INDUSTRIAL SUBDIVISION OF LOT 21 WEBSTER ROAD, FORRESTFIELD. PUBLIC ENVIRONMENTAL REVIEW (ASSESSMENT NUMBER 1386)

R. PETERS & D. PAPAGIOFTSIS

Prepared by:

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Direct all inquiries to:

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Invitation to make a submission

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

R. Peters and D. Papagioftsis propose to subdivide Lot 21, Webster Road in the suburb of Forrestfield into a number of industrial lots. This requires clearing of the bushland on the Lot (1.84 ha in size). To offset this, it is proposed that the valuable components of the bushland be transferred to an adjacent Reserve C31709, which is part of *Bush Forever* Site 319, to enhance this site and ensure its long-term viability. In accordance with the *Environmental Protection Act 1986* a Public Environmental Review (PER) has been prepared which describes this proposal and its likely effects on the environment. The PER is available for a public review period of 4 weeks from **12 January 2004** closing on **9th February 2004.**

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.

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 workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 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 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; and
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

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

The closing date for submissions is: 9th February, 2004

Submissions should be addressed to:

The Environmental Protection Authority
Westralia Square
141 St George's Terrace
PERTH WA 6000
Attention: **Sarah Williams**

The EPA prefers submissions to be sent in electronically. You can either e-mail the submission to the project officer at the following address:

sarah.williams@environment.wa.gov.au

OR

use the submission form on the EPA's website:

www.epa.wa.gov.au/submissions.asp (click on the EIA Assessment Submission option).

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Lot 21 Webster Road, Forrestfield: Public Environmental Review

This Public Environmental Review (PER) has been prepared by Ecoscape (Australia) Pty Ltd on behalf of R. Peters and D. Papagioftsis (the proponents) who have proposed subdividing Lot 21 into a number of industrial lots. The purpose of this PER is to identify and assess the environmental impacts of the proposal and to outline the measures and strategies that the proponent will undertake to manage and minimise any adverse environmental impacts.

Public Environmental Review – Assessment and Approvals Process

Western Australia's Environment Protection Authority has decided to assess the proposal as a Public Environmental Review (PER) under the *Environmental Protection Act, 1986*. Public Environmental Review is used for proposals of local or regional significance that raise a number of significant factors, some of which are considered complex and require detailed assessment to determine whether, and if so how, they can be managed The EPA has supplied a list of instructions to carry out this PER.

Following the public comment period, the EPA will assess the proposal, considering the PER document itself, issues raised by the public, specialist advice from Government agencies, the proponent's response to those issues, the EPA's own review and, in some cases, assessments provided by other expert agencies. At the end of an assessment, the EPA reports and makes recommendations to the Minister for the Environment indicating whether the proposal is environmentally acceptable and, if so, whether environmental conditions should be imposed. Based on this information, the Minister makes the final decision on whether a proposal may proceed.

The Proposal

Lot 21 is privately owned by R. Peters and D. Papagioftsis and is located at 92 Bedford Crescent, Forrestfield in the Shire of Kalamunda. The Lot is approximately 1.84 ha in size and is zoned under the Metropolitan Region Scheme as *Industrial* and the Shire of Kalamunda District Town Planning Scheme No. 2 as *Light Industrial*. The proponents wish to sub-divide Lot 21 into a number of industrial lots. This requires clearing the Lot of remnant vegetation.

This PER addresses the proposed clearing of Lot 21 in the context of the potential to improve the sustainability and value of adjacent bushland. The plan to offset the loss of bushland on Lot 21 by transferring the biologically valuable components of the bushland on Lot 21 to the adjacent Reserve C31709, which is vested in the Water Corporation and forms part of *Bush Forever* Site 319 and is an integral part of the proposal. The aim of this plan is to balance the loss of bushland from Lot 21 by enhancing the value, and contributing to the long-term viability, of the Reserve C31709. The Reserve C31709 is much larger (13 ha) than Lot 21 (1.84 ha) and is therefore more sustainable with less intensive management required over the long-term. The Reserve C31709 is also part of a larger *Bush Forever* site, which has been reserved as a Parks and Recreation in the Metropolitan Region Scheme.

