GREENDENE DEVELOPMENT CORPORATION PTY LTD

RIVERSLEA SUBDIVISION (SUSSEX LOCATIONS 9002 AND 9101)

PUBLIC ENVIRONMENTAL REVIEW (EPA ASSESSMENT NO. 1463)

VERSION 4

JULY 2005

REPORT NO: 2004/131

ATA Environmental
environmental scientists

AN INVITATION TO COMMENT ON THIS PUBLIC ENVIRONMENTAL REVIEW

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

The Greendene Development Corporation Pty Ltd is proposing a residential subdivision at Margaret River in Western Australia. A subdivision approval was granted for the land on July 25, 2002.

In accordance with the Environmental Protection Act 1986, a Public Environmental Review (PER) has been prepared by the Company to examine the environmental effects associated with the proposed development and how they will be managed. The PER describes the proposal, examines the likely environmental effects and the proposed environmental management procedures.

The PER is available for public review for up to 4 weeks from 25 July 2005 to 21 August 2005.

Comments from government agencies and from the public will help the EPA to prepare an assessment report in which it will make recommendations to government.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach.

It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in the EPA's report.

Submissions may be fully or partially utilised in compiling a summary of the issues raised or where complex or technical issues are raised, a confidential copy of the submission (or part of it) may be sent to the proponent.

The summary of issues is normally included in the EPA's Assessment Report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group interested in making a submission on similar issues.

Joint submissions may help to reduce the work for an individual or group, as well as increase the pool of ideas and information.

If you form a small group (up to ten people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the PER or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific elements of the PER:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- Attempt to list points so that the issues raised are clear. A summary of your submission is helpful.
- Refer each point to the appropriate section, chapter or recommendation in the PER.
- If you discuss different sections of the PER, keep them distinct and separate, so there is no confusion as to which section you are considering.
- Attach any factual information you wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name;
- your address;
- date; and
- whether you want your submission to be confidential.

The closing date for submissions is:

21August 2005

Submissions should be emailed to: melinda.macleod@environment.wa.gov.au or addressed to:

Chairman
Environmental Protection Authority
PO Box K822
PERTH WA 6842
Attention: Melinda Macleod

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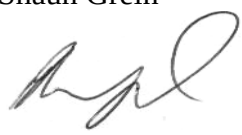
Report No: 2004/131

Checked by: Signed: 

Name: Shaun Grein Date: 15 July 2005

Approved by: Signed: 

Name: Paul van der Moezel Date: 15 July 2005

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EXECUTIVE SUMMARY

Introduction

Greendene Development Corporation Pty Ltd is planning to develop Lots 9101 and 9002, Willmott Avenue and Forrest Rd, located approximately 1km east of the Margaret River townsite, for the purpose of a residential subdivision. The subdivision development is known as Riverslea Gardens. The location of the proposed subdivision is shown in Figure 1.

Conditional subdivision approval for 86 lots was granted for the proposal area by the Western Australian Planning Commission (WAPC) on July 25, 2002. A condition requiring the deletion of 16 lots (lots 244-259) that front a proposed public open space and drainage reserve was subsequently removed by the Town Planning Appeal Tribunal on an uncontested appeal.

The Proposal

The proposed residential development of the Riverslea area involves:

1. the creation of 74 residential allotments ranging in size from 473 - 876m^2;

2. the construction of subdivisional roads;

3. the setting aside of an area for the purpose of "Reserve for Recreation" (i.e. Public Open Space) in accordance with the Riverslea ODP;

4. the establishment of reservations for Darch Brook and its tributary which are currently in private ownership; and

5. the re-construction of a natural wetland environment within a degraded tributary of Darch Brook.

Proposal Justification and Alternatives

The proposal to develop the Riverslea Gardens landholding as a residential subdivision is in accordance with the current zoning under Town Planning Scheme No 17 and the approved Outline Development Plan (ODP) that was prepared for Sussex Locations 2141, 2142 and Lots 81 and 1002 Willmott Avenue and Forrest Road, Margaret River in 2001.

The proposed subdivision for the Riverslea Gardens portion of the estate is adjacent to an existing development that has been extended into the proposed area (Figure 3). Services such as power reticulation, sewer reticulation, road networks and water and gas supply have all been designed with an expectation that the subdivision of Riverslea would continue to be developed in accordance with the approved ODP and the successive subdivisions that have been given planning approval for the estate.

Public Environmental Review

The Public Environmental Review (PER) describes the impact of the proposed Riverslea Gardens development on the following environmental factors:

- Vegetation
- Significant Flora
- Fauna
- Significant Fauna
- Watercourses
- Surface Water Quantity and Quality
- Aboriginal Heritage

The PER provides a description and justification of the project on a site specific, local and regional scale. Each of the environmental factors listed is addressed with a description of the existing environment, potential impacts, proposed management and commitments made by the proponent. Issues in relation to pollution control are also discussed.

This PER document deals specifically with the following environmental issues:

Biological

- Development of the proposed Riverslea Gardens subdivision will result in the removal of approximately 6.3ha of predominantly regrowth upland native vegetation and its associated flora and fauna. The vegetation is not considered regionally or locally significant and has regenerated after a history of clearing by the original farming owners.

- One Priority 3 listed plant species, *Gahnia scleroides*, was recorded from immediately adjacent to the proposal area. This species is generally associated with riparian vegetation and as a consequence is unlikely to be significantly impacted by the proposed subdivision. No Declared Rare Flora have been recorded from the proposal area.

- No loss of Specially Protected (Threatened) Fauna, Priority Fauna or ecological linkage as a result of the proposal is anticipated. Although Baudin's Cockatoos have been observed from the general area, there are large stands of similar vegetation in the nearby area in which Baudin's Cockatoos have been observed. No Baudin's Cockatoos have been observed nesting in the area.

- The vegetation on the site is not classified as a Threatened Ecological Community at either the State level or the Commonwealth level.

- As the development will occur in vegetated areas that are regionally and locally common, the direct impact on the regional fauna assemblage in the forested area will be negligible, as the vertebrate assemblage is typical of the region.

- The subdivision boundary is very close to the fringe of Darch Brook and its tributary. The current lot configuration and road layout would result in the loss

of a very small area (0.0172ha) of riparian vegetation along the western fringe of Darch Brook.

- The degraded tributary to the immediate south of the proposed subdivision will be rehabilitated as a sumpland/dampland-type wetland to improved habitat for wetland fauna (Figure 3).

Physical

- Water quality within Darch Brook and associated tributaries is unlikely to be affected by the residential development, as principles and features of water sensitive urban design will be incorporated into managing urban stormwater for the subdivision.

Social

- The development will create 74 residential lots, the residents of which will add to the commercial, educational and social environment of Margaret River.

- Several lots in the southeastern portion of the subdivision are within the buffer of Darch Brook, an area considered by local Aboriginals to be of cultural significance.

The implications of the residential development for each of the environmental factors is summarised in Table 1.

The proponent has made a number of commitments in this PER to minimise the environmental impact of this development. Summaries of these commitments are provided in Section 4.

In addition, the subdivision would not adversely affect the function of the riparian vegetation in maintaining water quality in Darch Brook or Margaret River and the proposed rehabilitated wetland will considerably improve the quality of water flowing from the proposed subdivision and the remainder of the catchment before it enters Darch Brook.

TABLE 1
RELEVANT ENVIRONMENTAL FACTORS

Environmental Factor	Relevant Area	Environmental Objective	Potential Impact	Potential Management
Biophysical				
Vegetation - Vegetation Communities - Declared Rare and Priority Flora - Riparian Vegetation	Subject site (approx. 9.2ha, including wetland area to be rehabilitated) The Riverslea Gardens subdivision area is located within the Warren Bioregion.	EPA Objective: To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through avoidance or management of adverse impacts and improvement in knowledge. Project Objectives: To ensure that the proposed subdivision is compatible with maintaining and enhancing the biological integrity of the surrounding environmental and minimising vegetation loss and degradation To protect Declared Rare and Priority Flora consistent with the provisions of the *Wildlife Conservation Act, 1950.* To minimise significant adverse impact on the survival of any Threatened Ecological Communities or regionally significant vegetation and, where possible, enhance, existing values through rehabilitation and revegetation	Clearance of approximately 6.3ha of upland and 0.0172ha riparian vegetation for the construction of lots, roads and infrastructure	Riparian vegetation and Priority listed taxa to be protected wherever possible. Delineate populations of significant flora and manage in accordance with recommendations of CALM. 1.7ha of wetland vegetation to the immediate south of the proposed subdivision areas to be created through the rehabilitation of the degraded tributary. A Stormwater and Watercourse Rehabilitation Management Plan to manage the quantity and quality of urban stormwater entering Darch Brook will be prepared and implemented prior to construction of the subdivision
Fauna - Terrestrial Fauna	Within the Warren Bioregion, within which	EPA Objective: To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through	Removal of potential vertebrate fauna habitat.	Fauna habitat association within riparian vegetation to be protected. 1.7ha of wetland fauna habitat to be created in the

Environmental Factor	Relevant Area	Environmental Objective	Potential Impact	Potential Management
- Special Protected (Threatened) fauna	the Riverslea Gardens subdivision proposal is located.	avoidance or management of adverse impacts and improvement in knowledge. Project Objectives: To minimise adverse significant impacts on terrestrial fauna known to occur in the area. To protect Specially Protected (Threatened) Fauna and Priority Fauna consistent with the provisions of the *Wildlife Conservation Act, 1950.*		rehabilitation of the degraded tributary.
Physical				
Watercourse	Project site and adjacent Darch Brook and Margaret River.	EPA Objective: To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance are protected. Project Objective: Protect the environmental values and maintain or enhance the key ecological functions of the wetlands and watercourse.	Clearing of approximately 0.0172ha of riparian vegetation associated with Darch Brook and 6.3ha upland vegetation associated with the remainder of the subdivision area has the potential to result in a decline in the ecological function of Darch Brook and Margaret River.	Stormwater management for the proposed subdivision will be undertaken in accordance with the Stormwater Management Manual for Western Australia (Department of Environment, 2004) to ensure that post development flows are maintained at pre-development rates into Darch Brook and its tributary. Riparian vegetation to be protected and enhanced through rehabilitation wherever possible. Clearing of upland vegetation to be kept to a minimum. A Stormwater and Watercourse Rehabilitation Management Plan to manage the quantity and quality of urban stormwater entering Darch Brook will be prepared and implemented prior to construction of the subdivision
Water - Surface Water Quantity and Quality	Water contained within the proposal area and in adjacent areas.	EPA Objective: To ensure that emissions do not adversely affect environment value of health welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards	The water quality of Darch Brook and the tributary may be affected by input of nutrient enriched stormwater and increased sedimentation.	Stormwater Management for the proposed subdivision will be undertaken in accordance with the Stormwater Management Manual for Western Australia (Department of Environment, 2004) to protect the quality of stormwater discharges to watercourses.

Environmental Factor	Relevant Area	Environmental Objective	Potential Impact	Potential Management
		and that stormwater management proposed for the subdivision is consistent with water sensitive urban design measures detailed in the Stormwater Management Manual for Western Australia (DoE, 2004) Project Objective: To ensure emissions do not adversely affect Darch Brook or Margaret River.		A Stormwater and Watercourse Rehabilitation Management Plan to manage the quantity and quality of urban stormwater entering Darch Brook and to c rehabilitate the degraded tributary will be prepared and implemented prior to construction of the subdivision.
Social				
Heritage: - Aboriginal Heritage	Project site and adjacent area	EPA Objective: To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation. Project Objective: To ensure that there is no unauthorised disturbance to Aboriginal Heritage sites associated with the proposed development.	Potential for material of Aboriginal cultural significance to occur on the site and potential impact on buffer of site considered to be of heritage significance to the local Aboriginal community.	Provisions of the *Aboriginal Heritage Act 1972* will be complied with. Clearance under Section 18 of the *Aboriginal Heritage Act 1972* will be required if the proposal is likely to impact on a site of Aboriginal Heritage significance. In the event that any new archaeological sites emerge as a result of earthmoving procedures located within the site, work within the immediate area will cease until further archaeological investigations are completed to the satisfaction of the Department of Indigenous Affairs.

1. INTRODUCTION

1.1 Project Background

Greendene Development Corporation Pty Ltd is planning to develop Lots 9101 and 9002 Willmott Avenue and Forrest Rd as a residential subdivision. The proposal area is located approximately 1km east of the Margaret River townsite. The subdivision application for the development was approved by the Western Australian Planning Commission (WAPC) in July 2002. A condition requiring the deletion of 16 lots (Lots 244-259) fronting the proposed public open space and drainage reserve was removed by the Town Planning Appeal Tribunal on an uncontested appeal in November 2002. The location of the proposed subdivision is shown in Figure 1.

The proposed subdivision is in accordance with the Leeuwin Naturaliste Ridge Statement of Planning Policy, the current zoning under the Shire of Augusta-Margaret River's Town Planning Scheme No 17 and the approved Outline Development Plan (ODP). The ODP for the Riverslea area was considered by the Augusta-Margaret River Shire Council in July 2000 and formally endorsed and adopted by Council and the WAPC in November 2001.

The subdivision application originally sought approval for 132 lots, including one parcel of 86 and another of 46 lots.

The 132 lot subdivision was referred to the EPA under Section 38 of the *Environmental Protection Act 1986* in December 2002. The EPA resolved to formally assess the project on the basis of the potential environmental impacts on the project and set the level of assessment as a Public Environmental Review (PER) (Assessment No. 1463).

The subdivision application was subsequently amended to two separate applications, of 86 and 46 lots each. The EPA consequently determined that the PER assessment related only to the 86 lot subdivision. The total number of lots has been subsequently reduced to 74.

1.2 The Proponent

The proponent for the subdivision of Riverslea (Lots 9002 and 9101) is Greendene Development Corporation Pty Ltd.

The office of and point of contact for Greendene Development Corporation Pty Ltd is:

Greendene Development Corporation Pty Ltd
Level 2
47 Stirling Highway
Nedlands 6009

Point of Contact: Mr. Andrew Lang
Phone: (08) 9423 5100

Please note that submissions on this PER should be directed to the Environmental Protection Authority (EPA) Services Unit as outlined in the first page of this document and should not be sent directly to the proponent.

1.3 Statutory Requirements

In addition to meeting the requirements of the *Environmental Protection Act 1986*, Greendene Development Corporation Pty Ltd in developing the Riverslea site is required to comply with, amongst others, any or all of a number of Acts of Parliament and Regulations at the State or Commonwealth level as listed below. A brief description of some of the more relevant legislation for this proposal is also given.

Environmental legislation relevant to the Riverslea subdivision includes:

- *Aboriginal Heritage Act, 1972*
- *Environmental Protection Act, 1986*
- *Environment Protection and Biodiversity Conservation Act, 1999*
- *Heritage of Western Australia Act (1990)*
- *Shire of Augusta-Margaret River TPS No. 17*
- *Soil and Land Conservation Act, 1945*
- *Waterways Conservation Act, 1976 (WA)*
- *Water and Rivers Commission Act 1995 (WA)*
- *Wildlife Conservation Act, 1950-1979*

Aboriginal Heritage Act 1972

The purpose of this legislation that is regulated and enforced by the Department of Indigenous Affairs, is to protect relics and significant areas of land from undue interference, while at the same time leaving traditional Aboriginal cultural rights in relation to such objects or areas unaffected, in so far as they are not inconsistent with the provisions of the Act.

The Act establishes the Aboriginal Cultural Material Committee. The Aboriginal Cultural Material Committee (ACMC) provides advice for the assessment of Section 18 Notices which developers are obliged to submit so the ACMC can determine whether or not an Aboriginal site should be disturbed by the development. The ACMC makes a recommendation to the Minister for Indigenous Affairs who makes the final decision as to whether consent for a development should be granted. Sacred beliefs and ritual or ceremonial usage are to be the primary considerations in the evaluation of places under the Act.

The Act also permits the Trustees of the Western Australian Museum to delegate their powers and duties for the care and protection of sites and objects to a representative group of Aboriginal people whom have a traditional interest in the place.

Environmental Protection Act 1986

This Act, administered by the Department of Environment, provides for an Environmental Protection Authority that has powers for preventing, controlling and abating environmental pollution. It also provides for conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the above. The Act establishes head powers to provide mechanisms for the development of Environmental Protection Policies, the referral and assessment of proposals (Environmental Impact Assessment), the control of pollution and enforcement.

The most relevant functions of the Act are to control the review of environmental impacts of proposed developments and to control pollution. The Act binds the Crown and it prevails over other State legislation with the exception of State Agreement Acts, which received Royal ascent before 1 January 1972.

The Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

The *Environment Protection and Biodiversity Conservation Act, 1999* (Commonwealth) established a legislative framework to enable the Commonwealth to deal with current and emerging issues and allow Australia to meet the environmental challenges of the twenty-first century.

The Act provides protection for matters of National Environmental Significance (NES). These are:

- World Heritage properties;
- RAMSAR wetlands of international importance;
- Nationally threatened flora and fauna species and ecological communities;
- Internationally protected migratory species;
- Commonwealth marine areas; and
- Nuclear actions.

The Commonwealth Department of Environment and Heritage (DEH) and the Commonwealth Environment Minister administer this Act.

In relation to the assessment of the impact of proposals, it remains that generally the responsibility for environmental protection lies with the States and the Government of the Northern Territory. However, the power of the States to legislate is effectively curtailed only by the existence of conflicting Commonwealth legislation. Particular Commonwealth powers, which may be used to promote environmental objectives, include those relating to trade and commerce, taxation, external affairs, corporations and “people of any race”. All of these are written into S51 of the Constitution.

A joint assessment process between responsible State and Federal Government authorities may be initiated if, due to the nature of the proposal, the Commonwealth has jurisdiction, but it is not proposed for Commonwealth lands. This may be the case, for example, when funding for the proposal requires approval of the Foreign Investment Review Board, thus triggering S51 (20) of the Constitution - the

Corporations Power, or if implementation of the proposal may impact on components of the environment where Australia has entered into international agreements.

The procedure for joint assessments is identified in the document *Basis for a National Agreement on Environmental Impact Assessment.* These joint assessments generally take the form of the local state process, following which the Commonwealth publishes its own report. The lead Commonwealth Agency in a joint assessment is Environment Australia.

Water and Rivers Commission Act 1995

The Department of Environment administers the *Water and Rivers Commission Act 1995* to ensure that the State's water resources are managed to support sustainable development and conservation of the environment, for the long-term benefit of the community.

Wildlife Conservation Act 1950-1979

The *Wildlife Conservation Act 1950-1979* provides for the "conservation and protection of wildlife" and is administered by the Department of Conservation and Land Management.

Native flora and fauna are 'protected' under the provisions of Section 14 of the Act. The Act provides penalties for taking protected flora or fauna unlawfully. It also contains provisions for the declaration of species as "rare or likely to become extinct" (i.e., endangered). "Fauna" is defined as meaning any animal indigenous to any State or Territory of the Commonwealth or the territorial waters thereof (i.e., it includes fish), and "flora" as any plant, which is native to the State. Prior to passage of the *Conservation and Land Management Act* 1984, responsibility for wildlife management and management of nature reserves was held by the Fisheries and Wildlife Development Proposals (Part 8).

1.4 Relevant Environmental Factors

The environmental factors relevant to this PER identified in the Scoping Document prepared for the project approved by the EPA in February 2004 (ATA Environmental, 2004) are as follows:

- Vegetation (Vegetation Communities, Declared Rare and Priority Flora, Riparian Vegetation);
- Fauna (Terrestrial Fauna, Specially Protected (Threatened) Fauna);
- Watercourses;
- Surface Water Quantity and Quality; and
- Aboriginal Heritage.

These environmental factors have provided a framework against which the structure and scope of this PER document have been written. Each of the relevant environmental factors has been individually addressed in Section 3 of this PER document.

1.5 Previous Studies of the Study Area

Dames and Moore undertook a previous environmental constraints assessment in the vicinity of the study area in December 1989 (Dames and Moore, 1989). ATA Environmental conducted the flora, vegetation and fauna surveys and assessments in 2003/2004 as part of the PER process (ATA Environmental 2005a and 2005b). ATA Environmental also undertook additional investigations and provided information on riparian for the Town Planning Tribunal Appeal No. 110 of 2002.

A preliminary survey of the upland vegetation in the proposal area was also conducted by an officer from the Department of Conservation and Land Management (CALM) Busselton District Office on 18 December 2002 prior to the EPA setting the level of assessment for the proposed development.

Aboriginal archaeological and ethnographic surveys of a proposed Water Corporation sewer pump station on Lot 667, which is immediately adjacent to the northern boundary of the proposal area, were undertaken in 2004 (Greenfield, 2004 and Goode, 2004).

2. THE PROPOSAL

2.1 Description of the Proposal

The proposed residential development of the proposed subdivision area that has planning approval covers approximately 7.5ha of undeveloped land and includes:

1. creation of 74 residential allotments ranging in size from 473 - 876m^2;

2. construction of subdivisional roads;

3. setting aside of an area the purpose of "Reserve for Recreation" or Public Open Space in accordance with the Riverslea ODP;

4. establishing reservations for Darch Brook and its tributary which are currently in private ownership; and

5. re-construction of a natural wetland environment within the degraded tributary.

The proposed development is a continuation of the Riverslea Estate which has substantially been constructed over a number of years and is located to the west of Darch Brook and north of the degraded Darch Brook tributary. The developed portions of the Riverslea Estate include standard residential blocks of 500-800m^2 with some larger lots adjacent to Margaret River in the north.

The current development proposes to rehabilitate a portion of the degraded tributary of Darch Brook as a natural sumpland/dampland-type wetland that caters for wetland flora and fauna, subdivision drainage, stormwater treatment and passive recreation. Detailed design information will be provided in the Stormwater and Watercourse Rehabilitation Management Plan that will be prepared for the proposed subdivision prior to construction.

2.2 Land Status

2.2.1 Ownership and Legal Descriptions

Wholly owned by Greendene Development Corporation Pty Ltd, the proposal area encompasses the following lots (or parts thereof):

- Lots 9101 and 9002 Willmott Avenue and Forrest Rd.

2.3 Project Timing

The timing for project implementation is contingent on the completion of the formal approval process of which this PER forms a part. It is the proponent's considered intention to commence on-site earthworks within the Proposal Area during the 2005-2006 financial year.

2.4 Basis for Justifying Proposal and Selecting Preferred Option

The proposal to develop the Riverslea landholding is in accordance with the current zoning under the Leeuwin Naturaliste Ridge Statement of Planning Policy, the Shire of Augusta-Margaret River's Town Planning Scheme No 17 and the approved Outlined Development Plan (ODP) that was prepared for Sussex Locations 2141, 2142 and Lots 81 and 1002 Willmott Avenue and Forrest Road, Margaret River in 2001.

The proposed subdivision is adjacent to an existing development that has been extended into the approved area. Services such as power reticulation, sewer reticulation, road networks and water and gas supply have all been designed with an expectation that the subdivision of Riverslea Gardens would continue to be developed in accordance with the approved ODP and the successive subdivisions that have previously received planning approval within the Estate.

3. RELEVANT ENVIRONMENTAL FACTORS

3.1 General Description

The proposed Riverslea Gardens subdivision is located approximately 1km east of the Margaret River townsite and forms part of the developing Riverslea residential area. The subdivision abuts the western side of Darch Brook (also known as Wild Dog Brook) and the northern side of a tributary into Darch Brook. Darch Brook flows in a northerly direction into the Margaret River, which is approximately 600m to the north of the subdivision area.

The site has a gentle slope from a high point of 82m AHD in the northwestern corner down to the east to Darch Brook (68m AHD) and to the south to the Darch Brook tributary (71m AHD).

The soils in the subdivision area belong to the Wilyabrup Valleys Land System (Tille and Lantzke, 1990). The upland areas over which the residential lots are proposed are mapped as Wilyabrup Slopes which slopes with gradients generally 5-15%, and gravelly soils. The soils in the creeklines are mapped as Wilyabrup Wet Valleys which are broad U-shaped drainage depressions with swampy floors.

Darch Brook consists of an almost flat, waterlogged and inundated valley approximately 80m wide. Darch Brook drains gradually to the Margaret River at a slope of approximately 1 in 120. A degraded tributary of Darch Brook to the immediate south of the proposed subdivision has a slightly steeper slope but is similarly contained within a flat waterlogged and inundated shallow valley. Most of Darch Brook is naturally vegetated while the tributary has mostly been cleared of native vegetation

The area of subdivision contains approximately 6.3ha of native vegetation (predominantly regrowth) and approximately 1.2ha of land that has been previously cleared for grazing prior to the land being zoned for residential subdivision purposes.

The following sections describe the features of the site that have been considered relevant environmental factors. These features are vegetation, significant flora, fauna, significant fauna, the watercourses, surface water quantity and quality and Aboriginal heritage. The Margaret River community was also consulted during the preparation of the PER to ensure all relevant environmental issues were addressed in the PER document.

3.2 Vegetation

3.2.1 EPA Objective

To maintain the abundance, species diversity, geographic distribution and productivity of flora at species and ecosystem levels through avoidance and management of adverse impacts and improvement of knowledge.

3.2.2 Project Objectives

To minimise the extent of clearing required for the project through careful design and rigorous management of construction activities.

3.2.3 Relevant Guidelines

- *EPA Guidance Statement No. 51 – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessments in Western Australia.*
- *EPA Draft Guidance Statement No. 2 – Environmental Protection of Native Vegetation in Western Australia.*
- *EPA Guidance Statement No. 3 – Terrestrial Biological Surveys as an Element of Biodiversity Protection.*

3.2.4 Existing Environment

Vegetation Description

Flora and Vegetation surveys of the proposal area have been conducted by Dames and Moore in 1989 and ATA Environmental on 22 October 2002, 30 October 2003 and 15 October 2004. The Department of Conservation and Land Management (CALM) also conducted a preliminary flora assessment of the site on 18 December 2002.

The vegetation within the area to be subdivided predominantly consists of a Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata* subsp. *marginata*) and Peppermint (*Agonis flexuosa*) Woodland to 30m tall. Most of the Marri and Jarrah trees are less than 30cm diameter at breast height, which suggests that the area was cleared or significantly logged in the past. The understorey of the Marri/Jarrah/Peppermint Woodland is in very good condition and contains numerous native species including *Mirbelia dilatata, Hakea lissocarpha, Hovea trisperma, Hibbertia hypericoides, Trymalium floribundum, Patersonia umbrosa, Leucopogon capitellatus* and Bracken Fern (*Pteridium esculentum*).

The vegetation fringing Darch Brook consists of a narrow band of Blackbutt (*Eucalyptus patens*) up to 12m high over Peppermint trees to 4m. Some of the Blackbutt are mature trees over 0.5m diameter. The understorey of the Blackbutt/Peppermint area is fairly open with *Mirbelia dilatata* common to 1.5m high. A section of mixed Blackbutt and Peppermint trees occurs at the junction of the tributary and Darch Brook adjacent to the dam.

The vegetation in Darch Brook consists predominantly of dense *Taxandria linearifolia/T. juniperina* thickets 3 - 4m high with occasional stands of *Astartea* aff. *fascicularis* and *Leptospermum erubescens* to 4m. The understorey mostly consists of native sedges such as *Juncus pallidus*, *Leptocarpus* sp., *Lepidosperma tetraquetrum* and *Gahnia trifida.* Introduced grasses and sedges such as Kikuyu Grass (*Pennisetum clandestinum*), Yorkshire Fog Grass (*Holcus lanatus*), *and Juncus microcephalus* also occur in patches particularly around the dam area.

The degraded tributary of Darch Brook to the immediate south of the proposed subdivision has mostly been cleared of native vegetation and consists of introduced plants, predominantly Kikuyu Grass, Yorkshire Fog Grass, *Juncus microcephalus* and some *Cyperus tenuiflorus*. Small native stands of *Taxandria linearifolia* and *Kunzea ericifolia* shrubs and isolated Peppermint trees occur in the tributary.

According to the condition rating scale used in Bush Forever (Government of Western Australia, 2000), the remnant vegetation of the area ranges from Excellent to Very Good condition, with very little weed invasion other than low levels of non-native annual grass species along the western and southern boundary as a result of the edge effects of the adjacent cleared areas.

3.2.5 Potential Impacts

Vegetation Significance

The study area is associated with the Warren Bioregion (Thackway and Cresswell, 1995) and comprises vegetation characteristic of the Cowaramup (Cw1) and Wilyabrup (W1) Vegetation Complexes (Mattiske and Havel, 1998). The Wilyabrup (W1) unit is comprised of Tall Open Forest of Karri (*Eucalyptus diversicolor*)-Marri (*Corymbia calophylla*)-*Allocasuarina decussata*-Peppermint (*Agonis flexuosa*) on deeply incised valleys of the hyperhumid zone while the Cw1 unit is comprised of a mixture of Open Forest of *Eucalyptus diversicolor-Corymbia calophylla* and woodland of Jarrah (*Eucalyptus marginata* subsp. *marginata*)-*Corymbia calophylla* on slopes.

Approximately 70% of the Shire of Augusta-Margaret River remains covered by original native vegetation (Grein, 1997), the majority of which occurs as State Forest, crown land or public reserves. The *Corymbia calophylla/Eucalyptus marginata* subsp. *marginata* Closed to Open Forest that dominates the study area is the most common vegetation type remaining in the Shire of Augusta-Margaret River. The 1989 Dames and Moore assessment (Dames and Moore, 1989) stated that the vegetation associated with the site was not unusual and it correlated well with documented habitats elsewhere. Approximately 213ha of similar regrowth vegetation representative of the Cowaramup (Cw1) and Wilyabrup (W1) Vegetation Complexes was identified during the October 2004 survey from secure State Forest approximately 2km north of the Margaret River townsite (Appendix 1).

According to Regional Forest Agreement (RFA) data, the total present area of the Wilyabrup (W1) Complex remaining is approximately 3,888ha (of which 50% is reserved within the CAR System (Government of Western Australia, 1999). Approximately 1391ha of the Cowaramup (Cw1) Complex presently remain, of which 44% is reserved within the CAR Reserve system. The RFA agreement requires that a minimum of 15% of the Pre-European extent of vegetation complexes be reserved within the CAR Reserve System. Therefore the clearing of approximately 6.3ha of vegetation from the Riverslea study area and 11.5ha of similar vegetation from adjacent proposed development is unlikely to have a significant impact on the conservation status of the Cowaramup or Wilyabrup Vegetation Complexes.

The vegetation on the site is not classified as a Threatened Ecological Community (TEC) at the State level or the Commonwealth level.

The vegetation on the site forms part of a corridor of vegetation along Darch Brook which links Margaret River with vegetation in road reserves (Rosa Brook Road) and other creeklines further south. The vegetation along the Darch Brook corridor mostly consists of the creekline only, particularly south of Riverslea. However, at Riverslea the corridor widens to include upland vegetation on both the western and eastern sides of the Brook. The vegetation on the eastern side of Darch Brook almost extends to State Forest (Bramley Block) to the east.

3.2.6 Cumulative Impacts

The proposed Riverslea Gardens subdivision development (i.e. proposal area) will result in the loss of approximately 6.3ha of native vegetation. In terms of the loss of vegetation from the proposal area, the remainder of the Riverslea subdivision which has already been constructed and other proposed subdivision developments identified for the local Margaret River area, the cumulative impact of loss of native vegetation is considered to be minimal. Other residential subdivision developments are proposed for adjacent Lots 9013 and 756 Tingle Avenue and Lot 27 Bussell Highway (Figures 4 and 5). An additional 213ha of regrowth *Corymbia calophylla/Eucalyptus marginata* subsp. *marginata* vegetation similar to that occurring in the upland portions of the proposal area was identified from an area of State Forest located approximately 2km to the north of the Margaret River townsite (Figure 6). The flora and vegetation on these sites was surveyed by ATA Environmental during October 2004 (Appendix 1). These proposed subdivision developments to the south of the proposal area may result in the loss of up to 11.5ha of vegetation similar to that occurring within the Riverslea subdivision study area and approximately 73ha of predominantly parkland cleared Marri/Peppermint/Blackbutt.

3.2.7 Proposed Management

The loss of approximately 6.3ha of native regrowth upland vegetation from the proposal area will be partially off-set by the rehabilitation of approximately 1.7ha of the degraded tributary immediate abutting the southern boundary of the proposed subdivision. The rehabilitation will result in the creation of a sumpland/dampland (i.e. seasonally waterlogged/inundated) type wetland surrounded by suitable wetland heath and thicket vegetation. The sumpland/dampland will contain and treat short-term flows of stormwater from the subdivision. Species used in the rehabilitation will be consistent with the wetland vegetation that would have occurred in the creekline prior to clearing for agriculture (Figure 2). Further detail relating to the creation and proposed management of the sumpland/dampland will be provided in the Stormwater and Watercourse Management Plan that will prepared for the subdivision.

Public access will be allowed into the creekline and rehabilitated sumpland/dampland by means of a Dual use Path (DUP) linking the Public Open Space (POS) in the subdivision with the created sumpland/dampland and the creekline. The DUP could eventually be extended across the creekline to the future development south of the tributary.

3.3 Significant Flora

3.3.1 EPA Objective

- *To protect Declared Rare and Priority Flora consistent with the provisions of the Wildlife Conservation Act 1950.*

- *Protect other flora of conservation significance.*

3.3.2 Project Objectives

- *Minimise the impact on significant flora species through design and rigorous management of construction activities.*

3.3.3 Relevant Guidelines

- *EPA Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia*. June 2004.

- *EPA Draft Guidance Statement No. 2 – Environmental Protection of Native Vegetation in Western Australia.*

- *EPA Position Statement No. 3 – Terrestrial Biological Surveys as an Element of Biodiversity Protection.* March 2002.

- *CALM Draft Policy, Statement No. 9 – Terrestrial Biological Surveys as an Element of Biodiversity Protection.*

- *Wildlife Conservation Act 1950.*

- *Environmental Protection and Diversity Conservation Act 1999.*

3.3.4 Existing Environment

Flora surveys of the subdivision area and adjacent areas were conducted by CALM on 18 December 2002 and by ATA Environmental on 30 October 2003 and 15 October 2004. Dames and Moore conducted a site investigation of the area in November 1989, primarily to determine whether any significant flora that may constrain development were likely to occur on the site.

The ATA Environmental surveys, which were undertaken in accordance with *EPA Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004a), included sampling of flora within five non-permanent 10m x 10m quadrats located within representative vegetation types identified from the proposal area as well as opportunistic recordings throughout the site. The timing of the surveys were considered optimal in terms of identifying ephemeral species such as orchids and lilies that may potentially occur on the site.

Prior to the surveys a search was undertaken of the CALM Threatened (Declared Rare) and Priority Flora database (February 2003) and the WA Herbarium Specimen database to identify any known populations of significant flora in the vicinity of the site. The search indicated that four Priority listed flora have been previously recorded from the vicinity of the site. These are:

- *Acacia inops* (P3)
- *Conospermum paniculatum* (P3)
- *Hybanthus volubilis* (P2)
- *Tyrbastes glaucescens* (P4)

The ATA Environmental botanist who conducted the survey visited the Western Australian Herbarium prior to undertaking the field assessment to familiarise himself with the Priority listed flora potentially occurring in the area.

The CALM survey identified a total of 114 plant species from the site, the majority of which (102 species or 90%) are native species. One Priority listed flora species, the Priority 3 listed *Gahnia scleroides*, was recorded from the lower slopes of the site.

A total of 142 plant species comprising 128 native and 14 introduced species were recorded from the Riverslea study area during flora and vegetation surveys conducted by ATA Environmental for the site during October 2003 and October 2004. The families with the greatest representation in the study area include the Orchidaceae (Orchid family with 12 species) and Papilionaceae (Pea family 12 species, 10 native and 2 non-native). The timing of the survey in October meant that the majority of the ephemeral species, such as orchids, lilies and daisies could be recorded from the site if present. A full list of species recorded from the site, along with quadrat data, is provided in Appendix 1.

A small population (10 plants) of the Priority 3 listed taxa *Gahnia scleroides was* recorded from the Closed Heath of *Taxandria linearifolia, T. juniperina, Leptospermum erubescens* and *Melaleuca hamulosa* on the edge of Darch Brook, abutting the eastern boundary of the proposed subdivision (Figure 2). The Dames and Moore investigation identified the waterplant *Hydrocotyle hirta* from adjacent to the project which was considered significant at the time.

3.3.5 Potential Impacts

The location of the Priority listed flora species, *Gahnia scleroides* is outside the area proposed to be subdivided and therefore will not be directly affected by the development.

No other species of conservation significance have been recorded in the area.

3.3.6 Proposed Management

Appropriate management measures will be initiated and implemented during construction of the proposed subdivision to ensure there are no adverse direct or indirect impacts the *Gahnia scleroides* population. The developer will distribute

educational material during the marketing phase of the proposed subdivision to inform prospective purchasers of land of the significance of flora in the vicinity of the area.

3.4 Fauna

3.4.1 EPA Objective

To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

3.4.2 Project Objectives

To minimise adverse significant impacts on terrestrial fauna known to occur in the area.

3.4.3 Relevant Guidelines

- *EPA Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*. June 2004.
- *EPA Position Statement No. 3 – Terrestrial Biological Surveys as an Element of Biodiversity Protection.* March 2002.
- *CALM Draft Policy, Statement No. 9 – Terrestrial Biological Surveys as an Element of Biodiversity Protection.*
- *Wildlife Conservation Act 1950.*

3.4.4 Existing Environment

A qualified ATA Environmental zoologist conducted Level 2 fauna surveys of the proposal area between 2 and 6 February 2004. The surveys were conducted in accordance with *EPA Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004b).

The fauna survey involved an intensive trapping program conducted over five days using pit-traps, funnel traps, Elliott traps and cage traps, as well as active hand foraging, spot-lighting in the evening and a desktop analysis of potential vertebrate fauna in the area.

The results of the survey including a list of fauna species recorded is provided in Appendix 2.

Fauna Habitats

The area contains one habitat type, although a second habitat type is found adjacent to the Darch Brook on the eastern boundary:

- *Eucalyptus* species dominated upland forest; and
- the riparian vegetation in the creekline (eastern boundary).

Faunal Assemblage

The survey undertaken by ATA Environmental recorded 11 species of herpetofauna, 33 species of avifauna and eight species of mammals occurring within the proposal area (Appendix 2).

Herpetofauna

Of the 53 species of herpetofauna 'potentially' occurring within the proposal area (15 amphibian and 38 reptile species), four species of frogs and seven reptiles were recorded during the survey.

Frogs were recorded from the southeast and northeast portions of the proposal area. Both of these sites were in close proximity to the riparian vegetation along the seasonally inundated creek line. Frog species that were heard calling during the survey period were observed or trapped.

While 38 species of reptiles potentially occur within the proposal area, only seven species of reptile, *Notechis scutatus* (Western Tiger Snake), *Pseudonaja affinis* (Dugite), *Acritoscincus trilineatum, Christinus marmoratus, Egernia kingii* (King Skink), *Hemiergis peronii tridactyla,* and *Tilqua rugosa* (Bobtail) were recorded as present during the survey. The low number of recorded species compared to the potential species list can be attributed to a variety of factors including, a single survey in summer, presence of feral animals, small size of the bushland (6.2ha) and nearby residential developments. All of the species recorded are typical of the habitats present at Riverslea and often persist in modified areas.

Avifauna

Thirty-three bird species were recorded during the site visits. The species recorded, are generally typical of the habitats in the area.

Mammals

Eight species of mammals were recorded during the site survey; three of these are introduced. The survey revealed evidence (mainly of scats and tracks) that foxes (*Vulpes vulpes*) and rabbits (*Oryctolagus cuniculus*) occur on site and feral or semi-domestic cats (*Felis catus*) were seen on multiple occasions.

Predation by cats and foxes from the adjacent existing and proposed future residential development is expected to have an impact on the abundance and composition of vertebrate fauna species occurring at the site.

Other

Observations from the survey conducted during February 2004 suggest that the vegetation along the seasonally inundated creekline is species rich with amphibians,

reptiles and birds compared to the forested area. Additional investigations of adjacent landholdings (Lots 9013 and 753 Tingle Avenue and Lot 27 Bussell Highway, Margaret River in October 2004) supported the findings from the February 2004 survey.

3.4.5 Potential Impacts

The proposed development will have the following impacts on fauna habitat:

- clearing of all the upland vegetation habitats;
- clearing of a small portion (i.e. 0.0172ha) of riparian vegetation; and
- creation of a sumpland/dampland-type wetland with riparian dense heath and thicket habitat suitable as waterbirds and amphibians habitat.

As the development will occur in vegetated areas that are considered regionally and locally widespread, the direct impact on the regional fauna assemblage in the vegetated area will be negligible as the vertebrate assemblage has been assessed as being typical of the region.

Several introduced mammal species are known or are expected to presently occur within the area and may increase following development of the site. These species could have significant impact on the local native fauna. Cats and foxes are known to predate on native fauna and dogs are known to also disturb and kill native fauna. These species could potentially deplete populations sufficiently to result in local extinction within the foreshore area. The additional impact of the subdivision in this regard, when considered in terms of the extent of residential development that already exists in Margaret River is considered to be negligible.

3.4.6 Proposed Management

The loss of approximately 6.3ha of native upland vegetation habitat will be partially offset by the rehabilitation of approximately 1.7ha of wetland fauna habitat. The rehabilitation will result in the creation of a sumpland/dampland surrounded by wetland heath and thicket vegetation. The proposed rehabilitated sumpland/dampland-type wetland, which will resemble the existing surface hydrology of the degraded tributary and is expected to result in no alteration to the natural surface or groundwater hydrology of the area, will contain short-term flows of stormwater water from the subdivision. Species used in the rehabilitation will be consistent with the wetland vegetation that would have occurred in the creekline prior to clearing for agriculture (Figure 2).

The developer will distribute educational material during the marketing phase of the proposed subdivision to inform prospective purchasers of land of the environmental values of the area.

3.5 Significant Fauna

3.5.1 EPA Objective

Protect Specially Protected (Threatened) Fauna and Priority Fauna species and their habitats, consistent with provisions of the Wildlife Conservation Act 1950.

3.5.2 Project Objectives

To minimise adverse significant impacts on terrestrial fauna known to occur in the area.

3.5.3 Relevant Guidelines

- *EPA Guidance Statement No. 56 Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*. June 2004.
- *EPA Position Statement No. 3 – Terrestrial Biological Surveys as an Element of Biodiversity Protection.* March 2002.
- *CALM Draft Policy, Statement No. 9 – Terrestrial Biological Surveys as an Element of Biodiversity Protection.*
- *Wildlife Conservation Act 1950.*
- *Environmental Protection and Diversity Conservation Act 1999.*

3.5.4 Existing Environment

A search of CALM's database of Specially Protected and Priority Fauna species listed many species potentially occurring in the region, some of which are not likely to occur there due to lack of suitable habitat. The following species may possibly occur in the vicinity of the Riverslea study area:

- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) - Schedule 1.
- Western Ringtail Possum (*Pseudocheirus occidentalis*) – Schedule 1.
- Baudin's Cockatoo (*Calyptorhynchus baudinii*) - Schedule 1.
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Schedule 1.
- Peregrine Falcon (*Falco perregrinus*) - Schedule 4.
- Carpet Python (*Morelia spilota imbricata*) - Schedule 4.
- Southern Brush-tailed Phascogale (*Phascogale tapoatafa tapoatafa*) – Priority 3.
- Southern Brown Bandicoot or Quenda (*Isoodon obsesulus fasciventer*) - Priority 5.
- Water Rat (*Hydromys chrysogaster*) - Priority 4.

