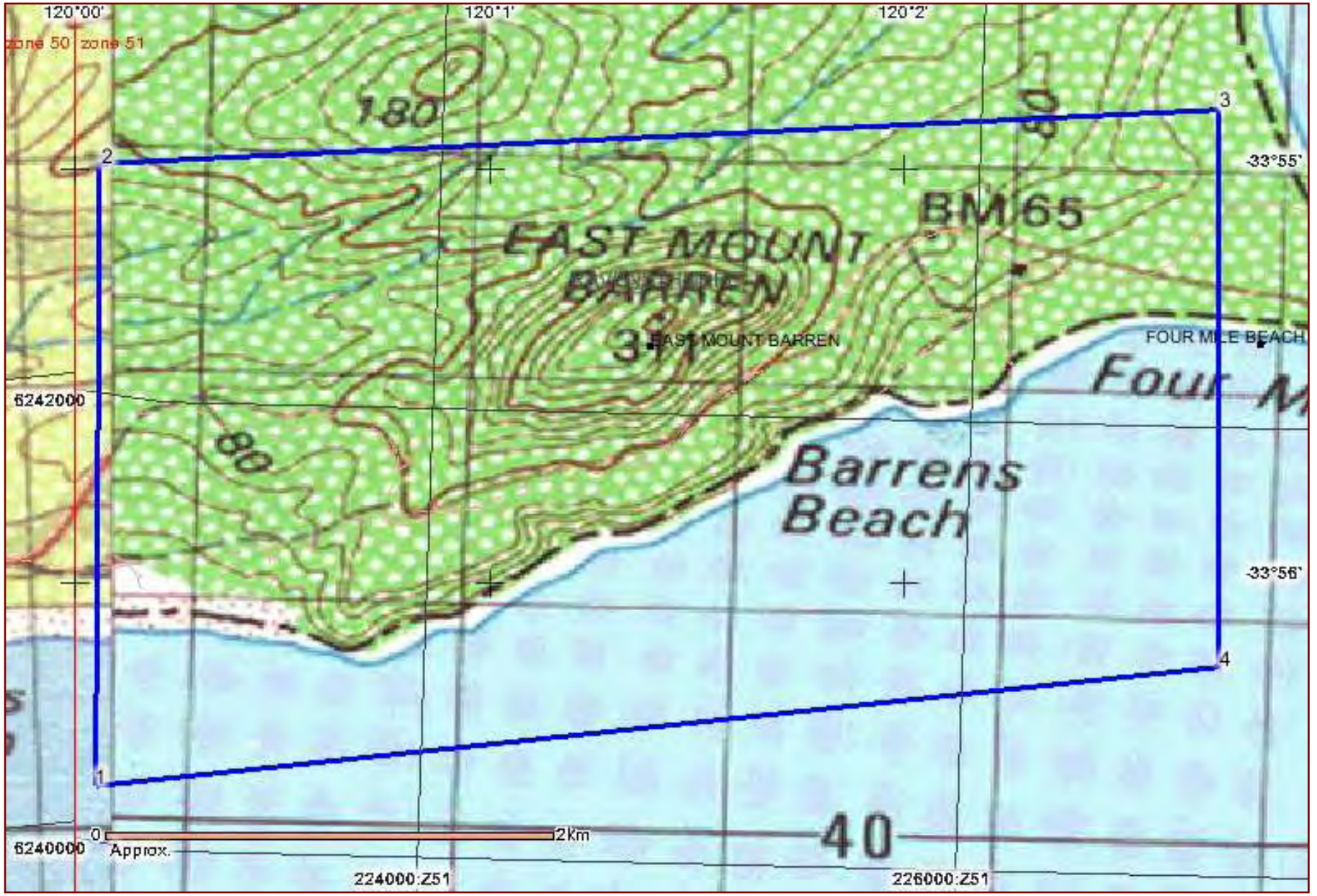

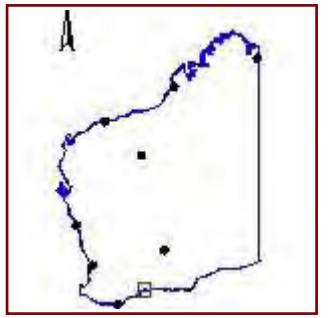

Legend

- Highlighted Area
- Town
- Map Area
- Search Area

Search Criteria

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

MGA Zone 50	
Northing	Easting
6241112	777300
6235186	770588
6241132	766561
6243050	777285

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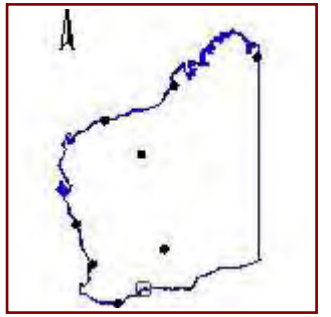
Aboriginal Heritage Inquiry System

Register of Aboriginal Sites

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
4934	P	O	N	West Beach	Artefacts / Scatter			775142mE 6239148mN Zone 50 [Reliable]	S01708



Legend

- Highlighted Area
- Town
- Map Area
- Search Area

Aboriginal Heritage Inquiry System

Register of Aboriginal Sites

Search Criteria

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

MGA Zone 51	
Northing	Easting
6242060	229549
6242887	229549
6242831	231365
6241745	231402

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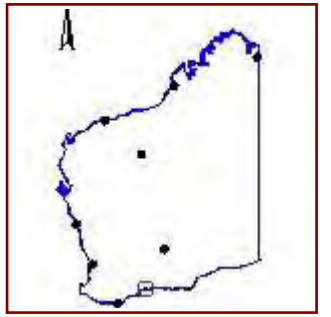

Legend

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- Town
- Map Area
- Search Area

APPENDIX 2: LETTERS OF ADVICE

Brad Goode & Associates Pty Ltd
Consulting Anthropologist
Heritage Assessments

79 Naturaliste Terrace
DUNSBOROUGH WA 6281
Phone: (08) 9755 3716
Fax: (08) 9756 7660
E-mail: bradnlee@westnet.com.au
ACN: 134 732 040
ABN: 41 134 732 040

15th November 2009

We the undersigned have been consulted by Bradley Goode on behalf of GHD Pty Ltd (for Main Roads) in regard to the Hamersley Road upgrade in Ravensthorpe. We would like to make the following recommendations in relation to the Western Australian Aboriginal Heritage Act (1972).

Recommendations:

x Archaeological sites avoid / monitor

x Gravel Pits ① Approved ② Not approved ③ not approved / Dieback / cultural material

x Work design information / consultation regards Carparks / creek crossings

Wagyl Kaip Native Title Claim Group WC98/70

Name	Date	Signature
Lyn Knapp	**15.11.2009**	Lynette Knapp
Alwyn Coyne	**15.11.2009**	Alwyn Coyne
Aden Eades	**15.11.2009**	Aden Eades
Bill Woods	**15.11.2009**	x William Woods
Geoff Wynne	**15.11.2009**	G.W.W
Errol Williams	**15.11.2009**	
Sandra Woods	**15.11.2009**	Sandra Woods
Graham Miniter	**15.11.2009**	
John Penny	**15.11.2009**	J Penny
	15.11.2009	

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Heritage Assessments

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E-mail: bradnlee@westnet.com.au
ACN: 134 732 040
ABN: 41 134 732 040

30th January 2010

We the undersigned have been consulted by Bradley Goode on behalf of GHD Pty Ltd (for Main Roads) in regard to the Gravel Extraction Pits (Loc 6382) for the Hamersley Road upgrade in Ravensthorpe. We would like to make the following recommendations in relation to the Western Australian Aboriginal Heritage Act (1972).

x No issues all clear

Wagyl Kaip Native Title Claim Group WC98/70

Name	Date	Signature
Lynette Knapp	**30.01.2010**	LB Knapp
Alwyn Coyne	**30.01.2010**	Alwyn Coyne
Aden Eades	**30.01.2010**	
William Woods	**30.01.2010**	William Woods
Geoffrey Wynne	**30.01.2010**	G.W. W
Errol Williams	**30.01.2010**	N/A
Sandra Woods	**30.01.2010**	S. Woods
Graeme Miniter	**30.01.2010**	G Minter
Vernon John Penny	**30.01.2010**	V J Penny
	30.01.2010	

APPENDIX 3: MAPS OF THE PROJECT AREA

GHD Fitzgerald Nation Park - Hammersley Road in relation to DIA Sites Extents

Legend
Hammersley_Rd
sites

Map created
Map printed
Survey Date

SCALE - A1 **1:16,000**

0 375 750 1,500 Mtr

1 cm equals 160 m

GDA 1994 MGA Zone 50

N W E S

Survey conducted by
BRAD GOODE & ASS
79 Naturaliste Terrace, DUNSBOROUGH WA 6281

Mapping provided by
WARPSPEED GIS
P.O. BOX 147, VASSE WA 6280

Location of Site ID 4934 West Beach.

Location of Site ID 19596 Location G Gnamma.

Report of an Archaeological Heritage Assessment along Hamersley Road, Fitzgerald River National Park, Western Australia

A REPORT PREPARED FOR BRAD GOODE AND ASSOCIATES AND MAIN ROADS WESTERN AUSTRALIA

DAVID GUILFOYLE

FEBRUARY 2009

APPLIED ARCHAEOLOGY AUSTRALIA

EXECUTIVE SUMMARY

Main Roads Western Australia (MRWA) proposes to upgrade Hamersley Road that passes through the Fitzgerald National Park, Western Australia, between Culham and Hamersley Inlet. The proposed upgrade involves asphalting of the existing un-paved track, associated construction activities (20 metres either side of the current road), and extraction of gravels from quarries established nearby within the Park and on private land.

In compliance with the Aboriginal Heritage Act (1972), MRWA commissioned an ethnographic and archaeological assessment to determine whether the proposed works will impact any cultural features/places, and to determine the extent of heritage sites and features within the proposed development area (PDA). The purpose of this type of survey is for land managers to receive enough information in order to assess their development plans and potential to avoid impacts upon heritage features and sites.

David Guilfoyle was contracted by Brad Goode and Associates to conduct an archaeological assessment of the proposed development area (PDA). The survey took place on November 14th to 16th of November, 2009, by David Guilfoyle, Cat Morgan, Wayne Webb and Toni Webb and a subsequent field day on the 21st of November, 2009. The quarry pits located on private land were surveyed on January 28th 2010.

The archaeological survey resulted in the identification of a large archaeological site complex truncated by the existing road. In addition, a previously recorded site was re-assessed that falls within the current project area. A background scatter of isolated artefacts (24) were also identified, several within the proposed gravel pit areas. The specific landform configurations of this area suggest that there is a high potential for additional cultural material to be present, currently obscured by dense vegetation and sand dunes.

The results of the survey suggest that the proposed works will have a direct impact on the archaeological resources of the area. Thus, several conditions should be adhered to relating to both the results and the limitations of the survey (ground surface visibility) and the likelihood for currently obscured archaeological material/features to be located in this area. This fact ensures that a process of management and monitoring is required, with associated recommendations.

It is recommended that the significant heritage sites – the newly recorded site "Kurda Gorge Site" and the previously recorded site West Beach - are protected from any direct or indirect disturbance, a wide area of avoidance is established, the sites are fully recorded, and a monitoring/mitigation programme established.

Given the very low ground surface visibility and potential for sub-surface cultural material, **it is recommended** that if development proceeds, the area is monitored and re-assessed by the Traditional Owners and a qualified archaeologist during the initial ground clearings and site preparation, and to assess the operation in the event that archaeological material is uncovered or impacted. Management of any heritage sites potentially impacted by the proposed development must involve discussions with the Traditional Owners, implementation of agreed management measures, and where necessary, clearance obtained under the Aboriginal Heritage Act (1972).

This report also identifies some preliminary management recommendations for the implementation of this project, including rehabilitation efforts and processes for community engagement.

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LIST OF FIGURES

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BACKGROUND

Main Roads Western Australia (MRWA) proposes to upgrade Hamersley Road that passes through the Fitzgerald National Park, Western Australia, between Culham and Hamersley Inlet. The proposed upgrade involves asphalting of the existing un-paved track, associated construction activities (20 metres either side of the current road), and extraction of gravels from quarries established nearby within the Park and on private land.

In compliance with the Aboriginal Heritage Act (1972), MRWA commissioned an ethnographic and archaeological assessment to determine whether the proposed works will impact any cultural features/places, and to determine the extent of heritage sites and features within the proposed development area (PDA). The purpose of this type of survey is for land managers to receive enough information in order to assess their development plans and potential to avoid impacts upon heritage features and sites.

David Guilfoyle was contracted by Brad Goode and Associates to conduct an archaeological assessment of the proposed development area (PDA). The survey took place on November 14th to 16th of November, 2009, by David Guilfoyle, Cat Morgan, Wayne Webb and Toni Webb and a subsequent field day on the 21st of November, 2009. The quarry pits located on private land were surveyed on January 28th 2010.

The archaeological survey resulted in the identification of a large archaeological site complex truncated by the existing road. In addition, a previously recorded site was re-assessed that falls within the current project area. A background scatter of isolated artefacts (24) were also identified, several within the proposed gravel pit areas. The specific landform configurations of this area suggest that there is a high potential for additional cultural material to be present, currently obscured by dense vegetation and sand dunes.

The results of the survey suggest that the proposed works will have a direct impact on the archaeological resources of the area. Thus, several conditions should be adhered to relating to both the results and the limitations of the survey (ground surface visibility) and the likelihood for currently obscured archaeological material/features to be located in this area. This fact ensures that a process of management and monitoring is required, with associated recommendations.

It is recommended that the significant heritage sites – the newly recorded site "Kurda Gorge Site" and the previously recorded site West Beach - are protected from any direct or indirect disturbance, a wide area of avoidance is established, the sites are fully recorded, and a monitoring/mitigation programme established.

Given the very low ground surface visibility and potential for sub-surface cultural material, **it is recommended** that if development proceeds, the area is monitored and re-assessed by the Traditional Owners and a qualified archaeologist during the initial ground clearings and site preparation, and to assess the operation in the event that archaeological material is uncovered or impacted. Management of any heritage sites potentially impacted by the proposed development must involve discussions with the Traditional Owners, implementation of agreed management measures, and where necessary, clearance obtained under the Aboriginal Heritage Act (1972).

This report also identifies some preliminary management recommendations for the implementation of this project, including rehabilitation efforts and processes for community engagement.

Figure 1. Aerial view of the survey area.