This provides some measure of protection and planning provision for the area. The main benefit of this proposal is the assistance it provides to the long-term conservation of the Threatened Ecological Communities and Declared Rare and Priority Flora (DRPF) found on Lot 21 and in *Bush Forever* Site 319.

This PER identifies a general area within Reserve C31709 that could receive material from Lot 21. The following criteria will be used to select a specific rehabilitation site within this area:

- Level of degradation – a relatively degraded area will be chosen to maximise the potential gains from the effort to undertake the transfer and rehabilitation. Less intensive rehabilitation techniques are more appropriate for good condition bushland;
- Similarity of surrounding/adjacent vegetation - the transfer of material needs to occur into an area of similar vegetation to minimise the risk of disrupting or altering in some way the composition or structure of an existing, but floristically different, adjacent community;
- Proximity to less disturbed vegetation – if possible (given the above), the rehabilitation site will preferably be located adjacent to less disturbed vegetation to help consolidate existing vegetation within Reserve C31709; and
- Provision of suitable environments for the Declared Rare and Priority Flora of Lot 21.

The proposal has received 'in principle' support from the Bush Forever Office of the Department for Planning and Infrastructure and the Water Corporation.

This proposal involves three components:

1. Clearing vegetation from Lot 21, which involves:
    - Exclusion of dieback infested material from transfer;
    - Removal and transplanting of Declared Rare and Priority Flora;
    - Removal of environmental weeds;
    - Vegetation removal, chipping and transfer;
    - Topsoil removal and transfer; and
    - Brush material transfer.
2. Preparation of the rehabilitation site, which involves:
    - Removal of environmental weeds;
    - Soil softening;
    - Spreading of transferred topsoil and mulch;
    - Planting of translocated species; and
    - Dieback management.
3. Post transfer management, which involves:
    - Monitoring the survival of transplants;
    - Weed management;
    - Monitoring of vegetation composition.

While the proposal to rehabilitate a portion of reserve C31709 has received 'in principal' support from the Water Corporation, it is understood formal agreement is required from the Corporation before the proposed rehabilitation can proceed. If this approval is not granted, it is proposed to provide funding of a similar order of the rehabilitation and associated costs, for conservation works in Bush Forever Site 319.

Environmental Factors

The following table summarises the environmental factors relevant to this proposal, the EPA objective for that factor, the impacts of the proposal, management strategies to offset those impacts and whether the EPA objective will be met.

Environmental Factor	EPA Objective	Existing Environment	Impacts of Proposal	Management measures	Predicted Outcome
Vegetation and Flora	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation	• Vegetation of Lot 21 and Reserve C31709 has been mapped as being of the Southern River Complex (Heddle *et al*., 1980), with mostly a *Eucalyptus marginata* (Jarrah) – *Allocasuarina fraseriana* (Sheoak) – *Banksia* species woodland present in Lot 21 • Lot 21 contains the Threatened Ecological Community (TEC) type 20a – *Banksia attenuata* woodland over species rich dense shrublands • *Bush Forever* Site 319 (which includes the Water Corporation site) contains 3 TECs – types 2, 3a and 20a • Much of Lot 21 is considered to be in good condition, the Reserve C31709 is fairly degraded • Lot 21 contains an area of *Phytophthora cinnamomi* dieback expression along the south-west boundary • Lot 21 contains 67 native plant taxa and 3 weed species	• Removal of all vegetation and flora from Lot 21 (1.84 ha)	• Develop a detailed Rehabilitation Plan which details the methods of clearing, transfer and rehabilitation to ensure maximise transfer success and minimise loss of vegetation components • Identify a rehabilitation site suitable in terms of similar vegetation • Transfer topsoil and brush material to offset loss from Lot 21 • Remove environmental weeds from Lot 21 and rehabilitation site • Transplant suitable species, e.g. *Xanthorrhoea preissii* • Monitor survival of transplants and germinants • Monitor soil conditions • Undertake weed management • Monitor development of vegetation community	EPA objective can be met