Schedule 1 designates fauna which are "rare or likely to become extinct" and Schedule 4 designates fauna which are "otherwise specially protected" but are not considered to be rare or likely to become extinct. These are known as Specially Protected (Threatened) Fauna and are protected by the *Wildlife Conservation Act 1950*.

Species listed as Priority Fauna do not have any special protection afforded them and are in need of monitoring. Priority 4 and 5 species are defined by CALM as "taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change".

Please note that subsequent to the fauna investigations at Riverslea the Southern Brown Bandicoot has been revised from Priority 4 to Priority 5 and the Forest Red-tailed Black Cockatoo has been revised from Priority 3 to Scheduled 1 under the *WA Wildlife Conservation Act*.

Schedule 1 - Fauna which are rare or likely to become extinct

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) - This species inhabits the southwest of WA. Its preferred habitat is the woodland where it preferentially feeds on plants of the Proteaceae family. In winter, flocks can be found in heaths. Due to the availability of suitable habitat it is ***likely*** to be a seasonal visitor to the study area.

Western Ringtail Possum (*Pseudocheirus occidentalis*) - Populations of this possum species are now restricted to coastal areas of Peppermint (*Agonis flexuosa*) and Peppermint-Tuart woodlands from Australind to the Waychinicup National Park. Highest densities seem to be in the Swan Coastal Plain near Busselton. Nests are on or near the ground in the absence of predators, but in tree hollows and dreys in the tree canopies when predators are present. Loss of habitat and predation by foxes are the two significant factors leading to their decline. Suitable habitat exist, however, no Western Ringtail Possums, dreys or scats were recorded during the fauna assessment. Similar assessments targeting Western Ringtail Possums on two properties adjacent to Riverslea (Lots 9013 and 753 Tingle Avenue and Lot 27 Bussell Highway, Margaret River in October 2004) also recorded no Western Ringtail Possums. Based on these three assessments, they are ***unlikely*** to occur in the area.

Baudin's Cockatoo (*Calyptorhynchus baudinii*) – This species is most common in the far southwest of WA where it breeds. Breeding records come from the southern forests north to Collie and east to near Kojonup. Baudin's Cockatoo is typically found in vagrant flocks and utilises the taller, more open Jarrah and Marri woodlands, where it feeds mainly on Marri seeds. Baudin's Black Cockatoos were ***recorded*** during this survey and surveys of adjacent land holdings in October 2004.

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – This species is most commonly seen in Eucalypts where it is attracted to seeding Marri, Jarrah, Blackbutt, Karri (*Eucalyptus diversicolor*) and Snottygobble (*Persoonia longifolia*). Forest Red-tailed Black Cockatoo's were formerly common but are now rare to uncommon and erratically distributed. Usually found in pairs or small flocks, though seldom in large flocks (up to 200). The main cause of population decline has been habitat destruction and alteration. Forest Red-tailed Black Cockatoos are ***likely*** to be found in the Riverslea area.

Schedule 4 - fauna that are in need of special protection

Peregrine Falcon (*Falco peregrinus*) – This species is found across most of Australia, but only occurs in low densities and has a wide and patchy distribution. It favours hilly or mountainous country and open woodlands and ***may*** be an occasional visitor to the study area.

Carpet Python (*Morelia spilota imbricata*) – A large python found across the southwest of Western Australia, north to Geraldton and Yalgoo, and east to Kalgoorlie, Fraser Range and Eyre. They inhabit forest, heath, or wetland areas and shelter in hollow logs or in branches of large trees. This species has a number of disjunct populations that are widespread within the southwest of Western Australia, however, its density is generally low across its distribution except on a couple of off-shore islands. The Carpet Python is ***likely*** to be found within the study area, because suitable habitat is found on site and there has been one previous record from the region.

Priority 3 - Taxa with several, poorly known populations, some on conservation lands

Southern Brush-tailed Phascogale (*Phascogale tapoatafa tapoatafa*) – Formerly widespread in eastern and southwestern Australia, it is now found from Perth to Albany, west of Albany highway. It occurs at low densities in the northern Jarrah forest, and higher densities in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton. Habitat clearing and fragmentation, and habitat alteration by logging and mining are the main causes threatening populations. The greatest threat appears to be the reduced availability of trees with hollows, and predation by cats and foxes. The Southern Brush-tailed Phascogale ***may*** be found in the Riverslea area, as one previous sighting has been made in 1999.

Priority 4 - Taxa in need of monitoring

Water Rat (*Hydromys chrysogaster*) – The Water Rat is found mainly near permanent bodies of freshwater, occasionally at temporary waterholes. They can also survive in areas where rivers and streams have become polluted or are brackish. There have been two recent previous sightings and captures from the Margaret River area. Although not recorded the Water Rat ***may*** be found on site.

Priority 5 - Taxa in Need of Monitoring

Quenda or Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) – Quenda prefer dense scrub (up to 1m high), with swampy vegetation. They will often feed in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and crop land lying close to dense cover. Major threats to Quenda include habitat fragmentation and loss of habitat on the coastal plain and wheat belt, fire in fragmented habitat, predation by foxes, predation of young by cats and predation around residential areas by dogs. Quenda ***were*** recorded from the site and were trapped near the wetter areas adjacent to Darch Brook.

Of the species listed under Commonwealth and State government legislation requiring special protection due to their vulnerability only the Southern Brown Bandicoot and Baudin's Black Cockatoo were recorded on the site.

Carnaby's Cockatoo, Western Long-billed Corella, Carpet Python, and Forest Red-tailed Black Cockatoo are likely to be present. The Orange bellied-Frog, Chuditch, Peregrine Falcon, Southern Brush-tailed Phascogale and Water Rat may utilise the proposal area, but ATA considers it unlikely.

Twelve threatened species of fauna and eight migratory species of birds were listed in a desktop search as having national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999* potentially occurring within the Riverslea area. Although listed in searches, only species or species habitat may be found at Riverslea for three threatened fauna and no migratory bird species. These species are listed in Table 2.

TABLE 2
SPECIES LISTED AS POTENTIALLY OCCURRING WITHIN THE STUDY AREA AND IDENTIFIED AS HAVING NATIONAL ENVIRONMENTAL SIGNIFICANCE UNDER THE *EPBC ACT 1999* OR STATE GOVERNMENT SIGNIFICANCE UNDER THE *WA WILDLIFE CONSERVATION ACT 1950*

Threatened Species	Status		Type of Presence
	EPBC Act	WA Act	
Calyptorhynchus latirostris Carnaby's Black Cockatoo	Endangered	Schedule 1	Species or species habitat *likely* to occur within area
Pseudocheirus occidentalis Western Ringtail Possum	Vulnerable	Schedule 1	Species or species habitat *unlikely* to occur within area
Calyptorhynchus baudinii Baudin's Black Cockatoo	Vulnerable	Schedule 1	Species recorded within area
Calyptorhynchus banksii naso Forest Red-tailed Black Cockatoo		Schedule 1*	Species or species habitat *likely* to occur within area
Falco peregrinus Peregrine Falcon		Schedule 4	Species or species habitat *may* occur within area
Morelia spilota imbricata Carpet Python		Schedule 4	Species or species habitat *likely* to occur within area
Phascogale tapoatafa tapoatafa Southern Brush-tailed Phascogale		Priority 3	Species or species habitat *may* occur within area
Isoodon obesulus fusciventer Southern Brown Bandicoot		Priority 5 **	Species recorded within area
Hydromys chrysogaster Water Rat		Priority 4	Species or species habitat *may* occur within area

* Subsequent to a CALM Threatened fauna search and field investigations, the Forest Red-tailed Black Cockatoo changed from Priority 3 to Schedule 1.
** Subsequent to the CALM Threatened fauna search and field investigations, the Quenda changed from Priority 4 to Priority 5.

Baudin's Black Cockatoo (listed as vulnerable under the *Environment Protection Conservation and Biodiversity Conservation* Act *1999* and Schedule 1 under the *WA Wildlife Conservation Act 1950*) and the Southern Brown Bandicoot (Priority 5 under the *WA Wildlife Conservation Act 1950*) were the only two significant fauna recorded at Riverslea. Baudin's Black Cockatoo is largely restricted to the tall forests of the

South-West. This vulnerable species was recorded on several occasions in the study area, feeding on the fruit of marri trees. Baudin's Black Cockatoos were also observed feeding in adjacent lots in October 2004, however they were not observed feeding within the Riverslea study area at that time. Two Southern Brown Bandicoots were caught near the dense vegetation along the creekline. This dense habitat is necessary for their continued survival.

No other species of significant fauna were recorded during the fauna survey conducted by ATA Environmental.

Although predicted as occurring in the area, the Western Ringtail Possum (*Pseudocheirus occidentalis*) was not observed during the field survey conducted by ATA Environmental in 2004. While suitable habitat for the Western Ringtail Possum exists at Riverslea, no Western Ringtail Possums, dreys or scats were recorded during the fauna assessment. Similar subsequent assessments targeting Western Ringtail Possums on two adjacent properties to Riverslea (Lots 9013 and 753 Tingle Avenue and Lot 27 Bussell Highway, Margaret River in October 2004) also recorded no Western Ringtail Possums. Based on these three assessments, they are *unlikely* to occur within the proposal area.

3.5.5 Potential Impacts

No impacts are anticipated for the Southern Brown Bandicoot (Priority 5 under the *Western Australian Wildlife Conservation Act 1950*) as the vegetation that this species inhabits will not be cleared as part of the subdivision. The loss of upland habitat is unlikely to have a significant impact on species that utilise both upland and riparian vegetation. The habitat for Baudin's Black Cockatoo (listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* and Schedule 1 under the *Western Australian Wildlife Conservation Act 1950*) will be affected by clearing of approximately 6.3ha of vegetation. However, there are large stands of similar vegetation in the nearby area in which Baudin's Cockatoos have been observed. No Baudin's Cockatoos have been observed nesting in the area.

3.5.6 Proposed Management

The loss of approximately 6.3ha of native upland vegetation habitat will be partially off-set by the rehabilitation of approximately 1.7ha of wetland fauna habitat. The rehabilitation will result in the creation of sumpland/dampland-type wetland surrounded by wetland heath and thicket vegetation. Species used in the rehabilitation will be consistent with the wetland vegetation that would have occurred in the creekline prior to clearing for agriculture. This created habitat will be suitable for some species of significant fauna, including Southern Brown Bandicoots and some water birds.

3.6 Watercourses

3.6.1 EPA Objective

To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected.

3.6.2 Project Objectives

To protect the environmental values and maintain or enhance the key ecological functions of the wetlands and watercourse.

3.6.3 Relevant Guidelines

- *Western Australian Planning Commission Development Control Policy 2.3.*
- *Water and Rivers Commissions Guideline 1: Determining Foreshore Reserves (August 2000).*
- *Water and Rivers Commission Water Note 23 "Determining Foreshore Reserves" (October 2001).*

3.6.4 Existing Environment

Watercourse Description

The subdivision occurs on the edge of two natural watercourses, Darch Brook to the east and a degraded tributary of Darch Brook to the south. Darch Brook joins Margaret River approximately 600m to the north. There are no other surface drainage features within the subdivision.

Darch Brook consists of a flat, waterlogged and inundated area approximately 80m wide adjacent to the subdivision which drains gradually to the Margaret River at a slope of approximately 1 in 120. Water flows in broad sheets and small rivulets throughout most of the brook's 80m width. The depth of the water in the brook is shallow and averages about 10cm. There is no marked incised creekline that can often characterise watercourses in the south-west. This may be due to the gentle slope of the brook.

A causeway has been constructed across Darch Brook at the northern extremity of the subdivision. The causeway has been constructed to allow maintenance of the power line that crosses the brook in this location. The causeway contains pipe culverts midstream to allow water to flow downstream.

The degraded tributary to Darch Brook consists of a flat, waterlogged and inundated area 40-60m wide and also does not have any incised creekline. The tributary contains slow-flowing water for the full extent of its breadth during times of peak flow in winter.

A small dam measuring about 20m x 15m and elongated in a north-south alignment has been excavated at the point where the degraded tributary joins Darch Brook. Spoil excavated to create the dam has been used to create dam walls on the west, north and east sides. An opening in the northern wall allows water to overflow the dam into Darch Brook.

Watercourse Boundaries

The boundary of a watercourse is important to determine as it usually denotes the area affected by flowing or stagnant water and marks the transition between different flora and fauna habitats. Such areas are important to protect for reasons of water quality in the watercourse, protection of biodiversity values and protection of development from the impacts of flowing water.

The boundary of a watercourse is determined by the extent of riparian vegetation in conjunction with the topography of the area. Strictly speaking, riparian vegetation is described as the vegetation that occurs in the riparian zone. The riparian zone, according to the Department of Environment (formerly Water & Rivers Commission) (Water and Rivers Commission, 1999), includes the floodway (seasonally or permanently flooded zone comprising the embankment and channel-bed), the floodplain (seasonally inundated flats bordering a watercourse) and the verge or upland area. The verge is an area of upland of indefinite width above the crest of the valley embankment (Pen, 1999). According to Pen (1999), however, the verge is not included as part of the riparian zone for ecological considerations but is included for river management considerations.

Pen (1999) further describes riparian vegetation as the corridor of vegetation that is distinct from the adjacent dryland vegetation. It includes wetland species in the centre of the zone, relatively high rainfall species on the very edge and a mixture of these species and those of the adjacent dryland vegetation on the very edge. Pen (1999) describes the riparian zone as "a ribbon of denser vegetation snaking its way through the more open widespread upland vegetation".

Using Pen's definition (1999), the riparian vegetation on Darch Brook is reasonably well-defined as the extent of the *Taxandria linearifolia* Thicket and the fringing Blackbutt/Peppermint zone. This area is relatively easily identified on the aerial photograph (Figure 2). During a site inspection on 22 October 2002 and again on 30 October, 2003, the majority of the thicket vegetation contained above-ground surface water up to 10cm deep and flowing towards the north.

At the junction of the degraded tributary with Darch Brook the riparian vegetation also included the broader area of mixed Blackbutt and Peppermint trees. At the time of the site inspection this area contained small rivulets of water, some of which had dried up only a short time previously. The mixed Blackbutt/Peppermint area measured about 45m west-east and 60m north-south. The eastern edge of the Blackbutt/Peppermint stand lies adjacent to the western dam wall.

The riparian vegetation of the tributary is harder to delineate. In the first instance, most of the native vegetation in the floodplain has been cleared and the area now consists predominantly of introduced grasses and sedges. As the riparian vegetation

refers to the natural vegetation of the floodplain, in this instance, the riparian vegetation has mostly been removed.

Secondly, unlike Darch Brook, flowing water in the tributary in places extends into the fringing Peppermint trees. Small rivulets of flowing waters were observed in the fringing Peppermint tree vegetation adjoining the cleared area and up to 20m in from the cleared vegetation during site visits on 22 October 2002, 30 October 2003 and 15 October 2004. Although some of the rivulets had dried up, the rivulets appeared to be consistent features of the drainage of the tributary and are therefore considered to be part of the riparian vegetation. Topography and contours of the land were also considered when delineating the boundary of the watercourses, as flowing water cannot go uphill. The presence of wetland species (i.e. *Taxandria linearifolia* and *Juncus pallidus*) in conjunction with topography and contours were also considered when delineating the boundary of watercourses as they aid in determining flood risk. Obviously if there are plant species present within the survey area which are expected to be inundated it can be expected that the area will flood during winter.

The boundary of the riparian vegetation adjacent to the subdivision is shown on Figure 3.

3.6.5 Potential Impacts

The impact of the subdivision on the two watercourses can be assessed in terms of direct impacts, i.e. clearing of riparian vegetation and indirect impacts.

Direct Impacts

Using the boundary of the riparian vegetation as described above and depicted in Figure 3, the subdivision contains a portion of one lot and an area of road reserve that will require the clearing of some riparian vegetation.

Lots/road reserves that require the clearing of some riparian vegetation:

- Portion of Lot 244 and road reserve (opposite Lots 200 and 201).

The extent of riparian vegetation to be cleared on each lot is an estimate based on aerial photography interpretation and groundtruthing during the ATA Environmental field investigations. The areas to be cleared are as follows:

TABLE 3
RIPARIAN VEGETATION ASSOCIATED WITH AREAS TO BE CLEARED

Portion of Lot 244	44.5m^2
Road Reserve opposite Lots 200, 201	127.7 m^2
Total	**172.2m^2**

Indirect Impacts

Riparian vegetation can be impacted by nearby residential development in a number of indirect ways as follows:

Disturbance of Vegetation from Access

Development adjacent to areas of native vegetation increases the pressure on the bushland from pedestrian and sometimes off-road-vehicle use. The nature and frequency of access and the degree of impact on the vegetation varies according to the type of bushland, the types of facilities provided and the level of on-going management of the bushland area. Generally, open vegetation such as woodlands that are readily accessible and have a high aesthetic appeal attract more recreational use than densely vegetated areas.

It could be expected that the dense, virtually impenetrable vegetation that characterises the waterlogged and inundated Darch Brook creekline would not attract many pedestrians and is not accessible for off-road-vehicle use. In addition, the wet creekline vegetation does not lend itself to the construction of pathways unless some form of boardwalk is installed. Impacts associated on vegetation associated with the recreational use of formal pathways/boardwalks are usually very minimal.

Therefore, with the expected very low use of the riparian vegetation at Darch Brook, it is considered unlikely that the subdivision would adversely affect the uncleared riparian vegetation.

Edge Effects

Residential lots created in the near vicinity of native bushland areas can have an impact from such activities as rubbish dumping and weeds escaping from gardens. It has been shown that lots directly abutting native bushland have a greater impact on the vegetation in this regard than lots separated from the bushland by a road reserve. However, provided guidelines (e.g. open fencing and pathways constructed to define the edge) for lots fronting POS are adhered to, the potential adverse impact of direct frontage to POS lots can be minimised.

From previous experience, the impact of the abutting lots is not expected to extend beyond more than 20m into the vegetation, depending on the openness of the vegetation. Other factors that determine the level of impact from abutting residences include the style of fencing and whether gates allow access into the bushland.

Only a small portion of one of the lots (i.e. Lot 244) currently directly abuts and directly impacts on riparian vegetation and would be expected to have an impact on the quality of the vegetation adjacent to the lots. Due to the density of the riparian vegetation which would greatly restrict pedestrian access to dump rubbish and growth of weed species, the impact would most likely be localised and of minor significance.

Water Quality

See Section 3.7 for comments on the impact of the subdivision on water quality.

3.6.6 Proposed Management

The current statutory planning mechanisms (i.e. WAPC Development Control Policy 2.3) for identifying foreshore management and protection areas are based on a

'foreshore reserve' width of 30m for waterways. However the waterway setback policy does allow for some flexibility for reasons of topography, condition of banks or flood protection. In the case of the proposed Riverslea subdivision development, the current minimal setback proposed will result in minimal loss of Darch Brook riparian habitat and is unlikely to result in any degradation of the ecological values of the waterway.

The rehabilitation of approximately 1.7ha of wetland within the degraded tributary will result in the creation of a sumpland/dampland-type wetland surrounded by wetland heath and thicket vegetation. The proposed sumpland/dampland will both treat and contain short-term flows of stormwater from the subdivision into Darch Brook. Species used in the rehabilitation will be consistent with the wetland vegetation that would have occurred in the creekline prior to clearing for agriculture (Figure 2).

3.7 Surface Water Quantity and Quality

3.7.1 EPA Objective

To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards and that stormwater management proposed for the subdivision is consistent with water sensitive urban design measures detailed in the Stormwater Management Manual for Western Australia (DoE, 2004).

3.7.2 Project Objective

To ensure that emissions do not adversely affect Darch Brook or Margaret River.

3.7.3 Relevant Guidelines

- *Stormwater Management Manual for Western Australia (DoE, 2004).*
- *National Water Quality Management Strategy: Australian Water Quality Guidelines for Fresh and Marine Waters Revised Guideline No 4. (ANZECC & ARMCANZ, 2001a).*
- *Australian Guidelines for Water Quality Monitoring and Reporting (Guideline No 7) (ANZECC & ARMCANZ 2001b).*

3.7.4 Existing Environment

The subdivision is adjacent to two watercourses, Darch Brook and a degraded tributary to Darch Brook. Both watercourses eventually drain into Margaret River approximately 600m to the north. Darch Brook flows through farming land from south of Rosa Brook Road down to Margaret River. Along most of its length, both sides of the brook have been cleared and used for grazing for many years. Only riparian vegetation in Darch Brook itself remains in most instances. In addition to the proposal area, significant stands of upland vegetation remain alongside Darch Brook

to the immediate east of the proposed subdivision, to the immediate north and in the north-eastern corner of the Riverslea Estate, near the confluence of Darch Brook and Margaret River.

The degraded tributary of Darch Brook also flows through old farming land and has mostly been cleared of any native vegetation both in the watercourse itself and on its banks.

No water quality information is available for Darch Brook or the degraded tributary. However, based on the predominantly cleared nature of the catchments and the historic agricultural land use of the area, it could be assumed that the water quality in the watercourses is likely to have elevated nutrient levels. The levels may attenuate downstream as the water passes through the native vegetation in Darch Brook.

3.7.5 Potential Impacts

Potential impacts resulting from the proposed development, both direct and indirect, on surface water quantity and quality include:

- alteration to the fresh water flow quantities and/or quality to the stream and river;
- altered watertable;
- altered fire regimes;
- increased terrestrial, air and water pollution inputs as a result of dumping, pesticide use, motor vehicle use;
- pollution of the brook and river ecosystem by sediment, nutrients and organochlorine and heavy metal compounds that may be released from the wetland sediment during earthworks associated with wetland modification and construction activities; and
- introduction of weeds, pests and disease such a dieback.

One of the primary reasons for protecting riparian vegetation is because the riparian vegetation itself plays a role in protecting the water quality of the watercourse and other watercourses downstream.

Water quality in creeklines can be affected by the input of nutrient-enriched stormwater and groundwater and by increasing sedimentation into the watercourse.

The Outline Development Plan (ODP) for the overall Riverslea subdivision allowed for stormwater drainage from the subdivision to be treated within a lake or detention basin to be created within the degraded tributary. The conditions of subdivision approval also made reference to construction of compensating/detention basins. However this type of stormwater management system no longer complies with the principles of water sensitive urban design as outlined in the Stormwater Management Manual for Western Australia (DoE, 2004). As a consequence, the original open

water/detention basin body concept proposed for the degraded tributary to the immediate south of the development will be abandoned and replaced with the creation of a more natural sumpland/dampland-type wetland to be rehabilitated with wetland heath and thicket vegetation. The proposed sumpland/dampland will treat and contain short-term flows of stormwater water from the subdivision. This proposed system would treat any nutrient-enriched stormwater from the subdivision and also treat any polluted water coming downstream from the catchment of the tributary. Water from upstream in Darch Brook can continue to flow down the brook uninterrupted.

Therefore, the proposed Riverslea subdivision will not adversely affect the function of the riparian vegetation by maintaining water quality in Darch Brook or Margaret River. The proposed vegetated swale system and the construction of a sumpland/dampland-type wetland system could improve the water quality flowing down the degraded tributary before it enters Darch Brook.

3.7.6 Proposed Management

Stormwater from the proposed subdivision as well as water from further upstream of the degraded tributary will be treated using the following water sensitive urban design principles:

- use of 'in-system' management measures including vegetative measures such as swales and riparian zones and structural quality improvement devices such as gross pollutant traps; and

- implementation of non-structural source controls such as minimisation of pollution inputs primarily via planning, organisational and educational measures, to minimise pollution entering the drainage system.

Two drainage swales are proposed for an area of POS to the immediate south west of the proposed subdivision (Figure 3). The swales will be vegetated with locally endemic rushes, sedges and tea-tree thicket, which will be similar in structure and composition to existing natural drainage lines and depressions. It is proposed that the swales will be relatively flat and broad with slopes of greater than 1:10. It is anticipated that the overflow from the two vegetated swales will flow through a gross pollutant traps (GPTs) and a rocky spillway (dry in summer) into the 1.7ha rehabilitated sumpland/dampland-type wetland section of the degraded tributary just above where it connects with Darch Brook. This proposed management will also have a positive impact on water quality in the watercourses that enter the Margaret River. Further details of the measures of proposed stormwater management proposed for the subdivision will be provided in the Stormwater and Watercourse Rehabilitation Management Plan to be prepared. The Shire of Augusta-Margaret River and the Department of Environment will be consulted during the preparation of this plan.

3.8 Aboriginal Heritage

3.8.1 EPA Objective

To ensure changes to the biophysical environment resulting from the proposal do not affect historical and cultural associations within the area and comply with the requirements of relevant Aboriginal and heritage legislation.

3.8.2 Project Objectives

To ensure that there is no unauthorised disturbance to Aboriginal Heritage sites associated with the proposed development.

3.8.3 Relevant Guidelines

- *Aboriginal Heritage Act 1972.*

3.8.4 Existing Environment

A review of the Department of Indigenous Affairs (DIA) electronic Aboriginal Sites Register was conducted by ATA Environmental in February 2003. The search revealed 62 registered sites of Aboriginal cultural heritage significance within the Shire of Augusta–Margaret River. A significant proportion of these sites are associated with the extensive limestone cave network that occurs in the region. Several other sites are associated with the stream, rivers, creeks, swamps and springs in the area. Two registered sites (Rosa Brook Road - Site ID No. 4494 and the Margaret River – Site ID No. 4495) occur within 10km of the proposal area.

An archaeological assessment of a proposed sewer pump station site on proposed Lot 667, which is located to the immediate northeast of the study area (Figure 4), was undertaken by Paul Greenfeld and Wayne Webb in February 2004 (Greenfeld, 2004) (Appendix 3). Due to the proximity to the proposal area, many of the archaeological issues associated with the proposed Lot 667 were considered to be relevant to the proposal area. The assessment included a search of the Department of Indigenous Affairs (DIA) Aboriginal Heritage Sites Register. The search indicated one previously recorded site of Aboriginal archaeological significance within a 10km radius of the study area (i.e. Rosa Brook Road - Site ID No. 4494). Additionally, Margaret River (Site ID. 4495), is considered to be a major mythological site by Aboriginal people of the South West region. As Darch Brook is a tributary of the Margaret River, it is considered to be of cultural significance to local Aboriginal people.

Consulting anthropologist Brad Goode conducted an ethnographic assessment of a proposed sewer pump station site on proposed Lot 667 to the northeast of the proposed Riverslea subdivision (Figure 4) in February 2004 (Goode, 2004) (Appendix 4). As with the archaeological assessment, many of the ethnographic issues associated with the proposed Lot 667 were considered to be relevant to the proposal area, particularly because of the proposed sites proximity to Darch Brook. An additional search of the DIA's Register of Aboriginal Heritage Sites by Brad Goode indicated that two registered Aboriginal Sites occur within 10km of the study area (i.e. Rosa Brook Road - Site ID No. 4494 and the Margaret River – Site ID No. 4495).

Rosa Brook Road is described as a meeting and corroboree ground, however due to the lack of precise information about its precise location, the DIA has placed a 10km buffered extent over the site. However from information recorded by McDonald Hales and Associates (2000) the site is believed to be located east of 10 Mile Dam, somewhere along Rosa Brook Road. As a result it is unlikely that this site will be affected by the proposed development of Riverslea. The Margaret River (Site ID 4495) is considered to be a site of generalised cultural significance but is also the site of specific mythological significance.

The ethnographic assessment of the proposed sewerage pump station (proposed Lot 667) included consultation with local Aboriginal groups identified from advice from the Department of Indigenous Affairs (Appendix 4). This included representatives of the Bibbulmun, Wadandi and Nyungar people.

As a result of consultations held with members of the Southwest Boojarah and Harris Family Native Title Claim groups, the wetlands that intersect the southernmost portion of proposed Lot 667 was identified as a site of Aboriginal cultural significance in association with Waugal beliefs.

The Aboriginal Community advised the proponent that all the tributaries and associated wetlands of the Margaret River system should be viewed as components of this site. All watercourses and wetlands within the South West region are protected by a standard 30m buffer from normal high water mark of the river. As a result of negotiations with the Elders, it was decided that a 4m buffer should be established between the wetland and all earthworks.

The Aboriginal community recommended that the DIA consider placing the Darch Brook and its associated wetlands within the boundaries of Site ID 4495.

3.8.5 Potential Impacts

The archaeological and ethnographic assessment previously undertaken was specific to proposed Lot 667 of the Riverslea Estate and did not consider the broader area within which the proposed residential subdivision is contained. Although the broader area wasn't considered, the ethnographic implications concerning site data will apply, however the community has not considered the broader area as such.

As many as six residential lots (i.e. Lots 244-249) in the southeast portion of the proposed subdivision are considered to be within the 4m buffer of Darch Brook that the Aboriginal elders agreed upon for the Darch Brook heritage site. Additionally, a proposed sewer line connecting the sewer pump station with a potential future residential development at Lot 27 Bussell Highway (located to the south of the site) has been planned for by Water Corporation. The final alignment of this sewer line has not yet been resolved however it is likely that sections of the alignment may be located within the agreed Darch Brook buffer. As a consequence the potential impact of the sewer line is considered relevant to the proposed Riverslea subdivision development.

3.8.6 Proposed Management

In response to the Aboriginal Elders concerns that the damage to the wetland may occur during the construction of the sewer line, Greendene Development Corporation have modified their plans and moved the tanks north and west of the additional 4m buffer. As a result of this action, the Aboriginal Community are in support of the amended location of the sewer pump station and have advised the developer that works can proceed (Appendix 4).

In the event that the proposed sewer line connecting the pump station with the residential subdivision impact on the Darch Brook buffer agreed to by the Elders, the proponent, as required under Section 18 of the *Aboriginal Heritage Act (1972)*, will seek the consent of the Minister for Indigenous Affairs to proceed with activities that will disturb the area.

With regards to the six residential lots that may impact on the agreed buffer, additional consultation was conducted which resulted in clearance under Section 18 of the Aboriginal Heritage Act 1972 being provided by the Minister for Indigenous Affairs on 15 January 2005. This clearance allowed for Site 4495 to be impacted on.

Additionally, if any surface or sub-surface artefacts that may be of cultural significance are identified from the site during construction activities, the proponent will report their findings to the Department of Indigenous Affairs in accordance with the *Aboriginal Heritage Act (1972).*

The proponent will commit to undertaking further archaeological investigations if required as part of the Section 18 clearance under *Aboriginal Heritage Act 1950*. Such investigations may include, but not be limited to:

- surface recording, mapping and collection of archaeological material;
- archaeological excavation and/or sub-surface evaluation;
- recovery of samples for radiometric dating; and
- analysis of recovered material.

4. COMMUNITY CONSULTATION

4.1 Introduction

An essential feature of any development project is the need to consult and address relevant issues, including environmental, with the wider community. The Greendene Development Corporation has recognised the importance of keeping the existing residents of the Margaret River townsite, businesses, landowners, local authorities and interest groups fully informed about the proposed Riverslea Gardens subdivision development. A targeted public consultation process has been undertaken to ensure these groups and individuals have the opportunity to comment on any aspect of the project, including the environmental issues associated with the proposal they wanted to have addressed in the PER. This pro-active approach to community consultation has resulted in identifying anticipated impacts and management measures associated with the design, construction and operation processes while providing opportunities for public awareness and comment.

The involvement of the community in developing the proposal has led to the modification of several aspects of the project to accommodate ideas and concerns of the public. The consultation process has proved to be very effective in developing a more environmentally sound project with broader community acceptance.

Specifically, the consultation approach has involved the following opportunities for public awareness and discussion:

Media Release

A media release was distributed to local media (August Margaret River Mail and the Busselton Margaret River Times), informing the community of the PER process.

Advertising

A half-page advertisement ran for two consecutive weeks in the August Margaret River Mail (Wed 4/5/2005 & Wed 11/5/2005) and the Busselton Margaret River Times (Thurs 5/5/2005 & Thurs 12/5/2005).

The advertisement provided information about the PER process and invited the community to nominate areas of interest to be included in the PER document.

Strategic Community Information

A cover letter and information pack were distributed to key stakeholders in the community who had or had demonstrated an interest in the project.

Information packs were also distributed on request from the advertisement.

4.2 Public Information & Display

In accordance with a commitment made by the Greendene Development Corporation in the Scoping Document (ATA Environmental, 2004), a Public Information Display was held during the preparation of this PER document to allow for issues and concerns of the local community to be incorporated in the PER prior to its public release.

The Public Information Display was held on 14 May 2005 in the Dewson's Shopping Centre, Margaret River. The display included aerial photographs of the proposed subdivision area, a poster outlining the PER process, information packs and submission forms. The display sought to provide an overview of the project to the general public in an informal setting. A member of the project team (environmental) was available during the display period to discuss aspects of the project with interested people.

An information package providing a summary of the proposed project, an aerial photograph of the proposal area and a submission form was provided to the members of the public wishing to prepare a submission. The two-week public submission period closed on the 26 May 2005. At the end of this period no further comments or submissions were received.

The display provided specific information for the public, including:

- overview description of the project;
- proposed location and structure plan for development; and
- description of project design to mitigate impacts.

Submission forms were available to assist the public with suggestions to be later considered in refining the project. Eleven attendees provided submissions.

Discussions and communications offered during the consultation process have provided information on potential environmental and social issues of concern to the community and decision-making authorities. The cooperation and input of these individuals and organisations is gratefully acknowledged.

4.3 Summary of Issues Raised During Consultation

A brief summary of the main issues of the eleven submissions received during following the Public Information Display is presented below in Table 4.

TABLE 4
SUMMARY OF ISSUES FROM PUBLIC SUBMISSIONS RECEIVED

Submission	Biodiversity	Water Pollution	Habitat	Watercourses	Linkages	Stormwater	Public Amenity/Open Space	State and Shire Planning	Flora and Fauna	Traffic
Leeuwin Environment Centre	X	X				X	X		X	
Shire of Augusta-Margaret River	X	X			X					
Local resident 1						X	X			
Local resident 2 (pro forma)	X					X		X		
Local resident 3 (pro forma)	X					X		X		
Local resident 4 (pro forma)	X					X		X		
Local resident 5 (pro forma)	X					X		X		
Local resident 6	X						X		X	
Local resident 7			X	X		X	X			
Local resident 8				X		X			X	X
Local resident 9	X	X	X			X				

The major issues and concerns identified by the public in the submissions included:

- the perceived lack of public open space;
- potential for stormwater flows from the subdivision and surrounding catchment to result in pollution of Darch Brook;
- biodiversity of the remnant vegetation;
- harmonious integration of the residential development with Darch Brook;
- proposal to clear native vegetation contravenes the Leeuwin Naturaliste Ridge Statement of Planning Policy and the Shire of Augusta-Margaret River's Town Planning Scheme 17; and
- bushland and foreshore vegetation provides wildlife corridor.

These issues and concerns have been taken into account in the preparation of this PER.

5. SUMMARY OF COMMITMENTS

5.1 Summary

This PER document provides information relating to the proposal to subdivide land wholly owned by the Greendene Development Corporation for the purposes of a residential subdivision. The document includes a description of the site, the characteristics of the proposal and identifies significant environmental issues.

Section 3 of this PER identifies the key environmental factors of significance that may be impacted as a result of the proposed residential development. The PER identifies how adverse environmental impacts, such as clearing of upland native vegetation and fauna habitats will be off-set by the rehabilitation of wetland vegetation and fauna habitats in the degraded tributary creek. This off-set will also have a positive impact on water quality in the watercourses that enter Margaret River.

In accordance with the generic EPA guidelines for preparing a formal environmental review for the proposal, Table 5 presents a summary of the relevant environmental factors identified for this PER document including potential impact, proposed management and predicted outcome.

In summary, the vegetation on the site is not significant at the State level or the Commonwealth level. The additional impact of the subdivision on fauna, when considered in terms of the extent of residential development that already exists in Margaret River is considered to be negligible.

No impact is anticipated on the Southern Brown Bandicoot (Priority 5 under the *Western Australian Wildlife Conservation Act 1950*) as the vegetation that they inhabit will not be cleared as part of the subdivision. The habitat for Baudin's Black Cockatoo (listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* and Schedule 1 under the *Western Australian Wildlife Conservation Act 1950*) will be affected by clearing approximately 6.3ha of upland eucalypt vegetation. However, there are large stands of similar vegetation in the nearby area in which Baudin's Cockatoos have been observed. No Baudin's Cockatoos have been observed nesting in the area.

The current minimal foreshore setback to Darch Brook proposed for the subdivision will result in a negligible loss of Darch Brook riparian habitat and is unlikely to result in any significant degradation of the ecological values of the waterway. Additionally, the rehabilitation of approximately 1.7ha of wetland within the degraded tributary of Darch Brook and the creation of a sumpland/dampland-type wetland will assist in the treatment of nutrient-enriched stormwater flows from the subdivision into Darch Brook. This will also have a positive impact on the quality of water entering the Margaret River.

Stormwater from the proposed subdivision as well as water from further upstream of the degraded tributary will be treated using water sensitive urban design principles as outlined in the Stormwater Management Manual for Western Australia (DoE, 2004). Details of the stormwater management measures proposed for the subdivision will be

provided in the Stormwater and Watercourse Rehabilitation Management Plan to be prepared prior to construction.

In the event that the proposed sewer line connecting the pump station with the residential subdivision impacts on the Darch Brook buffer agreed to by the Elders, Greendene Development Corporation, as required under Section 18 of the *Aboriginal Heritage Act (1972)*, will seek the consent of the Minister for Indigenous Affairs to proceed with activities that will disturb the area.

With regards to the six residential lots that may impact on the agreed buffer, additional consultation was conducted which resulted in clearance under Section 18 of the Aboriginal Heritage Act 1972 being provided by the Minister for Indigenous Affairs on 15 January 2005. This clearance allowed for Site 4495 to be impacted on.

Additionally, if any surface or sub-surface artefacts that may be of cultural significance are identified from the site during construction activities, the proponent will report their findings to the Department of Indigenous Affairs in accordance with the *Aboriginal Heritage Act (1972).*

The proponent will commit to undertaking further archaeological investigations if required as part of the Section 18 clearance under *Aboriginal Heritage Act 1950.*

5.2 Commitments

Normal commitments at this stage of a residential development project would be included as part of the future subdivision approval. However, in this unusual instance, the subdivision approval has already been granted. Therefore, the proponent commits to preparing the following documents prior to titles being provided.

5.2.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) relating to construction-specific management requirements to maintain environmental quality will be prepared implemented during construction.

The CEMP to be prepared and implemented for the site will address each of the following issues: watercourse management, rehabilitation management, stormwater management, noise, dust and Aboriginal heritage.

Operational management during the period of the proposed subdivision will be identified in the various approved management plans discussed in Section 5.2.2 to 5.2.6.

5.2.2 Construction Noise Management Procedures

Noise Management Procedures will be developed and implemented to the satisfaction of the DoE and Shire of Augusta-Margaret River.

It is considered the following activities may cause complaints and as such measures will need to be taken to control such activities:

i) starting of machinery before 0700hours;
ii) working on Sundays and Public Holidays;
iii) maintenance of machinery outside normal working hours; and
iv) collection or delivery of plant outside normal working hours.

5.2.3 Construction Dust Management Procedures

Construction Dust Management Procedures will be developed and implemented to the satisfaction of the DoE that will include, but not be limited to:

- watering of exposed surfaces;
- minimising working surfaces at any one time;
- wind fencing; and
- progressive stabilisation of disturbed areas (eg hydromulching).

5.2.4 Site Heritage Protocol

A Site Heritage Protocol will be developed and implemented to the satisfaction of the Department of Indigenous Affairs, the local Aboriginal community. The Site Heritage Protocol will include but not be limited to:

- induction of all employees and site contractors of the requirements for dealing with Aboriginal heritage under section 15 of the *Aboriginal Heritage Act 1972*, to report the discovery of any Aboriginal cultural material which may be uncovered in the course of their work;

- management of the identified site; and

- action to be taken should further sites be identified.

A qualified archaeologist and relevant Aboriginal representatives will monitor earth-disturbing work, particularly during the excavation in the vicinity of Darch Brook. Should a suspected Aboriginal site be located, all work in the vicinity will cease immediately and will not resume until such time as clearances have been obtained from the DIA in regards to obtaining a Section 18 clearance.

The proponent will apply for clearance under Section 18 of the *Aboriginal Heritage Act 1972* to remove both previously recorded sites and any new sites that emerge as a result of earthmoving procedures located within the site that will be impacted by the proposed development.

The proponent will also undertake further archaeological investigations if required as part of the Section 18 clearance. Such investigations may include, but not be limited to:

- surface recording, mapping and collection of archaeological material;
- archaeological excavation and/or sub-surface evaluation;

- recovery of samples for radiometric dating; and
- analysis of recovered material.

5.2.5 Stormwater and Watercourse Rehabilitation Management Plan

A Stormwater and Watercourse Rehabilitation Management Plan will be prepared and implemented to the satisfaction of the DoE and the Shire of Augusta-Margaret River. The Plan will be developed to assist rehabilitation and creation of a natural wetland (i.e. sumpland/dampland) surrounded by wetland heath and thicket vegetation. The proposed sumpland/dampland that will replace the degraded tributary of Darch Brook and will contain short-term flows of stormwater water from the subdivision. Species used in the rehabilitation will be consistent with the wetland vegetation that would have occurred in the creekline prior to clearing for agriculture. This created habitat will be suitable for some species of significant fauna, including Southern Brown Bandicoots and some water birds.

The plan will include, but not be limited to:

- design of the swales;
- periodic monitoring of the vegetated swales to ensure continued function and maintenance as required;
- maximising infiltration of uncontaminated stormwater at sources to recharge the groundwater system;
- water conservation principles;
- nutrient control;
- prescribed fertilizer applications for areas of POS;
- determination of flushing requirements, associated impacts and management options;
- treating contaminated stormwater via gross pollutant and sediment traps;
- monitoring criteria to determine the success of the plan;
- progress and compliance reporting;
- timing and implementation schedule;
- a management plan for the Darch Brook;
- a plan to re-construct a portion of the degraded tributary of Darch Brook as a natural wetland (i.e. sumpland/dampland) that caters for wetland flora and fauna, subdivision drainage and passive recreation;
- methods of rehabilitation;

- plant species to be used;
- details on drainage management;
- completion criteria for rehabilitation success; and
- monitoring of rehabilitation and water quality.

5.2.6 Fire Management Plan

A Fire Management Plan will be prepared and implemented in accordance with *Planning for Bush Fire Protection* (2001). The management plan will demonstrate that any dual use paths (DUPs) within the proposed POS can accommodate emergency vehicles in the event of a bush fire and will adequately address the interface between lots and remnant vegetation in the POS and foreshore area.