ENVIRONMENTAL CONTEXT

The Fitzgerald River National Park is noted for its geological and biological diversity. The landforms consist of uplands, gorges, plains, valleys, dunes, inlets, rivers, and swamps. The project area connects the Culham Inlet with the Hamersley Inlet, with the eastern section shadowed by the massive quartzite ranges. The environmental diversity accounts for the rich archaeological record associated with area. The following overview is taken from the FRNP Management Plan (Moore et al 1991, DEC)

> The Park's diverse landscapes, with extensive vistas free of any signs of human disturbance, hold a particular appeal. These landscapes include a combination of windswept and protected beaches, rugged sea-cliffs, the steep Barren Ranges rising to 450 m, extensive plains and abrupt river valleys ending in inlets. The natural vegetation forms an important element in the appeal of the Park and is an integral part of its conservation and recreation values (Moore et al 1991:iii).
>
> The Fitzgerald River National Park comprises of sweeping sandy plains, numerous sand dunes, rugged hills, inlets, wetlands and large river systems with many smaller creeks and tributaries. The **upland environment** is comprised of granite domes and outcrops, shallow loamy soil dotted along coastal plains. The vegetation characteristic of this environment type is open mallees such as *E. Redunca* and *E. Tetragona* and coastal heath consisting of *Allocasuarina*, *Acacia* and *Grevillea*. These sloping granite domes are well drained and slightly susceptible to flooding due to the sloping of the domes and the shallow soil associated with them.

The Plains are formed by spongolites and siltstones and are characterised by shallow loamy soils, colluvial sands and clay pans. The plains are generally flat, can become inundated during winter rains and the vegetation consists of open mallee woodlands of *E. Decipiens*. The fine silt soils are highly susceptible to wind and water erosion due to poor drainage, while the disturbance of water-logged areas can create soil structure break down. The sandy plains close to coastal areas are highly vulnerable to erosion and so it is necessary to stabilise these areas by restricting access to the area and revegetating.

The valleys of the region are steep sided and formed by spongolite and siltstones, the soil is shallow on the slopes and deeper on the valley floor where the vegetation is characterised by open mallee woodland of *E. Conglobata, E. Incrassata*. Low woodland characterises the slopes and rims of the valley, with open mallee on the mesas. The valley floors are generally broad, well drained with intermittent flow during winter and spring which creates small pools of water. The high slopes of the valleys are well drained, but due to shallow soils are susceptible to water erosion.

The ranges are formed by quartzite, dolomite, phyllite and conglomerates and can be comprised of steep slopes and rugged hills. Soil types are quartzite sand on quartzite, vegetation characterised by Adenanthos and Banksia scrub, or phyllitic loamy sand or schist duplex soils vegetation consisting of open shrub mallee of *E. Incrassata* and Allocasuarina and Banksia. The steep slopes and hills are well drained, however due to unconsolidated soils and rapid water run-off they are highly susceptible to erosion.

Sand dunes are formed when silicious or calcareous sands settle over spongolite or quartzite landforms. These sand dunes generally occur close to the coast, can range from 2-5m in height and the vegetation consist of mallee and shrubland which becomes denser when closer to the coast. It is well drained except for parts over limestone and due to loose soils they are highly susceptible to wind and occasionally wave erosion.

Inlets are formed in quartzite, spongolite or limestone, with saline soils deposited adjacent and some alluvium, colluvium sediments at the base of cliffs or slopes. The vegetation on the edge of the inlets consists of *Melaleuca* woodland or shrubland, and samphire heath on the flats. The majority of the inlets are formed at the base of cliffs or steep slopes and all the major rivers in FRNP terminate in these inlets, which are poorly drained and mostly blocked from the ocean. The cliffs and steep slopes are highly susceptible to erosion, especially close to the coast, while the water-logged soils of the inlet are vulnerable to degradation if not properly protected.

The rivers, swamps and lakes are formed by granites, spongolite and quartzite and are dominated by woodland of *E. Occidentalis*. The River systems are generally well drained, single channelled flowing through the uplands and plains; while the swamps are mostly on the plains and poorly drained. Silt soils which characterise river and wetland systems are vulnerable to water erosion and degradation of not protected and cared for properly.

Figure 2. An example of the rocky landscape and thick coastal heath obscuring most of the surveys carried out adjacent to the roadside.

There is evidence to suggest that people exploited the now submerged continental shelf during times of lower sea levels associated with the height of the last glacial maximum (approximately 18,000 years ago). During most of the period between 40,000 and 10,000 years ago sea levels were some 85 metres below current levels and the coastline a minimum of 80 km distant from the current coastline (based on the 50 fathom line on marine charts). By c. 7,000 to 10,000 years ago, the shoreline of that coastal plain would have been reduced to 10km from the current coastline (Smith 1993:32).

The direct evidence for utilization of the now submerged plain is in the form of stone artefacts and other cultural features located on the islands of the Recherche Archipelago. During an expedition to Middle Island in 1984, archaeologists identified stone artefacts atop the massive granite dome of Flinders Peak on Middle Island (approximately 6 kms offshore from Cape Arid) (Dortch and Morse 1984). The findings indicate that the chert and quartz artefacts, some of which were located near shallow gnamma holes, were created prior to the island's formation.

The Australian coastline did not "stabilize" to its present form until approximately 6-5000 years ago. With rising sea levels following the end of the last Ice Age, a period of environmental instability and adjustment affected human populations, altering patterns of mobility, technological adaptation, and settlement. Numerous archaeological resources can be expected to now lie submerged on the continental shelf, and also in the deep Holocene sands that are a prominent feature of the Esperance coastline today.

Geology

Fitzgerald River National Park lies on the southern edge of the Yilgarn Block and the adjoining Albany-Fraser Province. The bedrock of the northern edge of the Fitzgerald River National Park is part of an ancient (2500 - 2900 million years old), essentially stable, crustal segment known as the Yilgarn Craton. Granite and gneiss are the predominant rock types with minor enclaves of altered sedimentary and mafic igneous rocks. One such form of mafic

igneous rock is the West River greenstone belt south-west of Ravensthorpe. The somewhat younger rocks (1100- 1800 million years old) of the Albany - Fraser Province form the bedrock across the southern portion of the Park. These rocks are dominated by the metasediments of the Mount Barren Group, with smaller enclaves of slightly older granitic gneiss appearing along the coast from Bremer Bay to Point Charles.

The Mount Barren Group forms the Barren Ranges which lie along the coast from Hopetoun to east of Bremer Bay. This group consists of a folded and faulted sequence of meta-sediments of quartzite, phyllite, dolomite and conglomerate which are generally slightly altered. Development of the Barren Ranges, through folding and faulting of the Mount Barren Group, is thought to have occurred between 1100 and 1400 million years ago. Subsequent changes in sea level have lead to the formation of elevated benches on various peaks within the Barren Ranges. The Plantagenet Group was deposited in shallow, warm waters near sea level 40-50 million years ago (Eocene Period). Changing sea levels led to deposition under both marine and non-marine conditions. The Werillup Formation, the lower part of the group, is composed of grey and black clay, siltstone, lignite and carbonaceous siltstone. The lignite ranges up to 3 m thick and occurs in the Fitzgerald River area and around Nornalup Inlet. T he Werillup Formation is overlain by the Pallinup Siltstone, a horizontally bedded white, brown or red siltstone and spongolite. The Plantagenet Group is exposed along all the major riverlines in the Park (FRNP Management Plan, Moore et al DEC 1991).

Figure 3. Extensive Holocene sand dunes have buried ancient archaeological places that are regularly exposed in blow-outs and disturbances.

Flora and Fauna

The area is within the Eyre Botanical District of the South-West Botanical Province (Bear 1980) and is the only remaining extensive representation of the Eyre District (DEC 2001:44). The vegetation is dominated by open mallee and heath, with woodlands confined to rivers and swamps (DEC 2001: 44).

FRNP is one of the richest areas for plants in Western Australia, with 1748 identified species. About 75 of these are endemic, that is, they are found nowhere else, and some 250 species

are either very rare or geographically restricted. The Park contains 20% of the State's described species. Although endemics occur throughout the Park, the highest concentration is in the Barren Ranges. FRNP has a richer fauna than any other conservation area in the south-west of Western Australia. The following numbers of species have been identified: 184 birds (3 declared rare and 2 declared in need of special protection), 22 native mammals (7 declared rare), 12 frog species and 41 reptiles (FRNP Management Plan, Moore et al 1991, iii).

CULTURAL HISTORICAL BACKGROUND

This section provides a brief review of relevant archaeological investigations to provide a context for the archaeological assessment and also to justify the recommendations made.

To understand and model the archaeological landscape requires an appreciation of regional patterns of change and adaptation. People have occupied the South West for tens of thousands of years, evident at a number of stratified archaeological sites such as Upper Swan near Perth (Pearce 1981) and Devil's Lair near Margaret River (Dortch 1974; 1976). Excavations at the limestone cave, Devil's Lair, remains one of the longest sequences of human occupation at a single locality in Australia, with a rich archaeological assemblage that includes flaked stone artefacts, bone (animal and human) and ornaments (bone pendants, beads) (Dortch 1974; 1976). There is evidence that the site was occupied as early as 50,000 years before present (Turney et al 2001), with occupation horizons dating to 12,000 years ago, when the cave entrance was blocked by natural processes.

In South Western Australia, regional archaeological models infer a late Holocene settlement-subsistence patterns based on broad environmental zones, that compares and contrasts the associated archaeological signatures (e.g. Anderson 1984). Very little regional studies have taken place within the sproject area, though some work in the Perth and Esperance region is a useful overview characterizing aspects of the Southwest and Sout Coast archaeological landscape. Anderson (1984) compared and contrasted the available archaeological site data for the three environmental zones of the Swan Coastal Plain, the Darling Range and Darling Plateau. The results indicate that site density of the Swan Coastal Plain was three to six times as great as that estimated for the Darling Ranges and Plateau, particularly in those areas of the Swan Coastal Plain containing alluvial deposits (Anderson 1984:34). Anderson (1984) found that larger sites and site clusters located in the Swan Coastal Plain tend to be situated on elevated dunes and/or sandy ridges while those from the Darling Range and inland plateau are commonly situated on low-lying and gently sloping ground.

Mattner and Harris' (2004) synthesis of previous studies relevant to the Darling Plateau included a number of predictive statements that provide some basis for conceptualizing and interpreting this assessment.

Table 1. Archaeological site types and predictive locations of the Darling Plateau and Range, south west Australia (Mattner and Harris 2004:50-51 - text cited directly).

Feature	Prediction
Major artefact scatters (1000 pieces+)	Will occur within a radius of about 500 m, but not closer that 100m of reliable and long-lasting water sources, such as soaks, springs, swamps, and deep river pools. Major artefact scatters will be situated on open and flat or slightly sloping ground in clearings. They are more likely in areas with broad valleys and major creeks or rivers, and where granite bedrock is exposed in large domes or hills.
Medium-sized artefact scatters (100s of pieces)	Will not be numerous but may occur at a variety of locations, especially near seasonal water sources such as creeks, swamps, soaks, and possibly near granite outcrops where these contain gnamma holes or soaks. They will occur close to water sources, probably within 200m.
Small artefact scatters	Will be numerous and principally occur close to watercourses, often within 20m of the drainage channel, and close to granite outcrops. But such sites will also occur in a wide variety of locations, provided the land is reasonably level.

Artefact clusters	Consisting of a few artefacts and possibly representing butchery sites, can be expected in valleys or on the crests of ridges. They will occur on a wide range of landforms and will not be tied to water sources.
Quarries	For stone to manufacture flaked stone tools will be uncommon. They will be found at outcrops of fine grained silicified dolerite, but most dolerite outcrops will not contain quarries. Quarries will also occur where quarry veins and seams are exposed in granite domes or outcrop, but most granite exposures will not host quartz outcrops and will not be potential quarry sites.
Stone arrangements	May be expected on a small number of the granite domes, particularly in locations near ephemeral water sources that are remote from major campsites.
Lizard traps	Can be expected on some granite domes, especially those where water was available nearby, either from gnamma holes or depressions in the rock or from seasonal creeks.
Engraving sites	Will be rare. If any undiscovered examples exist, they will be located with large boulders that provide surfaces to engrave.
Painting sites	Will be rare. They are only likely to exist in protected overhands or rock shelters.
Scarred or marked trees	Will be uncommon. They are more likely to occur in woodland than forest, and likely sites are more likely to exist in clearings than in broad valleys.
Other	Other sites reported for the region, such as ochre quarries and grinding grooves are rare.
Burial sites	Are known to exist in the region. These appear to be historic and possibly the graves have markers. There are unlikely to be nay undiscovered graves but if any exist, they probably will be reasonably close to historic settlements, such as farms or timber camps.

In a regional study of the Esperance area by Smith (1993), over 200 sites were located, most classified as short-term camps, consisting of stone artefact scatters of less than 300 artefacts and less than 50m² in area. The largest sites are associated with large granite domes and/or sources of permanent freshwater.

> As part of her PhD research in the 1980s, Moya Smith (1993) identified and analyzed 217 archaeological sites in an area between Esperance and Cape Arid. The great majority of sites recorded are non-stratified scatters of stone artefacts, sometimes associated with other features including gnamma holes, lizard traps, stone quarries, stone arrangements and paintings. Smith found that site location is associated with topographical features, notably granite domes or pavements, watercourses, salt lakes and swamps. In areas near the coast nearly 60% of sites are located on and around granites. As noted in conversation with Indigenous consultants, granite domes are known to provide a variety of vegetation and other food sources; they are convenient look out posts to watch for game animals and approaching people; they provide easy access to shelter from wind, rain and sun, are predictably used for gnamma holes and lizard traps and importantly have desirable water catchment properties (Morse et al 2007:3).

People adapted to, and shaped the natural environment, embedding systems of movement, settlement, and subsistence that exists today in the form of archaeological places and features that dot the landscape. Such places include stone artefact scatters, gnamma holes, lizard traps, quarry sites, scarred trees, burials, rock art sites, hearths/camps, and associated features. There is ethnographic information detailing the complex knowledge and associations of people using this area associated with hunting, fishing, settlement and seasonal movement.

More fine-grained survey and analysis is required before definite statements can be made regarding the nature of past occupation and use across the Region. It should also be noted that extensive use of fire as a food acquisition strategy, for environmental management, and also to facilitate movement through the landscape (Hallam 1975; J.Dortch 2000; Hassell and Dodson 2003) undoubtedly created a mosaic of micro-environments within any one environmental or landform unit that are not so clearly defined today.

Recent wildfires and further archaeological investigations in recent years have revealed a complex of large archaeological sites and features throughout the region, requiring greater investigation before detailed understanding of the changing settlement-subsistence patterns can be developed.

> Further field study… is greatly needed in formulating a more complete conception of Aboriginal hunter-gatherer land usage and cultural history from late Pleistocene times to the historic period along the 600-km-long coastal zone between King George Sound and Israelite Bay (Dortch 2007:9).

In sum, archaeological models suggest that the area encompassing the project area was part of a seasonal settlement-subsistence pattern focused on winter occupation, and with an overall (perceived) scarcity of food resources, lack of surface water (at least seasonally), and limited ethno-historical accounts of past human use (c.f. Hallam 1975; Anderson 1984), it has been characterized as a marginal area of occupation. For this project area, the regional models suggest that this type of upland, open woodland environment to be characterized by an extensive archaeological signature comprised of small, un-structured artefact assemblages dominated by amorphous quartz artefacts. However, these environments are characterized by low ground surface visibility and have not been studied to any great extent. Regional models are very general and ignore much of the variation in landform systems, past methods of resource utilization (such as fire) that involved environmental management/manipulation, and also social processes of movement, trade and ceremony. Therefore, any predictive statement or survey result should factor in these processes.