Environmental Factor	EPA Objective	Existing Environment	Impacts of Proposal	Management measures	Predicted Outcome
Declared Rare and Priority Flora	Protect Declared Rare and Priority Flora, consistent with the provisions of the *Wildlife Conservation Act 1950* and the *Environment Protection and Biodiversity Act 1999*	• Lot 21 contains the Declared Rare Flora, *Conospermum undulatum* and Priority 3 flora, *Isopogon drummondii* • *Bush Forever* site 319 contains two Declared Rare Flora, one Priority 1 flora, three Priority 3 flora and two Priority 4 flora	• Removal of significant flora from Lot 21	• Develop a detailed Rehabilitation Plan which details the methods of clearing, transfer and rehabilitation • Transfer individuals of *Conospermum undulatum* and *Isopogon drummondii* to rehabilitation site • Monitor success of transfer • Undertake remedial action if required	EPA objective can be met
Fauna	Maintain the species abundance, diversity and geographical distribution of fauna	Based on the vegetation present in Lot 21 the following species may be present: • *Banksia attenuata* nectar attracts Honey Possums, Honeyeaters, Silvereyes, Wattlebirds, Carnaby's Black Cockatoo and the Red-capped Parrot • *Banksia menziesii* nectar attracts a number bird species, while seeds and cones attract weevil and moth larvae • *Banksia grandis* indirectly attracts Robins, Willie Wagtails, Black-faced Cuckoo-Shrikes and Bee-eaters, while its seeds and cones attract Carnaby's Black Cockatoo and weevil larvae • *Allocasuarina fraseriana* provides habitat for a number of invertebrates • *Tadarida australis* (White-striped Bat) may occur in the area Given the small size of the Lot, few of these species will reside in the Lot	• Removal of fauna habitat from Lot 21	• Transfer and re-establish components of fauna habitat in rehabilitation site	EPA objective can be met

1.0 Introduction

Lot 21 Webster Road, Forrestfield: Public Environmental Review

This Public Environmental Review (PER) has been prepared by Ecoscape (Australia) Pty Ltd on behalf of R. Peters and D. Papagioftsis (the proponents) who have proposed subdividing Lot 21 into a number of industrial lots. The purpose of this PER is to identify and assess the environmental impacts of the proposal and to outline the measures and strategies that the proponent will undertake to manage and minimise any adverse environmental impacts.

1.1 Proposal Background

R. Peters and D. Papagioftsis (the proponents) acquired Lot 21 in Forrestdale during the 1970s, with the intention of eventually developing the site for light industry in accordance with the existing zoning for the site.

The proposal is to subdivide Lot 21 Webster Road into a total of seven industrial lots. The subsequent use of the site will be consistent with the site's present zoning as Industrial (light industry) as described in the Shire of Kalamunda District Planning Scheme No. 2.

In order to utilise the land for this purpose, the site needs to be cleared. To offset the environmental impacts of this, it is proposed that the biologically valuable components of the bushland on Lot 21 be transferred to adjacent Reserve C31709 (part of *Bush Forever* Site 319) to enhance its value and contribute to the long-term viability of the bushland in Reserve C31709.

1.2 The Assessment Process

Environmental impact assessment is designed to ensure that the environment is protected when new development proceeds. Proponents, or project developers, are required to tell the Environmental Protection Authority (EPA) and the community what they want to develop, what they expect the environmental impacts to be, and how they plan to manage their projects so the environment will be protected. Based on preliminary information about a proposal the EPA determines whether an environmental impact assessment is needed and at what level. Proposals may or may not be formally assessed by the EPA. Informal assessment is referred to as 'Not Assessed – public advice given'. The five levels of formal assessment are:

- Assessment on Referral Information (ARI);
- Proposal Unlikely to be Environmentally Acceptable (PUEA);
- Environmental Protection Statement (EPS);
- Public Environmental Review (PER); and
- Environmental Review and Management Programme (ERMP).