TABLE 5
SUMMARY TABLE OF RELEVANT ENVIRONMENTAL FACTORS, POTENTIAL IMPACTS, PLANNED MANAGEMENT AND PREDICTED OUTCOMES FOR THE PROPOSED RIVERSLEA SUBDIVISION RESIDENTIAL DEVELOPMENT

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
BIOPHYSICAL					
Vegetation	To maintain the abundance, species diversity, geographic distribution and productivity of flora at species and ecosystem levels through avoidance and management of adverse impacts and improvement of knowledge.	The proposed subdivision area includes approximately 6.3ha of upland Jarrah/Marri and 0.0172ha of riparian vegetation. The subdivision is adjacent to riparian thicket vegetation in Darch Brook and cleared vegetation in the tributary to Darch Brook. One Priority flora species, *Gahnia scleroides*, occurs on the edge of the riparian zone.	Clearance of approximately 6.3ha of upland vegetation and 0.0172ha of riparian vegetation for the construction of the proposed subdivision. No impact on the Priority listed flora species *Gahnia scleroides* will not be cleared.	Riparian vegetation and Priority listed taxa to be protected wherever possible. Delineate populations of significant flora and manage in accordance with the recommendations of CALM. 1.7ha of wetland vegetation to be created through the rehabilitation of the degraded tributary. A Stormwater and Watercourse Rehabilitation Management Plan will be prepared and implemented.	Based on the results of the vegetation surveys undertaken, the partial off set of vegetation loss through rehabilitation and knowledge of the extent of the development and reasonable construction to be adopted, it is considered that the implementation of the project can be managed to meet the EPA's objectives in relation to vegetation (predicted impact low with a high degree of confidence).
Fauna	To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement of knowledge.	Thirty-three species of birds, 4 species of amphibian, 7 species of reptile and 8 species of mammal were recorded during the survey.	Clearance of approximately 6.3ha of vertebrate fauna habitat. Creation of 1.7ha of wetland fauna habitat in the rehabilitation of the degraded tributary.	Fauna habitat association within riparian vegetation to be protected. 1.7ha of potential wetland fauna habitat to be created in the rehabilitation of the degraded tributary.	Based on the results of a fauna survey undertaken and knowledge of the extent of the development and habitat enhancement proposed, it is considered that the implementation of the project can be managed to meet the EPA's objectives in relation to fauna.
Watercourses	To maintain the quantity of water so that existing and potential environmental values, including ecosystem maintenance are protected.	The proposed subdivision is adjacent to Darch Brook and one of its tributaries both of which flow into Margaret River about 600m to the north.	Clearing of approximately 0.0176ha of riparian vegetation associated with Darch Brook which is unlikely to result in a decline in quality of water entering Darch Brook and Margaret River.	Stormwater Management will be undertaken in accordance with the Stormwater Management Manual for Western Australia (Department of Environment, 2004) to ensure that post development flows are maintained at pre-development rates into Darch Brook and its tributary. Riparian vegetation to be protected wherever possible. A Stormwater and Watercourse Rehabilitation Management Plan will be prepared and implemented.	The proposed loss of 0.0172ha of riparian vegetation associated with Darch Brook will be offset by the rehabilitation/creation of approximately 1.7ha of sumpland/dampland-type wetland within the degraded tributary
Surface Water Quantity and Quality	To ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards and that stormwater management proposed for	The subdivision is adjacent to Darch Brook and one of its tributaries both of which flows into Margaret River about 600m to the north. The riparian vegetation associated with Darch Brook is generally in excellent condition. A minor tributary of Darch Brook is in degraded condition.	The water quality of Darch Brook and the degraded tributary may be affected by input of nutrient enriched stormwater and increased sedimentation.	Stormwater drainage will be treated within vegetated swales and a sumpland/dampland-type wetland prior to discharge into watercourses. The degraded tributary will be rehabilitated to improved habitat for wetland fauna through the creation of an sumpland/dampland-type wetland within the degraded sections of the tributary creek. A Stormwater and Watercourse Rehabilitation	Based on the knowledge of the extent of the development, wetland rehabilitation, enhancement and other mitigation measures proposed, it is considered that the implementation of the project can be managed to meet the EPA's objectives in relation to surface water quality (predicted impact low with a high degree of confidence).

Environmental Factor	EPA Objective	Existing Environment	Potential Impacts	Environmental Management	Predicted Outcome
	the subdivision is consistent with water sensitive urban design measures detailed in the Stormwater Management Manual for Western Australia (DoE, 2004)			Management Plan will be prepared and implemented.	
SOCIAL					
Aboriginal Heritage	To ensure changes to the biophysical environment resulting from the proposal does not adversely affect historical and cultural associations within the area and comply with the requirements of relevant Aboriginal and heritage legislation.	DIA registered sites (Rosa Brook Road - Site ID No. 4494) occurs within 10km of the study area. Darch Brook, a tributary of Margaret River (Site ID 4495), is considered by the local Aboriginal community to be a place of significance	Potential for material of Aboriginal cultural significance to occur on the site and likelihood that up to six lots (Lots 244-249) within the subdivision, as well as the proposed sewer line connecting pump station with Lot 27 Bussell Highway, will be within 4m of a place of ethnographic significance (i.e. Darch Brook).	In the event that the proposed sewer line route and proposed residential subdivision impact on the Darch Brook buffer agreed to by the elders, the proponent, as required under Section 18 of the *Aboriginal Heritage Act (1972)*, will seek the consent of the Minister for Indigenous Affairs to proceed with activities that will disturb the area. With regards to the six residential lots that will impact on the agreed buffer, a section application under Section 18 of the *Aboriginal Heritage Act (1972)* for consent to use the land that may contain an Aboriginal site was lodged. Clearance was obtained by the Minister for Indigenous Affairs on 15 January 2005. In the event that any surface or sub-surface artefacts that may be of cultural significance are identified from the site during construction activities, the proponent will report their findings to the Department of Indigenous Affairs in accordance with the *Aboriginal Heritage Act (1972)*. The proponent will also undertake further archaeological investigations if required	Provisions of the *Aboriginal Heritage Act 1972* will be complied with. Clearance under Section 18 of the Act allowing Site No. 4495 has been provided by the Minister for Indigenous Affairs. Additional clearance will be required should infrastructure be required to be installed in any other registered site and any new sites that emerge as a result of earthmoving procedures located within the site The proponent will also undertake further archaeological investigations if required as part of the Section 18 clearance. Such investigations may include, but not be limited to: • surface recording, mapping and collection of archaeological material; • Archaeological excavation and/or sub-surface evaluation; • recovery of samples for radiometric dating; and • analysis of recovered material.

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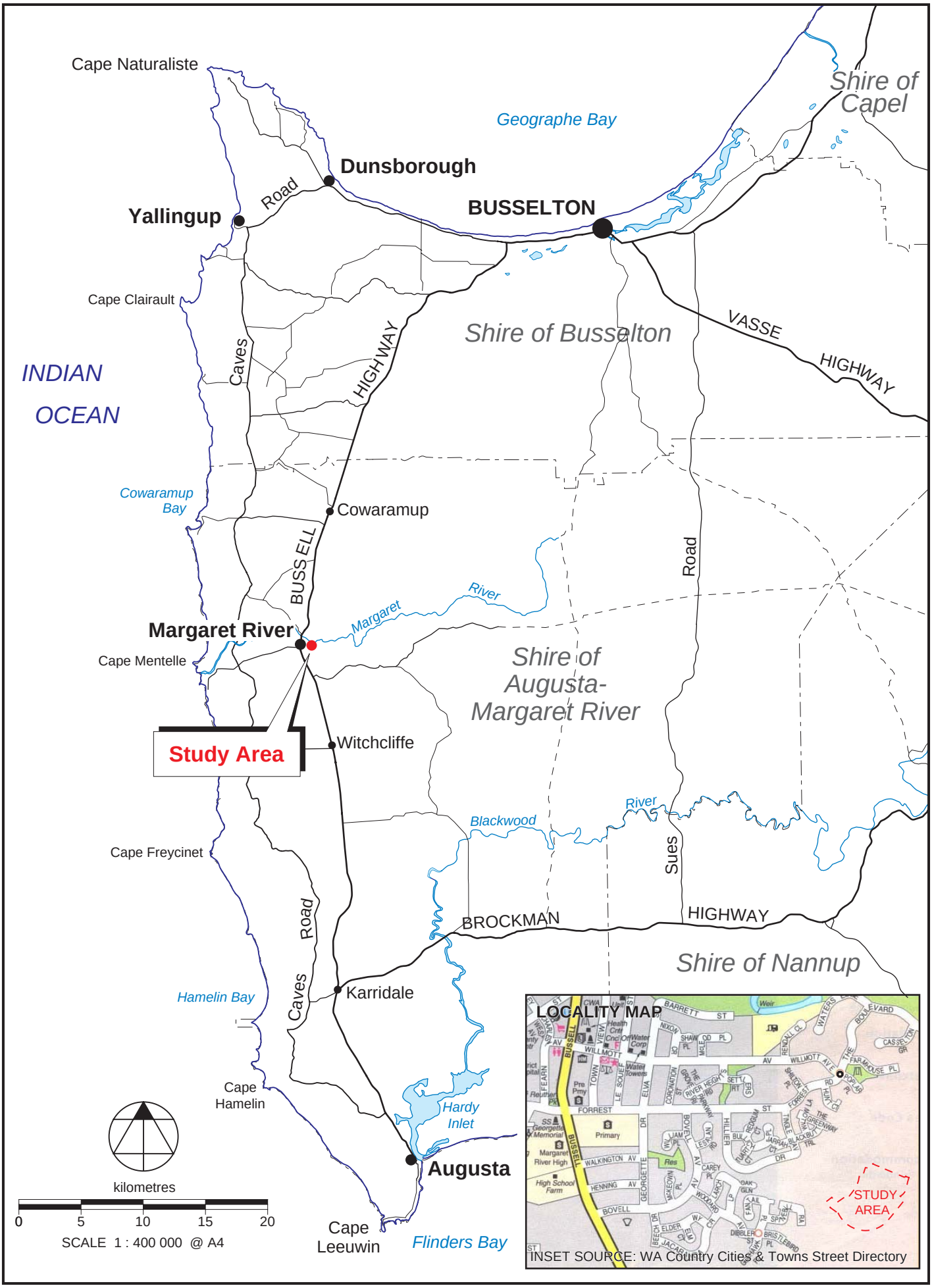
FIGURES



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RIVERSLEA SUBDIVISION - PUBLIC ENVIRONMENTAL REVIEW

REGIONAL LOCATION

FIGURE 1

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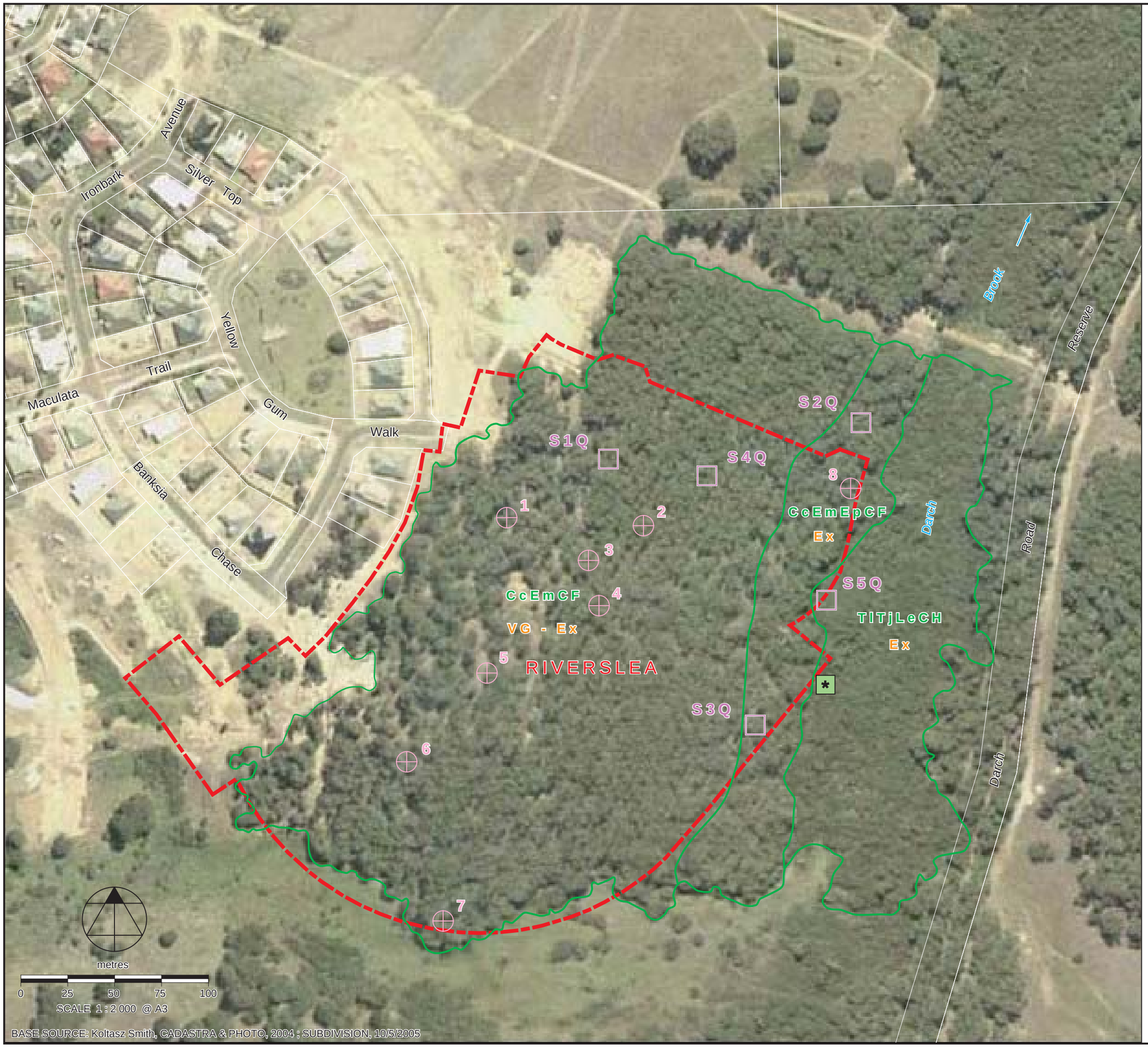

LEGEND

- Riverslea Boundary
- Vegetation Type Boundary
- S 2 Q — Flora Quadrat Location (10mx10m)
- * — *Gahnia scleroides* (Priority 3 Listed Taxa)
- 8 — Fauna Trapping Site

VEGETATION TYPES

CcEmCF *Corymbia calophylla* l*Eucalyptus marginata* subsp. *marginata* Closed to Open Forest.

CcEmEpCF *Corymbia calophylla* l*Eucalyptus marginata* subsp. *marginata* Closed Forest with scattered *Eucalyptus patens* .

TlTjLeCH *Taxandria linearifolia/Taxandria juniperina/ Leptospermum erubescens* Closed Heath.

VEGETATION CONDITION (SOURCE: BUSH FOREVER Govt. of W.A., 2000)

Pristine (Not Applicable)
Pristine or nearly so, no obvious signs of disturbance.

Ex Excellent
Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species.

VG Very Good
Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (Not Applicable)
Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (Not Applicable)
Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

Completely Degraded (Not Applicable)
The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

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RIVERSLEA SUBDIVISION
PUBLIC ENVIRONMENTAL REVIEW

VEGETATION TYPES & CONDITION AND FAUNA TRAPPING SITES

FIGURE 2

GDC-2003-001/PER/24_131F3.dgn DATUM: MGA DRAWN BY: GLM 29-6-05 CHECKED BY: SG 29-6-05 PRINTED: Fri 08 Jul 05

MARGARET RIVER

THE BOULEVARD

WILLMOTT AVENUE

FORREST ROAD

THE GREENWAY

BLACKBUTT TRAIL

TINGLE AVENUE

IRON BARK AVENUE

YELLOW GUM TRAIL

MACULATA WALK

BANKSIA CHASE

PROPOSED ARCHIBALD DRIVE

RIVERSLEA

PUBLIC OPEN SPACE
14.9 ha

Darch Brook Reserve

PUBLIC OPEN SPACE

PUBLIC OPEN SPACE

PUBLIC OPEN SPACE

Area Covered by Figure 2

Boundary of Riverslea

Tributary to Darch Brook (Placed Approx.)

Riparian Vegetation

Degraded Tributary to be Rehabilitated as a Sumpland/Dampland Type Wetland

metres

0 50 100 150 200

SCALE 1 : 4 000 @ A3

BASE SOURCE: KOLTASZ SMITH
PHOTO, 2004 ; SUBDIVISION, 10-5-05

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RIVERSLEA SUBDIVISION
PUBLIC ENVIRONMENTAL REVIEW
SUBDIVISION PLAN
FIGURE 3

LIMIT OF CADASTRAL DATA

SEE FIGURE 6

STATE FOREST

CARTERS ROAD

CALM Office

BUSSELL HIGHWAY

RIVER

MARGARET

BRAMLEY NATIONAL PARK

Swan View Drive

MARGARET RIVER

ROAD

FORREST ST

WALLCLIFFE

Proposed Lot 667

Brook

SEE FIGURE 5

SEE FIGURE 2

Lots 9013, 756

Darch

BUSSELL ROAD

Lot 27

BOODJIDUP

HIGHWAY

Ten Mile Brook Dam

metres

0 200 400 600 800 1000

SCALE 1 : 20 000 @ A3

LEGEND

- Outline of Other Figure
- Vegetation Mapping
- Approximate Location of Proposed Lot 667

BASE SOURCE: KOLTASZ SMITH, 2004

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MARGARET RIVER VEGETATION OVERVIEW

FIGURE 4

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VEGETATION CONDITION (Legend Source: BUSH FOREVER Govt. of W.A., 2000)

P Pristine or nearly so, no obvious signs of disturbance. (Not Applicable)

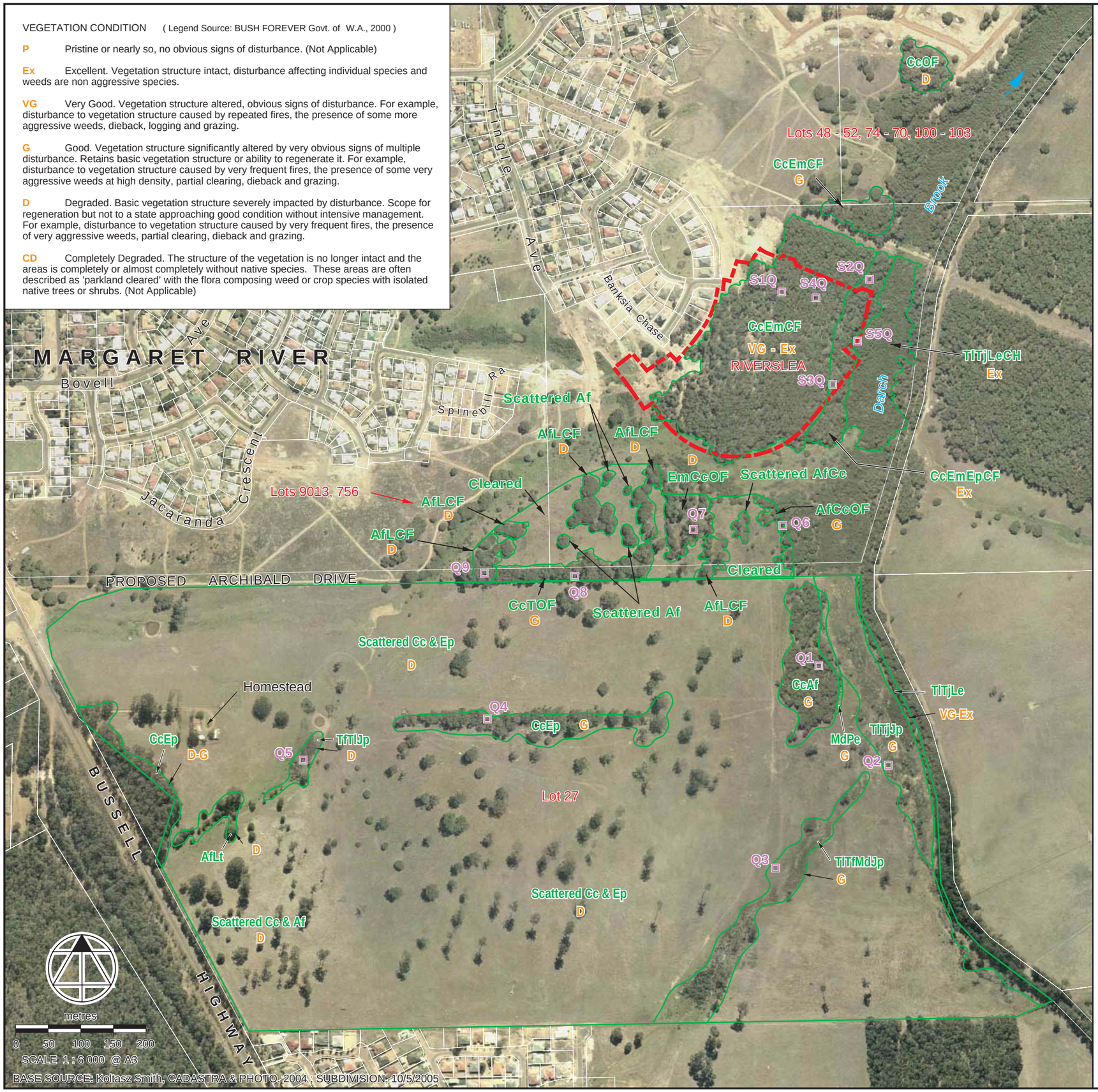
Ex Excellent. Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species.

VG Very Good. Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

G Good. Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

D Degraded. Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

CD Completely Degraded. The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs. (Not Applicable)



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LEGEND

Cadastral Boundary

Riverslea Boundary

Vegetation Boundary

S2Q Flora Quadrat, 10 x 10m (see Appendices 2 and 3 for details)

VEGETATION TYPES - Riverslea

CcEmCF *Corymbia calophylla/Eucalyptus marginata* subsp. *marginata* Closed to Open Forest

CcEmEpCF - *Corymbia calophylla/Eucalyptus marginata* subsp. *marginata* Closed Forest with scattered *Eucalyptus patens*

TlTjLeCH - T*axandria linearifolia/Taxandria juniperina/Leptospermum erubescens* Closed Heath

VEGETATION TYPES - Lot 27 Bussell Highway

CcAf Marri (*Corymbia calophylla*) Open Forest with occasional Jarrah (*Eucalyptus marginata* ssp. *marginata*) over a midstratum dominated by Peppermint (*Agonis flexuosa*) over an open understorey with scattered Balga (*Xanthorrhoea preissii*), *Trymalium floribundum* and *Hibbertia hypericoides* and patches of Bracken Fern (*Pteridium esculentum*).

MdPe *Mirbelia dilatata* Shrubland over dense stands of Bracken Fern.

TlTjJp Previously cleared area which has naturally regenerated to comprise a Open to Closed Heath of *Taxandria linearifolia* and *T. juniperina* over *Juncus pallidus* with *Leptospermum erubescens* and *Melaleuca hamulosa* and open areas of grasses and Bracken Fern.

TlTjLeCH Closed Heath of *Taxandria linearifolia, T. juniperina, Leptospermum erubescens* and *Melaleuca hamulosa.*

TlAfMdJp Shrubland to Open Heath of *Taxandria linearifolia, Agonis flexuosa* and *Mirbelia dilatata* over scattered stands of *Juncus pallidus*.

CcEp High Open Woodland dominated by Marri and scattered Blackbutt (*Eucalyptus patens*) over a cleared understorey of pasture grasses.

AfTlJp Low Open Woodland of Peppermints over occasional *Taxandria linearifolia* and patches of *Juncus pallidus* in damp and inundated areas.

AfLt Low Open Woodland of Peppermints over occasional stands of *Lepidosperma tetraquetrum.*

VEGETATION TYPES - Lots 48 to 52, Lots 74 to 79 and Lots 100 to 103 off Poplar Avenue and Halcyon Way, Riverslea

CcEmCF Marri (*Corymbia calophylla*) / Jarrah (*Eucalyptus marginata* subsp. *marginata*) Closed to Open Forest

CcOF Marri (*Corymbia calophylla*) Open Forest

VEGETATION TYPES - Lots 9013 and 756 Tingle Avenue

AfCcOF Peppermint (*Agonis flexuosa*) and Marri (*Corymbia calophylla*) Open Forest to 15m in height with scattered Jarrah (*Eucalyptus marginata* subsp. *marginata*) over Bracken (*Pteridium esculentum*) dominated Open Low Heath

CcEmCF Marri (*Corymbia calophylla*) and Jarrah (*Eucalyptus marginata* subsp. marginata) Open to Closed Forest (to 30m in height) over Peppermint (*Agonis flexuosa*) Tall Shrubland over Bracken (*Pteridium esculentum*) dominated Open Shrubland

CcTOF Marri (*Corymbia calophylla*) Tall Open Forest to 30m in height with scattered Jarrah (*Eucalyptus marginata* subsp. *marginata*) and Peppermint (*Agonis flexuosa*) over Bracken (*Pteridium esculentum*) dominated Shrubland

AfLCF Peppermint (*Agonis flexuosa*) Low Closed Forest (to 6m in height) with scattered Marri (*Corymbia calophylla*) over Winter Grass (*Poa annua*) and Couch (*Cynadon dactylon*) Grassland

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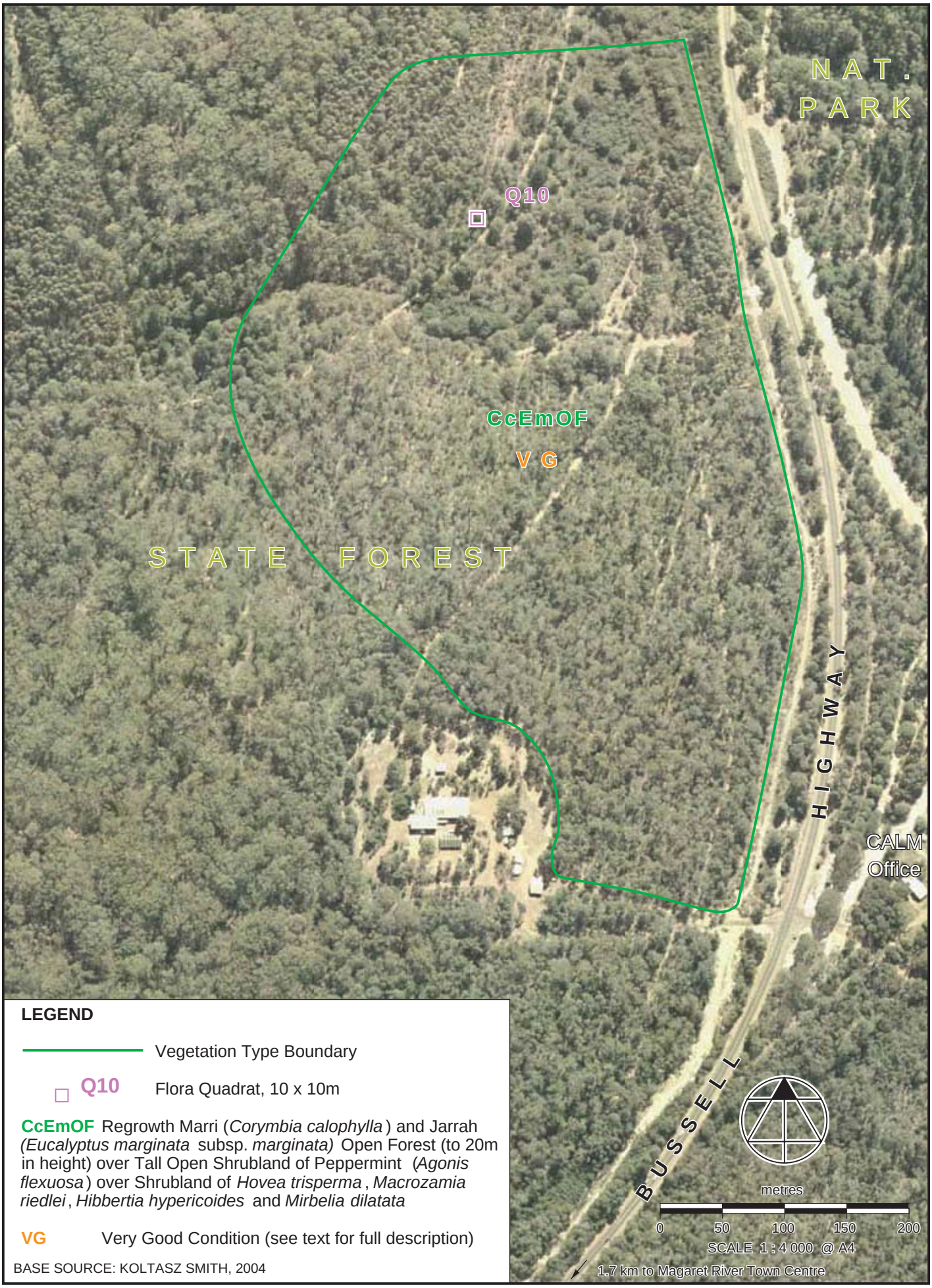
RIVERSLEA SUBDIVISION
PUBLIC ENVIRONMENTAL REVIEW

VEGETATION TYPES & CONDITION ASSOCIATED WITH ADJACENT PROPOSED DEVELOPMENTS

FIGURE 5



LEGEND

Vegetation Type Boundary

Q10 Flora Quadrat, 10 x 10m

CcEmOF Regrowth Marri (*Corymbia calophylla*) and Jarrah *(Eucalyptus marginata* subsp. *marginata)* Open Forest (to 20m in height) over Tall Open Shrubland of Peppermint (*Agonis flexuosa*) over Shrubland of *Hovea trisperma*, *Macrozamia riedlei*, *Hibbertia hypericoides* and *Mirbelia dilatata*

VG Very Good Condition (see text for full description)

BASE SOURCE: KOLTASZ SMITH, 2004

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RIVERSLEA SUBDIVISION - PUBLIC ENVIRONMENTAL REVIEW

VEGETATION TYPE AND CONDITION OF STATE FOREST IN THE MARGARET RIVER AREA

FIGURE 6

APPENDICES

APPENDIX 1

RIVERSLEA SUBDIVISION VEGETATION AND FLORA ASSESSMENT (ATA ENVIRONMENTAL, 2005b)

GREENDENE DEVELOPMENT CORPORATION PTY LTD

RIVERSLEA SUBDIVISION

VEGETATION AND FLORA ASSESSMENT

VERSION 3

JUNE 2005

REPORT NO: 2004/62

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An internal quality review process has been applied to each project task undertaken by us. Each document is carefully reviewed by core members of the consultancy team and signed off at Director level prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

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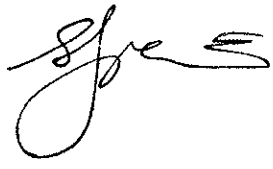
Checked by: Signed: 

Name: Shaun Grein Date: 23 June 2005

Approved by: Signed: 

Name: Paul van der Moezel Date: 23 June 2005

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1. INTRODUCTION

1.1 Background

Greendene Development Corporation Pty Ltd is planning to further develop Lots 9101 and 9002, Willmott Avenue and Forrest Rd, approximately 1km east of the Margaret River townsite. The location of the approved subdivision is shown in Figure 1.

The Riverslea Gardens subdivision is located approximately 1km east of the Margaret River townsite and forms part of the developing Riverslea residential area. The study area encompasses a total area of approximately 6.3ha of remnant bushland in the Shire of Augusta-Margaret River.

The Outline Development Plan (ODP) for the Riverslea Subdivision area was considered by the Augusta-Margaret River Council in July 2000 and formally endorsed and adopted by Council and the WAPC in November 2001. This area is shown in Figure 1.

1.2 Purpose and Scope

This assessment has been undertaken to investigate the significance of the native vegetation and flora of the study area with respect to the areas future residential development potential.

The scope of works included undertaking a flora and vegetation survey of the study area and to identify potential significant flora.

2. METHODOLOGY

2.1 Extent and Level of Survey

The level of the flora and vegetation surveys required for the Riverslea Subdivision area was formulated on the basis of indicative levels expected by the EPA in relation to the relative sensitivity of the receiving environment (i.e. Bioregion) and the scale and nature of the proposed impact and commitments made in the approved scoping document (ATA Environmental, 2004). Based on the proposed high level of impact and the sensitivity of the Warren Bioregion, Level 2 surveys were deemed necessary for the study area. Level 2 surveys require:

- background research or 'desktop' study;
- reconnaissance survey, to verify accuracy of background research, delineate and characterise flora and range of vegetation units and identify potential impacts;
- detailed survey, including one or more visits in main flowering season and visit in other season and replication of plots in vegetation units; and
- comprehensive survey; involving survey, at the same level as applied in the 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.

The following methodology was proposed and agreed to by the officers from the Environmental Protection Authority Services Unit (EPASU) in the approved scoping document prior to conducting the survey:

- Review of updated Department of Conservation and Land Management Declared Rare and Priority Flora and Threatened Ecological Community databases.
- Conduct a comprehensive flora and vegetation survey of the area in accordance with *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004) as a component of the environmental impact assessment of the site. This will include an assessment of both the upland and riverine vegetation associated with the site, identification and mapping of the type, condition and extent of vegetation types, and the identification of any significant plant species (i.e Declared Rare and Priority listed flora) and Threatened Ecological Communities (TECs). The vegetation will also be considered in the context of the Regional Forest Agreement and from a local perspective, and in terms of existing and potential linkages between riparian and upland vegetation.
- Compare the vegetation complexes, vegetation associations and floristic community types of the entire landholding with distributions in nearby reserves (i.e. state forest) using available data or new data as required.
- Determine the cumulative impact on the environment from surrounding developments. This will be achieved on a locale scale by determining a figure for

the loss of vegetation on the site resulting from the proposed development and on a regional scale from loss of vegetation from surrounding developments.

Mr Shaun Grein, an experience botanist from ATA Environmental undertook a detailed flora and vegetation survey of the Riverslea study area on 30 October 2003, and conducted an additional follow-up survey on 15 October 2004.

In accordance with *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004), temporary 10m x 10m quadrats were established and the flora sampled in each of the vegetation types identified from the Riverslea study area. A total of five non-permanent 10m x 10m quadrats were established in representative vegetation types within the Riverslea study area (Appendix 2, Figures 2 and 3b).

An additional survey was conducted in an adjacent area of similar vegetation (i.e. Lots 48 to 52, Lot 74 to 79 and Lots 100 to 103 Poplar Avenue and Halcyon Way, Riverslea) (approximately 1ha) on 30 October 2003, as part of an assessment of a potential Water Corporation Pump Station site while flora and vegetation surveys, which were undertaken in accordance with *Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004), were conducted on adjacent Lots 9013 and 753 Tingle Avenue and Lot 27 Bussell Highway, Margaret River (Figure 3b) in October 2004. A flora and vegetation survey, including collection of floristic, quadrat-based data was also conducted within an area of regrowth State Forest approximately 2km to the north of the Margaret River townsite on 15 October 2004 (Figure 3c). Quadrat based flora data, including photographs, collected from these additional local areas is provided in Appendix 3.

In addition to the quadrat based data collected, additional plant species were opportunistically recorded by systematically traversing the Riverslea study area on foot. Plant specimens that were recorded but could not be definitively identified in the field were collected pressed and identified using relevant keys and compared with specimens from the Western Australian Herbarium.

Approximately six hours was spent undertaking a flora and vegetation survey of the Riverslea site during the initial 2003 survey, and a further four hours during the follow-up October 2004 survey. This was considered an adequate survey period considering the relatively small size, homogeneity of vegetation within the study area and ease of access through the vegetation. The principal purpose of the survey was to identify the main vegetation types and condition and identify any significant flora from the site.

A CALM search for significant flora (Declared Rare and Priority Flora) for the Margaret River area was undertaken prior to the survey. These are:

- *Acacia inops* (P3) – Warren and Jarrah Forest Region on Black peaty sand, clay. swamps, creeks. Flowering period: Sep–Nov.

- *Conospermum paniculatum* (P3) – Warren Jarrah, Swan Coastal Plain Regions on Sandy or clayey soils, in swampy areas, plains, slopes. Flowering period: Jul–Nov.

- *Hybanthus volubilis* (P2) - Warren and Jarrah Forest Regions, on clay or sandy clay; River banks. Flowering period: Sep–Dec.

- *Tyrbastes glaucescens* (P4) – sedge-like herb from Warren, Jarrah Forrest, Swan Coastal Plain and Esperance Plains regions in sand or peat in swamps and along stream banks.

While not listed on the CALM database search conducted for the area, the Priority 3 listed taxa *Gahnia sclerioides* was recorded from the site during an assessment of the site conducted by a CALM officer in December 2002 (CALM, 2002). *Gahnia sclerioides* is sedge known from the Warren and Jarrah Forest regions on loam and sandy soils in moist shaded situations.

2.2 Limitations of the Surveys

Although the surveys were conducted at an appropriate time of the year for detecting the majority of ephemeral flora species likely to occur in the area, there may be some species (eg. annual daisies that would germinate and flower immediately after late winter rains) may not have been present or identifiable at the time of either the 2003 or 2004 surveys.

Fungi and nonvascular flora (e.g. algae, mosses and liverworts) were not specifically surveyed for during this assessment.

No floristic analysis of the quadrat data collected from the surveys was conducted for this study.

3. FLORA AND VEGETATION

3.1 Vegetation Complexes

The study area is associated with the Warren Bioregion (Thackway and Cresswell, 1995) and comprises vegetation characteristic of the Cowaramup (Cw1) and Wilyabrup (W1) Vegetation Complexes (Mattiske and Havel, 1998). The Wilyabrup (W1) unit is comprised of Tall Open Forest of Karri (*Eucalyptus diversicolor*)-Marri (*Corymbia calophylla*)-*Allocasuarina decussata*-Peppermint (*Taxandria flexuosa*) on deeply incised valleys of the hyperhumid zone while the Cowaramup (Cw1) unit is comprised of a mixture of Open Forest of *Eucalyptus diversicolor-Corymbia calophylla* and woodland of Jarrah (*Eucalyptus marginata* subsp. *marginata*)-*Corymbia calophylla on* slopes and low woodland of *Melaleuca preissiana-Banksia littoralis* on depressions.

3.2 Vegetation Types

There are three main vegetation types that are related to the landform features of the site dominate the Riverslea study area. The western three quarters of the study area is dominated by regrowth Marri (*Corymbia calophylla*)/Jarrah (*Eucalyptus marginata* subsp. *marginata*) Closed Forest to Open Forest to 30 m in height with a mid-stratum comprised of Peppermint (*Taxandria flexuosa*) over an Open Shrubland (to 2m) dominated by *Hovea trisperma, Hibbertia hypericoides, H. cuneiformis, Bossiaea ornata, Lasiopetalum floribundum, Xanthorrhoea brunonis* and *Conostylis aculeata.*

The eastern quarter of the study area, which adjoins Darch Brook, supports a Marri/Jarrah Closed Forest to 20m in height with scattered Blackbutt (*Eucalyptus patens*) over a Low Shrubland dominated by *Mirbelia dilatata* and *Xanthorrhoea preissii*. Darch Brook, which immediately abuts this vegetation type, is dominated by a Closed Heath (to 2m) of *Taxandria linearifolia, T. juniperina, Leptospermum erubescens* and *Melaleuca hamulosa* over an Open Sedgeland dominated by *Lepidosperma tetraquetrum.*

The vegetation types and condition of the Riverslea study area is shown in Figure 2.

Figure 3 provides an aerial overview of vegetation within the Margaret River area while figures 3b-3c shows the vegetation types and condition of adjacent properties and reserves (i.e. State Forest), including that associated with other proposed developments in the area.

3.3 Condition

The condition of the vegetation was assessed using the condition rating scale of Keighery published in Bush Forever (Government of Western Australia, 2000).

While the understorey of areas of vegetation along the western and south boundary of the study area have been highly degraded by weed invasion (i.e. Bracken Fern), the overstorey, which is predominantly regrowth Marri/Jarrah, is structurally intact and is

classified as being in Very Good to Excellent condition. Grassy weed species are present around the edge of the study area with fewer introduced species present in the central and eastern portions of the study area.

3.4 Flora

A total of 142 plant species including 128 native and 14 introduced species were recorded from the Riverslea study area during flora and vegetation surveys conducted for the site during October 2003 and October 2004. This is comparable with the 2002 CALM survey of the site which identified a total of 114 plant species from the site. The families within the study area with the greatest representation include the Orchidaceae (Orchid family with 12 species) and Papilionaceae (Pea family 12 species, including 10 native and 2 non-native species). The timing of the surveys in October meant that the majority of the ephemeral species, such as orchids, lilies and daisies, were recorded from the site. A full list of species recorded from the site is provided in Appendix 1, while the flora recorded from each of the five quadrats sampled from the site is provided in Appendix 2.

3.5 Conservation Significance of Vegetation and Flora

3.5.1 Vegetation

The vegetation occurring within the Riverslea study area is characteristic of the Cowaramup (Cw1) and Wilyabrup (W1) Vegetation Complexes (Mattiske and Havel, 1998). According to Regional Forest Agreement (RFA) data, the total area of the Willyabrup (W1) Complex remaining is approximately 3,888ha (of which 50% is reserved within the CAR System (RFA, 1999). Approximately 1391ha of the Cowaramup (Cw1) Complex currently remains, of which 44% is reserved within the CAR Reserve system. The RFA agreement requires that a minimum of 15% of the Pre-European extent of vegetation complexes be reserved within the CAR Reserve System. Therefore, at the local scale, the clearing of approximately 6.3ha of vegetation from the Riverslea study area is unlikely to have a significant impact on the conservation significance of the Cowaramup or Wilyabrup Vegetation Complexes.

The 1989 Dames and Moore assessment of the site (Dames and Moore, 1989) stated that the vegetation associated with the site was not unusual and it correlated well with documented habitats elsewhere.

The vegetation on the site also forms part of a corridor of vegetation along Darch Brook which links the Margaret River with vegetation in road reserves (Rosa Brook Road) and other creeklines further south. The vegetation along the Darch Brook corridor mostly consists of the creekline only, particularly south of Riverslea. However, at Riverslea the corridor widens to include upland vegetation on both the western and eastern sides of the Brook. The vegetation on the eastern side of Darch Brook almost extends to State Forest (Bramley Block) to the east.

Approximately 213ha of similar regrowth revegetation was identified during the October 2004 survey from secure State Forest approximately 2km north of the Margaret River townsite.

3.5.2 Significant Flora

According to the Department of Conservation and Land Management's database of Declared Rare and Priority Flora, a total of 31 CALM listed Priority Flora species have previously been recorded from the Margaret River area including four species of Declared Rare.

A small population of ten plants of the Priority 3 listed taxa *Gahnia sclerioides* was recorded from the Closed Heath of *Taxandria linearifolia, T. juniperina, Leptospermum erubescens* and *Melaleuca lanceolata* that is associated with Darch Brook (Figures 2 and 3b). No other Declared Rare or Priority listed flora were recorded from the site during either of the 2003 or 2004 surveys.

The timing of the October 2003 and October 2004 surveys was considered optimal the identification of the CALM listed Declared Rare and Priority listed species for the area.

3.6 Cumulative Impacts

The proposed Riverslea subdivision development will result in the loss of approximately 6.3ha of native vegetation. In terms of the cumulative impact through loss of native vegetation clearing of vegetation from the Riverslea subdivision and from other known proposed subdivision developments in the local Margaret River area, the impact will be negligible. Greendene Development Pty Ltd is proposing subdivision developments on adjacent Lots 9013 and 756 Tingle Avenue and Lot 27 Bussell Highway (Figure 3a, 3b). These proposals will result in the loss of approximately 11.5ha of similar to that occurring within the Riverslea subdivision study area and approximately 73ha of predominantly parkland cleared /Marri/Peppermint/Blackbutt. On a regional scale, the proposed loss through clearing, of this area of vegetation from the surrounding proposed developments is unlikely to be significant.