European exploration of the South Coast began during the 1600's, and several of these expeditions noted the presence of Indigenous people on the mainland. By the early 1800s, a South Coast sealing and whaling industry had established itself though focused on the islands of the Recherche Archipelago with regular incursions to the mainland, closer to the project area, whaling and sealing concentrated on the Doubtful Islands and Bremer Bay areas. By the mid 1800's the early settlers had moved in, most often with Noongar guides. John Hassell settled at "Jarramongup" in 1850 and John Wellstead followed shortly after at Quaalup (1858),. In 1868 the Dunn's began the first permanent settlement of the Ravensthorpe District at Cocanurup. Sheep were grazed along the Fitzgerald River and the Phillips and Gairdner Rivers were used as travelling stock routes (DEC 2001:58).

Relationships between Noongar people and the earliest settlers were often hostile though some working relationships eventually developed - albeit exploitative relationships by today's standards.

> In 1864, the colonial administration instituted land regulations which explicitly applied to all Crown Lands within a defined area, south of the Murchison and west of line drawn between Hopetoun and Esperance, which effectively denied the traditional relationships of Noongars to the land in the area (Forrest and Crowe, 1996). Outside of this area, the regulations
>
> '...recognised the Noongars' right to enter, at all times, the unenclosed or enclosed but otherwise unimproved parts of the pastoral lease, for the purposed of seeking sustenance in their traditional manner' (Biskup cited in Forrest and Crowe, 1996:37).
>
> In 1868, John Dunn took up a lease of 28,000 acres in the hills to the northwest of the current Ravensthorpe townsite (Archer, 1979). John Dunn selected a block about 20 miles up the stream 'Cocanarup' where the Noongars said that the water was always fresh (Eliza Dunn, John's sister in a letter written in 1882 or 1883, reproduced in Archer 1979:185). With the help of Noongar shepherds, John Dunn and his brothers cleared their land, and three years

later, they brought the first flocks to 'Cocanarup '(Archer, 1979). Their wagon track from Jerramungup (the Hassell's station) to Cocanarup became the road, and with a few alterations, is still the main road to Albany and Broomehill (Archer, 1979). The Dunn brothers had their goods and stores brought by boat to a place called Mary Anne Haven and Mary Anne Point, which is the area now known as Hopetoun (Archer, 1979). Around 1875, after the previous year's attempts to cart the wool by tracks to Albany had failed, the Dunn brothers built a stone hut and shearing shed about 2 miles from the harbour so that the wool could be sent to Albany by boat (Archer, 1979) (Cue et al 2008).

A series of disputes over land and sheep resulted in several altercations between the Dunns and Moirs and the local Noongar communities.

In February 1880, John Dunn was fatally speared by Aboriginals on his property 'Cocanarup'. Various news reports of the time, together with information relayed by his sister some two or three years later, suggests that Dunn was speared through the neck by a small party of Noongars alone in the bush not far from his homestead (Archer, 1979; Eades and Roberts, 1984). Oral histories of the event held by the Noongar community suggest that the spearing was necessary according to tribal law, as John Dunn had been having inappropriate sexual relations with young Noongar women when the men were away droving (Eades and Roberts, 1984; Forrest and Crowe, 1996). Other accounts from settlers say that the spearing was due to trouble with sheep stealing (Archer, 1979; Anon, 1995). Some two or three years later, John Dunn's brother James was speared, although not fatally, when relations between the Noongars and the settlers had deteriorated, again due to the continued appropriation of sheep (Eliza Dunn, cited in Archer, 1979:187). In retaliation for one or possibly both of these attacks, it appears that the remaining Dunn brothers, together with other settlers from the district and possibly police also, led a reprisal attack on the local Noongar population, killing many men, women and children (Eades and Roberts, 1984; Forrest and Crowe, 1996; Anon, 1995). The site of this massacre was on the Phillips River not far from the Cocanarup Homestead (Cue et al 2008).

Many people were progressively moved into Reserves and Missions via successive government policies aimed at controlling the lives of Indigenous people; however, the community maintains strong cultural connections to the area and surrounds, including that encompassing the current PDA.

ARCHIVAL RESEARCH

Archival research is necessary in order to determine if there are any previously-recorded Aboriginal Heritage sites located within the proposed development area that would be impacted by the operation. Additionally, the research provides an indication of the likely character and structure of archaeological resources across the area, with a review of relevant historical, environmental, ethnographic, and archaeological documents/reports. A primary resource is the Department of Indigenous Affairs (DIA) Sites Register and associated unpublished archaeological and ethnographic reports that relate to the area. There are two previously recorded archaeological sites within or in close proximity to the survey areas: Site ID 4934 West Beach and Site ID 19596 Gnamma Hole. Site ID 4934 West Beach's DIA coordinate locates the site 65m south east of the car park at West Beach. The site will be potentially affected by the proposed upgrade to the car park should the car park be widened. This site was re-located and assessed during this preliminary assessment, in terms of likely impacts and required conservation measures (see below).

Site ID 19596 is located 630m west of the south west corner of proposed gravel pit B and 560 southeast of the southeast corner of proposed gravel pit C and will not be affected by the materials extraction proposal at Lot 6382 Steeredale Road.

The name, type and indicative location of the previously recorded sites in the general area are shown in Table 2.

Table 2. Summary of Registered Aboriginal Heritage Sites in the vicinity of the project area.

SITE ID.	Status	Name	Location (AMG Zone 50)* East	North	Site Type	Description
21598	L	Rav01/ Marked Trees	226675mE	6279847mN	Marked tree	Modified Tree
4671	I	Carmichael Scatter	755144mE	6265149mN	Artefacts/ scatter	Artefact scatter
4673	I	West River	755144mE	6265149mN	Man-made structure	structure
4672	I	West River Soak	755144mE	6265149mN	Artefacts/ Scatter	Artefact scatter
5620	I	Cocanarup Station	775145mE	6265149mN	Skeletal material/ burial	burial
2879	S	Kundip	238136mE	6269656mN	Ruins	Ruins
19596	L	Location G Gnamma Hole	232672mE	6244015mN	Water source	Water source
19597	L	Rivermouth Rockhole	226968mE	6243059mN	Water source	Water source
4934	P	West Beach	775142mE	6239148mN	Artefacts/ scatter	Artefact scatter
19596	L	Gnamma Hole	232672mE	6244015mN	Gnamma Hole	Water Hole

* Please note: Coordinates are indicative locations that represent the centre of sites as shown on maps produced by the DIA – they may not necessarily represent the true centre of all sites.

L – Lodged, I – Interim Register, S – Stored Data, P – Permanent Register, O – Access Open, N – File Not Restricted.

The few previously recorded sites in this wider area reflect more the lack of formal, regional archaeological survey than the actual distribution of heritage places.

SURVEY METHOD AND CONDITIONS

The survey method was designed on the basis of the proposed development with a series of UTM coordinates provided to the archaeologists prior to the survey that were uploaded to a hand-help GPS unit (Appendix B).

Figure 4. Roadside surveys were the order of the day (and the project scope).

The surveys took place on November 14th to 16th of November, 2009, by David Guilfoyle, Cat Morgan, Wayne Webb and Toni Webb and a subsequent field day on the 21st of November, 2009. The quarry pits located on private land were surveyed on January 28th 2010. The survey methodology involved pedestrian transects by the four archaeologists on either side of the road spaced ten metres apart. Observed environmental conditions were noted including ground surface visibility and other associated environmental observations. Much of the area was located in cleared tracks adjacent to the road or in thick coastal heath, also adjacent to the road which made artefact identification very difficult. Ground surface visibility was generally poor across the survey area, ranging on average from 5% – 25% with dense leaf litter and shrubs. Some areas in the low-lying flats provided moderate visibility, with patches of exposed, light grey sands.

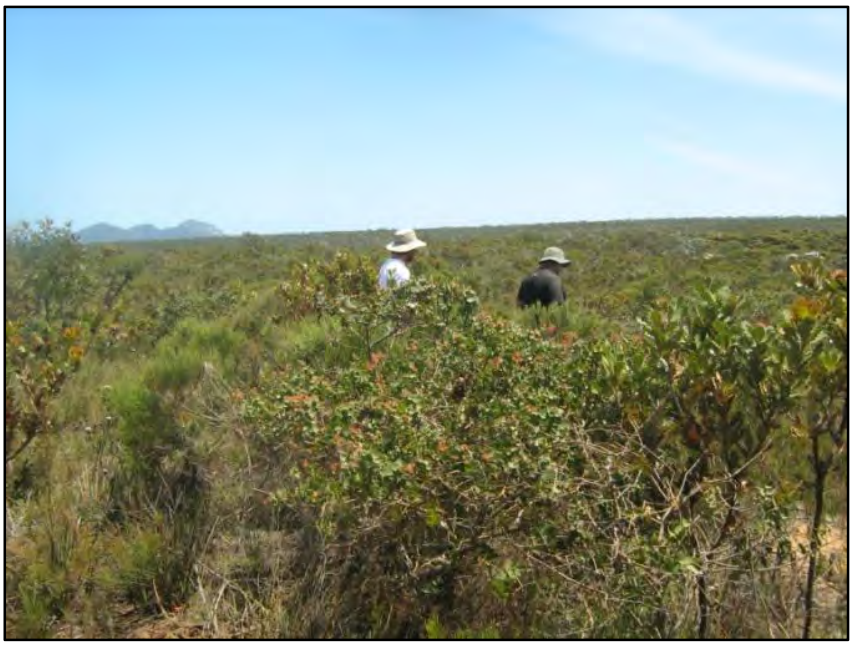

Figure 5. Very dense coastal heath limited the effectiveness of the archaeological survey.

Figure 6. Archaeological surveys were carried out on the roadside and in vegetation adjacent to road. Note thick coastal scrub which made for low surface visibility.

Figure 7. The majority of the cultural material identified was located in localized blow-outs or washes, implying that the area contains a relatively dense archaeological signature though mostly obscured by dense vegetation or buried by sand dune systems.

This point suggests that conditions were generally not favourable for positive artefact identification within the confines of the designated survey area. At the same time, the PDA encompasses a variety of different micro-environments suggesting that archaeological resources should be present within this general area, based on previous investigations. Also, areas of more stable, sedimentation processes, such as the lower-lying flats, are likely to contain additional, un-identified sub-surface material. The specific survey conditions justify the management recommendations outlined below.

Figure 8. Archaeological survey in newly exposed/disturbed exposed areas.

Given the iconic and sensitive nature of the Park and associated biodiversity, the archaeological crew was careful to ensure that they minimized risks in the spread of Dieback, washing vehicles and boots regularly.

Figure 9. Spraying boots to reduce the risk of spreading Dieback.

RESULTS OF SURVEY

The archaeological survey resulted in the identification of a very large and significant site, the identification of a previously recorded site, a distribution of isolated finds across the PDA, and area of archaeological potential, and areas requiring rehabilitation/management.

Figure 10. Map showing the distribution of sites and monitoring/management areas.

The map shown in Figure 10 outlines the results of the field survey, discussed in more detail below. The two archaeological sites are highly significant and must be avoided from any disturbance. A mitigation/heritage site protection plan should be instigated by the proponent. The Elders noted that the newly recorded site is highly significant and should not be disturbed (see ethnographic section).

The gravel areas contain artefacts in a context of previous disturbance and dense vegetation and should be monitored during ground clearing. A meeting subsequent to the archaeological survey was to be set up between the Nyungar community in Albany to discuss the Die-back management plans for the gravel pit areas, as during the ethnographic survey the Elders expressed concern with the plan to extract gravel from areas that all ready contain die-back (see ethnographic section).

Areas dashed green are areas of archaeological potential based on the environmental configuration (water crossings, creeks, vegetation mosaic) and/or presence of isolated finds. The Elders also requested archaeological monitoring at water crossings and at the car park at West Beach that contained the previously recorded site (see ethnographic report). Areas dashed green (Waypoints 177 and 183) are areas of erosion that require management/conservation efforts (see Figure 11).

Figure 11. Stabilization of eroded areas is a positive step to minimize erosion and any disturbance to sub-surface archaeological deposits in the area.

Figure 12. Map showing the distribution of waypoints associated with the survey (see Table 3).

Table 3. Waypoint data associated with Figure 12.

Waypoint No.	Easting	Northing	Description	Material	Type
177	224031	6241542	Rehab area - soil erosion, likely sub-surface archaeological material		
178	223847	6241811	Artefact see measurements	Q	FFD
179	223576	6241953	Quartz outcrop, arch potential		
180	776019	6241569	Monitoring area - good soil deposition, likely sub-surface material		
181	775948	6241540	Artefact see measurements	Q	CF
182	775950	6241539	Artefact see measurements	Q	FFMe
183	776345	6241158	Rehab area - eroding limestone ridge		
185	775186	6239280	Artefact see measurements	Q	CF
186	775183	6239277	Artefact see measurements	Q	FFD
187	775187	6239279	Artefact see measurements	Q	FFD
188	775182	6239282	Artefact see measurements	Q	FFMe
189	775177	6239286	Artefact see measurements	Q	FFMe
190	775163	6239279	Artefact see measurements	Q	CF
191	775179	6239265	Artefact see measurements	Q	FFMe
192	775184	6239267	Artefact see measurements	Q	FC
193	775351	6239909	Artefact see measurements	Q	FC
195	774806	6240445	Veg change - coastal heath to mallee woodland, arch potential		
196	774368	6240566	flat clay plan , arch potential		
197	774019	6240488	Artefact see measurements	Q	FC
198	774018	6240487	Artefact see measurements	Q	FFMe
199	773978	6240489	Artefact see measurements	Q	FFMe
200	773846	6240531	Artefact see measurements	Q	SPC
201	773061	6241368	Large artefact scatter on ridge (centre point only)		Artefact Scatter
202	772478	6241005	Artefact see measurements	Q	TBF
203	772484	6241001	Artefact see measurements	Q	FFMe
204	772501	6240927	Artefact see measurements	Q	FFMe
205	772387	6240926	Artefact see measurements	Q	FFMe
206	772376	6240918	Artefact see measurements	Q	CF
207	772374	6240916	Artefact see measurements	Q	FFD

Kurda Gorge Site (773061 E/ 6241368 N)

A large archaeological site complex was located during the survey, consisting of hundreds of stone artefacts, a variety of formal tools, and diverse lithologies. The site is located on the southern edge of an east-west running canyon and river. It measures approximately 150 metres east and west of the centre-point, 80 meters south of the centre-point (crossing the road) and an unknown distance to the north). The local terrain is relatively flat, with quartz sands and some localized clay plans that appear to have been recent blow-puts/washes, exposing dense artefact scatters, some that likely represent "knapping floors". Two distinctive backed blades were located on site, formal implements that are said to appear in the Australian archaeological record in the early-to-mid Holocene (~10,000 – 5,000 years ago). Large quartzite boulders and heath scrub provide a dramatic setting above the shallow, yet vertical, gorge. It is expected that further surveys in the area will reveal an extremely dense and large site complex.