The EPA may also initiate a Public Inquiry that will assist in the assessment of a proposal that is very complex and has intense public interest.

In the case of this proposal, the EPA originally set the level of assessment as 'Not Assessed – public advice given' (previously known as Informal Review with Public Advice). It is understood the EPA decided not to assess the proposal as the property was small and isolated from the core conservation area covered by Bush Forever Site 319 by Industrial Zoned Land and Road infrastructure, which reduces its potential long-term conservation viability. The Minister for the Environment upheld an appeal against this decision and instructed the EPA to undertake a formal assessment of the project.at the EPA subsequently set the level of assessment at PER with a four week public review period. PER is used for proposals of local or regional significance that raise a number of significant environmental factors, some of which are considered complex and require detailed assessment to determine whether, and if so how, they can be managed. The EPA supplied a list of instructions to carry out this PER (Appendix One).

Following the public comment period, the EPA will assess the proposal, considering the PER document itself, issues raised by the public, specialist advice from Government agencies, the proponent's response to those issues, the EPA's own review and, in some cases, assessments provided by other expert agencies. At the end of an assessment, the EPA reports and makes recommendations to the Minister for the Environment indicating whether the proposal is environmentally acceptable and, if so, whether environmental conditions should be imposed. Based on this information, the Minister makes the final decision on whether a proposal may proceed. An outline of the process is shown in Figure 1.

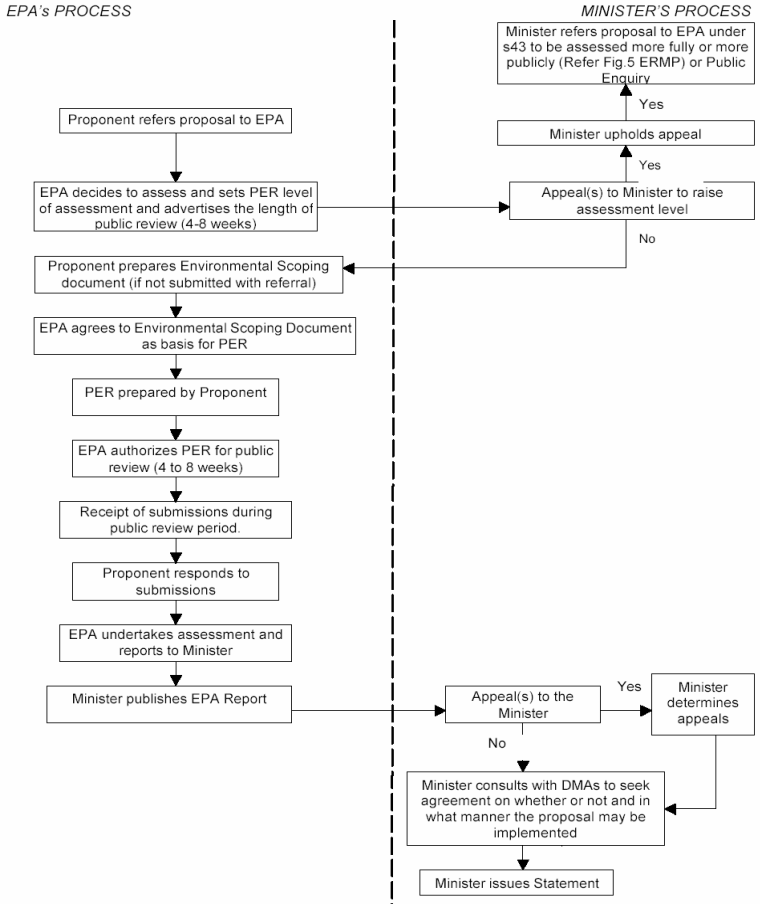


Figure 1 Outline of PER Assessment Procedures

1.3 Purpose and Scope of PER Document

This PER has the following aims:

- Provide a source of information from which interested individuals and groups may gain an understanding of the proposal, the need for the proposal, the alternatives, the environment which it would affect, the impacts that may occur and the measures to be taken to minimise and manage these impacts;
- Provide a forum for public consultation and informed comment on the proposal and supply the EPA with these;
- Provide a document which clearly sets out the reasons why the proposal should be judged by the EPA to be environmentally acceptable;
- Provide a basis for a revision of the proponent's environmental management program;
- Demonstrate compliance with the goals, objectives and guiding principles of Ecologically Sustainable Development as set out in the National Strategy for Ecologically Sustainable Development;
- Place proposal in the context of the local and regional environment; and
- Adequately describe all components of the proposal so that the Minister for the Environment and Heritage can consider approval of a well-defined project.

2.1 State Government

2.1.1 Water Corporation

The proposal to transfer the biologically valuable components of Lot 21 to the adjacent Reserve C31709 was first discussed with the Water Corporation in early 2001, as part of the Not Assessed – public advice given assessment (previously known as Informal Review with Public Advice). These discussions highlighted the desire by the Water Corporation to relinquish the vesting it has in land contained within *Bush Forever* Site 319. Policy related to divesting of sites indicates that in order for this to occur, the rubbish that has accumulated on the site would have to be removed.

As part of the PER, an 'in principle' agreement has been sought and obtained from the Water Corporation to co-operate with the owners of Lot 21 in their proposal to transfer bushland components from Lot 21 to the Water Corporation part of *Bush Forever* Site 319 (Appendix Two).

2.1.2 Department of Conservation and Land Management

In September 2001, the Department of Conservation and Land Management provided informal comments on the proposal as outlined in the report produced for the 'Not Assessed – public advice given' assessment (previously known as Informal Review with Public Advice). At that time, the proposal was essentially the same as that provided in this PER, although it contained less detail on necessary on-going management. These comments indicated that the Department of Conservation and Land Management believed that the proposal should be assessed formally through the EPA process.

The Department's informal comments indicated that they did not support the clearing of Lot 21 because of its significant conservation values, which were identified as being:

- Presence of *Conospermum undulatum* and *Isopogon drummondii;*
- Presence of the TEC community type 20a – *Banksia attenuata* woodlands over species rich dense shrublands;
- Presence of plant communities representative of the eastern Swan Coastal Plain that are floristically diverse and have been heavily cleared;
- The good to excellent condition of much of the Lot, with an intact understorey and overstorey and few aggressive weeds; and
- The Lot functions as an indirect linkage between Western Australian Planning Commission lands to the south and *Bush Forever* Site 319.

The current report seeks to address these concerns in terms of why management should be focused on the adjacent Reserve C31709, and that the clearing of Lot 21 be viewed in the context of the proposed offset through the transfer of material to the degraded portion of Reserve C31709.

The Department also provided informal comments on the proposed transfer and rehabilitation plan, which will only apply if the proposal is approved by the Environmental Protection Authority. The Department's comments (**in bold**), and the proponent's responses, are:

- **The material would be best used to rehabilitate tracks and small areas of degradation within the areas in 'good' condition.** The current proposal argues that less intensive rehabilitation methods should be used in such areas and that selecting a more degraded area would maximise the gains from the effort required to undertake the transfer (see Section 5.1.1).

- **Similarity in vegetation types in Lot 21 and the Water Corporation site will need to be established.** This is one of the criteria for selecting the rehabilitation site (see Section 3.5.1).