4. CONCLUSIONS

Approximately 70% of the Shire of Augusta-Margaret River remains covered by original native vegetation (Grein, 1997), the majority of which occurs as secure State Forest, National Park, crown land or public reserves. The *Corymbia calophylla/Eucalyptus marginata* subsp. *marginata* Closed to Open Forest that dominates the study area is the most common vegetation types remaining in the Shire of Augusta-Margaret River.

The clearing of approximately 6.3ha of vegetation from the Riverslea study area and approximately 11.5ha of vegetation similar to that occurring within the Riverslea study area is unlikely to have a significant impact on the conservation significance of the Cowaramup or Wilyabrup Vegetation Complexes. An additional 213ha of Cowaramup/Wilyabrup Vegetation Complexes comprised of similar regrowth *Corymbia calophylla/Eucalyptus marginata* subsp. *marginata* vegetation was identified from an area of State Forest surveyed during this assessment, which is located approximately 2km to the north of the Margaret River townsite (Figure 3c).

A small population of the CALM listed Priority 3 listed taxa *Gahnia sclerioides,* was recorded within the Riverslea study area from riparian vegetation associated Darch Brook during the October 2003 and 2004 surveys. A total of ten plants were recorded from the area.

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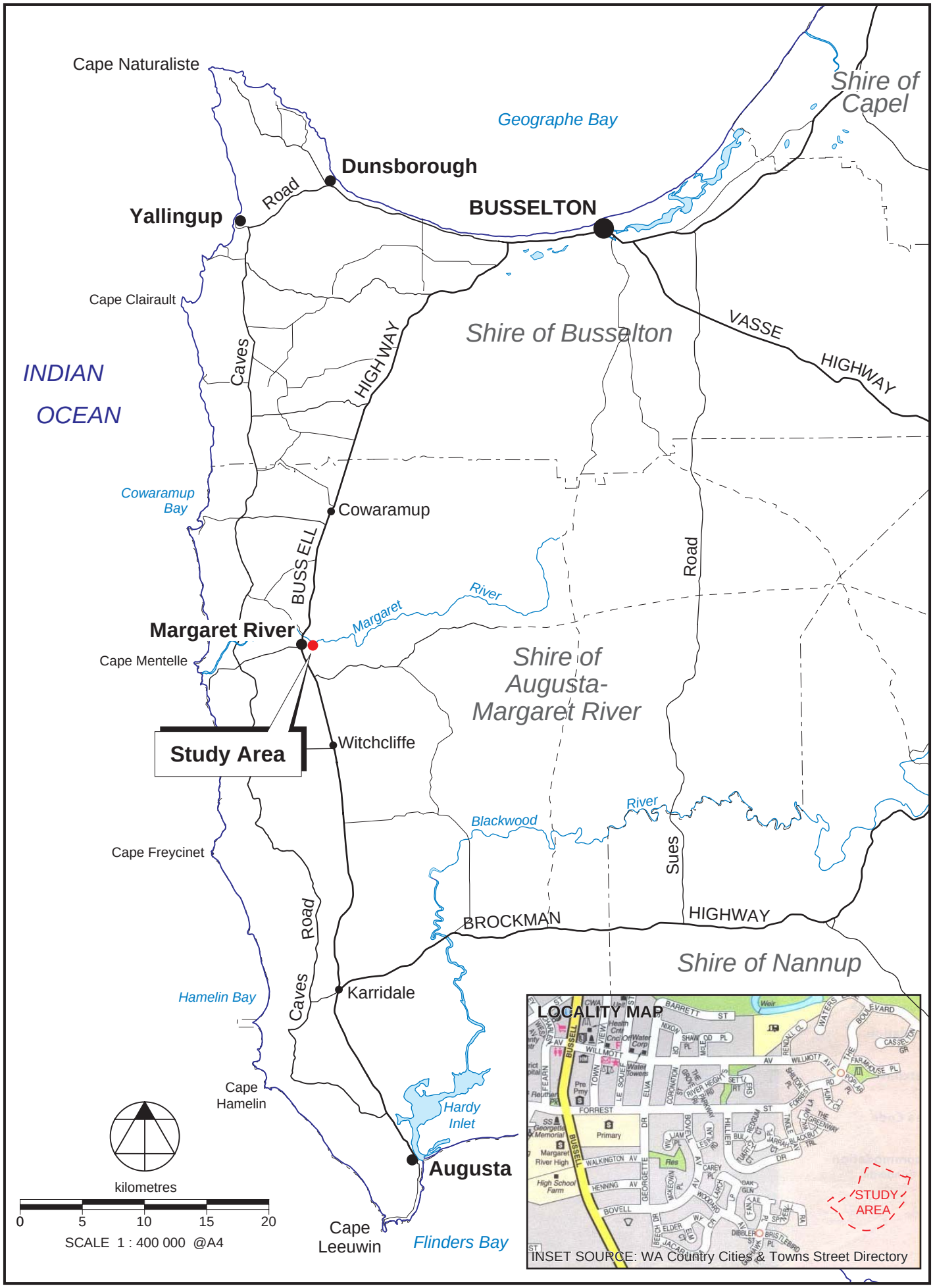
FIGURES



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RIVERSLEA SUBDIVISION
VEGETATION AND FLORA ASSESSMENT
REGIONAL LOCATION
FIGURE 1

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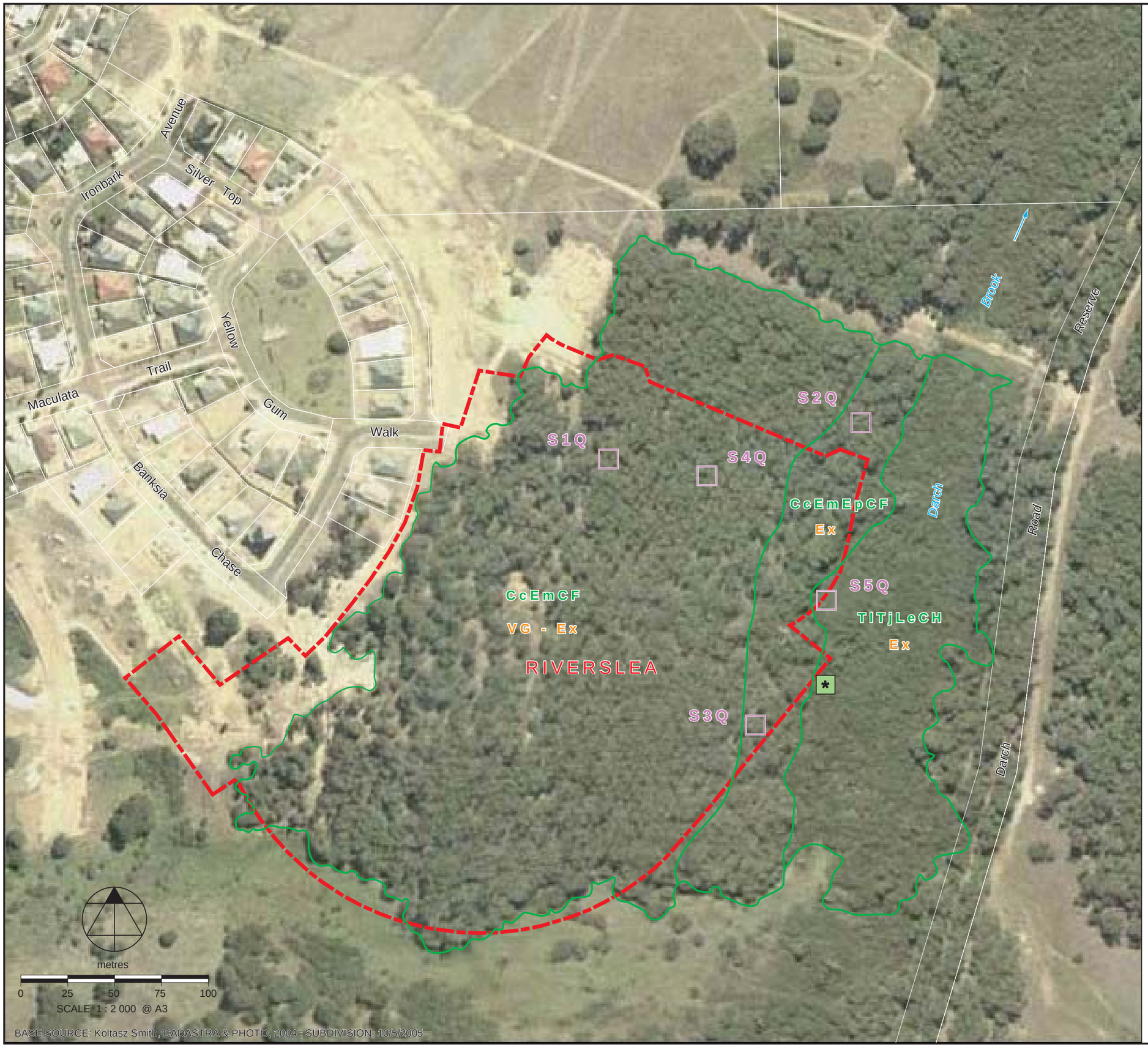

LEGEND

- Riverslea Boundary
- Vegetation Type Boundary
- S2Q — Flora Quadrat Location (10mx10m)
- * — *Gahnia scleroides* (Priority 3 Listed Taxa)

VEGETATION TYPES

CcEmCF *Corymbia calophylla* l*Eucalyptus marginata* subsp. *marginata* Closed to Open Forest.

CcEmEpCF *Corymbia calophylla* l*Eucalyptus marginata* subsp. *marginata* Closed Forest with scattered *Eucalyptus patens* .

TITjLeCH *Taxandria linearifolia/Taxandria juniperina/ Leptospermum erubescens* Closed Heath.

VEGETATION CONDITION (SOURCE: BUSH FOREVER Govt. of W.A., 2000)

Pristine (Not Applicable)
Pristine or nearly so, no obvious signs of disturbance.

Ex Excellent
Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species.

VG Very Good
Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (Not Applicable)
Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (Not Applicable)
Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

Completely Degraded (Not Applicable)
The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

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RIVERSLEA SUBDIVISION
VEGETATION AND FLORA ASSESSMENT
VEGETATION TYPES & CONDITION
FIGURE 2

LIMIT OF CADASTRAL DATA

SEE FIGURE 3c

STATE FOREST

CARTERS ROAD

CALM Office

BUSSELL HIGHWAY

RIVER

MARGARET

BRAMLEY NATIONAL PARK

Swan View Drive

MARGARET RIVER

ROAD

FORREST ST

WALLCLIFFE

Proposed Lot 667

Brook

SEE FIGURE 3b

SEE FIGURE 2

Lots 9013, 756

Ditch

BUSSELL ROAD

Lot 27

BOODJIDUP

HIGHWAY

Ten Mile Brook Dam

metres

0 200 400 600 800 1000

SCALE 1 : 20 000 @ A3

LEGEND

- Outline of Other Figure
- Vegetation Mapping
- Approximate Location of Proposed Lot 667

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RIVERSLEA SUBDIVISION
VEGETATION AND FLORA ASSESSMENT

MARGARET RIVER
VEGETATION OVERVIEW

FIGURE 3a

BASE SOURCE: KOLTASZ SMITH, 2004

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VEGETATION CONDITION (Legend Source: BUSH FOREVER Govt. of W.A., 2000)

P Pristine or nearly so, no obvious signs of disturbance. (Not Applicable)

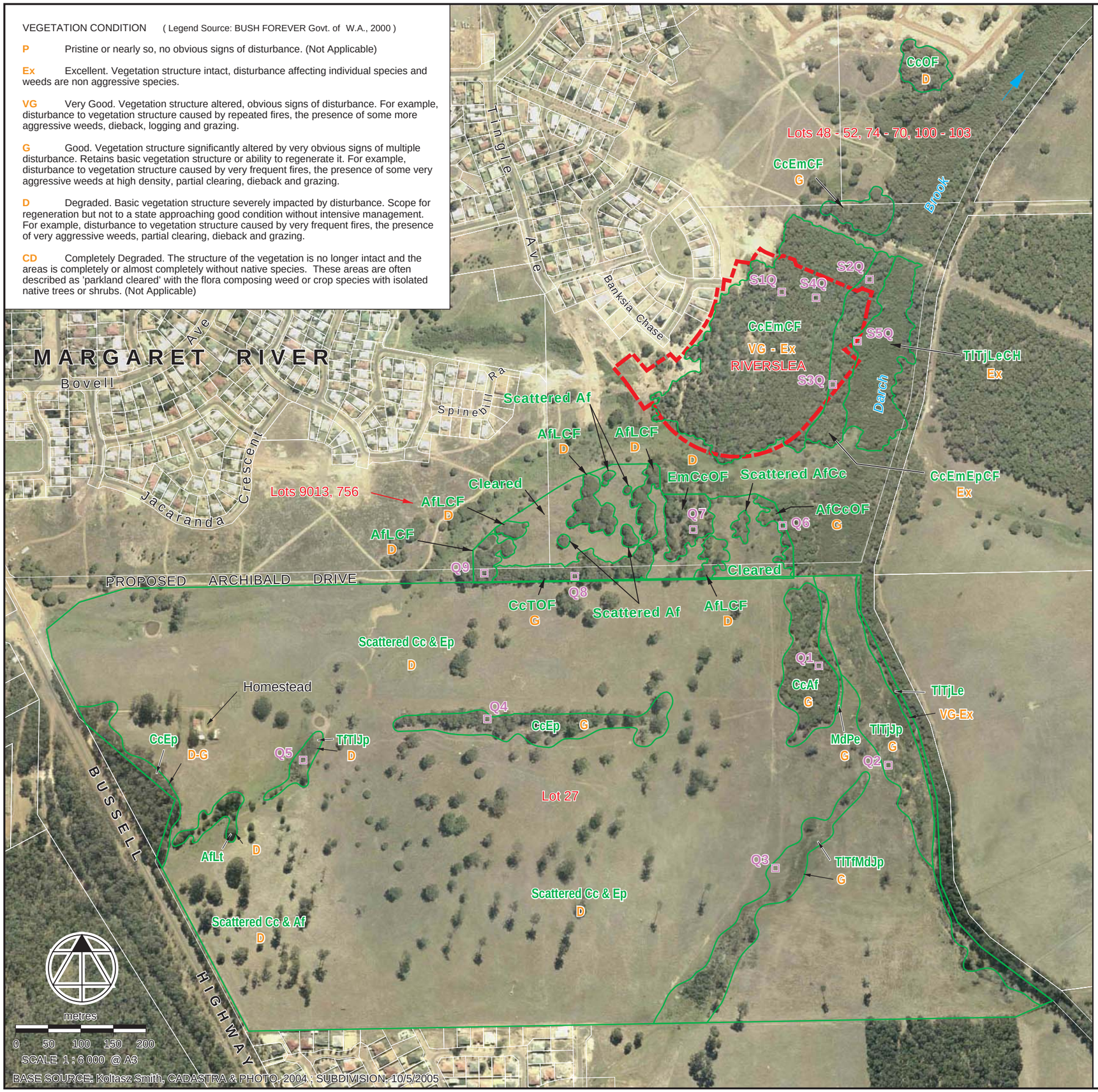
Ex Excellent. Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species.

VG Very Good. Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

G Good. Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

D Degraded. Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

CD Completely Degraded. The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs. (Not Applicable)



LEGEND

Cadastral Boundary

Riverslea Boundary

Vegetation Boundary

S2Q Flora Quadrat, 10 x 10m (see Appendices 2 and 3 for details)

VEGETATION TYPES - Riverslea

CcEmCF *Corymbia calophylla/Eucalyptus marginata* subsp. *marginata* Closed to Open Forest

CcEmEpCF - *Corymbia calophylla/Eucalyptus marginata* subsp. *marginata* Closed Forest with scattered *Eucalyptus patens*

TlTjLeCH - T*axandria linearifolia/Taxandria juniperina/Leptospermum erubescens* Closed Heath

VEGETATION TYPES - Lot 27 Bussell Highway

CcAf Marri (*Corymbia calophylla*) Open Forest with occasional Jarrah (*Eucalyptus marginata* ssp. *marginata*) over a midstratum dominated by Peppermint (*Agonis flexuosa*) over an open understorey with scattered Balga (*Xanthorrhoea preissii*), *Trymalium floribundum* and *Hibbertia hypericoides* and patches of Bracken Fern (*Pteridium esculentum*).

MdPe *Mirbelia dilatata* Shrubland over dense stands of Bracken Fern.

TlTjJp Previously cleared area which has naturally regenerated to comprise a Open to Closed Heath of *Taxandria linearifolia* and *T. juniperina* over *Juncus pallidus* with *Leptospermum erubescens* and *Melaleuca hamulosa* and open areas of grasses and Bracken Fern.

TlTjLeCH Closed Heath of *Taxandria linearifolia, T. juniperina, Leptospermum erubescens* and *Melaleuca hamulosa.*

TlAfMdJp Shrubland to Open Heath of *Taxandria linearifolia, Agonis flexuosa* and *Mirbelia dilatata* over scattered stands of *Juncus pallidus*.

CcEp High Open Woodland dominated by Marri and scattered Blackbutt (*Eucalyptus patens*) over a cleared understorey of pasture grasses.

AfTlJp Low Open Woodland of Peppermints over occasional *Taxandria linearifolia* and patches of *Juncus pallidus* in damp and inundated areas.

AfLt Low Open Woodland of Peppermints over occasional stands of *Lepidosperma tetraquetrum.*

VEGETATION TYPES - Lots 48 to 52, Lots 74 to 79 and Lots 100 to 103 off Poplar Avenue and Halcyon Way, Riverslea

CcEmCF Marri (*Corymbia calophylla*) / Jarrah (*Eucalyptus marginata* subsp. *marginata*) Closed to Open Forest

CcOF Marri (*Corymbia calophylla*) Open Forest

VEGETATION TYPES - Lots 9013 and 756 Tingle Avenue

AfCcOF Peppermint (*Agonis flexuosa*) and Marri (*Corymbia calophylla*) Open Forest to 15m in height with scattered Jarrah (*Eucalyptus marginata* subsp. *marginata*) over Bracken (*Pteridium esculentum*) dominated Open Low Heath

CcEmCF Marri (*Corymbia calophylla*) and Jarrah (*Eucalyptus marginata* subsp. marginata) Open to Closed Forest (to 30m in height) over Peppermint (*Agonis flexuosa*) Tall Shrubland over Bracken (*Pteridium esculentum*) dominated Open Shrubland

CcTOF Marri (*Corymbia calophylla*) Tall Open Forest to 30m in height with scattered Jarrah (*Eucalyptus marginata* subsp. *marginata*) and Peppermint (*Agonis flexuosa*) over Bracken (*Pteridium esculentum*) dominated Shrubland

AfLCF Peppermint (*Agonis flexuosa*) Low Closed Forest (to 6m in height) with scattered Marri (*Corymbia calophylla*) over Winter Grass (*Poa annua*) and Couch (*Cynadon dactylon*) Grassland

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RIVERSLEA SUBDIVISION
VEGETATION & FLORA ASSESSMENT

VEGETATION TYPES & CONDITION ASSOCIATED WITH ADJACENT PROPOSED DEVELOPMENTS

FIGURE 3b

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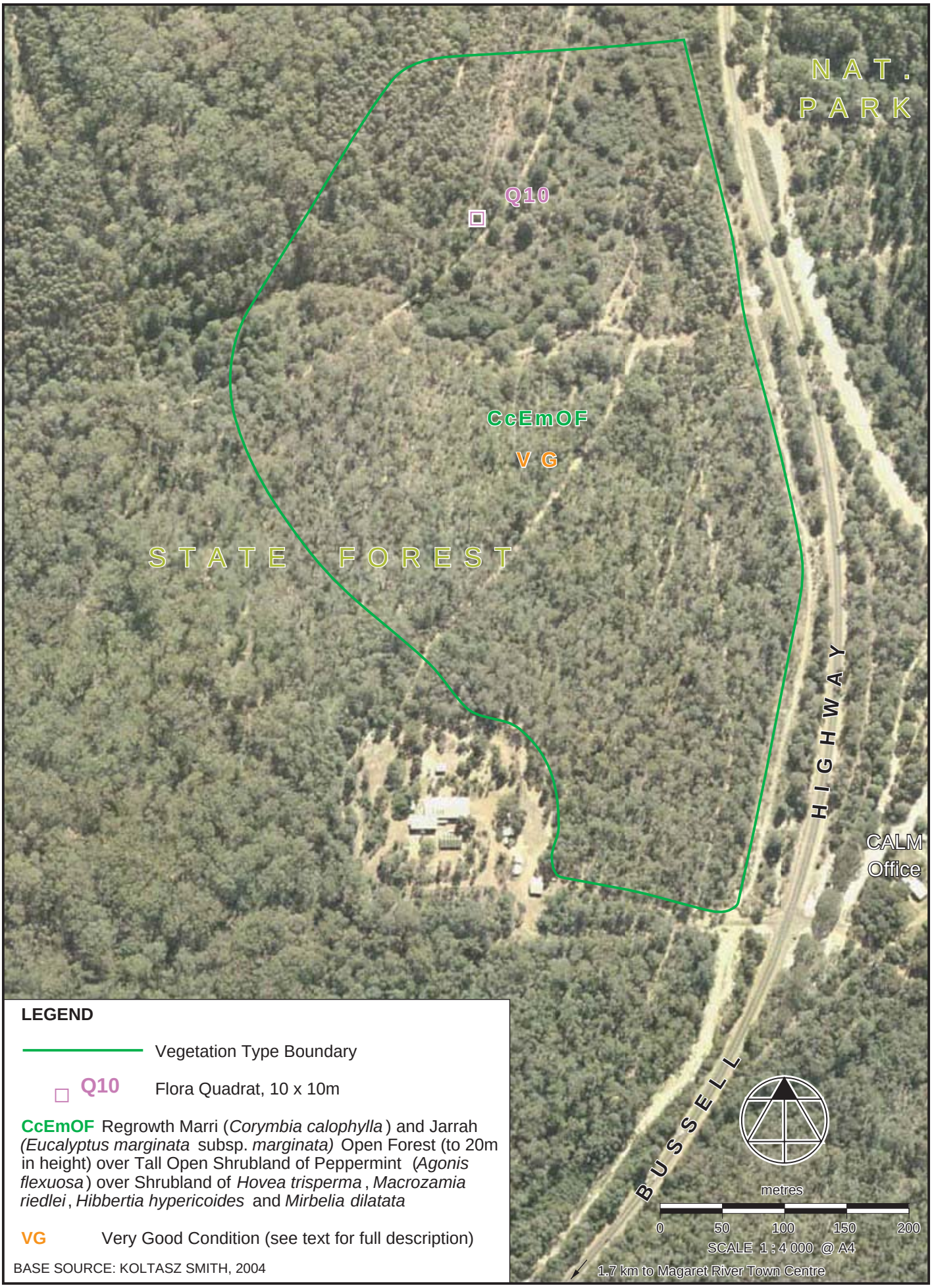

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DATUM: MGA

GDC-2003-001/23_62f3c.dgn

LEGEND

Vegetation Type Boundary

Q10 Flora Quadrat, 10 x 10m

CcEmOF Regrowth Marri (*Corymbia calophylla*) and Jarrah *(Eucalyptus marginata* subsp. *marginata)* Open Forest (to 20m in height) over Tall Open Shrubland of Peppermint (*Agonis flexuosa*) over Shrubland of *Hovea trisperma*, *Macrozamia riedlei*, *Hibbertia hypericoides* and *Mirbelia dilatata*

VG Very Good Condition (see text for full description)

BASE SOURCE: KOLTASZ SMITH, 2004

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RIVERSLEA SUBDIVISION - VEGETATION & FLORA ASSESSMENT

VEGETATION TYPE AND CONDITION OF STATE FOREST IN THE MARGARET RIVER AREA

FIGURE 3c

APPENDICES

APPENDIX 1

FLORA LIST RIVERSLEA SUBDIVISION

APPENDIX 1
FLORA LIST - RIVERSLEA

FAMILY	SPECIES
GYMNOSPERMS	*Macrozamia riedlei*
PTERIDOPHYTA	
ADIANTACEAE	*Cheilanthes* sp.
DENNSTAEDTIACEAE	**Pteridium esculentum*
MONOCOTYLEDONS	
AMARANTHACEAE	*Ptilotus manglesii*
ANTHERICACEAE	*Agrostocrinum scabrum* *Agrostocrinum stypandroides* *Caesia micrantha* *Chamaescilla corymbosa* *Johnsonia lupulina* *Thysanotus multiflorus* *Thysanotus manglesianus*
DASYPOGONACEAE	*Dasypogon bromeliifolius* *Lomandra nigricans* *Lomandra purpurea* *Lomandra sericea*
CYPERACEAE	*Baumea vaginalis* *#Gahnia scleroides* *Lepidosperma angustatum* *Lepidosperma gracile* *Lepidosperma squamatum* *Mesomelaena tetragona* *Schoenus curvifolius* *Tetraria capillaris* *Tetraria octandra*
HAEMODORACEAE	*Anigozanthos flavidus* *Conostylis aculeata* subsp. *aculeata* *Conostylis candicans* *Conostylis setigera*

IRIDACEAE	*Patersonia occidentalis*
	Patersonia umbrosa
	**Romulea rosea*
JUNCACEAE	*Juncus capitatus*
	Juncus pallidus
	Juncus kraussii
ORCHIDACEAE	*Caladenia attingens*
	Caladenia flava
	Caladenia latifolia
	Caladenia longiclavata
	Caladenia macrostylis
	Elythranthera brunonis
	Prasophyllum brownie
	Pterostylis barbata
	Pterostylis nana
	Pterostylis vittate
	Pyrorchis nigricans
	Thelymitra crinata
POACEAE	*Austrostipa elegantissima*
	Austrostipa flavescens
	**Briza maxima*
	**Holcus lanatus*
	**poan annua*
	**Cynodon dactylon*
	**Poa annua*
	**Pennisetum clandestinum*
PODOCARPACEAE	*Podocarpus drouynianus*
RESTIONACEAE	*Desmocladus flexuosus*
	Loxocarya cinerea
XANTHORRHOEACEAE	*Xanthorrhoea brunonis*
	Xanthorrhoea gracilis
	Xanthorrhoea preissii
DICOTYLEDONS	
APIACEAE	*Daucus glochidiatus*
	Pentapeltis peltigera
	Platysace tenuissima
	Xanthosia candida

	Xanthosia huegelii
ASTERACEAE	*Craspedia variabilis* **Hypochaeris glabra* *Lagenifera heugelii* *Quinetia urvillei* **Taraxacum officinale* *Trichocline spathulata*
DILLENIACEAE	*Hibbertia commutata* *Hibbertia cuneiformis* *Hibbertia cunninghamii* *Hibbertia hypericoides* *Hibbertia inconspicua*
DROSERACEAE	*Drosera pallida*
EPACRIDACEAE	*Astroloma ciliatum* *Leucopogon australis* *Leucopogon propinquus* *Leucopogon parviflorus* *Leucopogon verticillatus*
EUPHORBIACEAE	*Amperea simulans* *Phyllanthus calycinus*
GOODENIACEAE	*Damperia linearis* *Scaevola calliptera*
LOBELIACEAE	*Isotoma hypocrateriformis*
LOGANIACEAE	*Logania serpyllifolia* *Logania vaginallis*
MIMOSACEAE	*Acacia alata* *Acacia browniana* *Acacia divergens* *Acacia gilbertii* *Acacia myrtifolia* *Acacia urophylla*
MYRTACEAE	*Agonis flexuosa* *Taxandria juniperina* *Taxandria linearifolia* *Corymbia calophylla*

	Eucalyptus marginata subsp. marginata
	Eucalyptus patens
	Leptospermum erubescens
	Melaleuca hamulosa
OROBANCHACEAE	**Orobanche minor*
PAPILIONACEAE	*Bossiaea linophylla*
	Bossiaea ornata
	Chorizema cordatum
	Chorizema nanum
	Daviesia decurrens
	Gompholobium tomemtosum
	Hovea chrorizemifolia
	Hovea trisperma
	**Lotus angustissimus*
	Mirbelia dilatata
	Sphaerolobium medium
	**Trifolium campestre*
POLYGALACEAE	*Comesperma confertum*
PRIMULACEAE	**Anagallis arvensis*
PROTEACEAE	*Adenanthos meisneri*
	Banksia grandis
	Hakea amplexicaulis
	Hakea lissocarpha
	Hakea ruscifolia
	Grevillea quercifolia
	Persoonia longifolia
RANUNCULACEAE	*Clematis pubescens*
RHAMNACEAE	*Trymalium floribundum*
RUBIACEAE	*Opercularia apiciflora*
	Opercularia hispidula
	Opercularia vaginata
RUTACEAE	*Boronia gracillipes*
	Philotheca spicata

STACKHOUSIACEAE	*Tripterococcus brunosis*
STERCULIACAEAE	*Lasiopetalum floribundum* *Thomasia pauciflora*
STYLIDEACEAE	*Levenhookia pusilla* *Stylidium adnatum* *Stylidium amoenum* *Stylidium fasciculatum*
THYMALAEACEAE	*Pimelea rosea* *Pimelea spectabilis*
TREMANDRACEAE	*Tremandra stelligera*
Total	142
Native	128
Introduced	14

* Introduced species
# Priority 3 Listed taxa

APPENDIX 2

FLORA QUADRAT DATA RIVERSLEA SUBDIVISION AREA

QUADRAT S1Q
Marri (*Corymbia calophylla*)/ Jarrah (*Eucalyptus marginata* subsp. *marginata*)
Closed Forest to Open Forest
Condition – Very Good

QUADRAT S1Q (10x10m)

SPECIES	% COVER	HEIGHT (M)
Eucalyptus marginata subsp. marginata	50	25
Corymbia calophylla	30	25
Xanthorrhoea preissii	5	1
Hibbertia hypericoides	5	0.5
Mirbelia dilatata	2	1.5
Hakea lissocarpha	2	1
Hovea trisperma	2	1.5
Philotheca spicatus	<1	0.5
Caladenia flava	<1	0.2
Lotus angustissimus	<1	0.1
Pimelea rosea	<1	0.5
Scaevola calliptera	<1	0.1
Acacia alata	<1	1
Clematis pubescens	<1	Creeper
Grevillea quercifolia	<1	0.5
Pimelea spectabilis	<1	1
Hakea amplexicaulis	<1	1
Drosera pallida	<0.1	Creeper

QUADRAT S2Q
Marri (*Corymbia calophylla*)/ Jarrah (*Eucalyptus marginata* subsp. *marginata*)
Closed Forest with scattered Blackbutt (*Eucalyptus patens*) to Open Forest
Condition - Very Good

QUADRAT S2Q (10x10m)

SPECIES	% COVER	HEIGHT (m)
Corymbia calophylla	40	20
Hibbertia hypericoides	20	0.5
Eucalyptus marginata subsp. *marginata*	10	20
Hovea trisperma	5	2
Mirbelia dilatata	5	1.5
Taxandria flexuosa	5	2
Leucopogon verticillatus	2	1.5
Xanthorrhoea preissii	2	1
Caladenia flava	2	0.2
Lasiopetalum floribundum	2	0.5
Dampiera linearis	1	0.1
Lomandra purpurea	<1	0.1
Chorizema cordatum	<1	0.05
**Cynodon dactylon*	<1	0.01
Philotheca spicata	<1	0.2
Pimelea rosea	<1	0.2
Cassytha sp	<1	Creeper

SPECIES	% COVER	HEIGHT (m)
Hakea lissocarpha	<1	0.5
Hibbertia cunninghamii	<1	0.1
Macrozamia fraseri	<1	0.5

QUADRAT S3Q
S33°57.405'; E115°05.404'

Marri (*Corymbia calophylla*)/ Jarrah (*Eucalyptus marginata* subsp. *marginata*) Closed Forest (to 20m in height) over *Mirbelia dilatata, Hibbertia hypericoides, Xanthorrhoea preissii* and *Hovea trisperma* Shrubland
Condition – Very Good to Excellent

QUADRAT S3Q (10x10m)

SPECIES	% COVER	HEIGHT (m)
Corymbia calophylla	50	20
Eucalyptus marginata subsp. *marginata*	20	20
Mirbelia dilatata	10	2.5
Xanthorrhoea preissii	5	0.6
Hibbertia hypericoides	5	0.3
Hovea trisperma	2	1.8
Hakea lissocarpha	2	1.2
Acacia browniana	<1	1.5
Astroloma ciliatum	<1	0.3
Pimelea rosea	<1	0.3
Caladenia flava	<1	0.2
**Cynodon dactylon*	<1	Groundcover
Acacia urophylla	<1	1.1
Acacia alata	<1	0.3

SPECIES	% COVER	HEIGHT (m)
Johnsonia lupulina	<1	0.7
Macrozamia riedlei	<1	0.6
Leucopogon verticillatus	<1	0.5
Lasiopetalum floribundum	<1	0.3
Philotheca spicata	<1	0.3
Schoenus curvifolius	<1	0.3
**Briza minor*	<1	Creeper
Kennedia coccinea	<1	Groundcover
**Poa annua*	<1	Groundcover
Cassytha racemosa	<1	Creeper
Clematis pubescens	<1	Creeper

QUADRAT S4Q
S33°57.477'; E115°05.414'

Marri (*Corymbia calophylla*)/ Jarrah (*Eucalyptus marginata* subsp. *marginata*)/ Blackbutt (*Eucalyptus patens*) Open Forest over Peppermint (*Agonis flexuosa)* Tall Open Shrubland over Low Shrubland of *Hibbertia hypericoides*
Condition: Very Good

QUADRAT S4Q (10x10m)

SPECIES	% COVER	HEIGHT (m)
Corymbia calophylla	30	15
Eucalyptus marginata subsp. *marginata*	20	20
Hibbertia hypericoides	5	1.5
Eucalyptus patens	10	20
Agonis flexuosa	5	5
Hakea lissocarpha	2	1.1
Macrozamia riedlei	5	0.6
Xanthorrhoea preissii	2	0.6
Acacia browniana	1	1.1
Hovea trisperma	<1	0.7
Dampiera linearis	<1	0.4
Craspedia variablilis	<1	0.4
Lomandra nigricans	<1	0.4
Lasiopetalum floribundum	<1	0.3
Boronia gracillepes	<1	0.3

SPECIES	% COVER	HEIGHT (m)
Conostylis setigera	<1	0.2
Caladenia flava	<1	0.2
**Hypochaeris glabra*	<1	0.2
**Cynodon dactylon*	<1	Groundcover
Lomandra purpurea	<1	0.1
Chorizema cordatum	<1	Groundcover

QUADRAT S5Q
323583mE; 6240872mN

***Taxandria linearifolia, Taxandria juniperina* and *Leptospermum erubescens* Closed Heath over *Lepidosperma tetraquetrum* dominated Open Sedgeland**
Condition: Excellent

QUADRAT S5Q (10m x 10m)

SPECIES	% COVER	HEIGHT (m)
Taxandria juniperina	30	4
Taxandria linearifolia	20	4
Leptospermum erubescens	20	3
Astartea aff. *fascicularis*	10	4
Lepidosperma tetraquetrum	10	1.2
Melaleuca hamulosa	2	1.2
Lepidosperma squamatum	5	1.5
Agonis flexuosa	2	3
**Juncus pallidus*	1	1.2
**Juncus microcephalus*	1	0.9
Gahnia trifida	1	0.7
**Holcus lanatus*	<1	0.6
Baumea articulata	1	0.5
**Pennisetum clandestinum*	<1	0.5
**Trifolium campestre*	<1	Ground cover
**Cynodon dactylon*	<1	0.01

APPENDIX 3

FLORA QUADRAT DATA FROM LOCAL MARGARET RIVER AREA

QUADRAT Q1
S33°57.710'; E115°05.400'
Lot 27 Bussell Highway

Open Forest of Marri (*Corymbia calophylla*) with scattered Jarrah (*Eucalyptus marginata* ssp. *marginata*) over a midstratum dominated by Peppermint (*Agonis flexuosa*) over an open understorey with scattered Balga (*Xanthorrhoea preissii*), *Trymalium floribundum* and patches of Bracken Fern (*Pteridium esculentum*). Condition: Good

QUADRAT Q1 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Eucalyptus marginata subsp. marginata	10	25
Corymbia calophylla	50	20
Agonis flexuosa	20	15
Xanthorrhoea preissii	1	3
**Juncus pallidus*	<1	1.2
Mirbelia dilatata	<1	1
Hakea lissocarpha	2	1
**Pteridum esculentum*	5	0.6
**Holcus lanatus*	<1	0.6
**Pennisetum clandestinum*	<1	0.6

SPECIES	% COVER	HEIGHT (M)
Trymalium floribundum	1	0.5
Lepidosperma tenue	<1	0.5
Hovea trisperma	<1	0.3
**Poa annua*	10	0.2
Kennedia coccinea	Creeper	0.2

QUADRAT Q2
S33°57.793' E115°05.436'
Lot 27 Bussell Highway

Open to Closed Heath of *Taxandria linearifolia* and *Taxandria juniperina* over *Juncus pallidus* with *Leptospermum erubescens* and *Melaleuca hamulosa* with scattered Blackbutt (*Eucalyptus patens*)
Condition: Good

QUADRAT Q2 (10x10m)

SPECIES	% COVER	HEIGHT (m)
Eucalyptus patens	5	20
Taxandria juniperina	20	1.5
Agonis flexuosa	10	2
Melaleuca hamulosa	20	1.2
Taxandria linearifolia	10	1.5
Acacia divergens	<1	1.5
Lepidosperma squamatum	1	1.5
Lepidosperma tetraquetrum	10	1.2
**Juncus pallidus*	1	0.9
Gahnia trifida	1	0.7
**Holcus lanatus*	<1	0.6
Baumea articulata	1	0.5
**Pennisetum clandestinum*	<1	0.5

SPECIES	% COVER	HEIGHT (m)
**Trifolium campestre*	<1	Ground cover
**Cynodon dactylon*	<1	0.01

QUADRAT Q3
S33°57.877'; E115°05.345'
Lot 27 Bussell Highway

Shrubland to Open Heath of *Taxandria linearifolia, Agonis flexuosa* and *Mirbelia dilatata* over scattered *Juncus pallidus* Sedgeland
Condition: Good

QUADRAT Q3 (10x10m)

SPECIES	% COVER	HEIGHT (m)
Taxandria linearifolia	20	2
Agonis flexuosa	20	2
Mirbelia dilatata	20	1.5
Leptospermum erubescens	4	1.5
Acacia divergens	<1	1
Juncus pallidus	10	0.6
**Avena fatua*	5	1
**Taraxacum officinale*	<1	0.2
**Trifolium campestre*	2	Ground cover
**Cynodon dactylon*	<1	0.01

QUADRAT Q4
S33°57.749'; E115°05.069'
Lot 27 Bussell Highway

Tall Open Woodland of Marri (*Corymbia calophylla* and Blackbutt (*Eucalyptus patens*) with scattered *Agonis flexuosa*
Condition: Degraded

QUADRAT Q4 (10x10m)

SPECIES	% COVER	HEIGHT (m)
Corymbia calophylla	20	20
Eucalyptus patens	10	20
Agonis flexuosa	2	10
**Avena fatua*	<1	0.4
**Avena barbata*	<1	).3
**Taraxacum officinale*	<1	0.2
Trifolium campestre	40	Ground cover
**Poa annua*	20	Ground cover
**Trifolium campestre*	2	Ground cover

QUADRAT Q5
(S33°57.78'; E115°04.885")
Lot 27 Bussell Highway

Taxandria linearifolia* Open Shrubland over *Lepdiosperma tetraquetrum* Tall Open Sedgeland with scattered *Juncus pallidus* in creekline and fringing scattered *Agonis flexuosa
Condition: Degraded

QUADRAT Q5 (10x10m)

SPECIES	% COVER	HEIGHT (m)
Taxandria linearifolia	10	3
Lepidosperma tetraquetrum	40	2.5
**Holcus lanatus*	5	0.3
Hydrocotyle sp.	<1	Water plant

QUADRAT Q6
Lot 9013 and 753 Tingle Avenue
S33°57.613'; E115°05.377'

Peppermint (*Agonis flexuosa*) and Marri (*Corymbia calophylla*) Open Forest to 15m in height with scattered Jarrah (*Eucalyptus marginata* ssp. *marginata*) over Bracken (*Pteridium esculentum*) dominated Open Low Heath
Condition: Good

QUADRAT Q6 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Corymbia calophylla	40	15
Agonis flexuossa	20	5
**Pteridium esculentum*	20	1.2
Eucalyptus marginata	5	20
Trymalium ledifolium	5	3
Hakea lissocarpha	2	1
Mirbelia dilatata	2	1.5
Xanthorrhoea preissii	1	1.2
Hibbertia hypericoides	<1	0.3
Pimelea rosea	<1	0.6
Tricoryne elatior	<1	0.2
Hovea trisperma	<1	Creeper
**Hypochaeris glabra*	<1	0.3
Chamaescilla corymbosa	<1	0.1

SPECIES	% COVER	HEIGHT (M)
**Briza minor*	<1	0.1
Caladenia flava	<1	0.2
Conostylis setigera	<1	0.2
Xanthorrhoea brunosis	<1	0.4
Schoenus curvifolius	<1	0.4

* Introduced or non-endemic species

QUADRAT Q7
S33°57.581'; E115°05.264'
Lot 9013 and 753 Tingle Avenue

Jarrah (*Eucalyptus marginata* ssp. *marginata*) and Marri *(Corymbia calophylla*) Open Forest (to 30m in height) over Peppermint (*Agonis flexuosa*) Tall Shrubland over Bracken (*Pteridium esculentum*) dominated Open Shrubland
Condition: Degraded, heavily grazed

QUADRAT Q7 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Eucalyptus marginata subsp.*marginata*	20	20
Corymbia calophylla	20	15
Agonis flexuosa	20	5
**Pteridium esculentum*	10	1.2
**Trifolium* sp.	5	0.1
**Pennisetum clandestinum*	2	0.6
**Briza minor*	2	0.2

Xanthorrhoea preissii	<1	0.5

*Introduced or non-endemic species

QUADRAT Q8
S33°57.630': E115°05; 105'
Lot 9013 and 753 Tingle Avenue

Marri (*Corymbia calophylla*) Tall Open Forest to 30m in height with scattered Jarrah (*Eucalyptus marginata* ssp. *marginata*) and Peppermint (*Agonis flexuosa*) over Bracken (*Pteridium esculentum*) dominated Shrubland
Condition: Good

QUADRAT Q8 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Corymbia calophylla	60	30
**Pteridium esculentuum*	15	0.7
**Pennisetum clandestinum*	10	0.5
Eucalyptus marginata	5	15
Agonis flexuosa	5	5
**Avena fatua*	1	0.3
**Briza minor*	<1	0.2

* Introduced or non-endemic species

QUADRAT Q9
S33°57.622'; E115°05.069'
Lot 9013 and 753 Tingle Avenue

Peppermint (*Agonis flexuosa*) Low Closed Forest (to 6m in height) with scattered Marri (*Corymbia calophylla*) over Winter Grass (*Poa annua*) and Couch (*Cynodon dactylon*) Grassland
Condition: Degraded

QUADRAT Q9 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Agonis flexuosa	80	6
Corymbia calophylla	5	15
**Cynodon dactylon*	5	Groundcover
**Poa annua*	5	Groundcover
**Pteridium esculentum*	1	0.5
**Juncus pallidus*	<1	1.2
**Geranium molle*	<1	0.1

* Introduced or non-endemic species

QUADRAT Q10
S33°55.801'; E115°04.687'
State Forest, approximately 2km north of Margaret River Townsite

Regrowth *Corymbia calophylla* and *Eucalyptus marginata* subsp. *marginata* Open Forest (to 20m in height) over Tall Open Shrubland of *Agonis flexuosa* over Shrubland of *Hovea trisperma, Macrozamia riedlei, Hibbertia hypericoides* and *Mirbelia dilatata*
Condition: Very Good

QUADRAT Q10 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Corymbia calophylla	40	20
Eucalyptus marginata subsp. *marginata*	20	20
Agonis flexuosa	10	5
Hovea trisperma	10	1.2
Mirbelia dilatata	5	1
Hibbertia hypericoides	5	0.4
**Pteridium esculentum*	2	1
Acacia browniana	1	1.5
Patersonia umbrosa	1	1
Leucopogon verticillatus	1	1
Hakea amplexicaulis	<1	0.7
Astroloma pallidum	<1	0.6

SPECIES	% COVER	HEIGHT (M)
Thelemitra crinata	<1	0.5
Dampiera linearis	<1	0.4
Burchardia umbellata	<1	0.3

* Introduced or non-endemic species

APPENDIX 2

FAUNA SURVEY RIVERSLEA SUBDIVISION (ATA ENVIRONMENTAL, 2005a)

GREENDENE DEVELOPMENT CORPORATION LTD

FAUNA SURVEY RIVERSLEA SUBDIVISION

VERSION 3

JULY 2005

REPORT NO: 2004/31

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1. INTRODUCTION

Greendene Development Corporation Pty Ltd is planning to further develop Lots 9101 and 9002, Willmott Avenue and Forrest Rd, approximately 1km east of the Margaret River townsite (Riverslea Gardens). The location of the approved subdivision is shown in Figure 1. The proposed Riverslea Gardens subdivision forms part of the overall Riverslea residential area. The study area encompasses a total area of approximately 6.3ha of remnant bushland in the Shire of Augusta-Margaret River.