The site is likely to have served as a congregative area at the upper reaches of well-defined waterways that feeds into the Hamersley Inlet. It is likely that people used the flat terrain above the gorge as the main movement corridor between these different eco-tones.

Investigations were limited to the current survey project, and it was noted that the site was truncated by the existing Hamersley Road, as artefacts were found on both sides of the Road, albeit at much lower densities on the southern side of the road. The Elders identified this artefact site as highly significant and have advised that they wished the site not to be affected. The archaeological assessment likewise **strongly recommends** that no work should take place in this area, and a wide conservation buffer zone be established to ensure no indirect impacts. A full-scale archaeological assessment is required at this highly significant heritage place (see recommendations below). Further consultations are required with the Traditional Owner Group to determine the management/mitigation process, including further archaeological work, as cultural protocols of access and methods of investigation/reporting must first be established.

Figure 13. View from the road towards the gorge and site area.

Figure 14. Some of the chert artefacts identified in the large artefact scatter.

Figure 15. Diverse flake typologies and lithologies at Kurda Gorge Site.

Figure 16. Distinctive backed artifact located at Kurda Gorge Site, quartz.

Figure 17. Another distinctive backed artefact from the site, chert.

Figure 18. Traditional Owner Group examines the artefact scatter with the archaeologists and anthropologists.

Previously Recorded Site (West Beach Site ID 4934)

A number of quartz flakes were identified within the area of the previously recorded site, known as West Beach (Site ID 4934). This site is a small artefact scatter adjacent to a car park and track, set within low coastal heath near the confluence of a creekline and the beach. The site is significant in representing a distinctive site type that forms part of a regional settlement-subsistence system, in lining the coastal zone with the river ways and uplands. This area should be avoided from the current proposed works and the area monitored during any nearby on-ground works. It is recommended that the rea be rehabilitated and the site fully recorded and mapped with a condition assessment made (to update the existing site file).

Isolated Finds

The survey identified 24 isolated finds along the survey corridor and within the proposed gravel pits (see Appendix A). The limited findings are attributed to the narrow corridor of disturbance that was investigated (and so reducing the likelihood of encountering cultural material) and the low ground surface visibility (dense vegetation) combined with coastal dune deposition that limits the effectiveness of surface survey. As is most common in Australian archaeology in densely vegetated environments, surface investigations are often limited to exposures of bare soil along waterways, road cuts, erosion scars or tracks (O'Halloran and Spennermann 2002:8).

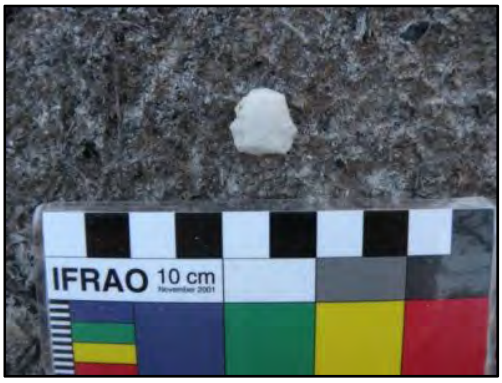

Figure 19. Chert artefact WP131.

Figure 20. Quartz artefact, Waypoint 186.

Gravel Pits

In addition to the survey of the road way, four gravel pits and one sand pit were to be assessed for any archaeological material. Each pit had evidence of previous disturbance and dense vegetation that limited the effectiveness of the surface assessment. Based on the results of the overall survey, it is likely that the areas contain currently obscured cultural material. The Traditional Group identified some concerns they had on the gravel pits within the National Park and the process of extraction (documented in the associated ethnographic report). Subsequently, four additional areas were identified, located on private property.

Gravel Pit 1 (west)

A total of six quartz flakes were located within or adjacent to this gravel pit suggesting that the area is likely to contain a small artefact scatter with potentially sub-surface deposits; given that the area was densely covered with vegetation and subject to previous disturbances. The area is very close to the significant site complex located during this survey, so a clear management plan and monitoring programme must be established for this area.

It is recommended that if the area is to be disturbed, that initial ground clearing activities are monitored by Traditional Owner representatives and a qualified archaeologist.

Figure 21. Quartz artefacts found within the gravel pit area.

Gravel Pit 2 (middle)

This relatively large, rectangular area was surveyed though thick scrub limited the effectiveness of the surface assessment. In addition, an area of Dieback infestation was avoided. Three quartz artefacts were located along the roadside within this designated area. These findings suggest that there is likely to be additional cultural material located in this vicinity, with the road verge providing a small "window" into the distribution of archaeological material.

It is recommended that this area is not disturbed or used as a gravel pit given the threat of Dieback and the likely presence of archaeological material.

If the area is to be disturbed, i**t is recommended** that initial ground clearing activities are monitored by Traditional Owner representatives and a qualified archaeologist.

Figure 22. Quartz core found within gravel pit area.

Gravel Pit 3 (east)

This rectangular area was surveyed and no cultural material was observed; however, thick scrub limited the effectiveness of the surface assessment. The general ware was noted for being in close proximity to a shift in the vegetation zones. Areas at the juxtaposition of diverse micro-environmental are often favourable areas of occupation and use given the diversity and proximity of resources. There is some potential that archaeological material exists within this gravel pit area, currently obscured by dense vegetation or buried by sand deposits.

If the area is to be disturbed, i**t is recommended** that initial ground clearing activities are monitored by Traditional Owner representatives and a qualified archaeologist.

Gravel Pit 4 (Fisher's Property)

Three proposed gravel pits are designated as separate blocks on Lot 3682, Steerdale Road, owned by the Fishers. These areas were surveyed on the 28th of January and one isolated quartz artefact was located with Block B (see Appendix A, Waypoint 208). However, these three areas were characterised by very dense coastal heath and previous disturbances, and so the likelihood of locating material within these areas was greatly reduced. Block B has some areas of archaeological potential with a distinct change of vegetation and

depositional environment profile, closer to the Culham Inlet, implying likelihood for buried cultural material. In general, the laterite and gravel horizons represent areas of low archaeological potential.

If the area is to be disturbed, **it is recommended** that initial ground clearing activities are monitored by Traditional Owner representatives and a qualified archaeologist.

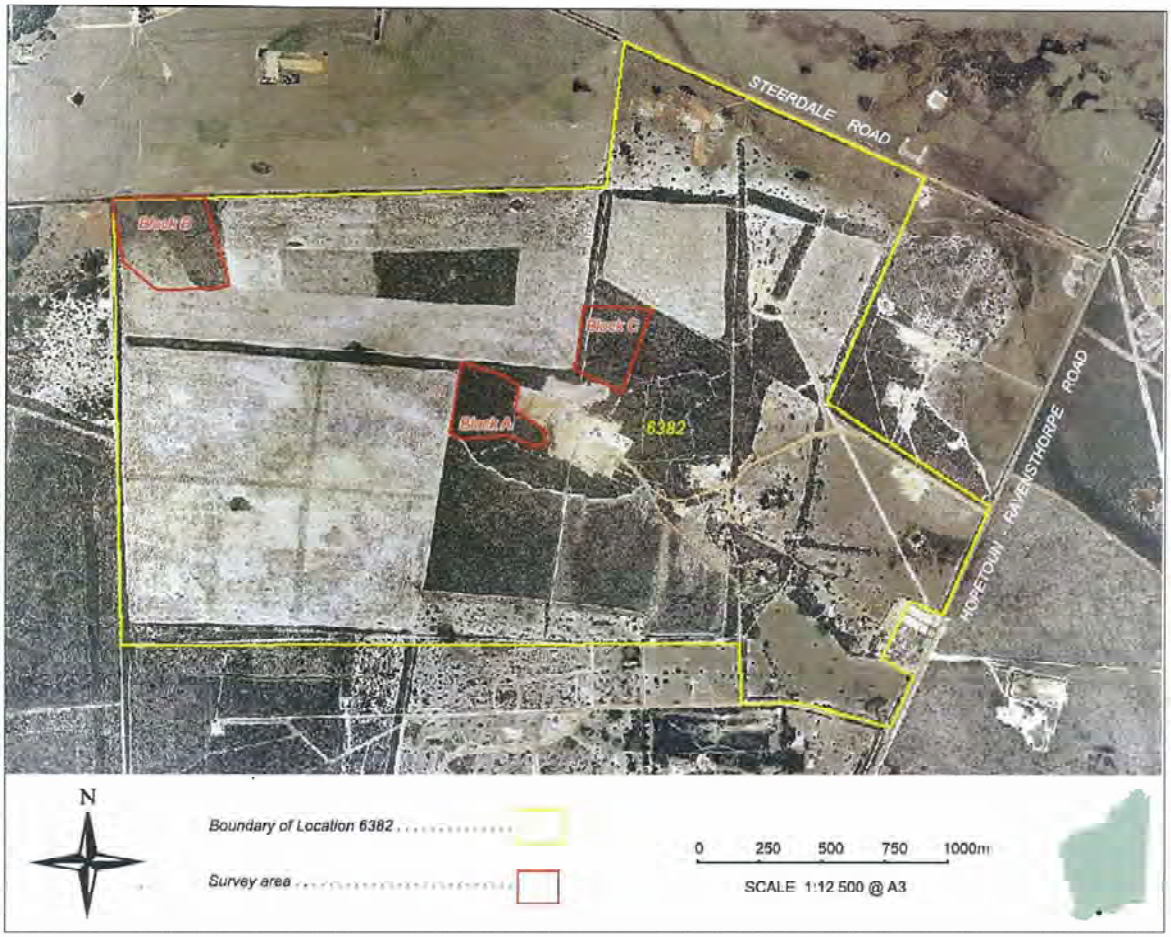

Figure 23. Aerial view of the three proposed gravel pits on the Fisher's property (see Appendix A).

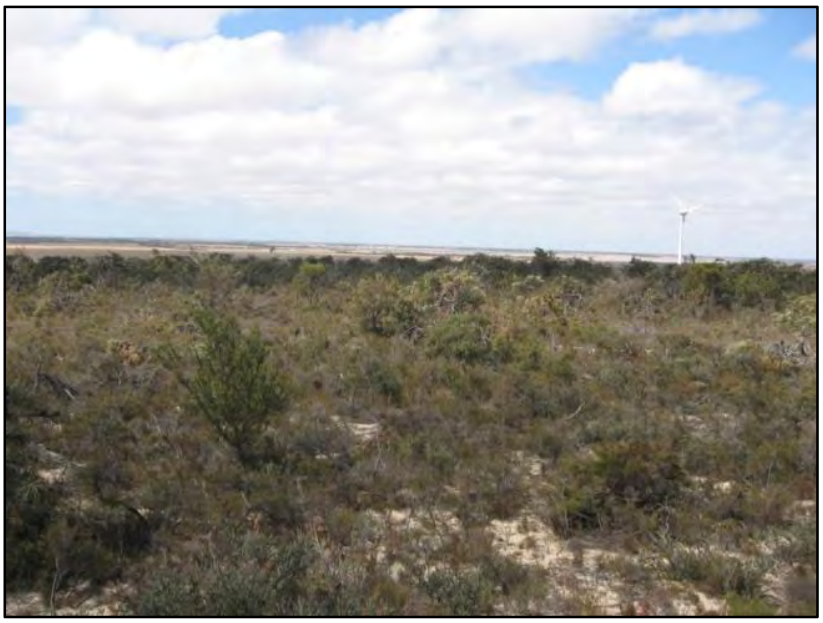

Figure 24. General view across the Fisher property containing three proposed gravel pit areas.

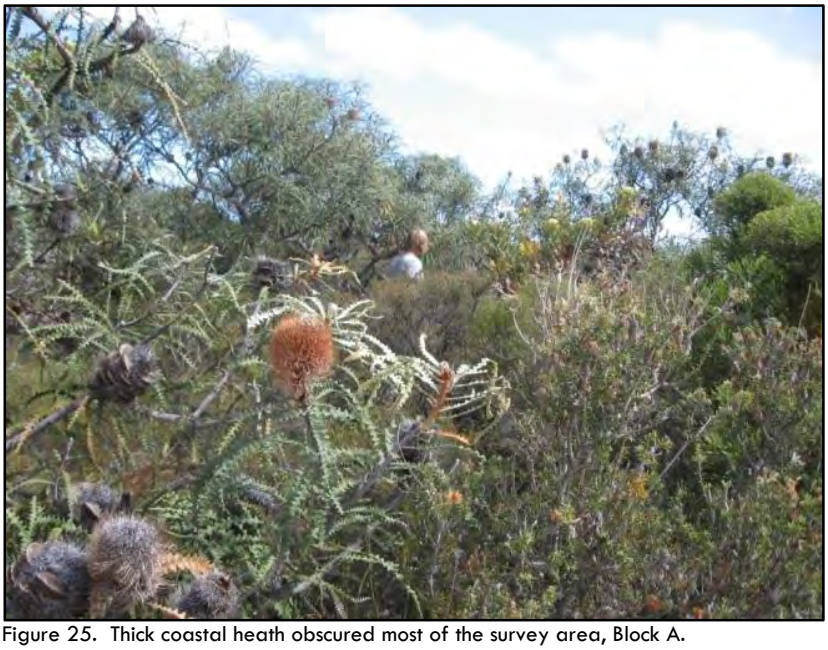

Figure 25. Thick coastal heath obscured most of the survey area, Block A.

Sand Pit 5 (horse paddock)

A small area within a horse paddock near Culham Inlet was the final proposed gravel pit area to be surveyed. This area was a sandy dune above a gravel bench highly disturbed by horses and tracks. A quartz artifact was located within a localized blowout and appeared to have been dug out by a fox or rabbit, with an animal burrow located nearby. Thus, there is some potential here for sub-surface cultural material.

If the area is to be disturbed, i**t is recommended** that initial ground clearing activities are monitored by Traditional Owner representatives and a qualified archaeologist.

Figure 26. Quartz artefact located within gravel pit area 5 that appears to have been dug out from an animal burrow (Waypoint 209).

In summary, the results and conditions of the survey suggest that the proposed works will have an impact on the archaeological resources of the area. Prior to the road's construction and extraction of the gravel pits, several conditions should be adhered to relating to both the results and the limitations of the survey (previous disturbances) and the likelihood for additional archaeological material/features to be located if the proposal proceeds, discussed below.

DISCUSSION

Previous archaeological investigations in the region indicate that this area contains a number of cultural feature and sites, and a high potential/likelihood for sub-surface archaeological material. The presence of large granite domes and headlands, abundant freshwater and a wetland system, well confined in a valley of well-drained soils and an abundance of plant and animal resources, all suggest a favourable area for past utilization. The archaeological survey was limited by dense vegetation cover and the narrow corridor investigated reduces the likelihood of encountering cultural material.