- **The dieback status of Lot 21 needs to be determined. If dieback is present the material could only be used in similarly affected areas.** A dieback survey of Lot 21 has been undertaken and this has identified a small area of infestation along the south-west boundary of the Lot. This area will be excluded from the proposed transfer and dieback hygiene procedures will be place for all works associated with this proposal (see Sections 4.1.4 and 5.4.3). Post-transfer monitoring for dieback will be undertaken in the Water Corporation Reserve.

- **Any invasive weeds should be removed from Lot 21 prior to clearing**. High priority environmental weeds will be removed from the Lot prior to clearing (see Section 5.3.2) and from the rehabilitation site to facilitate and improve plant establishment (Section 5.3.2).

- **Transfer of brush material is more practical than transplanting vegetation. The use of brush material is preferable to mulch and material should be transferred directly to areas for rehabilitation.** The transfer of brush material forms an important part of the proposal (Section 5.3.6), although the Rehabilitation Plan will address the transfer of vegetation, particularly the Declared Rare and Priority Flora in Lot 21 and other species suitable for translocation. Mulch will not be used, although some material will be cut to produce tritter to reduce fuel loads.

- **A boundary fence is needed to protect the transferred material.** The rehabilitation site will be fenced following the transfer of material for Lot 21 (Section **Error! Reference source not found.**).

- **The transfer of the top 100 mm of topsoil appears sound.**

Further discussions were held with the Department of Conservation and Land Management in early 2003, following their review of a draft of the PER. These discussions indicated that they would prefer the proposal to not go ahead, but that the plan to transfer material had some merit. The Department will provide formal comments on the proposal during the public comment period.

2.1.3 Department of Environmental Protection

The Department of Environmental Protection has been consulted extensively in regards to this proposal, both in writing and through meetings to discuss specific issues and requirements. The Department reviewed and commented on drafts of both the report prepared in 2001 by Ecoscape, for the 'Not Assessed – public advice given' assessment (previously known as Informal Review with Public Advice), and the current report. These comments and those made during meetings with Ecoscape, have been incorporated into both reports, and have developed the detail of the proposal.

A meeting with representatives of the proponent, Water Corporation, Department of Environmental Protection and Bush Forever Office of the Department for Planning and Infrastructure was held in December 2002 to discuss the final form of the Public Environmental Review report and responsibilities and commitments involved in the proposal.

2.1.4 Department for Planning and Infrastructure

A summary of the report being prepared as part of the Public Environmental Review, outlining the proposal, was provided to the Bush Forever office of the Department for Planning and Infrastructure in July 2002. This was followed up with a meeting with a representative of the Bush Forever Office, also in July 2002. Based on the information provided and discussions held, the Bush Forever Office provided 'in principle' support for the proposal (Appendix Two). The Bush Forever Office indicated in that for it to approve the plan the following would be required:

- A rehabilitation plan providing details of the type and condition of vegetation to be cleared in Lot 21;
- The boundary of the rehabilitation site within *Bush Forever* Site 319 and a description of the type and condition of vegetation at this location;
- A description of the techniques to be used for translocation and rehabilitation; and
- Details of the ongoing management measures that will be implemented to ensure successful rehabilitation.

This report provides information on the methods for transferring material from Lot 21 to the rehabilitation site, and the ongoing management requirements for the rehabilitation site to ensure that the transference of material is successful. A more detailed Rehabilitation Plan for the project will be developed prior to the commencement of rehabilitation. This plan will identify a specific area for rehabilitation, which will be selected following site surveys and assessment of the four criteria outlined in Section 5.2.2.

A meeting with representatives of the proponent, Water Corporation, Department of Environmental Protection and Bush Forever Office of the Department for Planning and Infrastructure was held in December 2002 to discuss the final form of the Public Environmental Review report and responsibilities and commitments involved in the proposal.

2.2 Conservation Groups

The report prepared for the 'Not Assessed – public advice given' assessment (previously known as Informal Review with Public Advice) was provided to the Conservation Council of Western Australia, Urban Bushland Council and Wildflower Society.