The Outline Development Plan (ODP) for the Riverslea Subdivision area was considered by the Augusta-Margaret River Council in July 2000 and formally endorsed and adopted by Council and the WAPC in November 2001. This area is shown in Figure 1.

1.1 Purpose and Scope

The fauna survey was undertaken before the Environmental Protection Authority's (EPA's) Guidance Statement No 56 for the Assessment of Environmental Factors Terrestrial Surveys for Environmental Impact Assessment (June 2004) was released. The scope of works was therefore based on discussions with officers from the Terrestrial Ecosystem Branch of the EPA Service Unit prior to conducting the surveys and as well as material provided in EPA's Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002). This Position Statement requires a Level 2 fauna assessment for developments with impacts that are assessed as either 'moderate' or 'high' in the bioregion of the proposed mine. A Level 2 assessment involves a comprehensive fauna survey in addition to a desktop study. Environmental variables that contribute to 'moderate' or 'high' impacts are the size of the area (e.g. 1-10ha is moderate, and > 10ha is high), potential for rare or range restricted fauna in the area, whether the area contains habitat of ecological or conservation significance, whether the area serves as an ecological refuge for fauna species or the area supports populations of statutory protected species (e.g. those listed under JAMBA/CAMBA treaties).

Based on these impacts, a Level 2 fauna survey of the study area was undertaken to identify the potential impacts of the proposal on terrestrial fauna within the study area. The survey included:

- a review of the Western Australian Museum (*FaunaBase*) on-line database to identify potential vertebrate fauna within the area;
- a search of the Department of Conservation and Land Management's Threatened and Priority Species database to identify potential scheduled and threatened species within the region;
- a search of the Commonwealth's on-line database to identify fauna species of national environmental significance that are protected under the *Environment Protection and Biodiversity Conservation Act 1999* potentially occurring within the area;

- results of a five day trapping program, avifauna survey, spotlighting surveys, hand searches and opportunistic sightings; and
- recommendations on measures to prevent or minimise impacts on any significant fauna.

1.2 Bioregional Assessment

The study area is associated with the Warren Bioregion (Thackway and Cresswell, 1995) and comprises vegetation characteristic of the Cowaramup (Cw1) and Wilyabrup (W1) Vegetation Complexes (Mattiske and Havel, 1998). The Wilyabrup (W1) unit is comprised of Tall Open Forest of Karri (*Eucalyptus diversicolor*)-Marri (*Corymbia calophylla*)-*Allocasuarina decussata*-Peppermint (*Taxandria flexuosa*) on deeply incised valleys of the hyperhumid zone. The Cowaramup (Cw1) unit is comprised of a mixture of Open Forest of *Eucalyptus diversicolor-Corymbia calophylla* and woodland of Jarrah (*Eucalyptus marginata* subsp. *marginata*)-*Corymbia calophylla* on slopes and low woodland of *Melaleuca preissiana-Banksia littoralis* on depressions.

No systematic fauna surveys (vertebrate or invertebrate) have been conducted across the bioregion. Some areas have preliminary survey data for a range of taxa, but this is limited and only a start has been made in resolving conservation issues and conservation taxa. The bioregion has been identified as a significant area for relict taxa and their habitat, but targeted survey and assessment has only just begun (McKenzie, *et al.*, 2003).

1.3 Site Description

The study area is approximately 1km east of the Margaret River townsite and is 6.2ha. It is characterised by a mixed Marri (*Corymbia calophylla*)/Jarrah (*Eucalyptus marginata* subsp. *marginata*) Tall Open Forest over 30m in height with a mid-stratum comprised of Peppermint (*Agonis flexuosa*) over a dense understorey layer dominated by Bracken Fern (*Pteridium esculentum*) with *Hovea trisperma, Hibbertia hypericoides, H. cuneiformis, Bossiaea ornata, Lasiopetalum floribundum, Xanthorrhoea brunonis* and *Conostylis aculeata.*

While the understorey of areas of vegetation along the western and south boundary of the study area have been highly degraded by weed invasion (i.e. Bracken Fern), the overstorey, which is predominantly regrowth Marri/Jarrah, is structurally intact and is classified as being in Very Good to Excellent condition. Grassy weed species are present around the edge of the study area with fewer introduced species present in the central and eastern portions of the study area.

2. METHODOLOGY

2.1 Database Searches

A search of *FaunaBase* was undertaken to develop a list of birds, reptiles, mammals and amphibians likely to be in the study area. The search of *FaunaBase* was bounded by latitude 33° 30' to 34° S and longitude 115° 00' to 115° 20'E. This wide search area was used, as there was not a lot of data in *FaunaBase* for the specific study area and the habitats represented at the study site are similar to those in the quadrant described by the latitudes and longitudes selected. Other more general texts were also used to provide supplementary information including Tyler *et al.* (2000) for frogs; Storr *et al.* (1983, 1990, 1999, 2002) for reptiles; Johnstone and Storr (1998; 2004) and Storr and Johnstone (2003) for birds; Strahan (2000) for mammals and consultant staff's personal experience.

A search of the Department of Conservation and Land Management's Threatened and Priority Species database and the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* on-line database was undertaken to identify potential Scheduled and Threatened species in the region.

These sources of information were used to create lists of species expected to occur at the site. Expected species are defined as those that are likely to utilise the study area. It should be noted that these lists often include species that have been recorded in the general region, but are vagrants, as suitable habitat is absent. Vagrants can be recorded almost anywhere. In addition, because *FaunaBase* is a historic record, it can include species that are now locally extinct. Many of the bird, mammal and reptile species have specific habitat requirements which may be present in the general area but not in the specific study area. Also, the ecology of many of these species is often not well understood and it can sometimes be difficult to indicate those species whose specific habitat requirements are not present in the study area. As a consequence some species will be included in the lists produced from these database searches but will not be present in the actual study area.

Taxonomy and nomenclature for fauna species used in this report generally follow that provided in *FaunaBase* which we presume is based on Aplin and Smith (2001) for amphibians and reptiles, How *et al.* (2001) for mammals and Johnstone (2001) for birds. Survey techniques were discussed with local officers from the Department of Conservation and Land Management before conducting the survey.

2.2 Trapping

A fauna trapping program was conducted at Riverslea from 2 to 6 February 2004. All fauna trapping was conducted under a licence issued by the Department of Conservation and Land Management (# SF 4390). A number of reptiles and mammals were vouchered with the Western Australian Museum to confirm identifications.

From a fauna perspective, the study area consists of a single habitat type.

Eight separate trapping sites were set up in the Riverslea study area. Each site consisted of three drift fence arrays spread 30m apart. Each trapping array consisted of one 150mm diameter stormwater pipe pit-trap (500mm deep), one 20L bucket pit-trap and four funnel traps [each is approximately 800mm long and has a capture area of 200mm * 200mm at either end, with a funnel entrance of 50mm] alternating along a 10m drift fence which is 300mm high. One cage trap and one Elliott trap were placed 5m either side of each drift fence.

The locations (UTMs) of each trapping site are listed in Table 1 and shown in Figure 1. Table 2 shows the trapping effort conducted for each site.

TABLE 1
LOCATION OF TRAPPING SITES

	Location (WSG 84)	
Site 1	50 323411 E	6240968 N
Site 2	50 323484 E	6240965 N
Site 3	50 323455 E	6240946 N
Site 4	50 323461 E	6240922 N
Site 5	50 323402 E	6240885 N
Site 6	50 323360 E	6240837 N
Site 7	50 323365 E	6240738 N
Site 8	50 323603 E	6240987 N

TABLE 2
NUMBER OF TRAP NIGHTS PER TRAPPING SITE CONDUCTED AT RIVERSLEA

	Trap type			
Site	**Pit-trap nights**	**Funnel Trap nights**	**Elliott trap nights**	**Cage trap nights**
1	24	48	12	12
2	24	48	12	12
3	24	48	12	12
4	24	48	12	12
5	24	48	12	12
6	24	48	12	12
7	24	48	12	12
8	18	36	9	9
TOTAL	**186**	**372**	**93**	**93**

Sites 1-7 were open for four nights and site 8 open for three nights. A total of 744 trap nights were conducted between 2 February and 6 February 2004.

2.3 Avifauna Surveys

Systematic avifauna surveys were conducted each morning between 3 and 5 February for three person hours and on 6 February 2004 for one person hour. Opportunistic sightings were also recorded for the whole survey period (2-6 February). All birds were identified by their call or direct observation.

The list of species expected to occur on the site was generated using the New Atlas of Australian Birds (Barrett *et al.*, 2003) with additional information from the Handbook of Western Australian Birds (Johnstone and Storr, 1998) and personal observations in the area. Additional information has been provided by Christine Wilder, a local naturalist, based on her observations between 11 November and 9 December 2003.

2.4 Spotlighting Survey

Spotlighting targets a particular suite of fauna, some of which are not readily caught by other means (e.g. pythons). It also enables observations of the large mammals that are often inactive during the day (e.g. kangaroos, cats, foxes, etc) or are nocturnal.

Spotlighting was carried out from a vehicle using hand-held spotlights. All access tracks in the study area were traversed by vehicle at approximately 4-8km/hr. The spotlights used are 1 million candle power lights that have an adjustment for flood light and spot light functions. In addition, halogen head torches were used for searches on foot in areas that could not be covered by vehicle. Spotlighting was conducted throughout the study area on three evenings. Each survey lasted approximately 2.5 hrs and included each trapping site.

2.5 Hand Searches

Hand searching identifies species that are often not caught in traps because of small activity areas, a wariness of traps, or an ability to escape from traps. Hand searching included digging out holes, removing bark from logs and trees, turning over rocks and sorting through leaf litter with rakes.

Hand searching was conducted at each of the trapping sites for 3 person hours. Additional hand foraging was also conducted in the similar adjacent habitats throughout the study area.

2.6 Invertebrates

Although most work focussed on vertebrate species, specimens of mygalomorph spiders, scorpions, land snails and isopods were collected opportunistically and from pit-traps. These were targeted because within these groups, some species are known to have restricted distributions and the groups are therefore rich in short-range endemics, often associated with relictual and fragmented habitats. In addition, the expertise exists to identify species within these groups, whereas, such expertise is not readily available for most other invertebrate taxa.

2.7 Survey Staff

Dr Scott Thompson (ATA Environmental) and Dr Rob Davis (Western Wildlife), both qualified zoologists, conducted the fauna survey with assistance from Luke Rogers.

2.8 Local Knowledge

The study area is near residential housing and locals, particularly those with an interest in the natural environment (e.g. CALM rangers, wildlife carers), can provide useful information. Therefore, an effort was made to talk with knowledgeable locals about the fauna in the study area.

2.9 Regional Comparisons

Additional fauna investigations were conducted on adjacent landholdings targeting significant threatened fauna including Baudin's Black Cockatoo (*Calyptorhynchus baudinii*), Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), and Western Ringtail Possums (*Pseudocheirus occidentalis*). The areas included adjacent Lots 9013 and 753 Tingle Avenue and Lot 27 Bussell Highway, Margaret River in October 2004.

2.10 Limitations

This assessment is primarily based on Western Australian Museum records made available through '*FaunaBase*', a search of CALM Threatened Fauna list and the known habitat preferences for each species. These databases do not provide a comprehensive coverage of the state and are not adequate to provide species lists for small scale sites. Large search areas are generally used in order to generate species lists for small sites, but these searches invariably include numerous species not likely to be found at any specific location within the search area. These are significant limitations to the assessment.

The list of species generated from a search of *FaunaBase* did not contain a number of species caught or observed in similar habitat in the region. A number of species that were expected to occur at the site were also not included in the *FaunaBase* generated lists. This information would suggest the area has not been surveyed by people (e.g. researchers, environmental consultants) likely to voucher specimens with the Western Australian Museum. The *FaunaBase* list is therefore likely to be incomplete.

The vertebrate survey at Riverslea was conducted over four nights during February 2004. Conclusions and management recommendations about the vertebrate faunal diversity have therefore been made based on the results relating to a single survey in the area and in the context of the results from searches of available databases. It is acknowledged that multiple surveys conducted in different seasons, repeated over several years are often necessary to cater for temporal variations in the faunal assemblage. It is therefore highly probable that we did not catch all of the species in

the area as there are many additional species potentially found in the area that were not observed (see Appendix 1-4).

Different trap types sample the small vertebrate assemblage differently (Thompson *et al.* 2005). Large reptiles, such as adult *V. rosenbergi*, are unlikely to be caught in the traps used. However, their size is such they are more likely to be seen than many smaller cryptic species. An additional limitation of the survey was that only a relatively small number of traps were used across the area, however, due to the fragmentation and proximity to residential development, this was considered adequate.

Invertebrates were sampled as part of the survey methodology, however, Western Australian Museum staff have not been able to locate the specimens since the relocation to Kew St, Welshpool. Feedback on whether there are short-range endemics or other species of importance are therefore not possible. No conservation listed invertebrate species were predicted in the area and groups that were collected included mygalomorph spiders, isopods, scorpions, land snails and centipedes. No millipedes were collected. Isopods, scorpions and centipedes are not potential short-range endemic species (Dr Mark Harvey, Western Australian Museum, pers. comm. 2005). Only the land snails and mygalomorph spiders have potential for short range endemic species.

Some frog species are only surface active and call only after rains and during the breeding period. As it didn't rain and the weather was fine and warm for the survey period only limited frog species were caught or observed. This is a limitation of this survey given there is suitable habitat for frogs nearby to the study area. Based on the database search results, frog species likely to be caught in the area are not considered likely to be of significant conservation concern.

The weather was fine and warm for a large part of the survey period enabling most species of reptile to be sufficiently active to be caught in traps. The night temperatures were also sufficiently warm for nocturnal species to be active. The results are therefore not likely to be limited by daily weather conditions, as the days and nights were suitable for trapping reptiles and small mammals.

The EPA *Guidance for Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56* (EPA, 2004) suggests that fauna surveys may be limited by many variables. Limitations associated with each of these variables are assessed in Table 3.

TABLE 3
FAUNA SURVEY LIMITATIONS AND CONSTRAINTS

Possible Limitations	Constraint (yes/no); Significant, Moderate or Negligible	Comment
Competency and experience of the consultant carrying out the survey	No	All members of the survey team have had appropriate training, experience and mentoring in vertebrate fauna identification and surveys.
Scope	No	A variety of trapping techniques, opportunistic sightings and hand foraging were used to characterise the faunal assemblage. The weather was suitable throughout the survey period to adequately survey all faunal groups.
Proportion of fauna identified, recorded and/or collected	No	All species captured have been previously recorded in the area. A complete inventory of vertebrate species present would only be achieved by multiple surveys repeated over multiple seasons and multiple years. This was not necessary for this parcel of remnant bushland with urban development in close proximity.
Sources of information	Moderate	Vertebrate fauna information was available using the Western Australian Museum *FaunaBase,* and other books on fauna from the region. There are no other systematic terrestrial fauna surveys undertaken in the bioregion (McKenzie, *et al.,* 2003).
Proportion of the task achieved	No	The conservation value of the area has been demonstrated by this survey. It is possible that further survey work would increase the species richness for reptiles, mammals or birds in the area, however, the conclusions about the conservation significance are unlikely to change.
Timing/weather/season/ cycle	Negligible	The timing of the survey was summer and warm. Surveying at other times of the year may have resulted in additional species or a slightly different assemblage, however, is unlikely to make a significant difference to our interpretation of the conservation significance of the site. Burrowing frogs are unlikely to be caught in warm weather.
Disturbances which affected results of the survey	No	No significant disturbances took place during the survey, which would affect the results or conclusions. Domestic dogs were walked through the area daily and domestic cats were observed each evening foraging in the bush. Both of these exotic species could have resulted in a diminished faunal assemblage for the site.
Intensity of survey effort	No	The intensity of trapping was adequate and comparable with other surveys previously accepted by the EPA.
Completeness	No	One fauna habitat type is present. Replicate trapping grids were established throughout this habitat type.
Resources	No	Adequate resources were available.
Remoteness and/or access problems	No	There were no access or remoteness issues.
Availability of contextual information on the region	Moderate	WA Museum fauna database, Department of Conservation and Land Management Threatened and Priority species lists, and consultants personal experience.

3. RESULTS

3.1 Avifauna

Bird species that may occur at the site and that were observed during the survey period are listed in Appendix 1. Based on the results of the database searches, a total of 95 species of birds may potentially occur in the general vicinity. However, it is unlikely all 95 species would occur at the site due to an absence of specific micro-habitat requirements for many of these species. The disadvantage of lists of predicted species is that, in the process of covering all eventualities, an area can appear to have a more diverse fauna than is actually the case.

Thirty-three species were observed during the survey period. An additional eight species of birds were observed by Christine Wilder between November 11 and December 9 2003.

3.2 Reptiles, Amphibians and Mammals

Reptile, amphibian and mammal species expected to occur in the general vicinity of Riverslea and observed during the survey are listed in Appendices 2, 3 and 4.

The search of *FaunaBase* and experience in similar habitats suggests that 15 species of amphibian, 34 species of reptile and 30 species of mammal (3 introduced or feral) may be present in the general vicinity of Riverslea. However, not all of these species will be necessarily present on site, again because of the absence of specific micro-habitat requirements. Four species of amphibian, seven species of reptile, and eight species of mammal, including three introduced species were observed during the fauna survey. The low number of recorded species compared to the potential species list can be attributed to a single survey in summer, presence of feral animals, the small size of the bushland (6.2ha) and nearby residential developments. All of the species recorded are typical of the habitats present at Riverslea and often persist in modified areas.

The averaged reptile species accumulation (Plate 1) for the site suggests that there were many additional reptile species not captured in the study area. An alternative interpretation of the curve is that the results are an artefact of the atypical reptile assemblage structure, which is a result of the high level of disturbance (proximity of urban areas or feral animals). Although it is a different bioregion, survey data for sites on the Swan Coastal Plain would indicate that no more than 15-25 species are found in bushland when it is in pristine condition. Typically as you move south, the number of reptile species predicted in an area is reduced. The average species accumulation curves for amphibians and mammals have, however, reached an asymptote (Plates 2 and 3). Frogs have asymptoted at seven species and mammals at 4 species. The averaged species accumulation indicates that four of the seven species (peak of asymptote) of trappable amphibian and three of a possible four trappable mammal species were caught.

3.3 Invertebrates

Although this survey was directed towards developing an understanding of the vertebrate fauna of the study area, some invertebrates were also collected. This collection was confined to groups where the technical expertise exists to enable identification to be carried out, and to groups that are known for their abundance of short-range endemics. Groups that were collected included mygalomorph spiders, isopods (slaters), scorpions, and land snails. Millipedes also include short-range endemic species, but no millipedes were encountered during the survey. Since relocating to Kew St, Welshpool, Western Australian Museum staff have not been able to locate the specimens that were lodged after this survey. Feedback on whether there are short-range endemics or other species of importance are therefore not possible. No conservation listed invertebrate species were predicted in the area and groups that were collected included mygalomorph spiders, isopods, scorpions, land snails and centipedes. Isopods, scorpions and centipedes are not potential short-range endemic species (Dr Mark Harvey, Western Australian Museum, pers. comm. 2005). Only the land snails and mygalomorph spiders have potential for short range endemic species.

3.4 Species Identified Under the EPBC Act 1999 as Potentially Occurring Within the Study Area

The fauna species listed in Table 4, which have special ecological significance under State and/or Commonwealth Government legislation, have been previously recorded or have the potential to occur in the vicinity of Riverslea. Species listed but not potentially found at Riverslea are not included in Table 4. Definitions of the classification system for significant fauna under the *WA Wildlife Conservation Act 1950* are provided in Appendix 5.

Twelve threatened species of fauna and eight migratory species of birds were listed in a desktop search as having national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999* potentially occurring within the Riverslea area. Although listed in searches, only species or species habitat may be found at Riverslea for three threatened fauna and no migratory bird species (Table 4).

Baudin's Black Cockatoo (listed as vulnerable under the *Environment Protection Conservation and Biodiversity Conservation* Act *1999* and Schedule 1 under the *WA Wildlife Conservation Act 1950*) and the Southern Brown Bandicoot (Priority 5 under the *WA Wildlife Conservation Act 1950*) were the only two significant fauna recorded at Riverslea. Baudin's Black Cockatoo is largely restricted to the tall forests of the South-West. This vulnerable species was recorded on several occasions in the study area, feeding on the fruit of Marri trees. Baudin's Black Cockatoos were also observed feeding in adjacent lots in October 2004, however, they did not feed in the Riverslea study area then. Two Southern Brown Bandicoots were caught at Site 8, near the dense vegetation along the creekline. This dense habitat is necessary for their continued survival. Subsequent to the fauna investigations at Riverslea the Southern Brown Bandicoot has been revised from Priority 4 to Priority 5 under the *WA Wildlife Conservation Act*.

No other species of significant fauna were recorded during the fauna survey conducted by ATA Environmental.

The Priority 3, Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) although not observed during the survey, is seen regularly in eucalypt woodlands, especially Jarrah forests of the south-west. Subsequent to the fauna investigations at Riverslea the Forest Red-tailed Black Cockatoo has been revised from Priority 3 to Schedule 1 under the *WA Wildlife Conservation Act*.

TABLE 4
SPECIES LISTED AS POTENTIALLY OCCURRING WITHIN THE STUDY AREA AND IDENTIFIED AS HAVING NATIONAL ENVIRONMENTAL SIGNIFICANCE UNDER THE *EPBC ACT 1999* OR STATE GOVERNMENT SIGNIFICANCE UNDER THE *WA WILDLIFE CONSERVATION ACT 1950*

Threatened Species	Status		Type of Presence
	EPBC	WA ACT	
Calyptorhychus latirostris Carnaby's Black Cockatoo	Endangered	Schedule 1	Species or species habitat *likely* to occur within area
Calyptorhychus baudinii Baudin's Black Cockatoo	Vulnerable	Schedule 1	Species recorded within area
Cacatua pastinator pastinator Western Long-billed Corella (southern)	Vulnerable		Species or species habitat *likely* to occur within area
Falco peregrinus Peregrine Falcon		Schedule 4	Species or species habitat *may* to occur within area
Morelia spilota imbricata Carpet Python		Schedule 4	Species or species habitat *likely* to occur within area
Phascogale tapoatafa tapoatafa Southern Brush-tailed Phascogale		Priority 3	Species or species habitat *may* to occur within area
Calyptohynchus banksii naso Forest Red-tailed Black Cockatoo		Priority 3 *	Species or species habitat *likely* to occur within area
Isoodon obesulus fusciventer Quenda		Priority 4 **	Species recorded within area
Hydomys chrysogaster Water Rat		Priority 4	Species or species habitat *may* to occur within area

* The Forest Red-tailed Black Cockatoo subsequent to the CALM Threatened fauna search and field investigations changed from Priority 3 to Schedule 1.
** The Quenda subsequent to the CALM Threatened fauna search and field investigations changed from Priority 4 to Priority 5

Definitions of the classification system for significant fauna under the *WA Wildlife Conservation Act 1950* are provided in Appendix 5.

3.5 Threatened or Priority Listed Fauna Potentially found in the Margaret River Region

The following provide commentary on fauna that are listed in *FaunaBase* or a search of the CALM Threatened fauna database as being potentially found in the Margaret River region.

3.5.1 Schedule 1 – Fauna which are rare or likely to become extinct

Western Ringtail Possum (*Pseudocheirus occidentalis*) - Populations of this possum species are now restricted to coastal areas of Peppermint (*Agonis flexuosa*) and Peppermint-Tuart woodlands from Australind to the Waychinicup National Park. Highest densities seem to be in the Swan Coastal Plain near Busselton. Nests are on or near the ground in the absence of predators, but in tree hollows and dreys in the tree canopies when predators are present. Loss of habitat and predation by foxes are the two significant factors leading to their decline. Suitable habitat exist, however, no Western Ringtail Possums, dreys or scats were recorded during the fauna assessment. Similar assessments targeting Western Ringtail Possums on two properties adjacent to Riverslea (Lots 9013 and 753 Tingle Avenue and Lot 27 Bussell Highway, Margaret River in October 2004) also recorded no Western Ringtail Possums. Based on these three assessments, Western Ringtail Possums are ***unlikely*** to occur in the study area.

Chuditch (*Dasyurus geoffroii*) – Formally known from over 70% of Australia, the Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-west WA. They den in hollow logs and burrows and have also been recorded in tree hollows and cavities. Habitat alteration and removal of suitable den logs and den sites following land clearing, grazing and frequent wildfire have contributed to a decline in Chuditch numbers. The Chuditch is ***unlikely*** to occur in the study area because of its proximity to residential areas and the highly fragmented habitat in the region.

Quokka (*Setonix brachyurus*) - Once very common in areas such as the Swan Coastal Plain near Perth and Gingin, Quokkas are now uncommon on the mainland and confined to isolated pockets within the south-west corner of WA. Densely vegetated areas around swamps or streams are preferred. There have been no recorded sightings of the Quokka in the Margaret River region since 1933, and therefore the species is ***highly unlikely*** to occur in the study area.

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) - This species inhabits the south-west of WA. Its preferred habitat is the woodland where it preferentially feeds on plants of the Proteaceae family. In winter, flocks can be found in heaths. Due to the availability of suitable habitat it is ***likely*** to be a seasonal visitor to the study area.

Baudin's Cockatoo (*Calyptorhynchus baudinii*) – This species is most common in the far south-west of WA where it breeds. Breeding records come from the southern forests north to Collie and east to near Kojonup. Baudin's Cockatoo is typically found in vagrant flocks and utilises the taller, more open Jarrah and Marri woodlands, where it feeds mainly on Marri seeds. Baudin's Black Cockatoos were ***recorded*** during this survey and surveys of adjacent land holdings in October 2004.

White-bellied Frog (*Geocrinia alba*) – This species is found in swamps and along creeklines in broad U-shaped valleys in the Witchcliffe-Karridale area (about 130km^2). Most of the populations are on private land. There has been one

previous record however the White Bellied Frog only lives in a few isolated areas. Due to the disjunct populations of the White-bellied frog it is ***highly unlikely*** to occur in the area.

Forest Red-tailed Black Cockatoo (*Calptorhynchus banksii naso*) – This species is most commonly seen in Eucalypts where it is attracted to seeding Marri, Jarrah, Blackbutt, Karri and Snottygobble. Forest Red-tailed Black Cockatoo's were formally common but now rare to uncommon and patchily distributed. They are usually seen in pairs or small flocks and seldom in large flocks (up to 200). The main cause of population decline has been habitat destruction and alteration. Forest Red-tailed Black Cockatoos are ***likely*** to be found in the study area.

3.5.2 Schedule 4 - Fauna that are in Need of Special Protection

Peregrine Falcon (*Falco peregrinus*) – This species is found across most of Australia, but only occurs in low densities and has a wide and patchy distribution. It favours hilly or mountainous country and open woodlands and ***may*** be an occasional visitor to the study area.

Carpet Python (*Morelia spilota imbricata*) – A large python found across the southwest of Western Australia, north to Geraldton and Yalgoo, and east to Kalgoorlie, Fraser Range and Eyre. They inhabit forest, heath, or wetland areas and shelter in hollow logs or in branches of large trees. This species has a number of disjunct populations that are widespread within the southwest of Western Australia, however, its density is generally low across its distribution except on a couple of off-shore islands. Carpet Pythons have previously been found in the vicinity of Margaret River and are therefore ***likely*** to be found at Riverslea because suitable habitat is found on site.

3.5.3 Priority 1 - Taxa with Few, Poorly Known Populations on Threatened Lands

Kawaniphila pachomai – This species of cricket feeds on pollen and nectar and has been collected at Karragullen. No further information is available on this species. It is ***highly unlikely*** to be found near Riverslea as the nearest record is 250km away.

3.5.4 Priority 2 - Taxa with Few, Poorly Known Populations on Conservation Lands, or Taxa with Several, Poorly Known Populations not on Conservation Lands

Black Bittern (*Ixobrychus flavicollis australis*) – This species inhabits freshwater pools, swamps, and lagoons that are well screened with trees. Although a sighting was made near Margaret River in 2001, it is ***unlikely*** that Black Bitterns are found at Riverslea due to unsuitable habitat.

3.5.5 Priority 3 - Taxa with Several, Poorly Known Populations, some on Conservation Lands

Southern Brush-tailed Phascogale (*Phascogale tapoatafa tapoatafa*) – Formerly widespread in eastern and southwestern Australia, it is now found from Perth to Albany, west of Albany highway. It occurs at low densities in the northern Jarrah forest, and higher densities in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton. Habitat clearing and fragmentation, and habitat alteration by logging and mining are the main causes threatening populations. The greatest threat appears to be the reduced availability of trees with hollows, and predation by cats and foxes. The Southern Brush-tailed Phascogale ***may*** be found in the study area, as there was one previous record from the area in 1999.

3.5.6 Priority 4 - Taxa in Need of Monitoring

Water Rat (*Hydromys chrysogaster*) – The Water Rat is found mainly near permanent bodies of freshwater, occasionally at temporary waterholes. They can also survive in areas where rivers and streams have become polluted or are brackish. There have been two recent previous sightings and captures from the Margaret River area. Although not recorded the Water Rat ***may*** occur on site.

Hooded Plover (*Charadrius rubricollis*) – This species frequents the margins and shallows of salt lakes, also along coastal beaches, where it forages for invertebrates along the water's edge. It is an uncommon to common resident on the southern sea beaches from Cape Naturalist east to Eyre. It is scarce to common throughout the rest of its distribution. The Hooded Plover is ***unlikely*** to be found at Riverslea due to unsuitable habitat.

Western Whipbird (*Psophodes nigroguaris*) – The Western Whipbird lives in mallee, heath and other dense understorey, with the structure of the vegetation being more important than the floristics. They are found in the south-west of WA, but have a restricted range and are only found in small, fragmented populations. The populations are threatened by clearing and fire. Due to its restricted range and fragmented populations it is ***unlikely*** to be found near Riverslea.

3.5.7 Priority 5 - Taxa in Need of Monitoring

Quenda or Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) – Quenda prefer dense scrub (up to one metre high), with swampy vegetation. They will often feed in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and crop land lying close to dense cover. Major threats to Quenda include habitat fragmentation and loss of habitat on the coastal plain and wheat belt, fire in fragmented habitat, predation by foxes, predation of young by cats and predation around residential areas by dogs. Quenda were ***recorded*** from the site and were trapped near the wetter areas adjacent to Darch Brook.

Of the species listed under Commonwealth and State government legislation requiring special protection due to their vulnerability only the Southern Brown Bandicoot and Baudin's Black Cockatoo were recorded on the site.

Carnaby's Cockatoo, Western Long-billed Corella, Carpet Python, and Forest Red-tailed Black Cockatoo are likely to be present. The Chuditch, Peregrine Falcon, Southern Brush-tailed Phascogale and Water Rat may utilise the study area, but ATA considers it unlikely.

An inspection of the general area within a 10km radius of the site indicated that there were other areas in either private or government ownership that had similar vegetated habitats. Baudin's Cockatoos therefore have a range of alternative feeding and roosting area in the region, however, the large Eucalyptus trees (e.g. Marri) do provide potential sites for feeding. ATA Environmental does not consider clearing this site will have a significant impact on Baudin's Cockatoo.

Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo and Western Long-billed Corellas have a range of alternative foraging and nesting areas in the region and are unlikely to be adversely affected by clearing. Southern Brown Bandicoots were recorded in the more densely vegetated areas around Darch Brook. This habitat is being retained so the development is unlikely to affect the Southern Brown Bandicoots. Carpet Pythons if they are in the area, would most probably be lost if the bushland was cleared.

3.6 Trap Type Comparison

There are many different trapping strategies used to measure small reptile and mammal assemblages. These include the use of cage traps and Elliott traps of varying sizes, snap traps, stick traps, funnel traps and opportunistic observations (road kill, hand searching, etc). Over the past 15 years, pit-traps have become an accepted methodology for surveying small terrestrial vertebrates, although the type of pit-trap used and the layout of the pit-trap arrays and grids can vary (Thompson *et al.* 2005).

The current ATA Environmental survey used a variety of trapping techniques including pit-traps (two types; 20L buckets and 150mm diameter PVC pipes), funnel traps, Elliott traps, cage traps and opportunistic hand searching. Most previous surveys used similar survey techniques, however, none have used funnel traps. Table 5 shows the number of captures per trap type and demonstrates that most reptile captures were in funnel traps, amphibians in bucket pit-traps and mammals in cage traps. Some species that are routinely caught in funnel traps are seldom, if ever, caught in pit-traps (e.g. large snakes). Different trap types capture a different component of the vertebrate assemblage and without employing a variety of trapping techniques it is not possible to adequately sample the vertebrate assemblage for an area. This is a significant limitation with the previous biological surveys in Western Australia.

3.7 Introduced and Feral Animals

A number of introduced and feral animals were recorded for the study site (Appendix 1-4). Mice (*Mus musculus*) were the caught throughout the area, a cat (*Felis catus*) and fox (*Vulpes vulpes*) were observed and domestic dogs frequent the area. As there is a housing development adjacent to Riverslea there is little that can be done to restrict feral animals on site. Continued predation of native animals by cats and foxes will no doubt degrade the faunal values of the area.

TABLE 5
REPTILE, AMPHIBIAN AND MAMMAL CAPTURES PER TRAP TYPE AT RIVERSLEA

		Pipe pit-traps	Bucket pit-traps	Funnel traps	Elliott traps	Cage traps	Opp.
AMPHIBIANS							
	Crinia georgiana	2	5				1
	Crinia insignifera		13	4			
	Litoria moori		2	5			4
REPTILES							
	Acritoscincus trilineatum	2	3	8			
	Christinus marmoratus		1				3
	Egernia kingii						2
	Hemiergis peronii		2	1			4
	Notechis scutulatus						1
	Pseudonaja affinis			1			
	Tiliqua rugosa					1	1
MAMMALS							
	Isoodon obesulus fusciventer					2	
	Mus musculus	2			1		
	Oryctolagus cuniculus						2
	Sminthopsis griseoventer	2	3				1
	Trichosurus vulpecula					5	
Amphibians	**Number of individuals**	2	20	9	0	0	5
	Number of species	1	3	2	0	0	2
Reptiles	**Number of individuals**	2	6	10	0	1	11
	Number of species	1	3	3	0	1	5
Mammals	**Number of individuals**	4	3	0	1	7	2
	Number of species	2	1	0	1	2	3

4. DISCUSSION

The trapping effort undertaken at Riverslea is comparable to effort undertaken for developments of a similar size. The most abundant captures were frogs and the most abundant mammal was the Brushtail Possum.

The trapping survey at Riverslea captured 4 of a possible 7 species of trappable reptiles and 3 of 4 predicted mammal species for the site (Plates 2 and 3). Given that the site is less than 7ha and contains one habitat type, few additional frog and mammal species are predicted on site. The site has a paucity of trappable reptile and mammal species, which was expected, due to the small study site, lack of habitat complexity, proximity of residential development and concentration of feral animals.

4.1 Faunal Assemblage Comparisons with Other Studies

We were able to find no unpublished reports for the local area describing the faunal assemblage and little data are available for the bioregion (McKenzie, *et al.,* 2003).

4.2 Assemblages with Ecological Significance

The EPA's Position Statement No 3, and Guidance Statement No. 56, indicate that field survey data should be used to assess the impact of the development on species and ecosystems.

Thompson *et al.* (2003) described the pit-trappable reptile assemblages for biotopes and heterogenous habitats for numerous semi-arid, arid and mesic sites in Australia. There is no similar summary of reptile or mammal assemblages for the south-west corner of Western Australia. Typically, heterogenous sites have between 27 and 50 species, larger areas have higher species richness. Undisturbed semi-arid and mesic biotopes generally have between 17 and 35 reptile species (How, 1998; Thompson *et al.* 2003). The composition of arid and semi-arid reptile assemblages is made up of mostly skinks and geckos, with less agamids and elapids, and fewer varanids, pygopods and blind snakes. The Bold Park coastal dunes also contain a relatively high number of skinks (12), fewer elapids (6) and less geckoes (2), pygopods (2), agamids (2), blind snakes (1) and varanids (1; How, 1998). A less diverse reptile species assemblage would be expected at Riverslea because of its higher latitude, however, fewer species than expected were actually caught. The low number of recorded species compared to the potential species list can be attributed a single survey in summer, presence of feral animals, the small size of the bushland (6.2ha) and nearby residential developments.

There are no characteristics of the faunal assemblage or the species recorded on site to indicate that it has particular conservation significance in the region.

For small mammal species, sites with heterogenous habitat types typically have up to 15 trappable small terrestrial species and six to eight species of bats (McKenzie *et al.* 2000), and larger more habitat diverse sites can have a higher diversity (How and

Cooper 2002). For biotopes or habitats that are less diverse, the number of small trappable mammal species is generally between five and eight (Masters 1993, How and Cooper 2002, unpublished data for the Goldfields). The species richness for small mammals at Riverslea is less than generally found in other semi-mesic or coastal habitats in WA. The study area contains feral cats and foxes and is adjacent to urban development. These factors both contribute to the low mammal species richness at Riverslea.

Other than the presence of Quenda, there are no characteristics of the mammal assemblage or the species recorded on site to indicate that they have particular conservation significance in the region. As the habitat most favoured by Quenda is being retained there will be limited impact on this species.

The site has potential to contain bat species, however, there are large areas of similar bushland on adjacent lots. Clearing of bushland at Riverslea Gardens is therefore unlikely to have any significant impacts on these species

It is particularly difficult to quantify bird assemblages at a site as there are appreciable temporal variations driven by seasonal effects, specific rain events, droughts, etc. The bird assemblage represented on a presence – absence basis for the Riverslea site appears to fit in with the regional pattern.

No conservation significant invertebrates were predicted or recorded in the region.

5. CONCLUSION AND RECOMMENDATIONS

The ATA Environmental fauna survey of the Riverslea area identified 33 species of birds from a possible 95 species (35%), four species of amphibian from a possible 15 species (27%), seven species of reptile from a possible 34 species (21%), and eight species of mammal, including three introduced species from a possible 30 species (27%). An additional eight species of birds were observed by Christine Wilder between November 11 and December 9 2003. This is a high capture success rate considering that not all of the species predicted for the area will be present due to micro-habitat requirements and seasonal variations. The low number of recorded species compared to the potential species list can be attributed to a variety of factors including, a single survey in summer, presence of feral animals, the small size of the bushland (6.2ha) and nearby residential developments. All of the species recorded are typical of the habitats present at Riverslea and often persist in modified areas.

The bushland at Riverslea has residential housing developments abutting the south-east boundary and residents regularly use the area for walking dogs. Domestic cats were also observed in the area during the day and at night. These anthropogenic influences may account for some species being absent from the survey results.

Baudin's Black Cockatoo (listed as vulnerable under the *EPBC Act 1999* and Schedule 1 under the *WA Wildlife Conservation Act 1950*) and the Southern Brown Bandicoot (Priority 5 under the *WA Wildlife Conservation Act* 1950) were the only two significant fauna recorded at Riverslea. Baudin's Black-Cockatoo is largely restricted to the tall forests of the south-west and clearing of the trees necessary for the subdivision will result in a minor impact upon this species at a local level. There are, however, other large areas of similar habitat suitable for this species in nearby areas. The Southern Brown Bandicoot was captured adjacent to the dense vegetation along the creekline at the eastern side of the proposed subdivision. This dense habitat is necessary for the continued survival of the Southern Brown Bandicoot in this area as they do not regularly inhabit the open Marri or Jarrah woodlands if more preferred habitat is available. This dense riparian habitat is being retained, and therefore limited impact upon Southern Brown Bandicoots is predicted on site.

It is unlikely development activity will substantially modify, destroy or isolate an area of important habitat of Baudin's Black Cockatoo or the Southern Brown Bandicoot, or seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significantly proportion of the population of this species because habitat utilised by these two species is found in the surrounding areas.

Any clearing of vegetation or disturbance associated with the development of a residential subdivision will have an impact on individual species, species assemblages and the functional value at the site level, however the proposed disturbance at Riverslea is not anticipated to have a significant impact on any of these scales in a regional context. There was no obvious feature of the reptile assemblage that necessitates special attention or protection as the reptile assemblage represented in the surrounding area is likely to be similar in composition. Other than the Carpet Python, none of the reptile species caught or predicted for the area are considered rare, have disjunct populations or require special protection.

No other extensive vertebrate fauna surveys are known to have been conducted for the area to compare the Riverslea data with. However, the composition of the small mammal assemblage is also what would be expected of a similar habitat with none of the species caught representing disjunct populations that require special protection. Avifauna observations by ATA Environmental in March 2004 were similar to the records by Christine Wilder.

From a fauna conservation significance perspective, there should be no impediment to the development of the Riverslea study area for residential purposes. The provision of vegetated fauna or wildlife corridors linking remnant bushland areas are generally considered for proposed subdivision, particularly in a rural setting. Wildlife corridors are considered essential for the movement of individuals and populations of fauna. However, under the proposed subdivision, the riparian vegetation along Darch Brook, which links sites to the north and south of the study area, will not be significantly altered. Creation of additional north-south corridors is therefore not considered necessary.