Well-watered corridors and terraces are areas of high archaeological potential and so any ground disturbance (including track construction/maintenance) should be carefully monitored. The most effective way to manage and stabilize cultural resources in this zone, aside from minimizing direct impacts, is through waterway and dune stabilization. As with the ecology of all coastal systems in an increasingly degraded and pressurized environment, associated cultural resources should be well protected.

> Any undeveloped land is likely to contain archaeological sites, and development without prior survey and analysis can result in irreparable damage to fragile archaeological sites, and the loss of not only potentially valuable elements of the Australian Heritage, but also of subsequently irretrievable information about regional socio-economic systems (Smith 1984:2).

These types of environments are also characterized by low ground surface visibility that influence the effectiveness of archaeological survey; given that much of the archaeological resource is expected to be covered by leaf litter and sedimentation. Regional surveys based on pedestrian survey may reflect more the nature of the environment than the actual intensity of past use (Hall and Lomax 1996). Therefore, it is predicted that (currently obscured) cultural material exists across the area. This fact ensures that a process of management and monitoring is required, with associated recommendations.

As with the natural heritage of this iconic Park, there is a need to preserve the cultural landscape quality of the area, and protect the wilderness and heritage values of the region. The archaeological heritage assessment notes that the upgrade of the road will, if not managed properly, disturb significant cultural heritage places, and is counter to the aims of the Fitzgerald River National Park Management Plan (DEC 2001):

> Fitzgerald River National Park is one of the few areas on the south coast of Western Australia that is of suitable size, terrain and condition to allow its designation as a wilderness area. "Wilderness" is essentially an undisturbed area or a 'window into the past' where management intervention is kept to an absolute minimum and where the number of visitors is low because of the area's remoteness. Visitors travel on foot (NPNCA, 1990). The "quality" of wilderness is often defined by the extent to which land or water is remote from, and substantially undisturbed by, the influence of modem technological society (CONCOM, 1986). 'Remoteness' and 'naturalness' are based on:
>
> - remoteness from settlements or other points of permanent occupation
> - **remoteness from access, in particular constructed vehicle routes**
> - aesthetic naturalness or the degree to which the landscape is free from the presence of permanent structures
> - biophysical naturalness or the degree to which the natural environment is free of biophysical disturbances caused by modem influences.
>
> Owing to the unique opportunity which exists in Fitzgerald River National Park, it is highly desirable to maintain a significant cross-section of the Park as a wilderness area including coastal areas, mountains and inland gorges.
>
> - The wilderness area should be of sufficient size and quality to meet nationally accepted criteria for wilderness designation.
> -
> - **Future management intervention within the wilderness zone should be strongly discouraged other than in exceptional circumstances.**

RECOMMENDATIONS

It is recommended that the significant heritage sites – the newly recorded site "Kurda Gorge Site" and the previously recorded site West Beach - are protected from any direct or indirect disturbance, a wide area of avoidance is established, the sites are fully recorded, and a monitoring/mitigation programme established.

Given the very low ground surface visibility and potential for sub-surface cultural material, **it is recommended** that if development proceeds, the area is monitored by the Traditional Owners and a qualified archaeologist during the initial ground clearings and site preparation, and to assess the operation in the event that archaeological material is uncovered or impacted. Management of any heritage sites potentially impacted by the proposed development must involve discussions with the Traditional Owners, implementation of agreed management measures, and where necessary, clearance obtained under the Aboriginal Heritage Act (1972).

Figure 27. Archaeological survey was limited by very dense vegetation.

From an archaeological heritage perspective, several management recommendations have been determined:

1. Avoid disturbance of cultural heritage places

Avoiding impacts to the surviving heritage places requires a combination of further archaeological research and modeling, education, well considered development/planning controls, and monitoring. This is to ensure that even restoration/upgrade projects minimize impacts to places of heritage value.

2. Mitigate impacts to cultural heritage places when disturbance is unavoidable

If ground disturbing activity must be undertaken, it should be undertaken in a manner that ensures that the Traditional Owner groups are provided with a detailed proposal and plan of the proposed development well before the plans are fully developed. This would provide an opportunity for the Group to influence the pattern of development/disturbance and avoids the reactive and expensive process of conducting heritage impact assessments.

3. Identify and define the distribution of cultural heritage places (tangible and intangible)

Further regional assessments should be undertaken to contribute to the understanding of the structure and changing patterns of cultural places throughout the National Park. This work is required to provide an accurate environmental impact assessment process at the regional level and to help establish whether particular cultural features are at risk, as well as the extent and severity of the risks.

4. Rehabilitate disturbed areas and the fragile environment

A direct management recommendation is to instigate a community driven process of rehabilitation and protection. Where there are natural and human-induced disturbances to the natural ecosystem, rehabilitation of these areas will be necessary to minimize on-going adverse effects. It also provides the pathway for

ensuring that traditional practice of *Caring for Country* is being supported by local government and government agencies.

In the protection of archaeological resources and heritage values associated with The National Park, management processes should focus on the dual conservation of the natural and cultural features. In many ways, this simply means integrating the actions required to maintain the ecological and biodiversity values of the local system with the integrated cultural heritage landscape. This also means providing opportunities for community-driven rehabilitation, management, and education.

> Incorporate information on Aboriginal occupation and use in interpretive programs for the Park (FRNP Management Plan, DEC 2001)

The most cost effective way to implement such works is to engage the Traditional Owner community in the construction project which provide a number of associated, positive outcomes, including increasing Traditional Custodians' involvement with the land, conserving sites and minimising disturbance to any cultural features, and providing opportunities for education and interpretation on the regional cultural heritage values across the Park. Under this scenario, heritage specialists and the Traditional Owner Group assist with the on-ground activities, and so manage the interface of on-ground works and heritage legislation/protocols compliance. Such a community-level mechanism provides a more culturally-appropriate, not to mention, cost-effective, method for undertaking land care activities.

The proponents are reminded of their obligations and responsibilities under the *Aboriginal Heritage Act (1972*).

APPENDIX A: ARTEFACT DATA

Waypoint No.	Easting	Northing	Material	Type	L (mm)	W (mm)	T (mm)	PW (mm)	PT (mm)	Platform Shape	Plat Surface	PFA/Ridge	Term.
178	223847	6241811	Q	FFD	12.5	19.61	7.34						
181	775948	6241540	Q	CF	11.29	9.27	2.6	6.29	3.24	wide	flat	b	f
182	775950	6241539	Q	FFMe	16.43	15.01	11.1						
185	775186	6239280	Q	CF	14.25	13.06	5.11	7.46	4.43	wide	flat	side	
186	775183	6239277	Q	FFD	18.73	31.74	9.93						f
187	775187	6239279	Q	FFD	11.03	12.15	4.55						
188	775182	6239282	Q	FFMe	21.76	24.21	4.53						
189	775177	6239286	Q	FFMe	14.1	14.9	4.24						
190	775163	6239279	Q	CF	46.16	16.81	10.05	7.54	5.56	focal	flat	b	step
191	775179	6239265	Q	FFMe	19.76	8.62	4.22						
192	775184	6239267	Q	FC	20.57	17.22	12.34						
193	775351	6239909	Q	FC	23.99	18.75	13.98						
197	774019	6240488	Q	FC	34.43	22.98	9.52						
198	774018	6240487	Q	FFMe	17.07	17.09	5.81						
199	773978	6240489	Q	FFMe	11.46	19.82	8.65						
200	773846	6240531	Q	SPC	33.43	29.65	18.18						
202	772478	6241005	Q	TBF	33.03	38.05	17.05	22.45	14.18				
203	772484	6241001	Q	FFMe	20.79	38.32	15.62						
204	772501	6240927	Q	FFMe	15.71	20.1	13.28						
205	772387	6240926	Q	FFMe	24.79	15.31	9.91						
206	772376	6240918	Q	CF	55.6	20.68	13.35	13.94	7.14	GW	flat	behind	
207	772374	6240916	Q	FFD	9.48	15.15	5.91						step
208	232044	6244947	Q	FC	32.08	26.57	14.04						
209	230141	6242286	Q	FFMe	26.50	27.71	17.4						

APPENDIX B: COORDINATES OF THE SURVEY AREA

Coordinates of the survey lines (labeled as 'end points', Zone 51).

HR101	226445	6242683
HR102	226247	6242714
HR103	226059	6242767
HR104	225895	6242862
HR105	225720	6242766
HR106	225535	6242692
HR107	225469	6242519
HR108	225384	6242345
HR109	225225	6242228
HR110	225044	6242147
HR111	224918	6242010
HR112	224788	6241860
HR113	224615	6241774
HR114	224423	6241721
HR115	224236	6241650
HR116	224048	6241581
HR117	223858	6241518
HR118	223795	6241691
HR119	223777	6241877
HR120	223620	6241969
HR121	223426	6241918
HR122	223231	6241926
HR123	223036	6241970
HR124	222847	6241930
HR125	222728	6241776
HR126	777270	6241605
HR127	777148	6241446
HR128	777028	6241329
HR129	776847	6241392
HR130	776658	6241431
HR131	776458	6241431
HR132	776260	6241444
HR133	776078	6241524
HR134	775887	6241570
HR135	775763	6241421
HR136	775659	6241251
HR137	775522	6241106
HR138	775361	6240991
HR139	775173	6240923
HR140	774985	6240854
HR141	774797	6240786
HR142	774610	6240715
HR143	774423	6240643
HR144	774236	6240572
HR145	774050	6240500
HR146	773855	6240512
HR147	773727	6240655
HR148	773696	6240850
HR149	773644	6241042
HR150	773548	6241215
HR151	773507	6241410
HR152	773317	6241406
HR153	773120	6241380
HR154	772946	6241283
HR155	772767	6241194
HR156	772583	6241116
HR157	772417	6241005

HR158	772243	6240907
HR159	772069	6240826
HR160	771936	6240676
HR161	771780	6240552
HR162	771602	6240465
HR163	771408	6240419
HR164	771212	6240381
HR165	771015	6240345
HR166	770830	6240273
HR167	770714	6240111
HR168	770599	6239947
HR169	770471	6239794
HR170	770416	6239613
HR171	770317	6239462
HR172	770245	6239282
HR173	770126	6239139
HR174	769945	6239188
HR175	769759	6239211
HR176	769648	6239054
HR177	769490	6238993
HR178	769407	6238820
HR179	769269	6238688
HR180	774660	6240720
HR181	774736	6240536
HR182	774786	6240343
HR183	774833	6240152
HR184	775011	6240071
HR185	775203	6240016
HR186	775362	6239901
HR187	775394	6239713
HR188	775275	6239559
HR189	775183	6239403
HR190	775079	6239257
HR191	775766	6241420
HR192	775916	6241291
HR193	776067	6241161
HR194	776237	6241065
HR195	777209	6241508
HR196	222737	6241387
HR197	222866	6241235

UTM Co-ordinates given for the proposed gravel pits to be used during the development within the National Park.

001	772337	6240922
002	772368	6240929
003	772415	6240954
004	772475	6240990
005	772527	6241040
006	772549	6241050
007	772543	6240936
008	772516	6240910
009	772476	6240854
010	772430	6240828
011	772377	6240839
012	772335	6240849
013	773706	6240838
014	773710	6240334
015	774115	6240334
016	774109	6240832
018	773781	6240669
019	773779	6240663

020	773777	6240658
021	773759	6240640
022	773778	6240599
023	773815	6240553
024	773841	6240541
025	773869	6240549
026	773896	6240570
027	773909	6240596
028	773903	6240634
029	773889	6240651
030	773864	6240652
031	773844	6240648
032	773827	6240666
033	773804	6240672
034	774394	6240636
035	774392	6240437
036	774701	6240440
037	774698	6240502
038	774666	6240555
039	774655	6240591
040	774650	6240637

UTM Coordinates for proposed gravel pit, Block A, Fisher's property.

006	233346	6244025
007	233392	6244323
008	233584	6244267
009	233638	6244218
010	233621	6244127
011	233741	6244056
012	233751	6243989
013	233704	6243971
014	233581	6244016
015	233409	6244004
016	233346	6244025

UTM Co-ordinates for proposed gravel pit, Block B, Fisher's property.

017	231980	6244981
018	232361	6244991
019	232464	6244622
020	232394	6244607
021	232163	6244603
022	232019	6244719
023	231980	6244981

UTM Co-ordinates for proposed gravel pit, Block C, Fisher's property.

001	233853	6244290
002	233891	6244556
003	234174	6244541
004	234055	6244190
005	233853	6244290

UTM Co-ordinates for proposed gravel pit, Area 5, Horse Paddock.

001	230116	6242348
002	230158	6242352
003	230202	6242355
004	230230	6242343
005	230239	6242308
006	230226	6242270
007	230188	6242261
008	230136	6242256
009	230116	6242348

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Appendix K Visual Assessment Report (prepared by DEC)

Fitzgerald River National Park

Department of
Environment and Conservation

Prepared by the Recreation & Landscape Unit

December 2009

CONTENTS

INTRODUCTION

BACKGROUND

Due to the recent closure of the BHP nickel mine near Ravensthorpe, the State Government allocated $20m to stimulate the local economies of the area. This financial injection is assigned primarily to upgrade and seal a portion of the Fitzgerald River National Parks (FRNP) road system. A further $20m has been requested from the Federal Government.

The majority of funding has been allocated to Main Roads of Western Australia (MRWA) as they have been engaged to undertake the design and documentation of the road upgrade. Stage 1 of the works is to seal Hamersley Drive from the eastern end of FRNP west to Hamersley Inlet. MRWA have commenced their design process and are intending to begin construction on the first 3km in February 2010.

SCOPE

This report assesses the upgrading of Hamersley Drive from the eastern Park entry station to the parking area at East Mt Barren (the study area). The current road comprises a gravel running surface, shoulders and associated table drains. Visual impacts are already evident due to the road's strong linear form and contrasting colour and texture within the natural setting.

The proposal is to widen and seal the road to 6.4m with 1m shoulders plus associated table drains. Within the study area, additional built elements are being proposed including kerbing and 800m of guard railing as an option to address drainage and safety issues. Due to environmental constraints, the alignment cannot be changed. The visual implications of these modifications are addressed in this report.

The scope of this assessment has been matched with the time and resources available on this project given the political imperatives to implement the works. Extensive seen area mapping, digital elevation modelling nor modelling of proposed changes have not been undertaken and are not necessary to determine the proposed visual impact and make appropriate recommendations.

STUDY AREA

The study area encompasses an approximate 3km section of Hamersley Drive from the Park entry west to East Mt Barren carpark. A further 13km of the Drive to Hamersley Inlet will be sealed in the near future. Hamersley Drive is the major tourist route and Park access road from the eastern side of FRNP.

The landscape in this section of the Park contains shallow soils over a quartz / granite substrate some of which is exposed. Low coastal vegetation shaped by the exposed southern aspect provides a thin blanket of vegetation from East Mt Barren to the coast some 400m away.

Due to the landform and geology within the current alignment, this portion of Hamersley Drive is potentially the most arduous in terms of road construction and engineering. The current alignment of the road is predominantly benched into the slope meandering around the southern portion of East Mt Barren.

ASSESSMENT PROCESS

METHODOLOGY

This study is based on a systematic method of visual landscape management adopted and developed by DEC, refer Appendix 1. The method, beginning with visual landscape inventory and assessment, identifies and analyses visual characteristics of landscape and the degree of significance and sensitivity placed on that landscape by those who view it.

Zones of priority for landscape values and resultant visual management objectives are then established against which proposed works can be assessed.

The main components of the method are –

- Inventory of landscape elements – identification and description of the visual character of the study area landscape.
- Classification of landscape character – description and classification of visual character into categories of relative scenic quality.
- Assessment of significance – identification of values of landscape character that are most important to the experience and enjoyment of people [Preference based].
- Assessment of access and viewer positions – a measure of how people experience a landscape.
- Establishment of management priority zones – an amalgamation of bio-physical and social components of visual landscape into zones of relative concern for landscape values.
- Determination of management objectives – visual management objectives are stated in terms of acceptable degrees of change to the established character of the landscape
- Recommendations to minimise visual impact due to proposed alterations

Visual impact assessment - evaluating proposals:

Changes to the natural character of an established landscape, either natural or modified, can have a detrimental impact on its visual values. Potentially negative impacts can be significantly ameliorated or eliminated if visual assessments of the proposed modifications landscape are analysed and assessed during project planning and construction.

Key components of a visual impact assessment report are:

- An understanding of landscape character, human perception/sensitivity, seen areas and view-sheds, landscape management zoning, visual management objectives and the ability of the landscape to absorb change, and;
- a comprehensive understanding of the development or modification

VISUAL LANDSCAPE INVENTORY AND CHARACTOR

FRNP is located within the broader 'Esperance Plains' Landscape Character Type (LCT)[1], a broad scale area of common visual characteristics. The Park is one of the highlights of the LCT forming the largest area of uncleared land being representative of the natural landscape prior to land being modified for agriculture.

[1] Pg 61, Reading the Remote; Landscape Characters of Western Australia, Department of Conservation and Land Management 1994.

The Park has since been broken down into smaller visual LCT consisting of 'Coastline' and 'Southern Slopes'[2]. The portion of Hamersley Drive referred to in this report is located in the 'Coastline' LCT.

The landform is characterised by the landward limit of marine influence including beaches, quartzite cliffs, extensive sand drifts and inlets. Gently inclined sand plains and rugged pyramidal ranges dominate this setting. The scale of this landscape is vast promoting extensive open views with large areas of sky. Views from the coast and beach however are often constricted to foreground scenery due to coastal dune systems.

Vegetation cover is dominated by diverse heath with patches of Melaleuca and Mallee woodland. Land use consists of occasional recreation site developments in carefully selected locations and Hamersley Drive.

The landscape is predominately natural in character with the steep, ragged Barren Ranges being the dominant focal point of many views over the Park. The ranges provide a strong contrast from the sand plain covered heath land and ocean elements. Hamersley Drive and its associated infrastructure are currently the only substantial foreign visual element. The roads impose a strong alien 'line' across a textural dominant natural landscape and the visual impact ranges from 'apparent' to 'dominant' depending on viewer position in the landscape.

Figure 1 - View looking west from East Mt Barren

VISUAL QUALITY CLASSIFICATION

There are three levels of scenic quality. High, Medium and Low classification is given based on importance and hierarchy of visual landscape elements within the landscape setting (landform, vegetation & water form). The study area is classified as High Scenic Quality[3] due to the area's high degree of naturalness and contrasting landscape elements and composition.

VISITOR SENSITIVITY

The importance of the natural landscape values of the FRNP have been frequently confirmed by the local community, planning agencies and management planning documents. There is a strong sentiment that development changes in this landscape should protect existing natural and visual characteristics.

[2] Pg 35, FRNP Management Plan 1991-2001, Department of Conservation and Land Management, 1991

[3] Further information can be attained from Pg 63, Reading the Remote; Landscape Characters of Western Australia, Department of Conservation and Land Management 1994.

No visitor surveys or studies were conducted specifically for this visual landscape assessment for the proposed roading modifications. It is recognised, however that the FRNP attracts local, regional and international visitors due to high landscape values, collection of rare flora and fauna, and relationship to nearby rural centres. Peak visitation occurs during spring and autumn due to wildflower season and weather considerations.

The study area is visible from Hamersley Drive (eastern approach prior to park entry), Hamersley Drive within the Park and associated spur roads in the Park. A short section of the drive, approximately 800m is seen from part way up East Mt Barren walktrail.

A number of points along the travel routes have been identified, mapped and are described below. (Refer Appendix 1 – pg18 for corresponding maps)

Park Entry - Travelling west from Hopetoun (Level 1 – high sensitivity):
The majority of visitors access the Park from Hopetoun along this road. Middle-ground views of road sections become apparent from around 7km, see travel route point 1. At 5km, travel route point 2, the views are more evident and begin to form a line on the landscape. Due to the linear road alignment on the eastern approach to the study area, a portion of the road heading upslope becomes more prominent. (Refer figure 2).

Views of the road become more evident upon approaching the Park entry and the impact of the road increases. The exception is at travel route point 3 at 3km where there are filtered views only. At travel route point 4 at 1.3km, vehicles travelling the road become visible (refer figure 3).

Figure 2 –Approach from eastern end (5km) travel route point 3

Figure 3 –Approach from eastern end (1.3km) travel route point 4

Figure 4 –View west from Park entry station travel route point 5

Park Entry Station (Level 1 high sensitivity):
The impact of the existing road from the entry station, travel route point 5, is lessened due to the parking area sitting lower in the profile and much of the road being screened by the plateau and vegetation at the base of East Mt Barren (refer figure 4). The visible section of road is within the foreground zone.

Traversing East Mt Barren (Level 1 high sensitivity):
Beyond the entry station the road is experienced in a dynamic sense while traversing the drive. The road moves up the slope and turns across and follows the contour along a bench formation along the side of East Mt Barren. Viewer position is low (1.1m), level and passengers attention is generally focused on middle-ground and background views beyond once the vehicle begins to skirt the mountain. The ocean and East Mt Barren become the dominant visual elements on this section of the drive (refer figures 5-9). Areas of taller vegetation along the road edge limit views to the south and provide screening from below.

Figure 5 –Approach to East Mt Barren from the east

Figure 6 – Ocean becomes the dominant visual element

Figure 7 – Road is cut into the slope with greater visual impact from batters evident. Pockets of taller vegetation (to 4m) provides screen of road for viewing from below.

Figure 8 – Road cut into natural profile with some road batter slow to rehabilitate

Figure 9 – Nearing East Mt Barren Carpark. Open views and focal points to the west. Viewer position is 'level'. Superelevation of corner increases batter on western side increasing visual impacts from the west.

View south from East Mt Barren walktrail (Level 2 - medium sensitivity):
Elevated viewer position from the walktrail exposes a 600m section of Hamersley Drive within the study area (refer figure 10). Viewer position is from above and in the foreground.

Figure 10 – view from along the East Mt Barren walktrail

Approaching East Mt Barren from the east (Level 1 - high sensitivity):
The existing road south of the East Mt Barren parking area is unseen when viewed from the east due to middle-ground views, low viewer position and vegetation screening (refer figure 11).

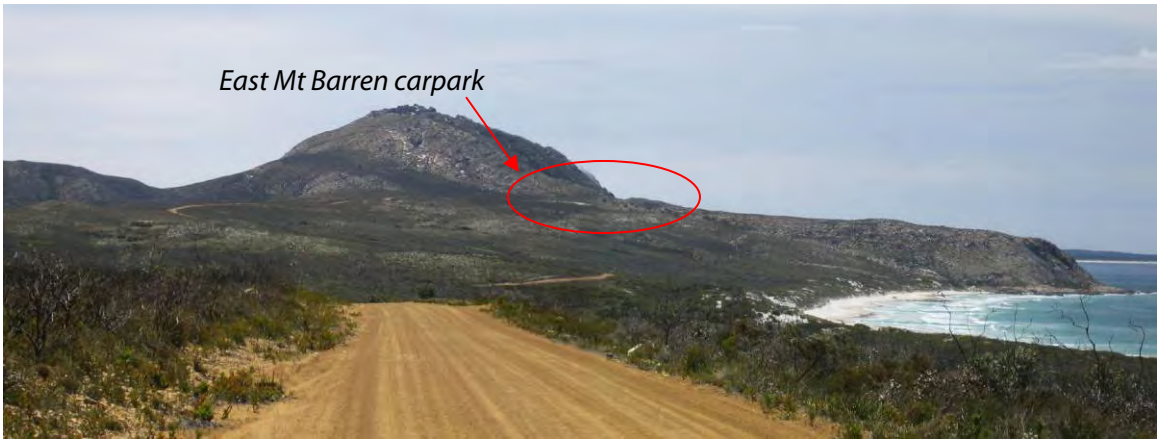


Figure 11 - view approaching East Mt Barren from the east (point 3, Map 4)

Cave Point viewing area (Level 2 - moderate sensitivity):
Offers middle-ground views to foothills of East Mt Barren. Viewer position is 'level' with no evidence of the existing road south of the East Mt Barren parking area (refer figure 12).

Figure 12 - view of East Mt Barren from Cave Point (point 1, map 4)

Other points along the travel routes were assessed, but like those at Cave Point, the existing road south of East Mt Barren parking area is not evident (refer to Map 4 and 5). The road north and west of East Mt Barren is evident but not part of this study.

VISUAL LANDSCAPE MANAGEMENT ZONES AND OBJECTIVES

The study area lies within Visual Landscape Management Zone A indicating the highest degree of concern for visual landscape values. The Zone A designation results from a systematic integration of the classification of physical elements – High Scenic Quality and social/cultural elements – Sensitivity Level 1 and 2 and distance from viewer positions – Foreground.

The resultant visual landscape management objective is least accepting of change and requires that changes to the established landscape in the study area are minimised.

VISUAL IMPACT ASSESSMENT

EXISTING CONDITIONS AND PROPOSED DEVELOPMENTS

Some sections of existing road in the study area do not meet the visual management objective for a VLM Zone A. It does however meet this objective when viewed from the western approach and Cave Point. The most apparent existing visual impacts are noted when approaching from the eastern side and when traversing the road itself. Curvilinear alignment and vegetation screening break up this impact with only two main portions of the drive evident from the viewing areas.

Components of the proposed works in the study area include:

- Clearing existing vegetation along road edges to allow for an increased running surface;
- Topping existing road level with additional layer of gravel to reshape surface, meet drainage and geometry requirements and provide suitable base for seal;
- Installing barrier kerbing to both sides of the road in a section along East Mt Barren. The upper side (north) kerb will alleviate the need for batters and table drains where excavation is difficult. The kerbing on the southern side is proposed to lessen the required batter angle and associated disturbance;
- Installing, sumps, culverts and headwalls where required;
- Installing an 800m section of 'Wire Rope Safety Barrier' along the southern edge of a section along East Mt Barren due to slope and potential safety hazard associated with roads near drop-offs;
- Constructing road to meet 60km design standards; and
- Constructing viewing rest area adjacent to existing site.

The road works are planned to commence in February 2010 starting from the eastern end.

ASSESSMENT OF VISUAL IMPACTS

Given the scope of the proposed works and nature of roads as being a strong imposition on any landscape, it is apparent that the Visual Management Objectives for Zone A will not be met in its entirety. This section examines the potential visual impacts of the proposed works as seen from the identified travel routes and visitor use areas (refer to Maps 1-6, Appendix 1). This section also outlines projected stages of visual impact over time and considers the immediate visual impact post construction.

Approach from eastern end (Level 1 – high sensitivity):
Limited visual impacts are anticipated from the extent of the middle-ground viewing zone due to distance, scale and visual absorption capacity of the East Mt Barren as a backdrop. From around 3km, travel route point 0, however the impacts will be more evident especially where the road rises directly up slope. At around 1.3km, travel route point 4, potential impact of new road batters will be evident along the horizontal section. This is primarily due to the road being widened and slightly elevated in the profile. A portion of the proposed wire safety barrier may also become apparent however may also be transparent enough to have minimal affect on visual amenity. The proposed kerbing, although a strong linear form, will be in-evident due to low viewer position.

The most obvious transient visual impacts will be vehicles and buses moving around the road along East Mt Barren between the two visible areas. Their impact is a result of

contrasting form, scale and colour when seen against this landform dominated by coastal heath.

The disturbance created by widening the road will have an immediate impact however the long term impacts of shoulders and associated batters will be of most concern.

Park Entry Station (Level 1 - high sensitivity):
Due to the low observer position in relation to the road much of the proposed changes will remain in-evident. The portion of the road heading upslope will now be in the foreground zone however will only form a broken line due to curvilinear alignment amongst heath vegetation. Using a darker aggregate material for the seal will reduce the impact of the running surface however the exposed shoulder areas will remain a contrasting element.

Traversing East Mt Barren (Level 1 - high sensitivity):
The experience in travelling from the Park entry station to East Mt Barren will have the largest visual impact due to the installation of heavily engineered roading elements and solutions. Views of the road itself will be in the foreground zone. The sections of kerbing and safety barriers will introduce a new aesthetic in this setting becoming dominant visual elements. Low observer position will mean the top of the safety barrier will sit just 300mm below eye level. (Refer to Appendix 1 – Barrier location photos)

Kerbing is proposed for the majority of the upper (north) edge from around 500m past the ranger's residence to 180m before East Mt Barren carpark. This will impose a strong linear element along the drive.

The proposed widening of the road will result in loss of vegetation to accommodate cut and fill batters. The initial visual impacts of these will be a dominant element within the foreground zone with impact also becoming evident when approaching from the east prior to the park entry station.

Focal points along this section such as the rock formations and the ocean will detract the viewer temporarily.

View south from East Mt Barren walktrail (Level 2 - medium sensitivity):
Walkers accessing the walktrail to East Mt Barren are exposed to views over a section of Hamersley Drive from the carpark to approximately 500m east of the western most ridgeline. Due to the high viewer position and view-shed angle much of the drive is evident from this location. Dominant views are in the background with the ranges to the west and the ocean and horizon to the south.

Sealing the road will have a positive visual impact from this viewing location. The potential darker surface colour will assist the road to visually recede into the landscape. The section of kerbing from this viewer position will be in-evident due to its location at the base of the cut on the upper side.

Approaching East Mt Barren from the west (Level 1 - high sensitivity):
Currently views of the road in the study area are in-evident from the western approach other than a section of the East Mt Barren carpark. Viewer position varies in distance zones however it would seem that in general the viewer position is low. Views are predominantly middle-ground until the East Mt Barren Carpark.

The proposed works will be apparent but not dominant with the impact being limited to exposed fill batters along the curved section of road at the base of the East Mt Barren ridge.