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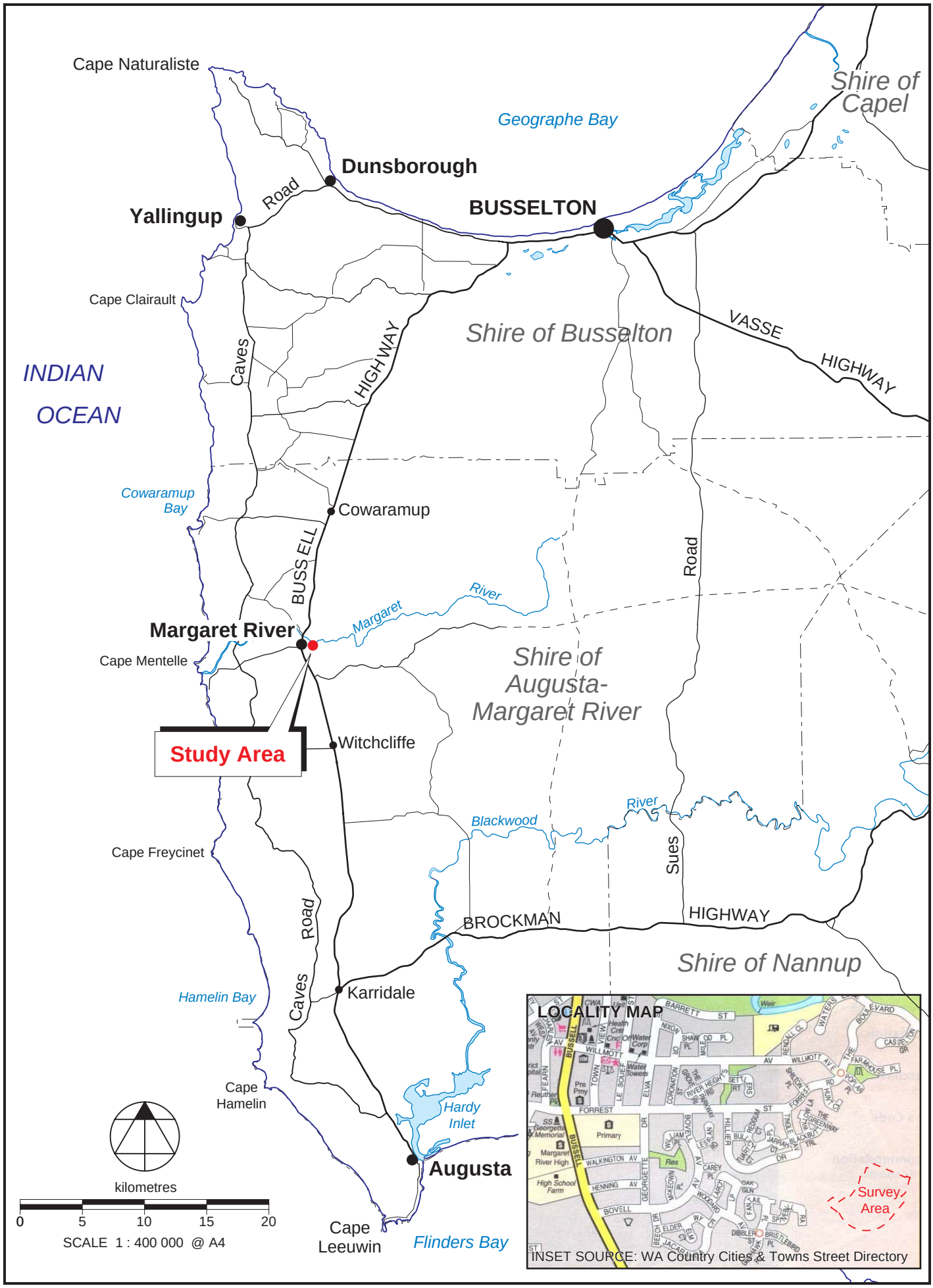
FIGURES



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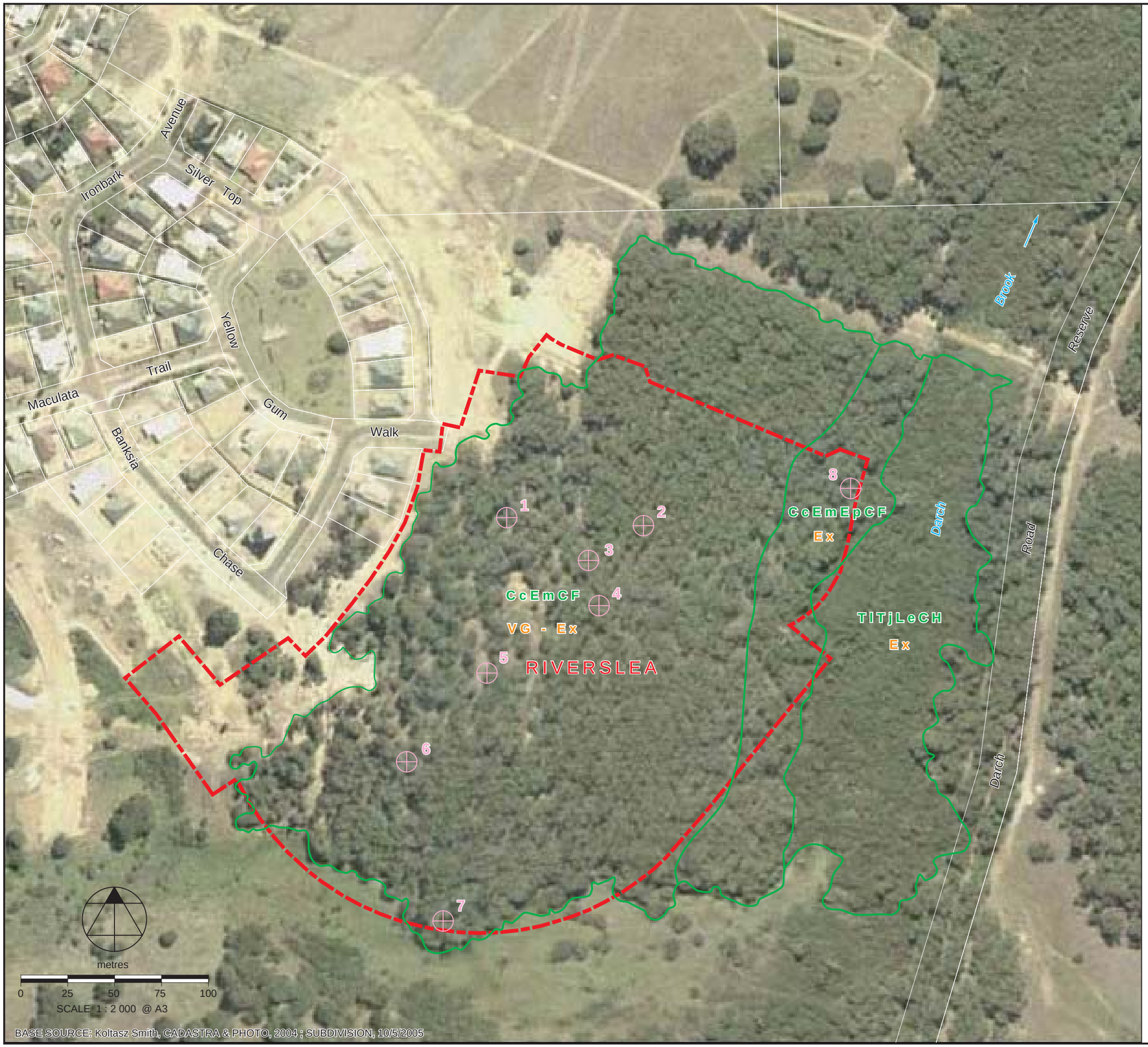
RIVERSLEA SUBDIVISION
FAUNA SURVEY
REGIONAL LOCATION
FIGURE 1

PRINTED: Mon 11 Jul 05 CHECKED BY: ST/SG 22-6-05 DRAWN BY: GLM 20-6-05 DATUM: MGA GDC-2003-001/VEA/24_31F2.dgn



LEGEND

Riverslea Boundary

Vegetation Type Boundary

8 Fauna Trapping Site

VEGETATION TYPES

CcEmCF *Corymbia calophylla* / *Eucalyptus marginata* subsp. *marginata* Closed to Open Forest.

CcEmEpCF *Corymbia calophylla* / *Eucalyptus marginata* subsp. *marginata* Closed Forest with scattered *Eucalyptus patens* .

TlTjLeCH *Taxandria linearifolia* / *Taxandria juniperina*/ *Leptospermum erubescens* Closed Heath.

VEGETATION CONDITION (SOURCE: BUSH FOREVER Govt. of W.A., 2000)

Pristine (Not Applicable)
Pristine or nearly so, no obvious signs of disturbance.

Ex Excellent
Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species.

VG Very Good
Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (Not Applicable)
Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (Not Applicable)
Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

Completely Degraded (Not Applicable)
The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

ATA Environmental
environmental scientists

RIVERSLEA SUBDIVISION
FAUNA SURVEY

LOCATION OF FAUNA TRAPPING SITES

FIGURE 2

APPENDICES

APPENDIX 1

BIRD SPECIES LISTED AS POTENTIALLY BEING FOUND OR RECORDED AT RIVERSLEA

APPENDIX 1
BIRD SPECIES LISTED AS POTENTIALLY BEING FOUND OR RECORDED AT RIVERSLEA

X represents species that were present during the survey period
E represents species listed under the *Environment Protection and Biodiversity Conservation Act* 1999
EM represents migratory bird species listed under the *Environment Protection and Biodiversity Conservation Act* 1999
S represents species listed on the Department of Conservation and Land Management's Scheduled Fauna list
P represents species listed on the Department of Conservation and Land Management's Priority Fauna list
I Introduced species
[1] Observed by Christine Wilder between November 11 and December 9 2003.

Species		Observed / expected
Casuariidae (Emus and Cassowaries)		
Emu	*Dromaius novaehollandiae*	
Phasianidae (Pheasants and Quails)		
Brown Quail	*Coturnix ypsilophora*	
Anatidae (Ducks, Geese and Swans)		
Australian Shelduck	*Tadorna tadornoides*	
Pacific Black Duck	*Anas superciliosus*	
Grey Teal	*Anas gibberifrons*	
Australian Wood Duck	*Chenonetta jubata*	X[1]
Ardeidae (Herons and Egrets)		
White-faced Heron	*Egretta novaehollandiae*	X[1]
White-necked Heron	*Ardea pacifica*	
Great Egret	*Egretta alba*	
Nankeen Night Heron	*Nycticorax caledonicus*	
Plataleidae (Ibis and Spoonbills)		
Australian White Ibis	*Threskiornis molucca*	
Straw-necked Ibis	*Threskiornis spinicollis*	
Accipitridae (Kites, Hawks and Eagles)		
Black-shouldered Kite	*Elanus notatus*	
Square-tailed Kite	*Lophoictinia isura*	
Whistling Kite	*Haliastur sphenurus*	
Swamp Harrier	*Circus approximans*	
Brown Goshawk	*Accipiter fasciatus*	X[1]
Collared Sparrowhawk	*Accipiter cirrhocephalus*	
Wedge-tailed Eagle	*Aquila audax*	
Little Eagle	*Hieraaetus morphnoides*	
Falconidae (Falcons)		
Peregrine Falcon	*Falco peregrinus* S	
Australian Hobby	*Falco longipennis*	
Brown Falcon	*Falco berigora*	
Nankeen Kestrel	*Falco cenchroides*	

Species		Observed / expected
Turnicidae (Button-quails)		
Painted Button-quail	*Turnix varia*	
Rallidae (Crakes and Rails)		
Buff-banded Rail	*Rallus philippensis*	
Columbidae (Pigeons and Doves)		
Common Bronzewing	*Phaps chalcoptera*	
Brush Bronzewing	*Phaps elegans*	
Cacatuidae (Cockatoos)		
Forest Red-tailed Black-Cockatoo	*Calyptorhynchus banksii naso* P	
Short-billed Black-Cockatoo	*Calyptorhynchus latirostris* S E	X[1]
Long-billed Black-Cockatoo	*Calyptorhynchus baudinii* S E	X
Galah	*Cacatua roseicapilla*	X
Psittacidae (Lorikeets and Parrots)		
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	X
Red-capped Parrot	*Purpureicephalus spurius*	X
Western Rosella	*Platycercus icterotis*	X
Australian Ringneck	*Barnardius zonarius*	X
Elegant Parrot	*Neophema elegans*	
Cuculidae (Cuckoos)		
Pallid Cuckoo	*Cuculus pallidus*	
Fan-tailed Cuckoo	*Cuculus pyrrhophanus*	
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	X[1]
Strigidae (Hawk-owls)		
Barking Owl	*Ninox connivens* P	
Southern Boobook Owl	*Ninox novaeseelandiae*	X
Tytonidae (Barn owls)		
Masked Owl	*Tyto novaehollandiae P*	
Barn Owl	*Tyto alba*	
Podargidae (Frogmouths)		
Tawny Frogmouth	*Podargus strigoides*	X
Aegothelidae (Owlet-nightjars)		
Australian Owlet-nightjar	*Aegotheles cristatus*	
Halcyonidae (Forest kingfishers)		
Laughing Kookaburra	*Dacelo novaeguineae* I	X
Sacred Kingfisher	*Todiramphus sanctus*	
Meropidae (Bee-eaters)		
Rainbow Bee-eater	*Merops ornatus* EM	
Climacteridae (Treecreepers)		
Rufous Treecreeper	*Climacteris rufa*	
Maluridae (Fairy-wrens)		
Southern Emu-wren	*Stipiturus malachurus*	
Splendid Fairy-wren	*Malurus splendens*	X
Red-winged Fairy-wren	*Malurus elegans*	X
Pardalotidae (Pardalotes)		
Spotted Pardalote	*Pardalotus punctatus*	
Striated Pardalote	*Pardalotus striatus*	X

Species		Observed / expected
White-browed Scrubwren	*Sericornis frontalis*	X
Western Gerygone	*Gerygone fusca*	X
Weebill	*Smicrornis brevirostris*	
Inland Thornbill	*Acanthiza apicalis*	X
Western Thornbill	*Acanthiza inornata*	
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	X
Meliphagidae (Honeyeaters)		
Red Wattlebird	*Anthochaera carunculata*	X
Western Wattlebird	*Anthochaera lunulata*	
Singing Honeyeater	*Lichenostomus virescens*	
White-naped Honeyeater	*Melithreptus lunatus*	X[1]
Brown Honeyeater	*Lichmera indistincta*	
New Holland Honeyeater	*Phylidonyris novaehollandiae*	X
White-cheeked Honeyeater	*Phylidonyris nigra*	
Western Spinebill	*Acanthorhynchus superciliosus*	
Petroicidae (Australian robins)		
Scarlet Robin	*Petroica multicolor*	X
Western Yellow Robin	*Eopsaltria griseogularis*	X
White-breasted Robin	*Eopsaltria georgiana*	X
Hooded Robin	*Melanodryas cucullata*	X
Neosittidae (Sittellas)		
Varied Sittella	*Daphoenositta chrysoptera*	
Pachycephalidae (Whistlers)		
Golden Whistler	*Pachycephala pectoralis*	X
Rufous Whistler	*Pachycephala rufiventris*	X[1]
Grey Shrike-thrush	*Colluricincla harmonica*	X
Dicruridae (Flycatchers)		
Magpie-lark	*Grallina cyanoleuca*	
Grey Fantail	*Rhipidura fuliginosa*	X
Willie Wagtail	*Rhipidura leucophrys*	X
Restless Flycatcher	*Myiagra inquieta*	
Campephagidae (Cuckoo-shrikes)		
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	X
Artamidae (woodswallows)		
Black-faced Woodswallow	*Artamus cinereus*	
Dusky Woodswallow	*Artamus cyanopterus*	
Grey Butcherbird	*Cracticus torquatus*	X
Australian Magpie	*Gymnorhina tibicen*	X
Corvidae (Ravens and Crows)		
Grey Currawong	*Strepera versicolor*	
Australian Raven	*Corvus coronoides*	X
Passeridae (Finches)		
Red-eared Firetail	*Stagonopleura occulata*	
Dicaeidae (Mistletoebird)		
Mistletoebird	*Dicaeum hirundinaceum*	
Hirundinidae (Swallows)		
Welcome Swallow	*Hirundo neoxena*	X

Species		Observed / expected
Tree Martin	*Hirundo nigricans*	X
Motacillidae (Pipits and true wagtails)		
Richard's Pipit	*Anthus novaeseelandiae*	X[1]
Zosteropidae (White-eyes)		
Silvereye	*Zosterops lateralis*	X

APPENDIX 2

AMPHIBIAN SPECIES LISTED AS POTENTIALLY BEING FOUND OR RECORDED AT RIVERSLEA

APPENDIX 2
AMPHIBIAN SPECIES LISTED AS POTENTIALLY BEING FOUND OR RECORDED AT RIVERSLEA

Numbers represent the number of individuals captured for each species
Opp represents species seen opportunistically
E represents species listed under the *Environment Protection and Biodiversity Conservation Act* 1999
S represents species listed on the Department of Conservation and Land Management's Scheduled Fauna list

Species	Sites								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Opp**
Hylidae									
Litoria adelaidensis									
Litoria moorei	1						4	2	4
Myobatrachidae									
Crinia georgiana							8	2	
Crinia glauerti									
Crinia insignifera							14	2	
Crinia pseudinsignifera									
Geocrinia alba S									
Geocrinia leai								1	
Heleioporus albopunctatus									
Heleioporus eyrei									
Heleioporus inornatus									
Heleioporus psammophilus									
Limnodynastes dorsalis									
Metacrinia nichollsi									
Pseudophryne guentheri									

APPENDIX 3

REPTILE SPECIES LISTED AS POTENTIALLY BEING FOUND OR RECORDED AT RIVERSLEA

APPENDIX 3
REPTILE SPECIES LISTED AS POTENTIALLY BEING FOUND OR RECORDED AT RIVERSLEA

Numbers	represent the number of individuals captured for each species
Opp	represents species seen opportunistically
Scr	represents scratchings
E	represents species listed under the *Environment Protection and Biodiversity Conservation Act* 1999
S	represents species listed on the Department of Conservation and Land Management's Scheduled Fauna list

Species		Sites								
		1	2	3	4	5	6	7	8	Opp
Agamidae (Dragons)										
	Pogona minor									
Boidae (Pythons)										
Carpet Python	*Morelia spilota imbricata* S									
Elapidae (Elapid Snakes)										
Bardick	*Echiopsis curta*									
	Elapognathus coronatus									
Western Tiger Snake	*Notechis scutatus*									1
Gould's Snake	*Parasuta gouldii*									
	Parasuta nigriceps									
Dugite	*Pseudonaja affinis*								1	
	Rhinoplocephalus bicolor									
Gekkonidae (Geckoes)										
	Christinus marmoratus			1						3

Pygopodidae (Legless Lizards)										
	Aprasia pulchella									
	Aprasia repens									
Burton's Legless Lizard	*Lialis burtonis*									
	Pygopus lepidopodus									
Scincidae (Skinks)										
	Acritoscincus trilineatum	1		2	1	4	4	1		
	Cryptoblepharus plagiocephalus									
	Ctenotus delli									
	Ctenotus impar									
	Ctenotus labillardieri									
King Skink	*Egernia kingii*									2
	Egernia luctuosa									
	Egernia napoleonis									
	Egernia pulchra pulchra									
	Glaphyromorphus gracilipes									
	Hemiergis peronii tridactyla	1					1	2		3
	Lerista distinguenda									
	Lerista elegans									
	Lerista microtis microtis									
	Menetia greyii									
	Morethia lineoocellata									
	Morethia obscura									
Bobtail	*Tiliqua rugosa*						1			1
Typhlopidae (Blind Snakes)										
	Ramphotyphlops australis									
Varanidae (Goannas)										
Southern Heath Monitor	*Varanus rosenbergi*									Scr

APPENDIX 4

MAMMAL SPECIES LISTED AS POTENTIALLY BEING FOUND OR RECORDED AT RIVERSLEA

APPENDIX 4
MAMMAL SPECIES LISTED AS POTENTIALLY BEING FOUND OR RECORDED AT RIVERSLEA

Numbers represent the number of individuals captured for each species
Opp represents species seen opportunistically
Scr represents scratchings or scats
I represents introduced or feral species
E represents species listed under the *Environment Protection and Biodiversity Conservation Act* 1999
S represents species listed on the Department of Conservation and Land Management's Scheduled Fauna list
P represents species listed on the Department of Conservation and Land Management's Priority Fauna list

Species	Sites								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Opp**
Burramyidae (Pygmy Possums)									
Western Pygmy Possum *Cercartetus concinnus*									
Canidae (Dingos, Dogs)									
Fox *Vulpes vulpes* I									Scr
Dasyuridae (Dunnarts, Quoll, Mardo, Wambengers)									
Mardo *Antechinus flavipes leucogaster*									
Chuditch *Dasyurus geoffroii* S									
Southern Brush-tailed Phascogale *Phascogale tapoatafa tapoatafa* P									
Gilbert's Dunnart *Sminthopsis gilberti*									
Grey-bellied Dunnart *Sminthopsis griseoventer griseoventer*		1	2		2				1
Equidae (Horses)									
Horse *Equus caballus*									
Felidae (Cat)									
Cat *Felis catus* I									2
Leporidae (Rabbits and hares)									
Rabbit *Oryctolagus cuniculus* I									2
Macropodidae (Wallabies, Kangaroos)									
Macropus eugenii derbianus									

Species		Sites								
		1	2	3	4	5	6	7	8	Opp
Western Grey Kangaroo	*Macropus fuliginosus*									
Western Brush Wallaby	*Macropus irma*									
Quokka	*Setonix brachyurus* S									
Muridae (Rodents)										
Water Rat	*Hydromys chrysogaster* P									
House Mouse	*Mus musculus*					1		2		
Bush Rat	*Rattus fuscipes*									
Black Rat	*Rattus rattus*									
Peramelidae (Bandicoots and Bilbies)										
Southern Brown Bandicoot	*Isoodon obesulus fusciventer* P4								2	
Phalangeridae (Brushtail Possums, Cuscuses)										
Common Brushtail Possum	*Trichosurus vulpecula*					1	2		2	
Potoroidae (Potoroos, Bettongs)										
Brush-tail Bettong / Woylie	*Bettongia penicillata ogilbyi*									
Long-nosed Potoroo	*Potorous tridactylus*									
Pseudocheiridae (Ringtail Possums)										
Western Ringtail Possum	*Pseudocheirus occidentalis* S									
Tarsipedidae (Honey Possum)										
Honey Possum	*Tarsipes rostratus*									
Tachyglossidae (Echidna)										
Echidna	*Tachyglossus aculeatus*									Scr
Vespertilionidae (Evening Bats)										
Gould's Wattled Bat	*Chalinolobus gouldii*									
Chocolate Wattled Bat	*Chalinolobus morio*									
Lesser Long-eared Bat	*Nyctophilus geoffroyi*									
Greater Long-eared Bat	*Nyctophilus timoriensis timoriensis*									
Southern Forest Bat	*Vespadelus regulus*									

APPENDIX 5

DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE *WA WILDLIFE CONSERVATION ACT 1950*

APPENDIX 5
DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE *WA WILDLIFE CONSERVATION ACT 1950*

In Western Australia, all native fauna species are protected under the *WA Wildlife Conservation Act 1950-1979*. Fauna species that are considered rare, threatened with extinction or have a high conservation value are specially protected under the Act. In addition, some species of fauna are covered under the 1991 ANZECC convention, while certain birds are listed under the Japan and Australian Migratory Bird Agreement (JAMBA) and the China and Australian Migratory Bird Agreement (CAMBA).

Classification of rare and endangered fauna under the Wildlife Conservation (Specially Protected Fauna) Notice 1998 recognises four schedules of taxa. These are;

Schedule 1 – fauna which are rare or likely to become extinct and are declared to be fauna in need of special protection.

Schedule 2 – fauna which are presumed to be extinct and are declared to be fauna in need of special protection.

Schedule 3 – birds which are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction which are declared to be fauna in need of special protection; and

Schedule 4 – fauna that are in need of special protection, otherwise than for the reasons mentioned in Schedule 1, 2 or 3.

In addition to the above classification, CALM also classify fauna under four different Priority codes:

Priority one – Taxa with few, poorly known populations on threatened lands. Taxa which are known from few specimens or sight records from one of a few localities on lands not managed for conservation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened species.

Priority two – Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority three – Taxa with several, poorly known populations, some on conservation lands. Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority four – Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed or for which sufficient knowledge is available and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands. Taxa which are declining significantly but are not yet threatened.

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

APPENDIX 3

ARCHAEOLOGICAL SURVEY OF PUMP STATION SITE (PROPOSED LOT 667) RIVERSLEA ESTATE, MARGARET RIVER, SOUTH WEST AUSTRALIA (PAUL GREENFELD, 2004)

Archaeological Survey of Pump Station Site (Proposed lot 667) Riverslea Estate, Margaret River, Southwest Australia.

Report prepared for
Koltaz Smith and Partners (Town Planners)

On behalf of
Greendene Development Corporation

By

Paul Greenfeld (Grad Dip; BA Hons)
Wayne Webb (Bibbulman/Wardandi Representative)

February 2004

EXECUTIVE SUMMARY

It is the authors understanding that the developers of Riverslea Estate intend to construct a pump station within Proposed lot 667, Riverslea Estate, Margaret River. Proposed lot 667 was identified as a suitable location because of its low-lying nature, which assists drainage (gravity fed system) and proximity to further proposed housing subdivisions located to the south. It is proposed that these subdivisions will link into the existing sewerage system and will also use the pump station to be built at Proposed lot 667.

Two large storage tanks, as well as two enclosed settlement ponds are to be constructed within Proposed lot 667. Associated machinery such as pumps and monitoring bores will also be installed. Any run-off will be collected in a retention basin constructed to the south of Proposed lot 667 (see map in ethnographic report).

The author was briefed by Brad Goode (anthropologist) and asked to consider the construction of a proposed pump station within Proposed lot 667. To this end, the archaeological survey was conducted on 3 February 2004 by Paul Greenfeld (archaeologist) and Wayne Webb (Bibbulman/Wardandi representative).

One registered Aboriginal site Rosa Brook Road (Site Id 4494) is registered as being located within 10km of Proposed lot 667, given its extent of 10km x 10km it appears to impact upon the area. According to McDonald Hales (2000: 29), the exact location of Aboriginal site Rosa Brook Road remains uncertain. Aboriginal informants maintained that the site is located somewhere along Rosa Brook Road. Since there was insufficient information to locate the site, the DIA placed a 10km x 10km square around it. As Rosa Brook Road is located south of Riverslea Estate it is unlikely that Aboriginal site Rosa Brook Road will impact upon the proposed pump station to be located within Proposed lot 667.

During the course of the archaeological and anthropological survey, it became clear that part of the proposed pump station is to be constructed within the margins of wetlands, associated with Darch Brook (a tributary of the Margaret River), which form the southern boundary of Proposed lot 667. This information caused considerable concern amongst all of the Aboriginal informants taking part in the Survey.

Margaret River (Site Id. 4495), is seen as a major mythological site by Aboriginal people in the southwest. However, the initial recording of the site does not discuss the significance of its tributaries. Research by Goode (2003), on the Yarragadee Aquifer has highlighted the fact that nearly all tributaries are seen as a part of the larger river and therefore afforded the same ethnographic significance as the main river itself.

As Darch Brook flows into the Margaret River, the local Aboriginal people interviewed expressed their concern over the fact that Darch Brook is a tributary of Margaret River it is of importance and significance to local Aboriginal people. Therefore, it is important that the landowner and developer are aware to avoid any disturbance to Darch Brook, its associated wetlands and any other tributaries of the Margaret River that exist within Riverslea Estate.

After extensive consultation, it was decided that a (4m wide) buffer between the wetlands and the southern part of Proposed lot 667 would be created along the existing track located close to the southern boundary (see Figure 2). Further details on the proposed southern buffer are contained within the Results section of this report.

Proposed lot 667 has been heavily disturbed in the past, mounds of industrial waste such as rubble and scrap metal litter the area. Combined with the poor ground visibility it was always unlikely that any archaeological sites or Aboriginal cultural material would be located (see Figure 3).

Even though all likely areas (clear areas, streams) were examined in detail, no archaeological sites or Aboriginal cultural material were located during the archaeological survey of Proposed lot 667, Riverslea Estate, Margaret River.

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** Cover Photo: Looking northwest through Peppermint trees from southwest corner, Proposed lot 667, Riverslea Estate, Margaret River.

INTRODUCTION

It is the authors understanding that the developers of Riverslea Estate intend to construct a pump station within Proposed lot 667, Riverslea Estate, Margaret River. Proposed lot 667 was identified as a suitable location because of its low-lying nature, which assists drainage (gravity fed system) and proximity to further proposed housing subdivisions located to the south. It is proposed that these subdivisions will link into the existing sewerage system and will also use the pump station to be built at Proposed lot 667.

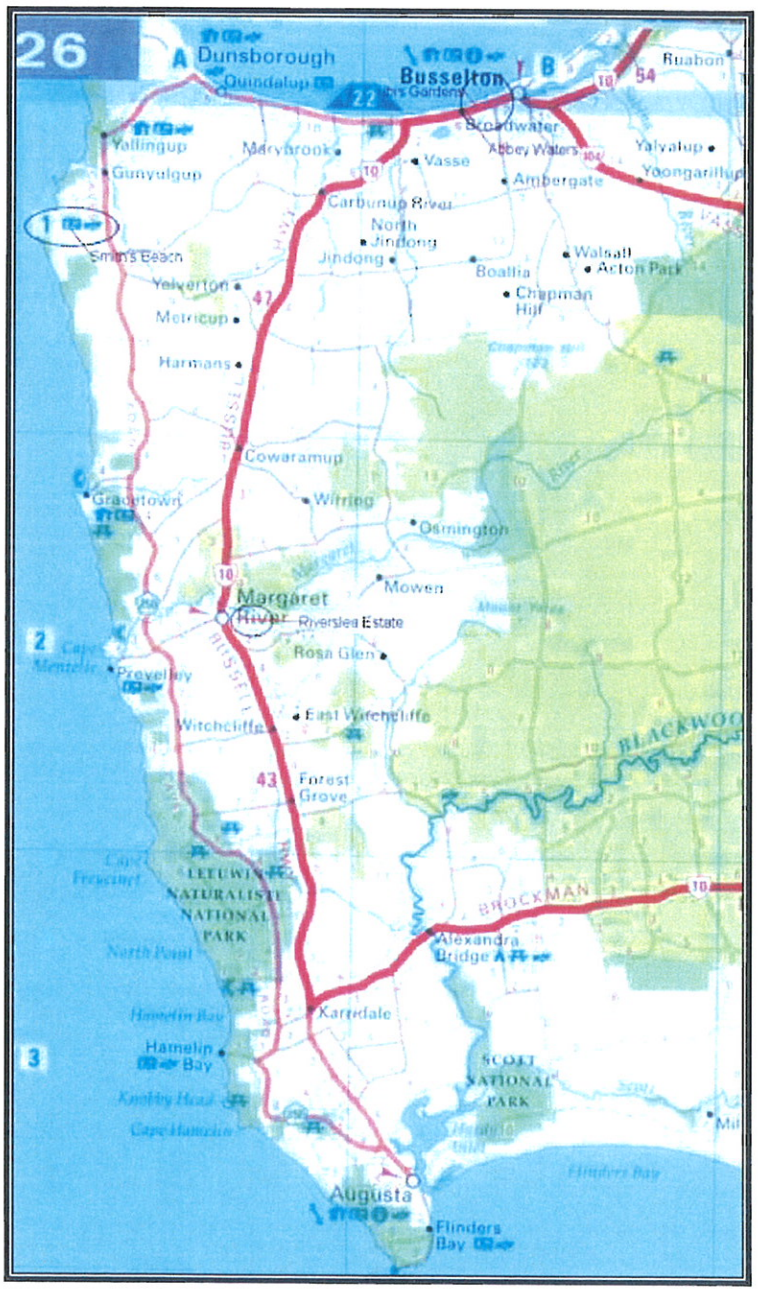

Figure 1: Map of Southwest Region.

Two large storage tanks, as well as two enclosed settlement ponds are to be constructed within Proposed lot 667. Associated machinery such as pumps and monitoring bores will also be installed. Any run-off will be collected in a retention basin constructed to the south of Proposed lot 667 (see map in ethnographic report).

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BACKGROUND

REGIONAL FRAMEWORK - ENVIRONMENTAL

Climate

According to Beard (1981:193), Margaret River is located within the Boranup System of the Warren Botanical Subdistrict. The climate is moderate Mediterranean, with an average rainfall of 650-1500mm, displaying a short dry season of only 3-4 months. Many previous researchers within the region have noted how the marked seasonal differences of southwest Australia would have played a large part in the traditional Aboriginal settlement patterns of the region.

Vegetation

Margaret River is situated in the central section of the Leeuwin-Naturaliste Ridge, which covers the region between Yallingup and Augusta. According to Beard (1981: 194), the Ridge is mantled with calcarenite and unconsolidated sand, and its seaward slope is much exposed to prevailing storm winds and sea spray, resulting in an intricate mosaic of vegetation that is controlled by the factors of soil and exposure.

On the exposed western slopes of the Ridge, vegetation mainly consists of heath (*Pimela ferruginea*) that improves locally to thicket as one moves away from the coast. With decreasing exposure, peppermint (*Agonis flexuosa*) and/or *Banksia* spp. dominate a range of structural types, low forest, low woodland or open low woodland. Jarrah (*Eucalyptus marginata*) may associate in the low forest on leached sands, and once off the limestone develops into jarrah-marri forest (Beard 1981: 194).

Geology

According to Beard (1981: 49), the geology of the Leeuwin-Naturaliste Ridge, the area between Yallingup to Augusta, is characterised by a north-south trending horst of Precambrian granite and granulite forming hills rising to 200m. Most of the granite outcrop is obscured by laterite and sand on the inland side, and by dune and calcarenite on the western, seaward side. The coast has a rugged retrograding shoreline with small sandy bays between promontories of granite and limestone.

According to Dortch (1998b: 6), archaeological sites in Australia are usually located within relatively young, Quaternary deposits, which are often still aggrading. The regional physiography of the Leeuwin Naturaliste Ridge will therefore indicate where there are sediments young enough to contain Aboriginal sites.

Within the Margaret River region, sites are likely to be located along streams, in both Pleistocene and Holocene dune sands, and on the thin surface material of the Cretaceous sediments, which according to Dortch (1998b) are the least likely environment in which to locate well-stratified archaeological deposits

Soils are calcareous sands on the seaward slope; on the inland side, the soils are acid grey earths, sometimes-containing ironstone gravels, and some sandy yellow-mottled soils (Beard 1981: 49). According to McArthur (1991), the presence of sand dunes and hummocks in many areas indicate the redistribution of sand by wind, probably during the periods of climatic instability of the late Pleistocene. Dortch (1998b: 6) says that these dune sands are young enough to have aggraded during periods of human occupation, and may contain Aboriginal artefacts.

According to Thom and Chappell (1975), there have been several major environmental fluctuations over the last 40,000 years, including a 120m variation in sea level, as well as periods of greater and lesser aridity. A number of archaeological sites located within the region (eg. Devil's Lair) show periods of abandonment. However, archaeological research carried out at other sites within the region, such as Ellen Brook to the south, shows that despite these environmental changes people were able to adapt their behaviour to accommodate climatic change.

Thom and Chappell (1975) have identified that the post-glacial rise in sea level had reached its present level by about 6,000 years ago. This rise in sea level effectively submerged the outcrops of Eocene fossiliferous chert that had been extensively quarried during the late Pleistocene to mid-Holocene.

Previous archaeological research (Dortch 1984, Dortch 1994, 1995, Ferguson 1980, 1985, Pearce 1978) at two sites, Walyunga and Dunsborough 1 has shown that the use of Eocene chert ceased in the southwest approximately 4,500 years ago.

REGIONAL FRAMEWORK - ARCHAEOLOGICAL

Site Definitions

DIA uses several categories, such as ceremonial, mythological, art site, engravings, artefact scatter, middens and burials to describe the different elements found in any particular Aboriginal site. For the present archaeological survey, I define an Aboriginal site as *any place where there is material evidence of Aboriginal occupation or activity* (Corsini 1999: 2). Please note that the above definition is a scientific one and may not be of sufficient significance to constitute a *place to which the Act applies* under Section 5 or 6 and 39 of the Western Australian *Aboriginal Heritage Act 1972.*

McCarthy (1976) in his work on stone tools notes that Aboriginal material culture (or artefacts) was dependent largely on natural raw materials. The resulting implements and tool kit were well adapted to their nomadic lifestyle. Wooden dishes, dilly bags, digging sticks, small grindstones and nets made of woven plant fibre or hair string were used by women. Men's implements included spears, shields, boomerangs and the woomera (combination spear thrower, dish and chisel). Bone points and fabricators indicate that both men and women used animal skins for warmth and clothing.

The Noongar tool kit also included composite tools such as the *Kodj* (stone axe) and the *Taap* (knife), a saw like implement made from embedding microliths to a wooden handle using plant resin for a glue (McCarthy 1976).

According to Corsini (1999: 2), archaeological excavations suggest that the microliths used in these types of implements occur only in deposits dated to between 6,000-4,000 BP, coinciding with the rise of sea level to its present level. Many researchers suggest that the

creation and use of microliths over such a short time frame may reflect a response to environmental changes bought about by the reduction in territory.

It would appear that the most common type of archaeological site in the region is the stone artefact scatter. These scatters can range from very small sites containing few pieces to very large complex campsites containing thousands of artefacts. *Isolated finds* are single stone artefacts located in isolation, it is usual for a certain proportion of *isolated finds* to occur sparsely across various landscapes as a *background artefact scatter.*

While stone artefact scatters are usually located in close proximity to sources of permanent and semi-permanent water, they can also be found in association with suitable rock outcrops or quarries, which contain suitable siliceous material for quarrying and artefact production. Stone artefact scatters may also be found in and on the slopes of caves or rockshelters.

Human burials within the region are numerous and are known to have occured in sandy areas such as dunes, hills and riverbanks. Burials are not usually discovered within the region unless disturbed by some form of development or natural processes such as erosion.

Other structures such as shelters (mia-mia's) and stone fish traps have been constructed and used within the region but their preservation within the local environment is usually poor and short lived.

Previous research within the southwest region also highlights the possibility of encountering scarred trees in most types of areas (coastal, inland, forest/woodland). Many scars appear to occur on old Jarrah trees.

Previous Archaeological Research conducted within the Region.

Over the last three decades, a large number of archaeologists and ethnographers have conducted research and consultancies within the southwest of Western Australia. The researchers include but are not limited to the following; Anderson 1984; Archer, Crawford & Merrilees 1980, Bavin 1993; Dortch 1984; Dortch 1994, 1995, 1996, 1998a, 1998b, 1999, 2000; Ferguson 1985; Goode 1998, 1999a, 1999b; Goode and Watson 1999; Hallam 1979; Lilley 1993; McDonald Hales 1992, 1993, 1998a, 1998b, 1998c, 2000; Western Infrastructure 2001.

Some of the archaeological sites previously located within the region have been dated. These include the Dunsborough 2 Site (S02856), dated to over 12,000 BP (Dortch 1995); Tunnel Cave (S02878) dated to over 22,000 BP (Dortch 1994), Devil's Lair (S00363) dated to over 30,000 BP (Dortch 1984) and Mammoth Cave (S00992) dated to over 37,000 BP (Archer, Crawford & Merrilees 1980).

Research has concluded that there has been more or less continuous occupation of the southwest region for over 30,000 years. This information coming mainly from the excavations carried out at Devil's Lair and Tunnel Cave.

Much of the research undertaken within the southwest has been directed at answering several outstanding research questions, several of which are listed below:
Evidence for late Holocene exploitation of the Leeuwin Naturaliste Ridge (Dortch 1984, Dortch 1996, Lilley 1993);

Longevity of human occupation within the region, including the occupation of its numerous limestone caves and rockshelters (Dortch and Dortch 1996);
Human use of and adaptation to a changing environment (Balme *et al* 1978, Ferguson 1980, 1985);
Aboriginal use of coastal resources (Dortch 1984).

Research has shown that Aboriginal people living within the region in the past exploited a wide range of aquatic and terrestrial foods (Hallam 1987). Moving as small groups into the adjacent woodland and forest, during the appropriate seasons in order to exploit their abundant resources, such as fish, lizards, ducks, turtles, several mammal species, bush tucker, etc. (Ferguson 1985, McDonald Hales 1992, 1993).

According to Dortch (1984), faunal evidence including the presence of rock wallabies and honey possums in large numbers between 33,000-25,000 BP at Devil's Lair, as well as other limestone caves in the area, indicate that a suite of fauna more characteristic of arid conditions were present throughout the region during the late Pleistocene.

Between 20,000-13,000 BP there are three separate trends suggesting increased aridity. These trends include an increase in numbers of *non-forest* species, an increase in the numbers and proportions of lizards and a decline in the number of *forest* species (McDonald Hales 1993: 2).

Because of the increased aridity, the vegetation of the southwest became more open, attracting large numbers of game, as well as allowing easier movement across the landscape (Balme *et al* 1978).

According to Ferguson (1985), around 12,000 BP, there was a reversal of the above trends of increased aridity, resulting in the present faunal assemblage adapted to forest, woodland and heath.

Open sites at Quininup Brook (Site Id 5513-5515) located just to the south of Smiths Beach and having dated occupation between 18,000-6,000 BP fit into the above period of increased aridity and subsequent amelioration of conditions, including the return of *forest* species (Ferguson 1985).

Dortch (1984: 48) sees Devil's Lair as being primarily an occupation or base camp for a family group. From Devil's Lair the nearby forest, woodland and wetlands could have been exploited, however, visits were most probably short and infrequent. This is because "even small parties of hunter gatherers camping there would have depleted available food resources within a few days" (Dortch 1984: 78).

At a regional level, Dortch (1984: 81) believes that the evidence from Devil's Lair suggests that past Aboriginal land use patterns may have involved seasonal or periodic movements, scheduled to the availability of key resources. Family groups most probably congregated on the coast during summer and autumn, dispersing inland during the winter months. There appears to be some evidence to suggest that this settlement-subsistence pattern may have continued up until European settlement of the region (Dortch 1984).

Lilley (1993) has undertaken research in the region focussed on the Margaret River valley and the lowermost reaches of Ellen and Boodjidup Brook, approximately halfway between Cape Naturaliste and Leeuwin. To date this constitutes the only known attempt at a regional research programme undertaken within the area.

From his research, Lilley (1993) suggested that during the mid to late Holocene human activity within the region was concentrated along the coastal margin and the near coastal transition zone, with the hinterland being used in a way which resulted in a poor archaeological signature. The faint overall archaeological evidence for the region suggests low population densities resulting from an impoverished resource base and not as a result of technical problems such as low survival rates or poor surface visibility and access.

Prediction of Site Location

Given the above archaeological information, it is predicted that the areas most likely to contain archaeological material, in the form of stone artefact scatters are the Quaternary gravels and dune sands. Likewise, it is predicted that most large scatters will be close to permanent sources of water. Knapping floors or reduction areas may occur wherever suitable outcrops of flakeable raw materials occur (river cobbles & rock outcrops). Burials are most likely to be found within the softer sands of the coastal dunes, inlets and rivers. Scarred trees appear to be found on old trees and can occur anywhere.