Cave Point viewing area (Level 2 - moderate sensitivity):
It is anticipated middleground views to foothills of East Mt Barren will remain intact. Viewer position is 'level' with no evidence of the existing road within the study area from some 4km away. Any visual changes from here resulting from exposed fill batters would be minimal to in-evident.

VISUAL MANAGEMENT RECOMMENDATIONS

Whilst the proposed developments will have visual impacts, measures can be taken to partially address some of the management objectives associated with VLM Zone A. These objectives include avoiding operations that lead to highly visible changes in visual quality and a focus on the maximum protection of all existing visual landscape features. Such actions are outlined below.

FORM

The most significant elements proposed for the site are road widening with associated earthworks and drainage measures. As the alignment of the road cannot be modified, the following recommendations will assist in reducing or mitigating visual impacts of the proposed upgrades. These include:

- Design for minimal road width to reduce extent of fill batters;
- Minimise earthworks and associated cut & fill to best suit the existing slope;
- Site the road as low as possible in the landscape profile. This will reduce amount of cut and fill required;
- Cut slopes are preferable as they are generally more conducive to recovery and rehabilitation, with replacement of sufficient top soil;
- Rehabilitate all exposed batters with topsoil and mulch to encourage vegetation growth; and
- Use minimum culverts and headwalls and when required use natural materials (eg. stone or rock pitching) for lining and outfall protection areas.

LINE

Currently, the existing road forms a strong line in this landscape. Several new and foreign lines will be further imposed as a result of the road upgrade. These include primarily –

- Sealed road edges (seam of seal and gravel shoulders)
- Kerbing
- Wire rope safety barriers
- Fill toe lines
- Line marking

Mitigation measures to reduce impacts of lines include:

- Explore more asymmetrical forms in relation to shaping fill batters as they are more akin with this landscape. Straight lines are not conducive and look unnatural in this setting. Batters should reflect form of the adjacent profiles;
- Partially break up imposed lines with vegetation, or segment by other means. For example, battering works required on fill slopes could incorporate larger rocks and areas of vegetation where possible;
- Investigate options for replacement of kerbing on southern side with subterranean drainage system;

- Construct kerbing constructed with minimal straight sections; and

- Consider replacing kerbing on upper side with low rock wall to better match the local colours and materials.

COLOUR

The site exhibits a subtle seasonal variation in vegetation foliage and floral colour. Colour choice of materials can significantly reduce potential visual impacts particularly when viewed from middleground. Options include:

- Sealing road surface with basalt and darker granites as they are more visually recessive and complementary to site colours; and

- Reducing impacts of kerbing by using a mid-grey colour (2-3% black oxide in Grey Portland Cement).

TEXTURE

Constructed elements in this site should respond to the subtle but continual textural variation in the landscape. Rehabilitation and revegetation works are critical components in mitigating visual impacts at the site. Mitigation actions include:

- Using rougher textured surfaces where possible such as natural stone of similar colour and texture to that found locally; and

- Accommodating both rock pitching and vegetation on proposed cut and fill slopes. These slopes have the potential to mesh with the existing coastal heath and adjacent rock formations

CONCLUSION

The Fitzgerald National Park offers a landscape predominately natural in character. This area is of national significance and is part of the main access route into the Park from the eastern end. Planned works are intended to encourage higher visitation and improve visitor facilities and experience.

This portion of the roading project is an integral part of the overall park upgrade and will form part of the 'sense of arrival' experience. Whilst the road currently exists upgrading it to a higher standard will have an impact on the visual amenity. It is well known that sealing a road can reduce the overall visual impact if done in a sensitive manner conducive to the local landscape elements.

Whilst the existing site has been impacted on in previous years with the construction of the existing gravel road access, the site has been identified as a Zone A site, of high visual quality, which requires maximum retention of visual quality.

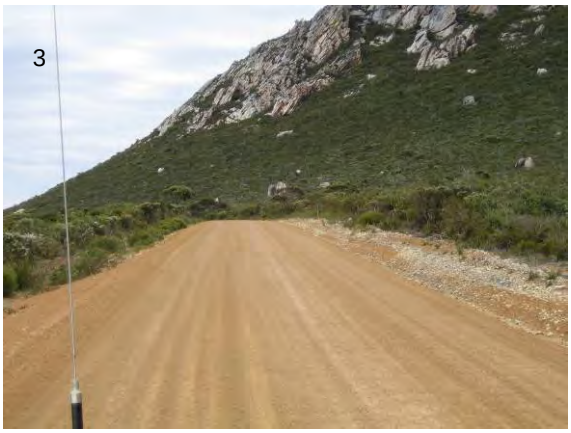
Given the prominence and exposed nature of this site, the proposed works will have a visual impact when compared with existing conditions. These impacts will vary over time, with the greatest visual impacts likely during the construction phase of the project, where initial disturbance from earthworks will be significant. The presence of vehicles will be a transient but obvious element for fore-ground and middle-ground views.

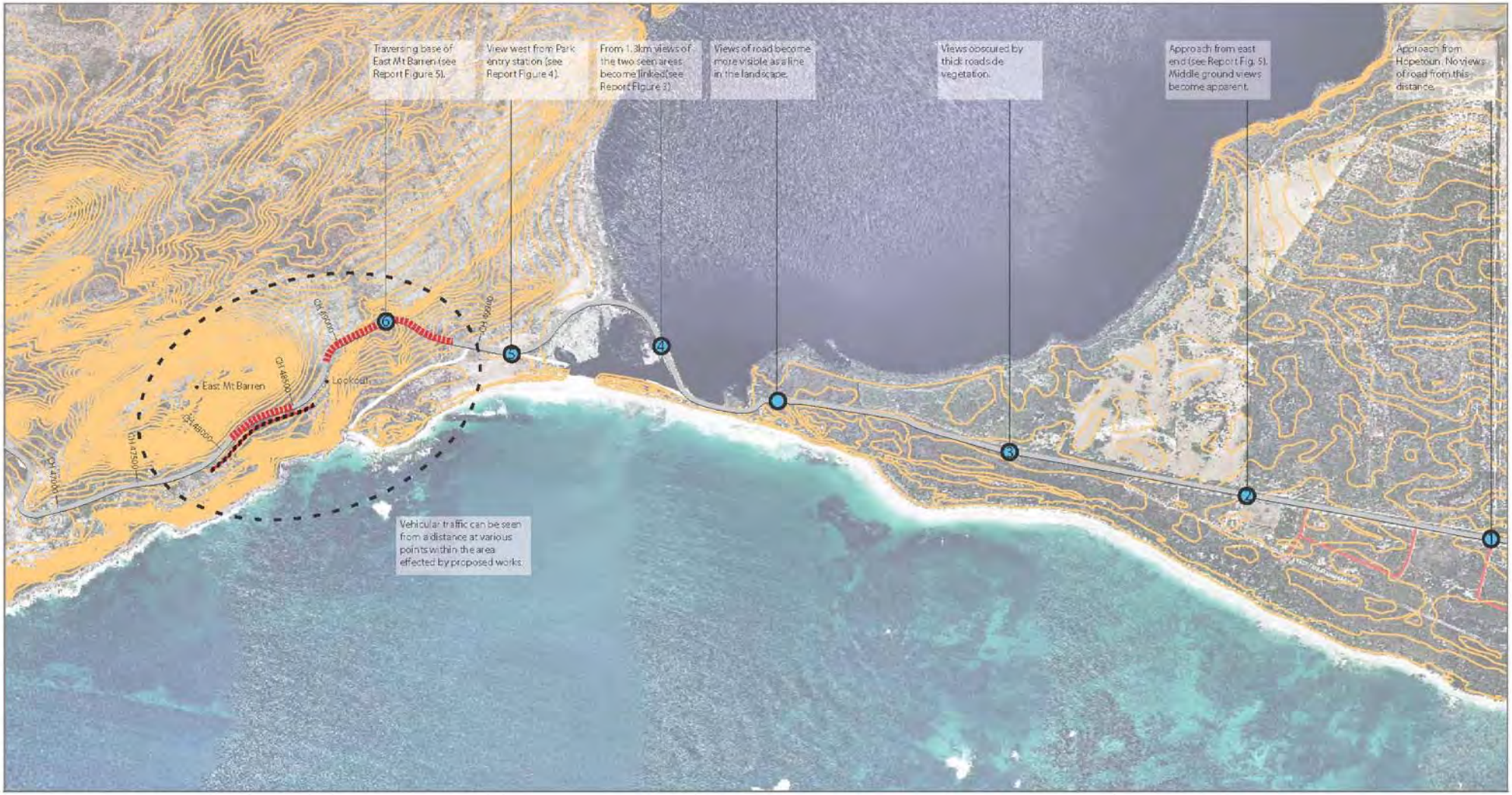
There are several mitigating measures that can be incorporated into the works to reduce the visual impact such as keeping extents of cut and fill to a minimum, utilising colours and textures that complement the landscape setting and sensitive siting of elements associated with roadwork's. Although the desired objective of maximum retention of visual quality can not be met in its entirety, such measures can significantly reduce the visual impacts resulting from these works .

APPENDIX 1

Analysis Maps & photos

Guard Rail Locations





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Metres

LEGEND

- AREA EFFECTED BY PROPOSED WORKS
- LEVEL 1 TRAVEL ROUTE (HAMERSLEY DVE)
- LEVEL 1 TRAVEL ROUTE POINTS (Number indicates photo - see Sheet 2)
- SEEN AREAS OF ROAD (EXISTING)
- PROPOSED ROADSIDE SAFETY BARRIER
- CHAINAGE POINTS (Approximate) - CH 42000

REV	DESCRIPTION	DATE
A1	VISUAL IMPACT ASSESSMENT - STAGE 1 ROADING - EXISTING CONDITION (EAST)	-

Department of Environment and Conservation

Designer/s:	Draftperson/s:	Engineer:
DS	BF	-
Date of Issue:	Checked by:	Region Approval:
-	-	-
Scale @ A3:	Revision:	District Approval:
1:25,000	A1	-

Drawing Title:

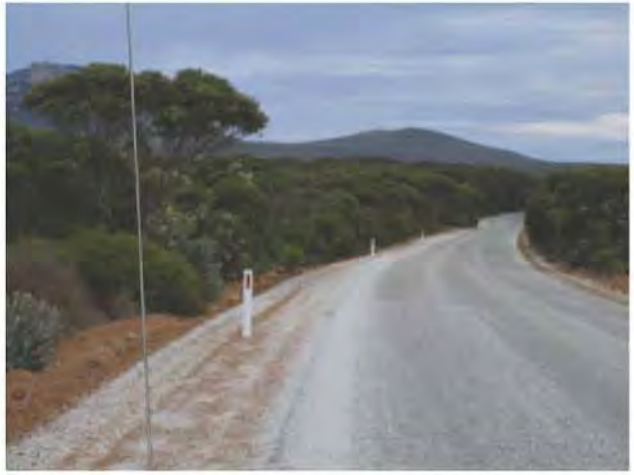
FITZGERALD RIVER N.P.

V.I.A. - STAGE 1 ROADING - EAST (EXISTING CONDITION)
SOUTH COAST REGION/ ALBANY DISTRICT

Date:	Project Number:	Drawing:	Sheet no:
YYMMDD	SC0903	091112_SC0903_frnp_VIA_25000_EAST_Ex.ai	1 of 6

1 Approach from Hopetoun. No views of road from this distance.

2 Approach from East end (see Report Fig. 5). Middle ground views become apparent.



3 Views obscured by thick roadside vegetation.

4 From 1.3km views of the two seen areas become linked(see Report Figure 3).

5 View West from Park entry station (see Report Figure 4).

6 Traversing base of East Mt Barren (see Report, Figure 5).

Department of Environment and Conservation

Designer/s:	Draftperson/s:	Engineer:
DS	BP	-
Date of issue:	Checked by:	Region Approval:
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REV	DESCRIPTION	DATE
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Drawing Title:
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SOUTH COAST REGION/ ALBANY DISTRICT

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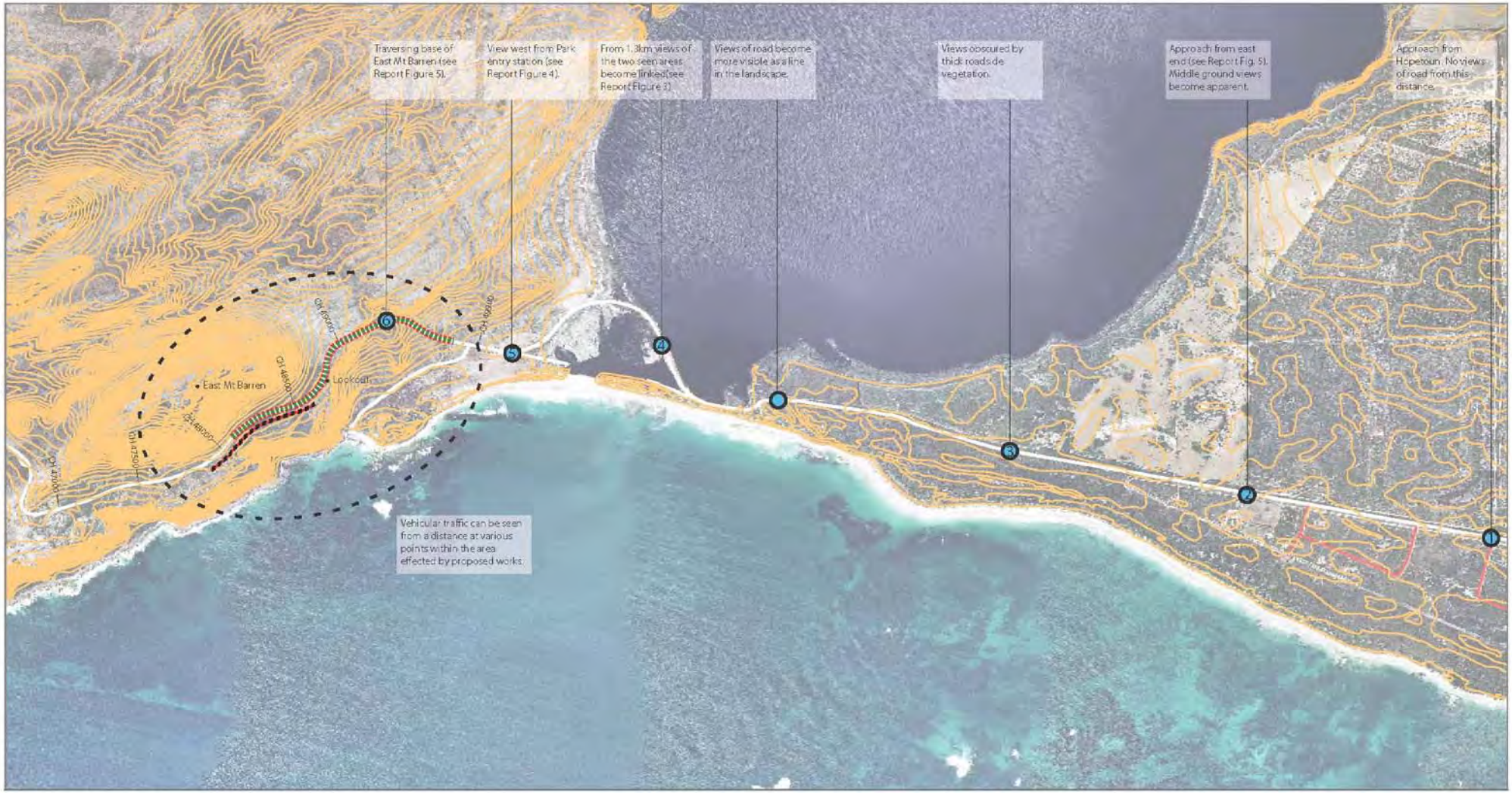

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Metres

LEGEND

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- LEVEL 1 TRAVEL ROUTE (HAMERSLEY DVE)
- LEVEL 1 TRAVEL ROUTE POINTS (Number indicates photo - see Sheet 2)
- SEEN AREAS OF ROAD (PROPOSED)
- PROPOSED ROADSIDE SAFETY BARRIER
- CHAINAGE POINTS (Approximate) - CH 42000

REV	DESCRIPTION	DATE
A1	VISUAL IMPACT ASSESSMENT - STAGE 1 ROADING - PROPOSED CONDITION (EAST)	-

Department of Environment and Conservation

Designer/s: DS	Draftperson/s: BP	Engineer: -
Date of Issue: -	Checked by: -	Region Approval: -
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Drawing Title:

FITZGERALD RIVER N.P.