METHODOLOGY

A complete (100%) archaeological survey of Proposed lot 667, Riverslea Estate, Margaret River and its boundaries was undertaken through the use of evenly spaced pedestrian transects (approx. 5m). Any areas clear of vegetation, as well as any creeks were inspected in detail.

The archaeological survey followed a site identification model. This type of survey allows archaeological sites to be located, recorded and avoided in compliance with the requirements of the *Aboriginal Heritage Act 1972.*

The archaeological survey involved three separate phases:

archival research;
field survey;
report preparation.

ARCHIVAL RESEARCH

The archival research was undertaken by the Brad Goode, and consisted of a review of all available information held on the Aboriginal Sites Register at the Department of Indigenous Affairs (DIA), Heritage and Culture Division (Perth).

The research revealed that three (1) previously recorded Aboriginal site, Rosa Brook Road (Site Id 4494) is located outside of but in close proximity (10km radius) to Proposed lot 667, Riverslea Estate, Margaret River.

Details of the one Aboriginal site is as follows:

Site Name: Rosa Brook Road
DIA Site Id: 4494
Site Status: Interim Register
Access Type: Open
Site Attributes: Ceremonial, Meeting Place, Campsite, and Battleground

According to McDonald Hales (2000: 29), the exact location of Aboriginal site Rosa Brook Road remains uncertain. Aboriginal informants maintained that the site is located somewhere along Rosa Brook Road. Since there was insufficient information to locate the site, the DIA placed a 10km x 10km square around it.

Margaret River (Site Id. 4495), is seen as a major mythological site by Aboriginal people in the southwest. However, the initial recording of the site does not discuss the significance of its tributaries. Research by Goode (2003), on the Yarragadee Aquifer has highlighted the fact that nearly all tributaries are seen as a part of the larger river and therefore afforded the same ethnographic significance as the main river itself.

As Darch Brook flows into the Margaret River, the local Aboriginal people interviewed expressed their concern over the fact that Darch Brook is a tributary of Margaret River it is of importance and significance to local Aboriginal people. Therefore, it is important that the landowner and developer are aware to avoid any disturbance to Darch Brook, its associated wetlands and any other tributaries of the Margaret River that exist within Riverslea Estate.

FIELD SURVEY

Previous archaeological research (Dortch 1995:1) has shown that areas of yellow Quaternary dune sand and gravels and not the white leached Holocene sand dunes are most likely to contain archaeological material. Proposed lot 667, contains neither Quaternary nor Holocene dunes being comprised mostly of a low lying peppermint woodland, with a dark loamy soil (see cover photo and Figure 3).

Any archaeological sites or cultural material located during the course of the survey, were recorded in terms of their extent, with their archaeological components described. All archaeological sites and cultural material located were photographed and their location recorded in AMG co-ordinates. All AMG coordinates provided in this report are in GDA 94 format, taken on a Garmin hand-held GPS.

Please **note** that co-ordinates in GDA 94 are similar to those in WGS 84.

RESULTS

It is the authors understanding that the developers of Riverslea Estate intend to construct a pump station within Proposed lot 667, Riverslea Estate, Margaret River. Proposed lot 667 was identified as a suitable location because of its low-lying nature, which assists drainage (gravity fed system) and proximity to further proposed housing subdivisions located to the south. It is proposed that these subdivisions will link into the existing sewerage system and will also use the pump station to be built at Proposed lot 667.

Figure 2: Looking west along proposed southern buffer (existing track), Proposed lot 667, Riverslea Estate.

Two large storage tanks, as well as two enclosed settlement ponds are to be constructed within Proposed lot 667. Associated machinery such as pumps and monitoring bores will also be installed. Any run-off will be collected in a retention basin constructed to the south of Proposed lot 667 (see map in ethnographic report).

Boundary coordinates for Proposed lot 667, Riverslea Estate, Margaret River

NW cnr	323704mE
(Zone 50, GDA94)	6241295mN
SW cnr	323667mE
(Zone 50, GDA94)	6241258mN
SE cnr	323701mE
(Zone 50, GDA94)	6241242mN
NE cnr	323719E
(Zone 50, GDA94)	6241316mN

Proposed lot 667 has been heavily disturbed in the past, mounds of industrial waste such as rubble and scrap metal litter the area. Combined with the poor ground visibility it was always unlikely that any archaeological sites or Aboriginal cultural material would be located (see Figure 3).

During the course of the archaeological and anthropological survey, it became clear that part of the proposed pump station is to be constructed within the margins of wetlands, associated with Darch Brook (a tributary of the Margaret River), which form the southern boundary of Proposed lot 667. This information caused considerable concern amongst all of the Aboriginal informants taking part in the Survey.

Figure 3: Dark loamy (wetland) soil, grounds surface, Proposed lot 667, Riverslea Estate.

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After extensive consultation, it was decided that a (4m wide) buffer between the wetlands and the southern part of Proposed lot 667 would be created along the existing track located close to the southern boundary (see Figure 2).

The proposed coordinates for the buffer to be placed between the wetlands and the southern part of Proposed lot 667 are as follows:

Proposed coordinates for buffer between wetlands and Proposed lot 667, Riverslea Estate

SW cnr	323671mE
(Zone 50, WGS84)	6241254mN
SE cnr	323698mE
(Zone 50, WGS84)	6241260mN

Even though all likely areas (clear areas, streams) were examined in detail, no archaeological sites or Aboriginal cultural material were located during the archaeological survey of Proposed lot 667, Riverslea Estate, Margaret River.

DISCUSSION AND RECOMMENDATIONS

Proposed lot 667, Riverslea Estate, Margaret River is the preferred location of Water Corporation. This is because Proposed lot 667 is low-lying and all sewer pipes from Riverslea Estate, and proposed housing subdivisions located to the south, can be gravity fed to the proposed pump station and then pumped up to the sewerage farm situated close to the town of Margaret River.

Two large storage tanks, as well as two enclosed settlement ponds are to be constructed within Proposed lot 667. Associated machinery such as pumps and monitoring bores will also be installed. Any run-off will be collected in a retention basin constructed to the south of Proposed lot 667 (see map in ethnographic report).

As mentioned previously, during the course of the archaeological and anthropological survey, it became clear that part of the proposed pump station is to be constructed within the margins of wetlands, associated with Darch Brook (a tributary of the Margaret River), which forms the southern boundary of Proposed lot 667. This information caused considerable concern amongst all of the Aboriginal informants taking part in the Survey.

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Even though all likely areas (clear areas, streams) were examined in detail, no archaeological sites or Aboriginal cultural material were located during the archaeological survey of Proposed lot 667, Riverslea Estate, Margaret River.

CONCLUSIONS

Given the fact that the majority of Proposed lot 667, Riverslea Estate, Margaret River has been heavily disturbed in the past, it was always unlikely that any significant Aboriginal sites or cultural material would be located. However as stated previously there has been concern expressed by the Aboriginal informants consulted during the course of the anthropological survey that no disturbance should occur to the wetland associated with Darch Brook (a tributary of the Margaret River), situated adjacent to the southern boundary of Proposed lot 667.

Revised coordinates for the southern buffer between the wetlands and the soluthern part of Proposed lot 667 have been supplied by the Aboriginal informants and are contained within the Results section of this report.

As long as the above concerns are adhered to, I can see no archaeological reasons why Water Corporation should not proceed with their plans to construct a pump station within Proposed lot 667, Riverslea Estate, Margaret River.

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APPENDIX 4

ABORIGINAL HERITAGE SURVEY OF PROPOSED LOT 667 RIVERSLEA ESTATE, MARGARET RIVER, WESTERN AUSTRALIA (BRAD GOODE, 2004)

AN ABORIGINAL HERITAGE SURVEY OF PROPOSED LOT 667 RIVERSLEA ESTATE, MARGARET RIVER, WESTERN AUSTRALIA

A report prepared for Koltasz Smith & Partners upon behalf of The Greendene Development Corporation

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Report submitted February 2004 to

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EXECUTIVE SUMMARY

Riverslea Estate in Margaret River is being developed and built by The Greendene Development Corporation with Koltasz Smith & Partners responsible for all town planning and compliance issues. As a requirement of the planning approval process, the Water Corporation has requested that the developers construct a sewerage pump station to service this area. This pump station is required to be built at the lowest point in the landscape within the development area. This location, proposed lot 667 Riverslea Drive is adjacent to a number of wetlands that are associated with the Darch Brook, a tributary of the Margaret River. Proposed lot 667 is located a short distance to the east of the Darch Brook. The works that are required are to be wholly contained within proposed lot 667. These works will require some clearing of peppermint trees and excavations to a depth of 10 meters to install an underground pump chamber and overflow retention tanks. These retention tanks are required to provide for the containment of wastes onsite if power or mechanical breakdowns cause the pumps to fail. After these works are completed the site will be fully rehabilitated.

A search of the Department of Indigenous Affairs (DIA) sites register on the 17th February 2004 did not locate any previously recorded sites within the boundaries of proposed lot 667. Two registered ethnographic sites were located a short distance to the east of the proposed project area.

Site ID 4494 Rosa Brook Road is described as a meeting place and corroboree ground that could not be accurately located from the records held at the DIA. Because of this, the DIA have put a 10 km buffer over the site which overlays Riverslea Estate. McDonald & Hales (2000) described the site as being located somewhere along Rosa Brook Road east of the Ten Mile Brook dam. From this description, this site is unlikely to be affected by the proposed works at proposed lot 667.

Site ID 4495 The Margaret River is described as a site of generalized religious significance in association with Waugal beliefs. The Margaret River is also a site of specific mythological significance that is associated with Wooditch, a dreamtime figure who created the river by the casting of a magic stick. The works proposed at proposed lot 667 will have no direct impact of this site as it has been previously recorded.

As a result of consultations held with members of the Southwest Boojarah & Harris Family Native Title Claim groups, the wetlands that intersect the southernmost portion of proposed lot 667 has been identified as a site of religious significance in association with Waugal beliefs. The Aboriginal Community have advised that this wetland and the Darch Brook, which is a tributary of the Margaret River should be viewed as components of Site ID 4495 Margaret River. The Aboriginal Community has further advised that all the tributaries and associated wetlands of the Margaret River system should be viewed as components of this site.

With regards to the significance attached to the wetland area at proposed lot 667 the Aboriginal Community have requested that the Greendene Development Corporation modify their plans with regard to the placement of the proposed sewerage retention tanks. Concerns have been raised about damages to the wetland during the construction and also pollution from runoff or spills from waste. In order to protect the integrity of the site the Aboriginal Community have advised that a four meter buffer should be established between the wetland and all earthworks. Any works south of this buffer would require the matter to be considered by the Aboriginal Cultural Materials Committee (ACMC) under Section 18 Application of the Aboriginal Heritage Act (1972).

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AN ABORIGINAL HERITAGE SURVEY OF PROPOSED LOT 667 RIVERSLEA ESTATE, MARGARET RIVER, WESTERN AUSTRALIA

ISSUE

Riverslea Estate in Margaret River is being developed and built by The Greendene Development Corporation. Koltasz Smith & Partners are responsible for all town planning and compliance issues. As a requirement of the planning approval process for the development the Water Corporation has requested that the developers construct a sewerage pump station to service the area. This pump station is required to be built at the lowest point in the landscape within the development area. This location is adjacent to a number of wetlands that are in association with the Darch Brook, a tributary of the Margaret River. Proposed lot 667 is located a short distance to the east of the Darch Brook. Prior to the construction of this pump station the Water Corporation have requested that the developers ensure that the plans are compliant with all their obligations set out under the Aboriginal Heritage Act (1972).

REPORT OBJECTIVES

To identify if there are any Aboriginal Heritage issues with the chosen location of the sewerage pump station at proposed lot 667 Riverslea Estate, Margaret River.

To record any archaeological or ethnographic sites within proposed lot 667 Riverslea Estate, Margaret River.

To generate consentual recommendations from the Aboriginal community on how sites and/or heritage issues can be managed in order for the developer (The Greendene Development Corporation) to be able to comply with their obligations set out under the Aboriginal Heritage Act (1972).

BACKGROUND

In January 2004, Mr Peter Gleed from Koltasz Smith & Partners made contact with the consultant and requested some preliminary advice as to the likely need for an Aboriginal Heritage Survey to be conducted at proposed lot 667 Riverslea Estate, Margaret River. Mr Gleed provided the consultant with a project plan and a locality map with the coordinates for a large polygon that took in a significant portion of Riverslea Estate and proposed lot 667.

Mr Gleed stated that proposed lot 667 was an area of peppermint woodland that was already partially parkland cleared and in a disturbed state from previous activities. Mr Gleed further stated that all the works required were to be wholly contained within proposed lot 667 and that some clearing and excavation would be required to build a sewerage pumping chamber and sewerage retention tanks. These retention tanks area required to provide for the containment of wastes onsite if power or mechanical breakdowns cause the pumps to fail. After these works are completed the site will be fully rehabilitated.

Mr Gleed stated that proposed lot 667 borders upon a wetland that is drainage area (soak) that is connected to the Darch Brook, a short distance to the east. Mr Gleed further stated that at present there are no plans for these works to impact upon this wetland, and that all works within proposed lot 667 would be located approximately 25 meters to the north.

Based upon the information supplied from the proponent Koltasz Smith & Partners, the consultant has conducted a site register search of the area and has also forwarded a copy of the information brief to Ms Monique Pasqua, Senior Heritage Officer at the Department of Indigenous Affairs (DIA) in Perth for comment and advice.

The results of the register search has identified that Site ID 4494 Rosa Brook Road's, buffered extent overlays the development area. Site ID 4495 The Margaret River is also located a short distance to the east of Riverslea Estate.

Advice from the DIA, Ms Monique Pasqua was that due to the works area's proximity to a wetland that contact with and comment from the Aboriginal community should be sought before development proceeds.

As a result from this advice, Mr Peter Gleed from Koltasz Smith & Partners has commissioned Brad Goode Consultant Anthropologist to conduct an Aboriginal Heritage survey of proposed lot 667 Riverslea Estate, Margaret River. This survey would include an archaeological inspection and onsite consultations with members of the South West Boojarah and the Harris Family Native Title Claim groups.

LOCATION

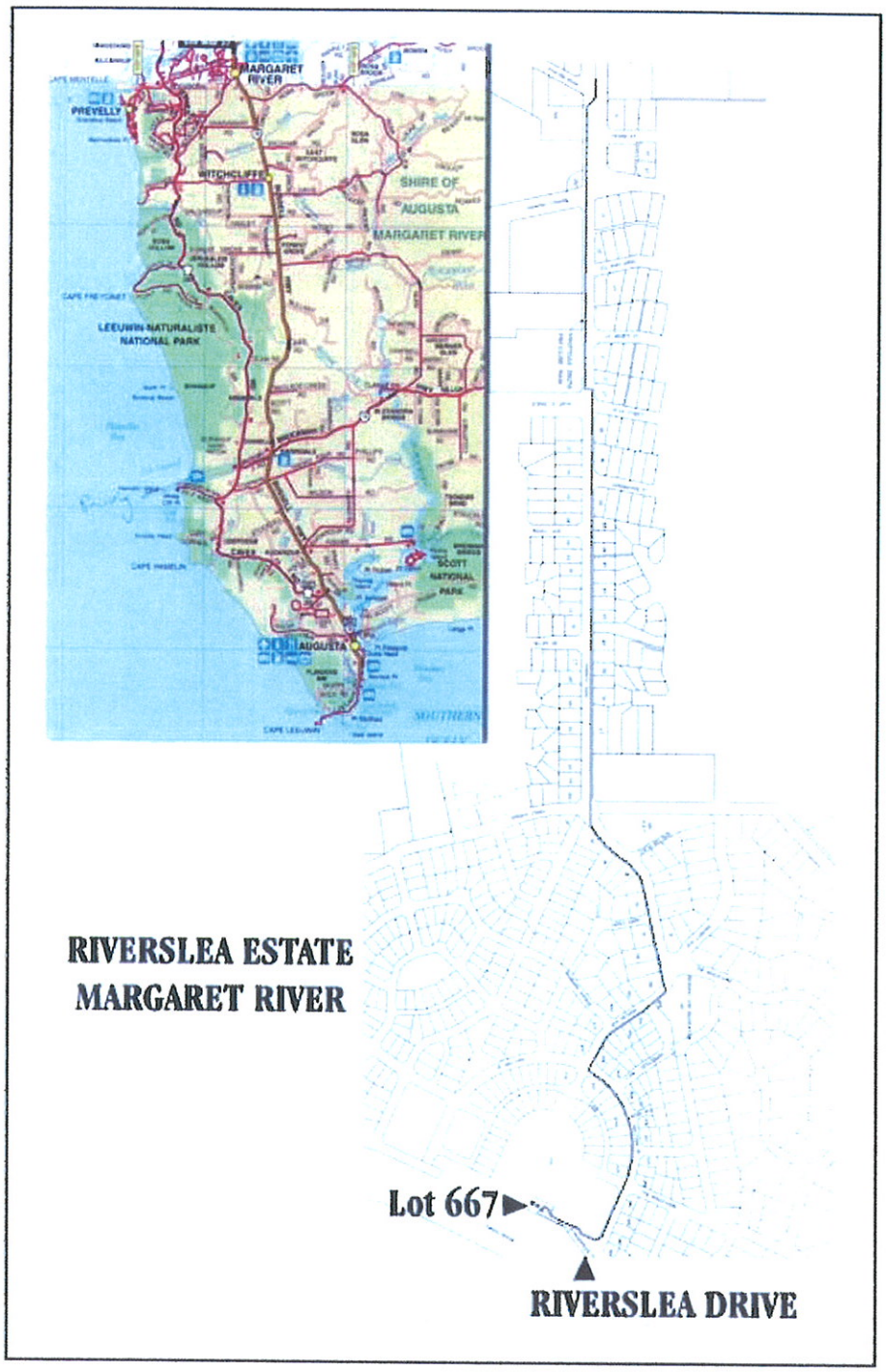

Figure 1. A Map showing the location of Proposed lot 667 Riverslea Estate Margaret River

ETHNOGRAPHIC BACKGROUND

TRADITIONAL NYUNGAR CULTURE

The south-west of Western Australia is considered to form a distinct cultural bloc defined by the distribution of the Nyungar language. Before Nyungar was used as a group or linguistic name the south-west people recognised themselves, their language and culture, as 'Bibbulman' (Bates, 1985). Daisy Bates writes that the Bibbulman people were the largest homogenous group in 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). Bates also mentions that over seventy groups that shared a common language and some local variations occupied the Bibbulman area.

> "All coastal *Bibbulmun* were *Waddarn-di* – sea people, and called themselves, and were called by their inland neighbours, *Waddarn-di Bibbulmun*. 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 1985:47).

Tindale (1974) identified thirteen 'tribal groups' in the south-west based on socio-linguistic boundaries and minor dialect differences. He describes the *Piblemen Bibbulmun's* territory as 'the lower Blackwood River, chiefly on the hills between the Blackwood and the Warren Rivers, east to the Gardner River and Broke inlet; on Scott River; inland to Manjimup and Bridgetown'. The *Piblemen* people maintained a number of paths between the Vasse area in the north and Augusta to the south, and as far as Bridgetown to the east, that followed the Blackwood River.

The Nyungar or Bibbulmun people of the south-west were a distinct group in that their initiation practices varied markedly from their desert and semi-desert dwelling neighbours. Unlike the desert people, the Nyungars did not practice circumcision or sub-incision, but rather practiced a ritual of nasal septum piercing and ciatricision of the upper body (Bates, 1985). The people who followed these socio-religious practices have been described by Berndt and Berndt (1979), as being of the 'Old Australian Tradition'.

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: *Tondarrup, Didarruk* and *Ballaruk, Nagarnook* (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..." (Bates 1966:24-25).

Each socio-linguistic group, sometimes referred to as the 'tribe', 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 themselves 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 and which may be 'owned' by either an individual, by the group or by part of the 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, 1994:124).

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 Aborigines 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. 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 recognized 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)

Traditionally, the Bibbulmun Nyungar people recognized six different seasons in the year. Each of these seasons coincided with a particular seasonal abundance of a wide variety of food resources. Fish traps such as the well documented Barragup Fish Trap were used to catch large migrations of estuarine and river fish. These fish traps were so efficient at providing food that they formed the basis of regular meetings between neighbouring groups and were a focus of cultural activities (Contos et al 1998, Bates 1985). Spears *Gidji-garbel & Gidgie-borryl,* axes *Kadjo* and digging sticks *Wonna,* were used to hunt and procure food (Berndt 1979, Tilbrook 1983). Trees known to contain bird's nests or possum hollows or to have hives with native honey

in them had notches cut into their trunks to facilitate climbing. The Bibbulmun Nyungars had an extensive knowledge of plants for both food and medicinal uses (Bird & Beeck 1988, Meagher 1974).

SETTLEMENT AND SOCIAL DISRUPTION

Prior to settlement in Western Australia, the Dutch and the French, as well as sealers and whalers of mixed nationalities, had already landed and made contact with the local Aborigines. From the beginning of the 17th century the Dutch had been sailing north along the Western Australian coast en route to the Dutch East Indies, and ships were often forced close to the coast by the prevailing southwesterly winds. Many who realized their proximity to the coast too late came to grief there. The early reports by the Dutch described the coast as a bleak and desolate place. Apart from some expeditions to try and rescue shipwrecked sailors, the Dutch showed little interest in Australia (McDonald et al., 1994).

The Dutch flute *Elburgh* is reported to have recorded the first brief description of the Aborigines near Cape Leeuwin in 1659:

> "An armed party sighted three Nyungar Aborigines wearing kangaroo skin cloaks. At the sight of the European sailors, the tribesmen ran off into the bush leaving behind spears and small axes" (Cresswell, 1989).

Contacts were also made by the whalers and sealers who visited the coast to take on water. The sailors were also interested in the local females, and this interest was discovered by the first settlers to the Augusta region when the local Aboriginal group used the English word 'woman' when referring to females (Shann, 1926). Two further items point to considerable pre-colonization contact with whalers, the first being that in 1827, Major Lockyer of the Albany garrison 'reported incidents of Aboriginal women being found on offshore islands, kidnapped and then abandoned by the sealers'. Secondly, when the first French and British expeditions of the late 17th and early 18th centuries did contact local Aborigines, they reported that while the men were approachable and friendly, they kept their women and children hidden or some distance away (Colwell, 1970).

The first 'settlement' in Western Australia was the establishment of a garrison of soldiers at King George Sound in 1827. In 1829 the Swan River colony was founded and the settlement of Augusta took place in 1830. Initially relations between the Aborigines and the settlers were friendly, the Nyungar people showed the settlers to water sources and the Europeans shared game shot while being guided by the Nyungar men (Shann, 1926). On the 1st of May 1830, the schooner *Emily Taylor* dropped anchor in Flinders Bay close by what is now Augusta. On board were the first settlers who were to create the town of Augusta, the Molloy, Bussell and Turner families and their servants, Dr Green, Sgt Guerin and a detachment of soldiers (Pickering, 1929; Turner, 1956). Horses, cattle, machinery, merchandise and general stores of every description were rafted ashore through the surf. Turner (1956) recounts:

> "While these strange operations were being enacted, natives lurked curiously in the background, watching every movement; it was something entirely new to them. The natives were timid and shy, but to cover this they 'simulated rage,' gesticulated and jabbered at the intrusion on their domain; but the settlers advanced, calling 'abba abba' and some of the few aborigine words they had already learned, and by offering

> a few trinkets and with friendly signs they soon established peace, and some natives led them to a 'soak', no doubt the spring so often referred to later" (1956:89).

Berndt (1979) suggests that the Aboriginals believed that the first European settlers, because of their light skin colour, were souls of the dead (*djanga*) returned from *Kurannup*, the home of the Bibbulmun dead located beyond the western sea. He describes:

> "...the *kanya* (soul of the newly dead) going first to the tabu-ed *moojarr* or *moodurt* tree (*Nuytsia floribunda* or Christmas tree), where it rested on its way to Kurannup...here, their old skins were discarded and they appeared 'white'" (1979:86).

Many of the tracks created by the Nyungar people were used by the early settlers to explore the land and eventually to create the basis for roads upon these tracks, many of which still follow similar alignments. Not only do the original paths used by the Nyungar people often coincide with existing road alignments but often link traditional areas of importance which are now the location of townsites (Collard, 1994). Augusta, Busselton and Bunbury, formally known as *Talanup, Yoonberup* and *Koombanup* by the Nyungar people, were important regional areas providing good hunting and food gathering opportunities. The settlers in Augusta employed the local Nyungars as guides and trackers and used the Nyungar paths through the bush to reach the Vasse district (Jennings, 1983).

In November of 1833, Georgina Molloy wrote to a friend in England that the Aborigines in Augusta were 'fond' of the settlers, and that the settlers and Aborigines lived "on the most peaceful terms". In the same letter, which took four months to complete, she writes of "being troubled with natives who, though amiable, required watching in case of theft" (Pickering, 1929:47). Whilst relations between the settlers and the Aborigines began amiable, pilfering of food and implements soon tested this. Early in 1834, an incident occurred in which a group of around 30 Aborigines attempted to intimidate Mrs. Molloy and Fanny Bussell whilst Captain Molloy and other male members of the settlement were absent. The Aborigines attempted to take a tablecloth and some potatoes before Mrs. Molloy's servant Dawson (the only male present) produced a pistol and a rifle that scared the aborigines off. From the Molloy house the Aborigines went to Miss Bussell's house from where they took three salt sellers. The Aborigines valued glass (*dillilah*) for pointing their spears. When the theft was discovered the settlers had the garrison of soldiers apprehend the Aborigines. There was an exchange in which the soldiers either threatened to shoot or to bayonet the women or woman responsible (the two accounts from Mrs. Molloy and Miss Bussell vary in detail). The salt sellers were recovered without any actual violence-taking place, yet it marked a significant worsening of relations between the Aborigines and the settlers (Pickering, 1929; letter of Fanny Bussell dated 16/2/1834). Georgina Molloy wrote of the incident:

> "I am sure if Dawson had not been present, Mrs. Dawson and I and the poor children would have been murdered or otherwise injured, for it seemed that mans full intention to prevent me leaving my own premises. It gave me a great fright" (Pickering, 1929).

In 1837, three Nyungar men were killed as a repisal for the theft of a heifer, in the same year a house belonging to the Turner family in Augusta was burnt to the ground and the Government store was raided (Jennings, 1983). As the settlers expanded their farming operations and took up more and more land, the pressure on the Nyungar people increased as the two lifestyles met. Cattle were speared and settlers attacked. Reprisals led to resentment and conflict replaced the early good will. On June 28, 1837, Lennox Bussell wrote a letter to Captain Molloy in Augusta

describing the killing of three Nyungar men as a reprisalfor the Aboriginal people taking a heifer (Jennings, 1983). On July 9, he wrote again to Captain Molloy about the reprisals.

> "....I do not view the present daring outrage (The *taking of the heifer*) as a mere breach of the law but as an act of open hostility and defiance... we have inflicted upon the offenders the only adequate punishment in our power... Let us first convince them of their inferiority and then extend to them our protection and it will be gratefully accepted, otherwise with the vanity inherent in a savage, they will fling back the proffered gift and considering every act of forbearance a confession of weakness and inability, will cause in their final subjection which sooner or later must be effected, a sacrifice of life on both sides double or treble to what would have befallen if severer measures had been adopted from the first" (Letter to Captain Molloy from Lennox Bussell, dated July 9, 1837, cited in Jennings, 1983).

As the settlers demand for labour increased, Aboriginal people were employed as farm labour and domestic help in exchange for goods such as flour, sugar and tobacco. The Aborigines became increasingly dependent on these European food supplements and, whilst still practicing some aspects of their traditional economies, the traditional lifestyle of the Nyungar people may have ended as early as the 1860's (Berndt and Berndt, 1979). This relationship between the settlers and the local tribes spelt the beginning of the end for the Aborigines 'fully traditional economies' (Moore, 1989).

Hamelin Bay became a port for ships loading timber cut in the Karridale area in 1875 when Willie Eldridge was granted a fourteen year lease to cut timber in a 75000 acre area around Augusta-Hamelin. There were no facilities to load the ships and the timber was towed into the water by oxen and then loaded onto lighters (sailing barges) to be loaded on the ships. After losing one ship and cargo, and unable to find either markets or financial backing, Eldridge was forced to admit defeat. He was, however, responsible for erecting buildings, building roads and establishing Hamelin Bay as a shipping harbour and base for a business (Creswell 1989). Maurice Cole Davies followed Eldridge in expanding the timber industry in the region. M C Davies took over Eldridge's expired lease in 1878 and in 1881 had laid a rail line linking Boranup and Hamelin Bay, in 1882 construction began on a 1800 foot long jetty at Hamelin Bay. Many miles of rail line were laid linking mills to Hamelin Bay, which rapidly became a thriving port. In 1885 Hamelin Bay was a 'considerable township'. Around 1895 the Cape Leeuwin lighthouse was commissioned and completed in 1896. One person known to have worked on the lighthouse was Joe Hill who was an expiree (a convict who had served his time) employed to drive a bullock team carting stone (Cresswell 1989). Mr Joe Hill is a European ancestor of several Busselton Nyungar families. M C Davies successfully tendered for the construction of the original Alexander Bridge was 400 feet (122 meters) long and seventeen spans wide. The original bridge was located a short distance upstream from the present bridge and much of its structure survived until 1982 when a summer flood destroyed it. It's location has been a popular picnic and bream fishing spot for many years (Cresswell 1989). As a shipping port and timber town, Karridale and Port Hamelin lasted around 35 years. By 1910, most of the best timber in the area has been removed and the mill at Karridale has closed. With the mill closed, Karridale almost disappeared overnight (Cresswell 1989). As work on the timber mill finished, the Nyungar people who worked there moved with the industry to other locations. Busselton and the Geographe Bay area also provided other employment opportunities.

> "In all likelihood the Aboriginal population of the area was attracted to the towns, timber camps and homesteads between the 1860's and 1880's, although as suggested above, a certain degree of mobility may have been maintained with Aboriginal

> people traveling as itinerant seasonal labourers. Mervyn Longbottom, a long time resident at Darradup, recalled that about the turn of the century there were still Aboriginal groups moving about that area, using traditional foods and camping places. Although they still had some traditional tools, they had European clothes and no longer wore skin cloaks. He also recalled that two hundred or so Aboriginal people would annually pass across the Darradup ford en-route to visit a 'king' at Karridale" (Hallam 1977 in Gibbs, 1989).

Aborigines were seen throughout Western Australia as a convenient source of labour which required little, if any, payment for work, even though the early settlers often relied on the extra labour the Aborigines were able to provide to establish European farming techniques. During the course of a parliamentary debate in 1883, John Forrest stated that, 'Colonization would go on with very slow strides if we had no natives to assist us' (Goddard and Stannage 1984). In 1898, John Forrest wrote a circular to the Aborigines department stating the 'care and protection' of Aborigines had now 'developed on the Government' and that, while the Government and its bureaucracies must provide help to aged and sick Aborigines, it was to be given'with due regard given to the practice of strict economy'. In the same circular, Forrest takes care to point out that 'no able bodies natives who can provide for their own maintenance should receive rations' (Battye Library Busselton Court House records. ACC #594).

Missionary work had begun as early as 1840, and in 1841 the Reverend George King went 'amongst the blacks and collected eighteen children' aged between five and ten. It was his belief that the children could be 'civilized' only if they were kept away from 'the dark influences of the wandering tribe' (Barley 1984). The missionaries took children from their parents and interfered with traditional marriage arrangements in order to remove their 'converts' from the influences of traditional Aboriginal culture.

The hardships facing the Aboriginal people steadily increased as their mode of life clashed with European notions of farming. Some settlers complained about Aboriginal hunting and fishing practices. Fish traps such as those at Wonnerup and Augusta were traditionally very important to the Nyungars, providing a means to feed large numbers of people. The fish traps were often the reason Nyungars visited certain locations, to take advantage of seasonal runs of fish, which provided enough food to enable large ceremonial gatherings. The settlers destroyed many fish traps in an effort to discourage Aboriginal people from coming onto land which was being farmed or otherwise occupied by the settlers. The weir type fish traps built by the Nyungar people were also sometimes a hazard to navigation and destroyed because of this. In 1899, the Government passed a law prohibiting the building or use of fish traps which caused a considerable blow to the traditional Nyungar economy (Tilbrook, 1983).

During the late 1800's and early 1900's, the Government passed a series of Acts which increasingly eroded the Aboriginal people's civil liberties. The Industrial Schools Act (1874) empowered managers of Aboriginal Missions to keep Aboriginal children to the age of 21 and place them as domestic servants or apprentices without their parent's permission. The Aborigines Protection Act (1886) introduced controls over Aboriginal employment. In 1889, the Constitution Act was introduced, it specified that 5000 pounds or 1% of the annual colonial gross revenue, whichever was greater, was to be used to provide for the Aborigines. The Aborigines Act (1897) repealed the Constitution Act (1889) and transferred control of Aboriginal affairs to the West Australian Government, which acted through the Aborigines Department, formed in the same year. Following the Roth Royal Commission in 1904, in which Roth described the Western Australian Police's treatment of Aborigines as 'most brutal and outrageous' and described the conditions experienced by many Aborigines as 'resembling cruelties committed in the Dark

Ages', the Aborigines Act (1905) was introduced (Haebich 1988). The Aborigines Act (1905) allowed the Government to remove Aboriginal people to live in mission camps such as Roelands and Carrolup, and to control many aspects of their lives including marriage and employment. Other hardships for the Aboriginal population included the Dog Act (1885), which forced Aborigines to license their dogs or risk their destruction. As the Nyungar people used the dogs to aid in hunting and providing for themselves, the Dog Act (1885) represented a blow to their means of survival.

Nyungar people adapted to the new conditions as best they could, obtaining mostly short term seasonal work as stock workers, domestic help, farm labourers and foresters (Haebich 1988).

Fringe camps occurred on the outskirts of towns as Aboriginal people followed 'runs' from one area of seasonal employment to another. Many Aboriginal people lived in the bush between jobs, surviving on whatever game or bush tucker was seasonally abundant (Tilbrook 1983). Those Aborigines who were working as farm labour and domestic help found that competition for employment increased suddenly with the influx of people attracted to Western Australia during the gold rushes of the 1880's and 1890's (Tilbrook, 1983).

Further inequity saw the Aboriginal unemployed receive a lower sustenance rate than the white unemployed during the Depression of the 1930's. Living more or less permanently in fringe camps, seeking out seasonal employment and supplementing their diet with game, fish and some bush tucker was a lifestyle which predominated for the Aboriginal people late into the 1960's (McDonald, Hales & Associates, 1995). In 1965, when two Busselton Nyungar families were moved from 'miserable primitive humpies' to government housing, the newspaper article which reported the move stated that, "although the men were hard and conscientious workers, they had never been able to secure *permanent* employment" (West Australian 29/4/1965). Many of the southwest's Nyungar people have lived in fringe camps at some time during their life, creating a living for themselves doing seasonal work and often supplementing their diet with fresh caught fish from the ocean.

In recent years, Nyungar culture has transformed itself and is currently in a process of 'cultural revitalization'. The Aboriginal Heritage Act, passed in 1972, has resulted in an increased interest in archaeological surveys in the southwest. Initial European settlement and the years that followed caused massive social disruption and a loss of nodal knowledge, individual and family stories, which create the Nyungar spiritual landscape. This has resulted in a low number of ethnographically significant sites in the area. Due to this paucity of ethnographic sites, local Nyungars have tended to place a greater significance on archaeological sites than Aborigines in other parts of the State, as the sites are seen as an important, tangible link to past Nyungar culture. Bestowing ethnographic significance on archaeological sites that current generations were not aware of has been described as part of the process of 'cultural revitalization' that is, a reinterpretation and a transformation of Nyungar culture (O'Connor, et al., 1995; McDonald, Hales & Associates, 1995).

WATER AND ABORIGINAL SIGNIFICANCE

There is no doubt that water, especially fresh water was of vital importance to traditional Aboriginal people, the rivers and pools were a source of food, linked campsites along walk tracks and in the case of the Blackwood River defined the territories or estates of the *Pibbelmen* and *Wardandi* people (Hallam 1979). As the Blackwood River, particularly in the lower reaches created an impassable barrier to people without boats the places where the river could be crossed created an intersection of tracks and as such became focal points of traditional activity (Gibbs

1989). Fish traps were located on creeks, in rivers and in the tidal zones of estuaries, as these were an efficient and abundant source of food these also created focal points for traditional activity.

> "It should also be recognised that a large number of Aboriginal names have been perpetuated in modern maps, although their original contexts and meanings are unknown. An examination of older maps, such as the 40 chain series held in the Battye Library, do not reveal much more detail, although a limited number of specific features, *especially springs and watercourses*, do have Aboriginal names indicated." (Gibbs. M. 1995)

Archaeologists have confirmed that all water sources were important to traditional Aboriginal people and have recognized there is a higher likelihood of finding artifacts around freshwater sources, lakes and estuaries. Dortch (2002) has investigated a model of hunter-gatherer socio-economic and territorial organization in the southwest coastal regions. The distribution of topographical features such as estuaries, rivers and wetlands would have had a bearing on the population distribution; "rivers, wetlands and lakes, dune fields, escarpments and other topographical features that certainly would have influenced the positioning of estate boundaries and band foraging ranges *are left out*" [of his model] (Dortch 2002).

> "Archaeologists and Anthropologists generally agree that prehistoric land use patterns were based on the seasonal migrations between the coastal plain and its hinterland to exploit the various food and water resources. There is a tendency, in all parts of the project area, for sites to be located near the various water sources, such as rivers, creeks, lakes, swamps and estuaries. Based on the existing information, the most important river systems in the project area are the Busselton Drainage Basins, Margaret River and the lower Blackwood River. The construction of dams on the rivers of the project area has the most potential to disturb archaeological sites compared to the development of bores to tap groundwater sources. However the latter has implications for ethnographic sites because of the potential alteration to the water table." (O'Connor et al 1995)

Several early writers recorded parts of the Aboriginal mythology about water in the southwest. Clearly a lot of knowledge and stories have been lost in the years since settlement and no complete record of traditional mythology was ever made. Many of the European observers did note the importance of water to the traditional people and that water also occupied a place in the traditional mythology. The small parts of mythology recorded and references to the *Waugle* or a snake like spirit of water are widespread both throughout the south west of Western Australia and other parts of Australia. Bates (1966) recorded that in the southwest. Their only deity was a *woggal* or serpent-god, that dominated the earth, the sky, the sea, and punnished evil doers"

> "All permanent native waters have legends attached to them, legends of the "dream" time, which go back to the days when birds and animals possessed human attributes, or were human beings, or were groups of which the bird or animal was representative, or were magic animals and birds possessing the power of human speech. The natives cannot say that the "founders" of the various permanent waters were altogether human, although birds or beasts, or half bird half human, but the bird or animal name only is always given in the legend never a human name." (Bates D. 1966 p. 157)

Another reference to the *Waugle* or snake like spirit of water was recorded by Salvado (1850) and indicates the fear or reverence with which Aboriginal people regard the spirit of water and also the harmful powers of the 'serpent'.

> "If the natives are afraid to walk about at nighttime, for fear of Cienga, they dread even more going near large pools of water, in which they believe there lurks a great serpent called 'Uocol' [Waugal], who kills them if they dare to drink there or draw water during the night. A large number of natives came to me one evening asking for water. The first ones took all I had and drank it, and the others, about fifteen of them, asked me to go to the pool nearby to get some for them. I showed them the bucket and told them to go themselves. They all fell silent, and no one dared take the bucket, or tell me what they were afraid of, until, about an hour later, one of them said respectfully: 'N-alla cape uoto, chetchet cuaragn: nunda uoto quaragn iuad' (If we go and take water, very soon we will be killed, but if you go, you will be alright). I saw quickly that they had some superstition on the subject, and said that I would go with them, with the idea of banishing their false fears. As we went to the pool or stream, they made me go ahead, and all followed me in single file, in deep silence. While they were quenching their thirst, I started to move away, but immediately they shouted, 'Nanap, nanap' ('Stop, stop'), fearing that I was going to leave them on their own. As we began to go back to the hut, they ran ahead and preceded me, again in single file, so that I came last. When I reproached them for their superstitious ideas, they replied condescendingly: 'Nunda tonga but' ('You don't know anything about it'). However much the natives of both sexes like to swim 'dog-paddle' style in summer, they will never go into water that is dark and deep, because they say that the serpent Uocol is there, and they are afraid of him even during the daytime." (Bishop Salvado 1850 in Stormon E.)

Salvado (1850) recorded that the Aborigines 'hide carefully from strangers their customs and, in particular, their beliefs'. Moore (1842) described the *Waugle* as a 'huge winged serpent' that lived in dark waters and was feared as a harmful force. A woman who fell ill or miscarried during a pregnancy was called *Waugalan.* The *Waugal* is of particular danger to pregnant women and so associated with fertility if in a harmful rather than replenishing manner.

Not all of the stories regarding the creation of water sources or rivers in the southwest and wider Nyungar country involve the *Waugal* or snake like spirit of water. In a story regarding the creation of the Margaret River a magic stick is the means of transformation or creation of the Margaret River. Another story that is believed to have been recorded in the Kojonup district tells of a crow and a hawk creating a fresh water soak.

> "...Dinah, the mother of the late, distinctive Ted Smith, told (him) this legend of the Kojonup district. The country was gripped in drought and the only known water was salty. The health of the parched Aborigines, birds and animals deteriorated. An eagle-hawk, soaring about the sky and swooping to earth, observed that a fat and shiny crow had a wet beak, wet with fresh water. The eagle-hawk, seething with unparalleled fury, attacked the cunning crow. In so doing his claws split the rocks and the blood of the attacked crow was splattered over the surrounding rocks and earth. So, a fresh water soak is to be found in the Wakhinup area, hidden amid rocks and surrounded by rich, red loam." (Bignell M. 1971).

Radcliffe-Brown (1926) wrote about 'the Rainbow Serpent Myth of Australia' he wrote that throughout Australia there is a belief in 'a huge serpent, which lives in certain pools or water holes'. He wrote that the serpent was sometimes associated with the rainbow, it could also occur

or be seen as " a wavy dark shadow" in the Milky Way. Certain commonalties exist in the myth of a serpent type creature that has creative and punitive powers and that lives in dark or deep pools of water. Radcliffe-Brown points out the similarities of this widespread myth although throughout his article he refers to different names and different attributes of the 'Rainbow serpent'. (It is drawing a long bow to see a dark line in the Milky Way as a rainbow although it does point to the presence or representation of the 'serpent' in the sky as well as the water and landscape).

> "Crossing now to Western Australia. I have been able to trace the belief in the rainbow-serpent, living in deep, permanent water holes, through all the tribes from the extreme southwest at least as far north as the Ninety Mile Beach and eastward into the desert. In the tribes around Perth it is called *wogal*, and certain water holes are pointed out as being each the abode of a *wogal*. It is regarded as dangerous for anyone except a medicine man to approach such a water hole, as the serpent is likely to attack those who venture near its haunts. "It generally attacks females, and the person whom it selects for its victim pines away and dies almost imperceptibly. To this creatures influence the aborigine's attribute all sore and wounds for which they cannot otherwise account." (Radcliffe-Brown 1926).

The notion of a serpent type deity associated with water also occurs throughout the northern and eastern parts of Australia. In these areas the deity is known as the Rainbow Serpent, it is the spirit of water, rain and flood. As a spirit creature it had excavated the beds of the rivers during its travels. It had 'reached down from the sky to the waterholes and pools, bringing water to the earth'. Throughout Arnhem Land and the Kimberleys the Rainbow Serpent is associated with other myths regarding fertility and is sometimes regarded as male at others as female (A.W. Reed 2001). Other similarities with the *Waugle* or *Marchant* include the Rainbow Serpent having powers to harm, particularly those who offended against it.

> "In the beliefs of many Aboriginal tribes, the rains would dry up, the earth would become parched, and life would cease to exist if it were not for the Rainbow Serpent." (Reed, A.W;2001).

Mudrooroo, an Aboriginal writer who has lectured at several Australian Universities offers a contemporary story about the *Waugle* placed in a modern context. The story deals with current social and environmental issues for Nyungar people and the wider community.

> "...this is a story about a big snake. European people do not like snakes. They think that they are bad and good for nothing, but to the Nyoongar people, the ancestor of all the snakes, the Waugyal, was not only good, but long ago made all the rivers and hills and valleys in South Western Australia. The rivers are the tracks he made as he twisted his way along. One of his tracks is the Swan River where this story happened. But before I begin our story, first of all I would like to say that after Waugyal had made everything, he went to sleep in a deep part of the river. And he is still there today. Perhaps I should say he *tries* to sleep, for these days there is too much noise and when he is disturbed, he becomes angry and restless and causes trouble. Sometimes he makes all the fish go away and other times he causes boats to capsize. He does not do these things because he is bad, but because people are bad. I'll tell you one thing about the Waugyal. Watjelas have studied us and have found that Aborigines all over Australia respect snakes, and they have joined up all these stories about snakes and made something called a rainbow serpent. They say and even tell us that the Waugyal is a rainbow serpent, whatever that

> is. But he isn't. He is a big hairy snake that made the rivers and hills and valleys and then, after he had done this, went to sleep in the deep part of the river. If he is any colour he is black, but when we tell them this, they say he is a Rainbow Serpent and refuse to listen." (Mudrooroo *A Snake Story of the Nyoongar People – a Childrens Tale,* in Giblett & Webb 1996)

Ethnographers and anthropologists continue to debate the importance of the *Waugle* or water spirit snake to Nyungar people. Some observers believe that so much of the knowledge about the *Waugle* mythology has been lost, and that what is currently retained by the Nyungar community is severely fragmented. Few stories about the *Waugle* or water spirit/snake are associated with particular places or features. Most places Aboriginal people identify with the *Waugle* do not have a story or explanation to accompany them.

While Bates (1985:221) reports that the 'woggal' [Waugle] "made all the big rivers of the Southwest" and "wherever it traveled it made a river" she does not indicate that all of the watercourses are of the same mythological significance. Rather, Bates (1985:221) notes: "the places where it camped (stayed, entered the land) in these travels were always sacred". That is these earlier reports referred to specific or "certain" places (Bates 1985, Radcliffe- Brown 1926). Moreover, the Waugle now does not generally seem to have the same evil or avoidance/sacred (*winnaitch*) qualities as found in earlier reports. In these circumstances most Nyungars reporting the presence of the Waugle are unable to provide any localised or contexted mythological/ritual/ ceremonial information with regard to the majority of reported Waugle sites. The Waugle is now essentially only the benign bringer of water. (McDonald; 2000).

The Aboriginal Communities views had changed over time. Historically the *Waugal* was both a creative and punitive spiritual force that inhabited deep pools and created other features of the landscape such as hills, where it traveled. In contemporary times the *Waugal* has become or is seen to be present in all water bodies – it is the benign 'bringer' of water. This change of view is largely based upon Aboriginal people now not knowing the traditional mythical stories but attributing significance by reading the country and assigning general significance. (Villiers 2002). McDonald describes the *Waugle* as having changed or been lessened in meaning, from an entity that made all of the rivers to a benign bringer of water. Although Bates recorded that the *Waugle* made all of the rivers and watercourses in the southwest it was the places where it had camped or where it lived in the land which were the sacred or were *winnaitch* areas. McDonald would seem to be suggesting that these places are of greater mythological significance than the other parts of the watercourses. This point of view explains the *Waugle* as being seen in a different way than that recorded by early European observers – Bates and Radcliffe-Brown can be contrasted with another view that sees the *Waugle* as a force in the present tense. Other contemporary observers have recorded the *Waugle* as a more complex entity and associated with a wider belief system.

> "The Waugle is not *just* a mythic serpent, an Australian version of the Loch Ness Monster. The Waugle is not *just* a totemic ancestor. The Waugle is not *just* a spiritual being, a semi deity. The Waugle is indeed all of these but is, more fundamentally, a personification, or perhaps more correctly *animalization*, of the vital force of running water." (O'Connor et al. 1989)

ARCHIVAL RESEARCH

Archival research involved an examination of the Department of Indigenous Affairs (DIA) sites register, a review of the relevant site files and a review of any ethnographic and archaeological reports relevant to the Riverslea Estate area.

SITE REGISTER SEARCH

A search of the Department of Indigenous Affairs (DIA) sites register on the 17th February 2004 did not locate any previously recorded sites within the boundaries of proposed lot 667. Two registered ethnographic sites were located a short distance to the east of the proposed project area. The name, type, and indicative location of the registered sites are shown in table 1.

Table 1 Summary of registered Aboriginal heritage sites located.

SITE Id No.	Name	LOCATION (MGA Zone 50)* EASTING	NORTHING	SITE TYPE
4495	Margaret River	337007mE	6246112mN	Mythological
4494	Rosa Brook	325139mE	6245147mN	Ceremonial

* Please note: Co-ordinates 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, particularly if access to specific site information is tagged as 'closed' or 'vulnerable'.

REVIEW OF RELEVANT SITE FILES

Site ID 4495 (S2614) Margaret River - AMG Coordinates 340000mE 6244000mN
Smith & McDonald first recorded the Margaret River as a mythological site in a survey of the Ten Mile Brook Dam for Main Roads WA in 1989. In this report the Aboriginal informants noted "While it was reported, the Margaret River was thought to once have had a Waugal, the Ten Mile Brook was not reported to have any significance". (McDonald 1989:14)

In a survey undertaken for a housing development at Sussex Location 972,412 and Lot 1 Burnside, the Margaret River was also reported to have mythological associations to a dreamtime ancestor known as "Wooditch". This ancestor was known to have created the Margaret River by casting a magic stick. In this report other Aboriginal consultants reported the Margaret River to have a Waugal. (McDonald 1989:30-2)

As a result of these reports the Margaret River was assessed by the ACMC as a site under Section 39.2(b) and 39.2(c) and under Section 5c "Sacred Beliefs" to be a site and placed upon the permanent register. This determination was made at Meeting 1687 on the 7/8/2001.

Site ID 4494 (S2613) Rosa Brook Road was recorded by McDonald Hales & Associates in November 1989. The site which is a meeting place (corroboree ground) is located somewhere along Rosa Brook Road. The informants could not accurately locate the site but it was though to be east of the Ten Mile Dam. The sites verification project on the 14.02.1998 assessed that there was insufficient information to list this report as a site and recommended that the file be moved to stored data.

REVIEW OF RELEVANT REPORTS

McDonald Hales & Associates 2000. *Report of an Aboriginal Heritage Survey of the Proposed Margaret River East Bypass.* Prepared for SMEC Australia upon behalf of Main Roads WA.

In May 2000 McDonald & Hales conducted an Aboriginal Heritage Survey for the Margaret River East Bypass. The results of this survey identified that the Margaret River Site ID 4495 would be impacted upon and that Site ID 4494 Rosa Brook Road could not be accurately located from the information held at the DIA. This survey also mentioned that an unnamed creek that crossed Darch Road was reported by the Aboriginal consultants to have cultural significance, in that it was an Aboriginal run. This run was reported to contain an abundance of foods and other resources. As a result of this report if it was necessary for any works to affect this creek then the works, should be monitored by an Archaeologist and Aboriginal community members.

The report of this creek is likely to be the Darch Brook or Wild Dog Gully, which also runs adjacent to our current survey area. No mention was made in McDonalds report of this creek having any mythological associations, however it was noted by the Aboriginal consultants that it was a drainage feature of the Margaret River. Site ID 4494 Rosa Brook Road could not be located during fieldwork. The Aboriginal consultants who participated in this survey had no knowledge of this site in this survey. The site was described in the 1989 report as a meeting place for tribal groups, a battleground or a corroberee ground. No other spacial information is known, thus the DIA have placed a ten kilometer box over the site which is located somewhere along Rosa Brook Road. It is unlikely that this site is located in the vicinity of proposed lot 667 Riverslea Road.

O'Connor, R., Quartermaine, G. & Bodney, C. 1989. *Report on an Investigation into the Aboriginal Significance of Wetlands and Rivers in the Perth* – Bunbury Region for the Western Australian Water Resources Council.

This report notes Waugal sites of significance at various locations along southwest rivers. The report provides a comparative theoretical explanation of what O'Connor terms to be "The ubiquitous Waugal myth." The Waugal, O'Connor (1989) et al states is seen as a water creative spiritual force with a serpentine physical manifestation that is said to have created many of the south west rivers and whose essence remains in these rivers today. According to O'Connor this religious view of the significance of water is not restricted to the south west but has been recorded by Maddock (1982) and Kingsford (1982) for similar systems in Arnhem Land and the Murchison – Gascoyne district. He adds that the imputation of religious significance to water sources is at least as old as recorded human history and that it is not surprising that in an arid country such as Australia that it occurs in many totemic forms.

O'Connor, R., *Quartermaine, G. and Yates, A. 1995. An Investigation into the Aboriginal Significance of wetlands and Rivers in the Busselton* – Walpole Region. Water Authority of Western Australia.

This report is a comprehensive archaeological, ethnohistoric and ethnographic study of the significance of water bodies in the area from Busselton out to Wagin and down to Walpole. Here the authors provide ethnohistorical data which records important water bodies to the regions Aborigines as recorded by the regions early explorers. This project records and locates

archaeological sites that are in association with the region's rivers, lakes and springs. The ethnographic section of the report records and locates significant water bodies as known by contemporary Aborigines. This section of the report also discusses this significance in light of the politics of heritage administration and the struggle between environmental movements versus developers. The report finds that the regions waterways were the main focuses of Aboriginal traditional life, for provision of resources, campsites and access highways from inland areas to the coast.

Goode et, al. 2003. *Report on South West Yarragadee-Blackwood Groundwater Area Aboriginal Cultural Values Survey* - Prepared for the Department of Environment, Waters and Rivers Commission, Bunbury WA.

This report documents consultations with the South West Boojarah Native Title Claim group with regards to the values that they attach to all water resources within their native title claim area. This report puts forward Aboriginal community view that water is of pivotal significance from both a religious and domestic perspective. In this report the South West Boojarah group argue that all watercourses that are connected are of the same spiritual essence and therefore should be considered by heritage management professionals as a single site with regards to the Aboriginal Heritage Act (1972). The Margaret River and its tributaries was identified as such a site by this claim group.

OUTCOMES OF ARCHIVAL RESEARCH

As a result of the research conducted for this report, no sites were located within the boundaries of proposed lot 667. Two registered ethnographic sites were located a short distance to the east of the proposed project area. These two sites will not be affected by the works proposal, however they are mentioned in order that the developer is aware of the general heritage values of the region.

Site ID 4494 Rosa Brook Road is described as a meeting place and corroboree ground that could not be accurately located from the records held at the DIA. Because of this, the DIA have put a 10 km buffer over the site which overlays Riverslea Estate. McDonald & Hales (2000) described the site as being located somewhere along Rosa Brook Road east of the Ten Mile Brook dam. From this description, this site is unlikely to be affected by the proposed works at proposed lot 667.

Site ID 4495 The Margaret River is described as a site of generalized religious significance in association with Waugal beliefs. The Margaret River is also a site of specific mythological significance that is associated with Wooditch, a dreamtime figure who created the river by the casting of a magic stick. The works proposed at proposed lot 667 will have no direct impact of this site as it has been previously recorded.

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 recognized owner is widely extended" (cited in Machin, 1995:22).

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 recognized 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 southwest has been seriously eroded since colonization, 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' seems 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 who, 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 has 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 fulfill at least one of these criteria.

SELECTION OF SPOKESPEOPLE FOR THIS SURVEY

Family groups and individuals with interests and association in the area were identified by advice from the Perth Office of the DIA. The consultant who has worked consistently in the region for the past eight years also has a detailed working knowledge of those families and individuals who have the rights and interests to speak with authority of heritage matters in the region.

The families and individuals that were consulted were the following:

Mrs Ellen Hill is a descendant of the traditional Biblemun Wadandi people. She is a member of the South West Boojarah Native Title Claim and an executive member of the Gnuraren Aboriginal Corporation of Busselton. She also assists with the Nyungar Education Committee which helps Nyungar children at school. The country she feels she has rights to speak for includes the Busselton, Margaret River, Karridale area through to Manjimup and north towards Bridgetown. She believes this is the traditional country of the Biblemun Wadandi.

Mrs Barbara Corbett Councillor Stamner is an applicant to the South West Boojarah Native Title Claim. She is the grand daughter of Frank Corbett and the great niece of Dan Corbett who were brought from the northwest at the turn of the twentieth century to be schooled at the Bussell family's Ellenbrook Mission. After leaving the mission they took work as farm laborers in the Busselton Margaret River area and married into local Aboriginal families. Mrs Corbett claims land ties to the area through matrilineal descent.

Mrs Vilma Webb is an applicant of the South West Boojarah Native Title Claim and is involved in its working party. Mrs Webb is also a member of the Biblemun Mia Aboriginal Corporation of Busselton and sits on the South West Commission of Elders. Mrs. Webb is also involved in teaching Nyungar language, history and culture to primary and high school students and at TAFE colleges. Mrs. Webb associates with the country around Busselton and Augusta, east towards Walpole and the Hay River and north again through Manjimup and Nannup. Mrs. Webb is able to trace her lineage to her great, great grandparents who were traditional people from the Biblemun country. She feels that she has an unbroken ancestral link with their country. Mrs. Webb has lived in the area most of her life and has a wide knowledge of both traditional and more recent historical usage of the region.

Mr Ken Colbung is a well-known Nyungar Elder in the Southwest is an applicant of the South West Boojarah Native Title Claim. Mr Colbung is also a member of the Aboriginal Cultural Materials Committee. Mr Colbung has hereditary ties to the southwest and is knowledgeable about both traditional and contemporary Nyungar culture.

Mr Phillip Prosser is an applicant to the Southwest Boojarah Native Title Claim and president of the Aboriginal Veterans Affairs Association. Mr Prosser was born in Busselton and grew up at Ryans Mill in Cowaramup with his parents, Arthur and Gladys Prosser. Mr Prosser's parents are

descendents of the Sambo's. His grandmother Eva Frances Wattling (who died at 82 years of age) was said to be the last of the traditional people in the area and had initiation scars on her shoulders and chest. Mr Prosser was taken from his parents by police officers in 1944 and was schooled at Roelands Mission. Currently Mr Prosser maintains regular association with the Busselton area through his political efforts to secure Native Title.

Mr Norman Harris is a claimant of the Harris Family Native Title Claim. Mr Harris worked in Eagle Bay for a local professional salmon fisherman. With his son Gary Harris and other Nyungar men he regularly camped in Eagle Bay for the duration of the salmon season. He associates himself with, or feels he can speak for, the Busselton and Margaret River area. Mr. Harris is Mrs Van Leeuwin's brother and so shares the same family lineage. Mr Harris is knowledgeable about the country's recent history through his own and his family's long-term association with it.

Mrs Mini Van Leeuwin is a sister to Mr. Norman Harris and is a member of the Harris Family Native Title Claim. Mrs Van Leeuwin speaks for the country west of Capel to Margaret River and Augusta. As she was born here and her family has lived in the area since white settlement and presumably in traditional times she feels she has unbroken ancestral ties with the country. Mrs Van Leeuwin is also a member of the Nyungar Circle of Elders, a group that participates in meetings with developers concerning heritage issues.

Ms Carrie Harris has worked for the Department of Community Services in Perth, Katherine and Alice Springs before returning to the South West. She shares the same ancestral ties as the rest of the family.

Mrs Dorothy Blurton is the sister of Mr Norman Harris, Mrs Carrie Harris and Mrs Mini Van Leeuwen and so shares the same family lineage and connections to the area. Mrs Blurton currently lives in Busselton.

Mrs Marie Harris shares the same family connection to the area and is knowledgeable about many Aboriginal heritage matters.

Mr Gary Harris is a claimant of the Harris Family Native Title Claim, is a member of the Gnuraren Aboriginal Corporation and the Biblemun Mia Aboriginal Corporation. He feels he can speak for the Busselton shire area and has some knowledge of the surrounding country. As he and his parents were born in the area he believes he has an ancestral association with the country. He admits he has little knowledge of traditional ways but believes he knows a great deal about the country through having been told stories about the historical period by elder people.

COMMUNITY CONSULTATION

AIMS

To determine if the pump site location would affect any Aboriginal Cultural interests and record any sites within the development area.

To receive Aboriginal advice and recommendations prior to proceeding with the development project, to prevent unnecessary hold ups.

To generate the necessary recommendations in order for the developer to be able to modify the project plans to manage an identified heritage issue and a site in the area without having to make application under Section 18 of the Aboriginal Heritage Act (1972).

METHOD

Members of the Aboriginal community were contacted by phone and onsite meetings were arranged. At these meetings the Aboriginal Community members were orientated to the project details with the aid of design drawings and an aerial photo of the development area. The proponent Mr Andrew Lang (the Greendene Development Corporation), Mr Peter Gleed (Koltasz Smith & Partners) and Mr Mike Evans (Consulting Engineer) also attended the meetings to explain the project details.

COMMUNITY CONSULTATION PROCESS

On February 3rd 2004 at 2.10pm the consultant met with members of the South West Boojarah Native Title Claim group: Mr Ken Colbung, Mr Phillip Prosser and Mrs Vilma Webb on site at proposed lot 667 Mr Andrew Lang from the Greendene Development Corporation was also present to explain the works. Koltasz Smith and Partners prior to the site meeting had their surveyors peg the cadastral boundaries of the pump station lot and its major infrastructure locations in relation to the wetland located on the southern boundary of proposed lot 667.

With the aid of a design drawing and an aerial photograph Mr Lang explained the works that were necessary to the Aboriginal community. Mr Lang explained the Greendene Development Corporation was required by the Water Corporation to construct a Sewerage Pump station that would take away the sewerage from Riverslea Estate and the adjoining estates and pump it to a Water Corporation treatment plant on the other side of the Margaret River town site. The works would require some clearing of Peppermint Trees to install the pumps and the overflow retention tanks. Excavations for the tanks and pump chamber to a depth approximately 10 meters would also be required. Upon completion of the installation, above the ground you would only see a concrete slab with an electrical box atop. The pumps and other infrastructure would be in a chamber underground that was assessed via a closed steel manhole. When the works were completed the surrounding environment would be rehabilitated with the adjoining land set aside as public open space. Mr Lang further explained that the pump station location was chosen as a result of the topography of the land. The pump station is required to be located at the lowest point in the landscape in order that the sewerage can gravity feed down the pipes from the estate to the

pump station to be pumped away to the treatment plant. After this explanation Mr Lang stated that the retention tanks were needed in case of a pump failure. If the pumps break down the sewerage is retained in these tanks so it does not pollute the surrounding environment. After this explanation the Aboriginal community was asked to comment.

Mr Colbung and Mr Prosser reviewed the plans and made a pedestrian inspection of the site. Stopping near a peg with yellow tape adjacent to the wetlands they inquired if this is where the plan showed the sewerage retention overflow tanks were to be located. Mr Lang stated, "yes". He said that the spot was chosen in order to avoid clearing Peppermint Trees.

The Aboriginal community members stated that they were concerned that the position of the sewer tanks was right next to the wetland. They were very concerned that the wetland would be damaged during the excavation to put in the tanks. They were also concerned that the tanks may leak or overflow and pollute the wetland. Here Mr Ken Colbung asked Mr Lang if this was possible in the event that either of the two pumps failed. According to Mr Lang the pump station is alarmed and is maintained by a works crew on a regular basis. In Mr Lang's opinion it was possible for the tanks to fill and overflow but extremely unlikely as the maintenance crew would be alerted by the alarms and would fix the fault before this could happen. Here Mr Colbung stated that he understood this explanation but as wetlands are significant to the Aboriginal community as sites under the Aboriginal Heritage Act (1972) for this work to take place, he advised that it would require the Aboriginal Cultural Materials Committee (ACMC) to consider this proposal and for ministerial consent to be given. Mr Colbung stated that he and the other community members would prefer these tanks to be relocated further away from the wetland which he identified as draining into the the Darch Brook,a part of the Margaret River system which was a registered Aboriginal site (Site Id 4495).

Following on from theses discussions the consultant asked Mr Colbung to describe the extent (boundary) of this site and its association with the Margaret River. Mr Colbung stated that all waterways that are connected i.e. that flow into each other are a part of the same spiritual system and are therefore the same site. In terms of the boundary of the site within proposed lot 667 Mr Colbung stated we see the site as the wetland, (where the reeds, tea trees and Melaleucas stand). However we also believe that to protect the wetland a small buffer needs to be established, so that machinery and other pollutants from the works area do not have direct contact with the wetland. Mr Colbung then placed his walking stick in the ground on the north side of the track adjacent to the wetland, a distance of approximately 4m. The co-ordinate is 323671mE and 6241254mN. Mr Colbung stated, with agreement from Mr Prosser and Mrs Webb that this point can be considered the sites buffered boundary within the development area. Any works south of this point would be seen to impact upon the site and would require consideration under Section 18 of the Aboriginal Heritage Act (1972). Any works north of this point would be outside the site and would not require a Section 18 Application.

Following this discussion the consultant asked the community if they had any other issues with the proposal. The Aboriginal community representatives stated that they did not. Following this Mr Lang then asked the community members if they required to be consulted about any plans for the area set aside as public open space adjoining the wetland. In reply Mr Colbung and Mr Prosser said that Mrs Webb should be contacted if any plans were created that would affect the area. After this statement business was concluded and the group returned to Busselton.

Figure 2. Mr Andrew Lang (Greendene Development Corporation) & the Southwest Boojarah Native Title Claim group discuss the location of the sewerage retention tanks at the above pegged position.

On February 4th 2004 Mrs Ellen Hill and Mrs Barbara Corbett inspected the pump station site at the end of Riverslea Drive Margaret River. The consultant explained the works that were required as Mr Lang had done to the group on the previous day. Following this explanation the Aboriginal community representatives were asked to comment.

Mrs Hill and Mrs Corbett also identified the wetland on the southern end of proposed lot 667and the Darch Brook to the east as a significant site that was associated with the Margaret River (Site Id 4495). Mrs Hill and Mrs Corbett stated that they would not like to see any work that would directly impact this wetland. They stated that they considered the wetland itself, the area where reeds and paper barks were, as the site and that the plans as explained to them did not in their opinion directly affect the site. They were however worried that any potential overflow from the retention tanks or runoff could pollute the wetland. They however made the comment that as engineers are experts in their field and that in their opinion the plant was designed so that this is not likely to happen, then they were satisfied that the works as planned were OK.

With regards to Mr Colbungs request to move the retention tanks north of the fire break between the wetland and the pump area north of co-ordinates 323671mE and 6241254mN, the Aboriginal community representatives made comment that this would achieve little. If the tanks leaked the sewerage would end up in the wetland anyway. "What difference, is a few meters going to make" (Barbara Corbett pers com).

In the opinion of Mrs Corbett and Mrs Hill moving the tanks was a good idea but you would have to move them a considerable distance to achieve any gain. As the area to the north has many large

Peppermint Trees that would need to be felled the Aboriginal community representatives stated that they preferred the tanks to remain where they were originally planned as this area is already cleared. If you could find an area with no trees that would not need to be cleared than by all means move the tanks. Mrs Corbett added that as this was a matter of public health she and Mrs Hill would support the work as planned but would have preferred the plant to be further away from the wetland.

Figure 3. Mrs Barbara Corbert and Mrs Ellen Hill review the plans for the sewerage retention tanks standing at the site boundary as identified by Mr Ken Colbung.

On February 6th 2004 the consultant in company with Mrs Mini Van Leeuwin, Ms Carrie Harris, Ms Marie Harris, Mr Norman Harris, Mr Gary Harris and Mrs Dorothy Blurton met Mr Peter Gleed (Koltasz Smith and Partners) and Mr Mike Evans (consulting engineer) at the pump station site at the end of Riverslea Drive in Margaret River.

The proponents explained the works required with the aid of an aerial photograph and design drawings. Since the first meeting on February 3rd 2004 the proponents had modified their plans due to heritage concerns voiced by the South West Boojarah Native Title Claim group. The modified plan had shifted the overflow retention tanks from the southern portion of the site adjacent to the wetland to a cleared area west of the pump pit. The tanks will now orientate north/south instead of east/west as originally planned. Both plans were shown to this group and the heritage concerns were explained to the Harris family by the consultant. Following these explanations some members of the Harris family made a pedestrian inspection of the planned works area, before the group reassembled to discuss the issues and make comment upon the proposal.

The Harris family confirmed the view of the South West Boojarah people that the wetland at the southern end of proposed lot 667 and the Darch Brook was a significant Aboriginal site. They stated that all watercourses in the southwest were created by and are home to the Waugal. The Harris family said that as this wetland is a part of the Margaret river drainage system it should be seen as part of that registered site (Site Id 4495). The Harris family advised that they supported Mr Colbungs delineation of a site boundary at 323671mE and 6241254mN. The Harris family also felt it was important for there to be some sort of buffer between the area of earthworks and the wetland. They agreed with the views of the South West Boojarah group with regards to the placement of sewerage retention tanks south of this boundary as constituting on unacceptable impact upon an Aboriginal site.

The Harris family however said that the revised plan was acceptable. The area planned for these tanks now was a considerable distance from the wetland, especially since the tanks were now orientated north/south taking them away from the wetland to the south. The area was also already cleared so minimal damage to the environment was expected form this option.

The Harris family stated that they had no further issues with the project and advised the proponent to proceed.

COMMUNITY CONSULTATION OUTCOMES

As a result of consultations held with members of the Southwest Boojarah & Harris Family Native Title Claim groups, the wetland that intersects the southern portion of proposed lot 667 Riverslea Estate has been identified as a site of religious significance in association with the Waugal. As this survey was only focused on proposed lot 667, no overall extent for this site has been established within the context of the broader region. However, the Aboriginal community have advised that as this wetland drains into the Darch Brook and that the Darch Brook is a tributary of the Margaret River (Site ID 4495) that as all these water bodies are connected they all should be considered as components of these sites. Further consultation would be required to systematically map all these water bodies that drain into the Margaret River. This task is however, outside the current brief of this survey.

As a result of the report of this wetland as site of significance, the Aboriginal community have advised the proponent (the Greendene Development Corporation) that the initial plans for construction of a pump station and more particularly the sewerage retention tanks are located too close to the wetland and in their opinion would place the wetland and the river system at risk from direct damage during construction and pollution from any potential overflows or spills. The Aboriginal Community have therefore advised that in order to follow the original plan the matter should be considered by the ACMC under Section 18 application of the Aboriginal Heritage Act (1972).

In order to avoid impacting this wetland and any necessary delays that would be required due to the Section 18 process, the Aboriginal community have requested that the proponent modify their plans and move the sewerage retention tanks away from the wetlands. The Aboriginal Community has stated that a buffer of approximately 4 meters from the wetland within proposed lot 667 should be considered as the boundary of the site. This boundary follows an East-West alignment across proposed lot 667 at the following co-ordinates.

SE Point	323 671E	6241 254N
SW Point	323 698E	6241 260N

As a result of this request the proponents engineer Mr Mike Evans has put forward a modified plan that has now moved location of the sewerage retention tanks north and to the west of its original position and the delineated sites boundary. As a result of this action the Aboriginal Community now support the project and have no further issues with the proposal.

SUMMARY AND RECOMMENDATIONS

Riverslea Estate in Margaret River is being developed and built by The Greendene Development Corporation with Koltasz Smith & Partners responsible for all town planning and compliance issues. As a requirement of the planning approval process, the Water Corporation has requested that the developers construct a sewerage pump station to service this area. This pump station is required to be built at the lowest point in the landscape within the development area. This location, proposed lot 667 Riverslea Drive is adjacent to a number of wetlands that are associated with the Darch Brook, a tributary of the Margaret River. Proposed lot 667 is located a short distance to the east of the Darch Brook. The works that are required are to be wholly contained within proposed lot 667. These works will require some clearing of peppermint trees and excavations to a depth of 10 meters to install an underground pump chamber and overflow retention tanks. These retention tanks are required to provide for the containment of wastes onsite if power or mechanical breakdowns cause the pumps to fail. After these works are completed the site will be fully rehabilitated.

A search of the Department of Indigenous Affairs (DIA) sites register on the 17th February 2004 did not locate any previously recorded sites within the boundaries of proposed lot 667. Two registered ethnographic sites were located a short distance to the east of the proposed project area.

Site ID 4494 Rosa Brook Road is described as a meeting place and corroboree ground that could not be accurately located from the records held at the DIA. Because of this, the DIA have put a 10 km buffer over the site which overlays Riverslea Estate. McDonald & Hales (2000) described the site as being located somewhere along Rosa Brook Road east of the Ten Mile Brook dam. From this description, this site is unlikely to be affected by the proposed works at proposed lot 667.

Site ID 4495 The Margaret River is described as a site of generalized religious significance in association with Waugal beliefs. The Margaret River is also a site of specific mythological significance that is associated with Wooditch, a dreamtime figure who created the river by the casting of a magic stick. The works proposed at proposed lot 667 will have no direct impact of this site as it has been previously recorded.

As a result of consultations held with members of the Southwest Boojarah & Harris Family Native Title Claim groups, the wetlands that intersect the southernmost portion of proposed lot 667 has been identified as a site of religious significance in association with Waugal beliefs. The Aboriginal Community have advised that this wetland and the Darch Brook, which is a tributary of the Margaret River should be viewed as components of Site ID 4495 Margaret River. The Aboriginal Community has further advised that all the tributaries and associated wetlands of the Margaret River system should be viewed as components of this site.

With regards to the significance attached to the wetland area at proposed lot 667 the Aboriginal Community have requested that the Greendene Development Corporation modify their plans with

regard to the placement of the proposed sewerage retention tanks. Concerns have been raised about damages to the wetland during the construction and also pollution from runoff or spills from waste. In order to protect the integrity of the site the Aboriginal Community have advised that a four meter buffer should be established between the wetland and all earthworks. Any works south of this buffer would require the matter to be considered by the Aboriginal Cultural Materials Committee (ACMC) under Section 18 Application of the Aboriginal Heritage Act (1972).

As a result of these concerns, the Greendene Development Corporation have modified their plans and moved the sewerage retention tanks north and west of the four meter buffer around the site. As a result of this action, the Aboriginal Community are in complete support of the project and have advised the developer that works can proceed.

As a result of the above survey, the following recommendations are made:

It is **recommended** that the DIA consider placing the Darch Brook and its associated wetlands within the boundaries of Site ID 4495 The Margaret River. These places should be considered as places of significance and assessed under Section 5c "Sacred Beliefs" of the Aboriginal Heritage Act (1972).

It is **recommended** that the Greendene Development Corporation do not impact the wetlands within the southern portion of proposed lot 667, south of the east/west axis that is delineated by the coordinates contained in this report. If this is not possible then the Greendene Development Corporation should apply for consent to use the land that contains an Aboriginal site under Section 18 of the Aboriginal Heritage Act (1972).

Should this application be necessary or the current plans for proposed lot 667 are changed that will result in impacts to this site, then it is **recommended** that further consultations take place with the Aboriginal Community before works can proceed.

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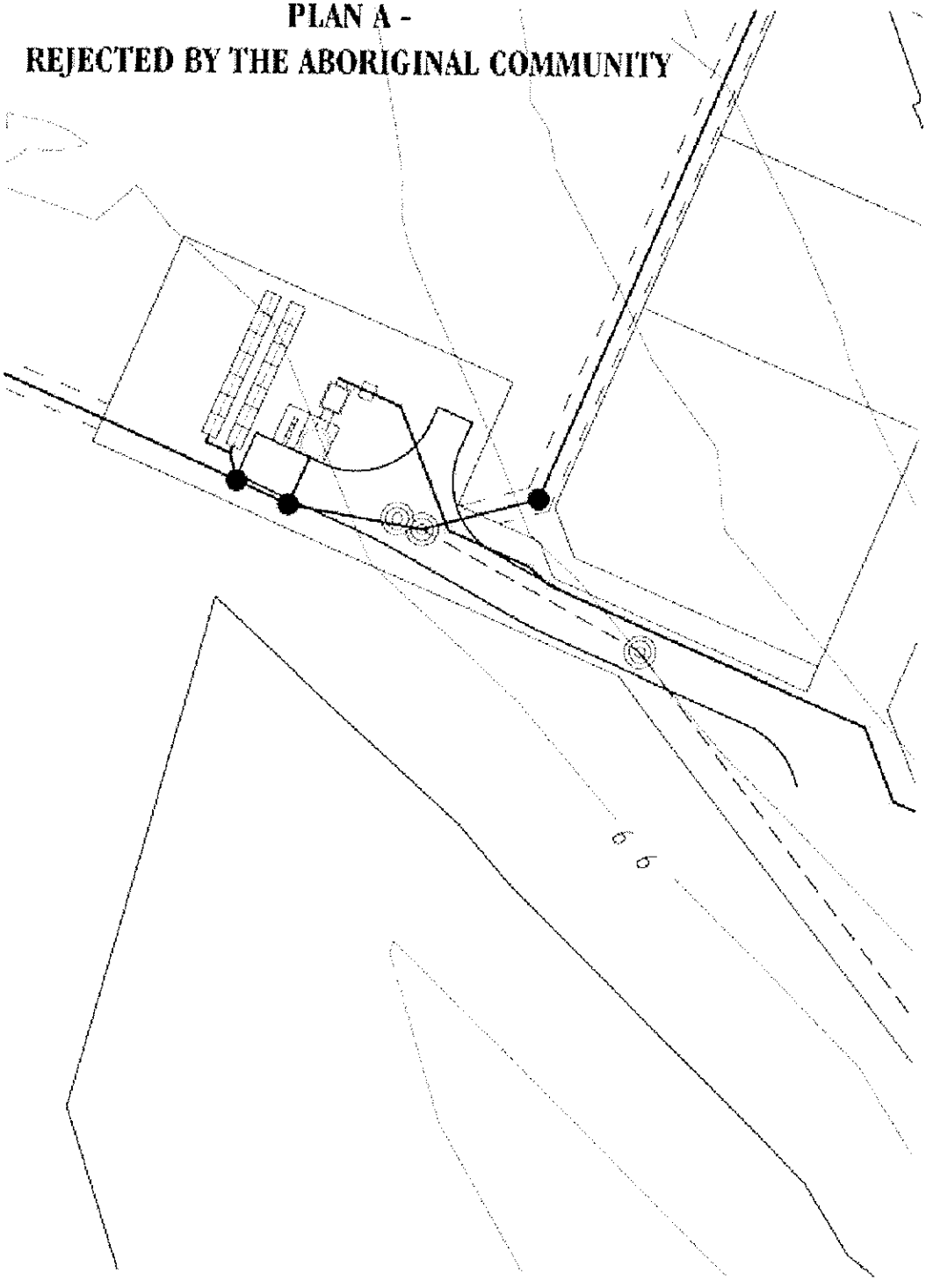
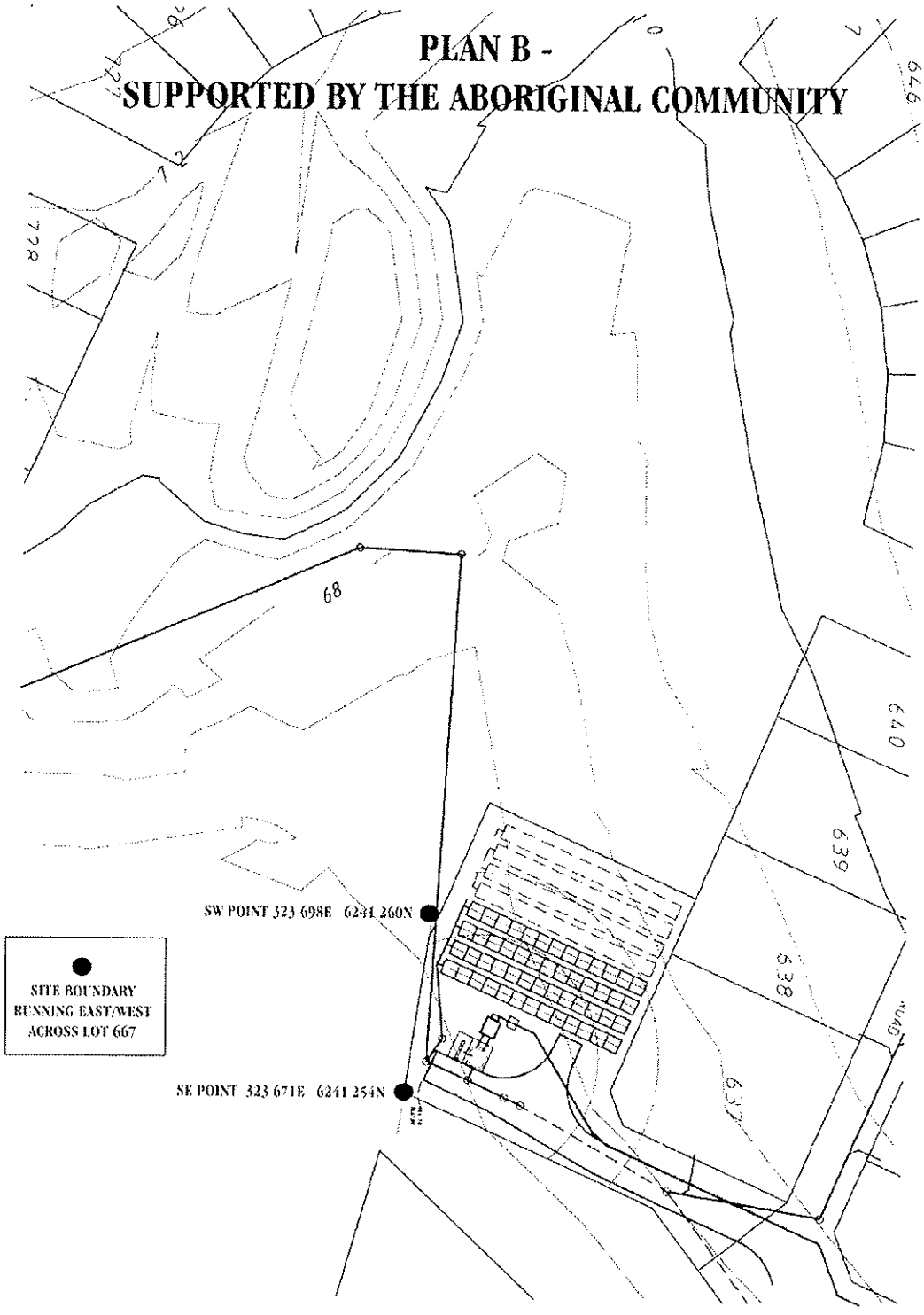
APPENDIX 1 – PROJECT PLANS IN RELATION TO ABORIGINAL SITES

PLAN A -
REJECTED BY THE ABORIGINAL COMMUNITY



PLAN B -
SUPPORTED BY THE ABORIGINAL COMMUNITY



APPENDIX 2 – LETTERS OF ADVICE FROM THE ABORIGINAL COMMUNITY

Brad Goode
Consulting Anthropologist
Heritage Assessments

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Phone: (08) 9755 3716
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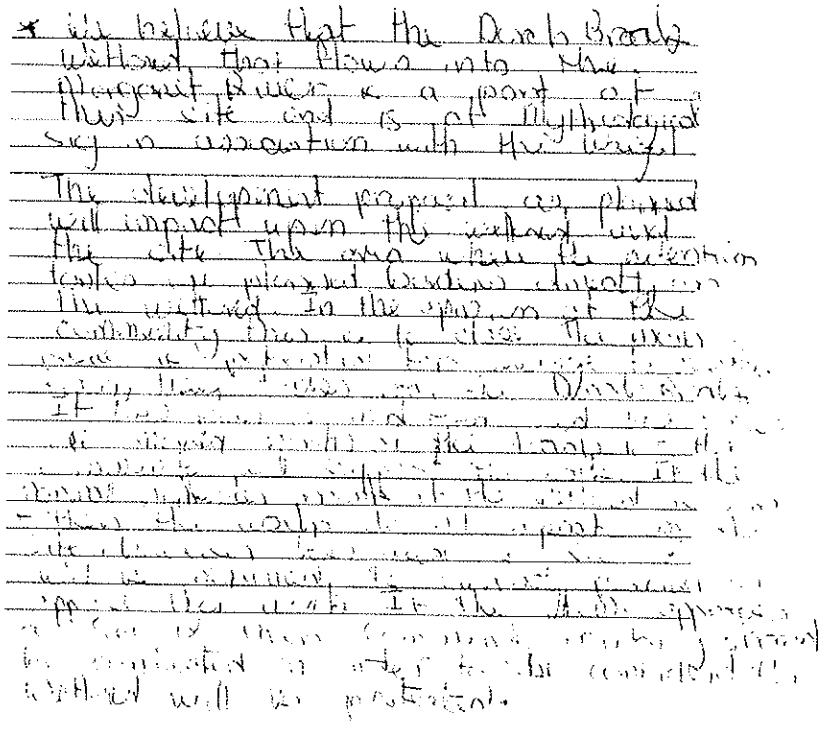
ABN: 40 803 184 260

03.02.2004

We the undersigned have been consulted by Brad Goode on behalf of Andrew Lang of the Lester Group with regards to the Im 1356 Waste Water Main in Margaret River. We have been fully informed with regards to the nature and extent of these proposed works and any likely impacts they will have on the Aboriginal heritage site.

We would like to make the following recommendations.



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Name	Date	Signature
Vilma Webb	03.02.04	
Phil Prosser	03.02.04	
Ken Colbung	03.02.04	

Brad Goode
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Heritage Assessments

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04.02.2004

We the undersigned have been consulted by Brad Goode on behalf of Andrew Lang of the Lester Group with regards to the Im 1356 Waste Water Main in Margaret River. We have been fully informed with regards to the nature and extent of these proposed works and any likely impacts they will have on the Aboriginal heritage site.

We would like to make the following recommendations.

We believe the Wetland (the Coach Brook) is a part of the Margaret River and is of significance the same as all wetlands are to Nyungars. We are concerned about the proposal to and sewerage overflows into the wetland however we must trust the engineers have designed the facility [illegible] and that will not happen. We therefore will support the proposal on the standards we prefer the [illegible] to be put where the plans say; we don't want them changed to [illegible] there. We do not believe the works impact the site which is the wetland.

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Name	Date	Signature
Ellen Hill	**04.02.04**	
Barbara Corbett	**04.02.04**	

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Harris Family Native Title Claim

Name	Date	Signature
Mini Van Leeuwin	06.02.04	
Carrie Harris	06.02.04	
Marie Harris	06.02.04	
Dorothy Blurton	06.02.04	
Norman Harris	06.02.04	

APPENDIX 3 – SITES REGISTER SEARCH