V.I.A. - STAGE 1 ROADING - EAST (PROPOSED CONDITION)
SOUTH COAST REGION/ ALBANY DISTRICT

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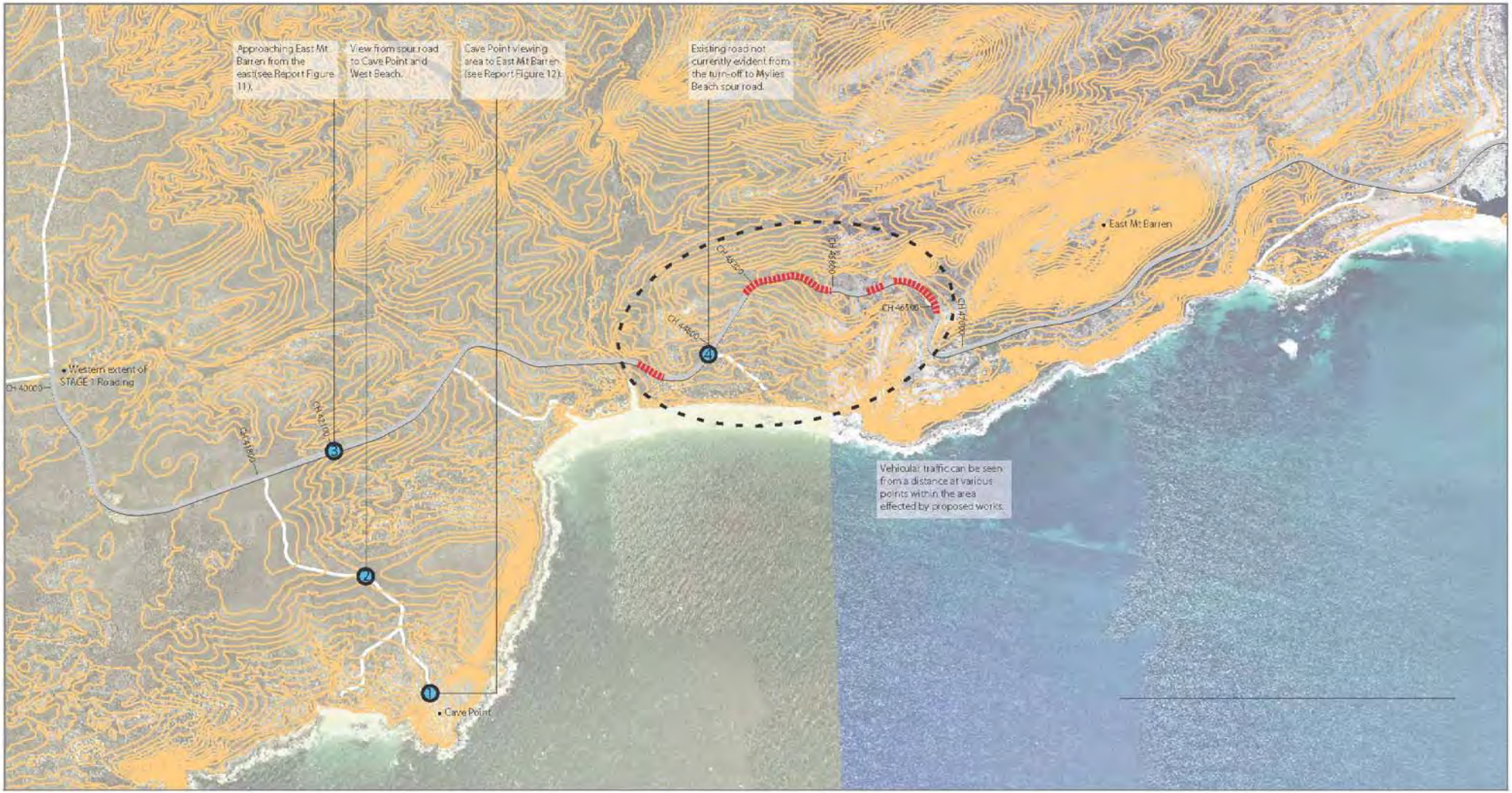

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Metres

LEGEND

- AREA EFFECTED BY PROPOSED WORKS
- LEVEL 1 TRAVEL ROUTE (HAMERSLEY DVE)
- LEVEL 1 TRAVEL ROUTE POINTS (Number indicates photo - see Sheet 2)
- SEEN AREAS OF ROAD (EXISTING)
- PROPOSED ROADSIDE SAFETY BARRIER
- CHAINAGE POINTS (Approximate) - CH 42000

REV	DESCRIPTION	DATE
A1	VISUAL IMPACT ASSESSMENT - STAGE 1 ROADING - EXISTING CONDITION (WEST)	-

Department of Environment and Conservation

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Drawing Title:

FITZGERALD RIVER N.P.

V.I.A. - STAGE 1 ROADING - WEST (EXISTING CONDITION)
SOUTH COAST REGION/ ALBANY DISTRICT

Date:	Project Number:	Drawing:	Sheet no:
YYMMDD	SC0903	091112_SC0903_frnp_VIA_25000_WEST_Ex.ai	4 of 6

1 Cave Point viewing area to East Mt Barren (see Report Figure 12).

2 View from spur road to Cave Point and West Beach.

3 Approaching East Mt Barren from the east(see Report Figure 11).

4 Existing road not currently evident from turn-off to Mylies Beach spur road.

A1	VISUAL IMPACT ASSESSMENT - STAGE 1 ROADING - EXISTING CONDITION (WEST) PHOTOS	-
REV	DESCRIPTION	DATE

Department of Environment and Conservation

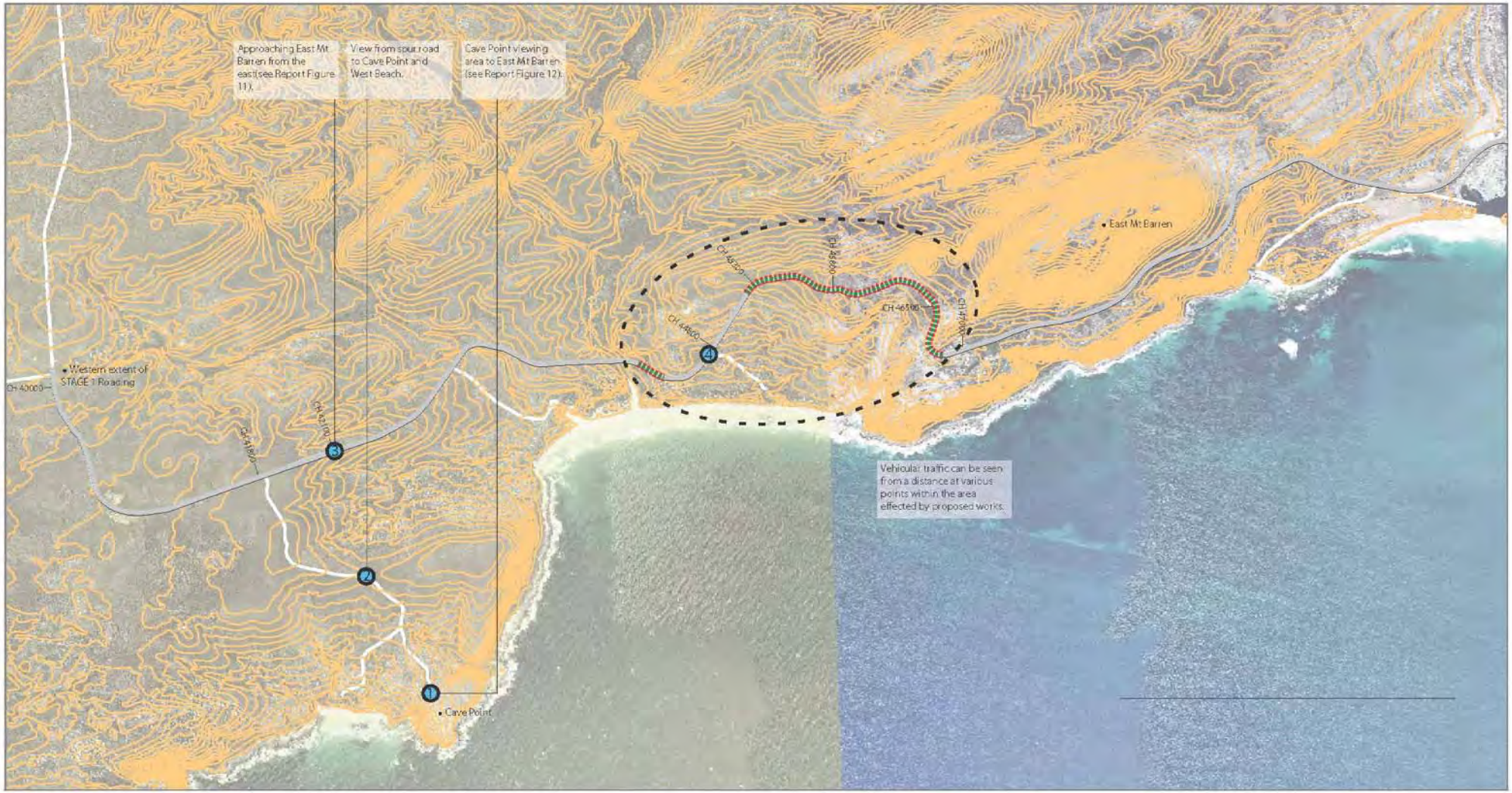
Designed: DS	Draftperson: BP	Engineer: -
Date of Issue: -	Checked by: -	Region Approval: -
Scale @ A3: 1:25,000	Revision: A1	District Approval: -

Drawing Title:

FITZGERALD RIVER N.P.

V.I.A. - STAGE 1 ROADING - WEST (PHOTOS)
SOUTH COAST REGION/ ALBANY DISTRICT

Date:	Project Number:	Drawing:	Sheet no:
YYMMDD	SC0903	091112_SC0903_frnp_VIA_25000_WEST_Ex_Photo page.ai	5 of 6



N

1:25,000 (A3)

0 250 500 1,000 1,500 2,000

Metres

LEGEND

- AREA EFFECTED BY PROPOSED WORKS
- LEVEL 1 TRAVEL ROUTE (HAMERSLEY DVE)
- LEVEL 1 TRAVEL ROUTE POINTS (Number indicates photo - see Sheet 2)
- SEEN AREAS OF ROAD (EXISTING)
- PROPOSED ROADSIDE SAFETY BARRIER
- CHAINAGE POINTS (Approximate) – CH 42000

REV	DESCRIPTION	DATE
A1	VISUAL IMPACT ASSESSMENT - STAGE 1 ROADING - PROPOSED CONDITION (WEST)	-

Department of Environment and Conservation

Designer/s: DS	Draftperson/s: BP	Engineer: -
Date of Issue: -	Checked by: -	Region Approval: -
Scale @ A3: 1:25,000	Revision: A1	District Approval: -

Drawing Title:

FITZGERALD RIVER N.P.

V.I.A. - STAGE 1 ROADING - WEST (PROPOSED CONDITION)
SOUTH COAST REGION/ ALBANY DISTRICT

Date:	Project Number:	Drawing:	Sheet no:
YYMMDD	SC0903	091112_SC0903_frnp_VIA_25000_WEST_Proposed.ai	6 of 6

APPENDIX 2

Visual Landscape Management System

VLM – Sensitivity Level Assessment Criteria

Sensitivity levelling component of the CALM VLM System requires classification of all travel routes and used areas into 'levels of public sensitivity' (Level 1 – High, Level 2 – Moderate, Level 3 – Low and Level 4 – Very Low) based on known public perceptions of the visual landscape and the criteria listed.

Level 1-Viewer Sensitivity

1. State highways and other main roads (sealed or unsealed) with high levels of vehicle usage.
2. Designated tourist, scenic drive, or scenic forest tour roads (sealed or unsealed)
3. Recreation, conservation, cultural or scenic sites, areas, viewpoints, and lookouts of national or state significance. (including their access routes as per 1 and 2 above)
4. Walking tracks of national or state significance.
5. Residential areas.
6. Rail and tram lines of cultural, historic or scenic significance.
7. Navigable rivers and streams, lakes and reservoirs of national or state recreation significance.
8. Any level 2,3 or 4 travel routes or use areas planned for upgrading to Level 1 within 5 years.

Level 2-Viewer Sensitivity

1. Main roads with moderate levels of vehicle usage(sealed or unsealed)
2. Recreation, conservation, cultural or scenic sites, areas, viewpoints, and lookouts of regional or high local significance (including their access routes as per 1 above).
3. Navigable rivers and streams, lakes and reservoirs of regional recreation significance
4. Walking tracks of regional significance
5. Any level 3 or 4 travel routes or use areas planned for upgrading to Level 1 or 2 , or Level 1 planned to be downgraded , within 5 years.

Level 3-Viewer Sensitivity

1. All remaining roads with low levels of vehicle usage (sealed or unsealed)
2. Recreation and other use areas of local significance (including their access routes as per 1 above)
3. Navigable rivers and streams, lakes and reservoirs of local recreational significance
4. Walking tracks of local significance
5. Any Level 4 travel routes or use areas planned for upgrading, or Level 2 planned to be downgraded, to level 3 within 5 years.

Level 4-Viewer Sensitivity

1. Management roads with infrequent traffic-very low levels of vehicle usage
2. Any other remaining forest tracks with infrequent usage.