The Conservation Council of Western Australia provided written comments to the Department of Environmental Protection. These comments were directed towards the process being undertaken at the time and the need for a more formal assessment of the proposal, which is now occurring.

A draft of the current report was provided to the same groups in December 2002. This was followed up with phone discussions with each group, which indicated that their initial positions in opposition to the proposal had not changed. The groups indicated that they would provide formal comments during the public comment period.

3.1 Location

Lot 21 is privately owned by R. Peters and D. Papagioftsis and is located at 92 Bedford Crescent in the suburb of Forrestfield in the Shire of Kalamunda (Figure 2). Bedford Crescent and, Webster and Dundas Roads bound the Lot. *Bush Forever* Site 319. which includes Reserve C31709, vested in the Water Corporation, is adjacent to Lot 21. Lot 21 is approximately 1.84 ha in size and it is bordered by industrial land use (Figures 1 and 2).

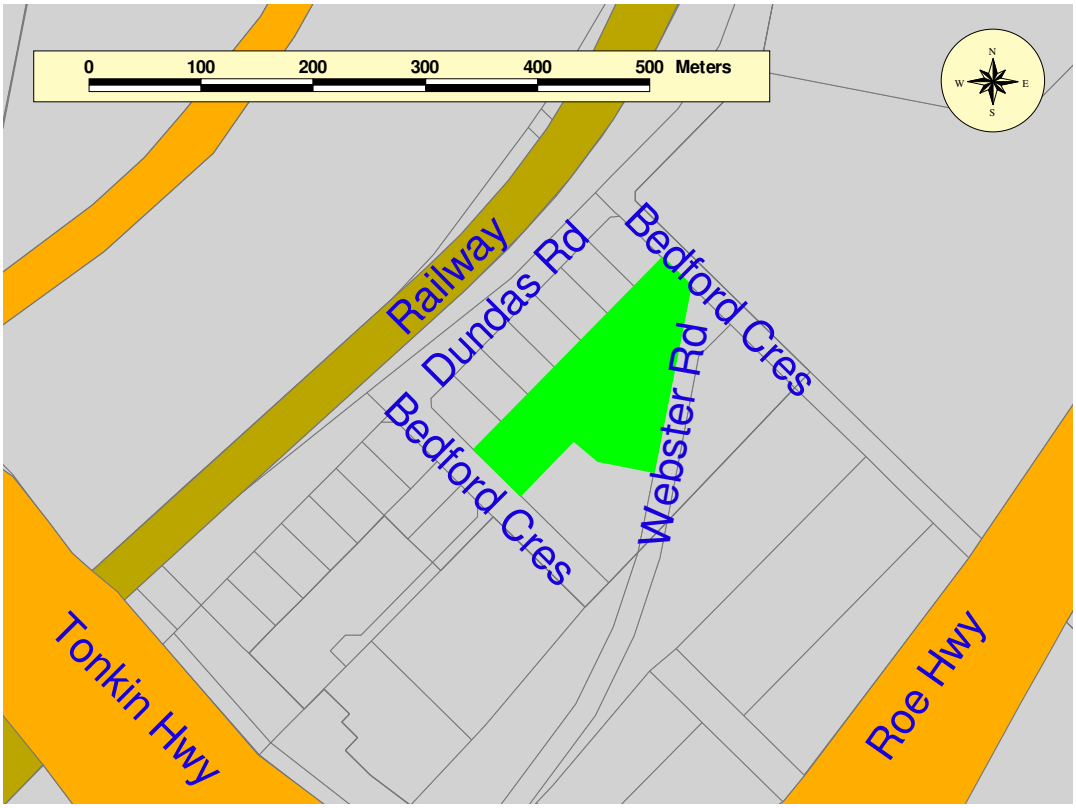


Figure 2 Location of Lot 21, Webster Road

Figure 3 Metropolitan Region Scheme Zones (2001)

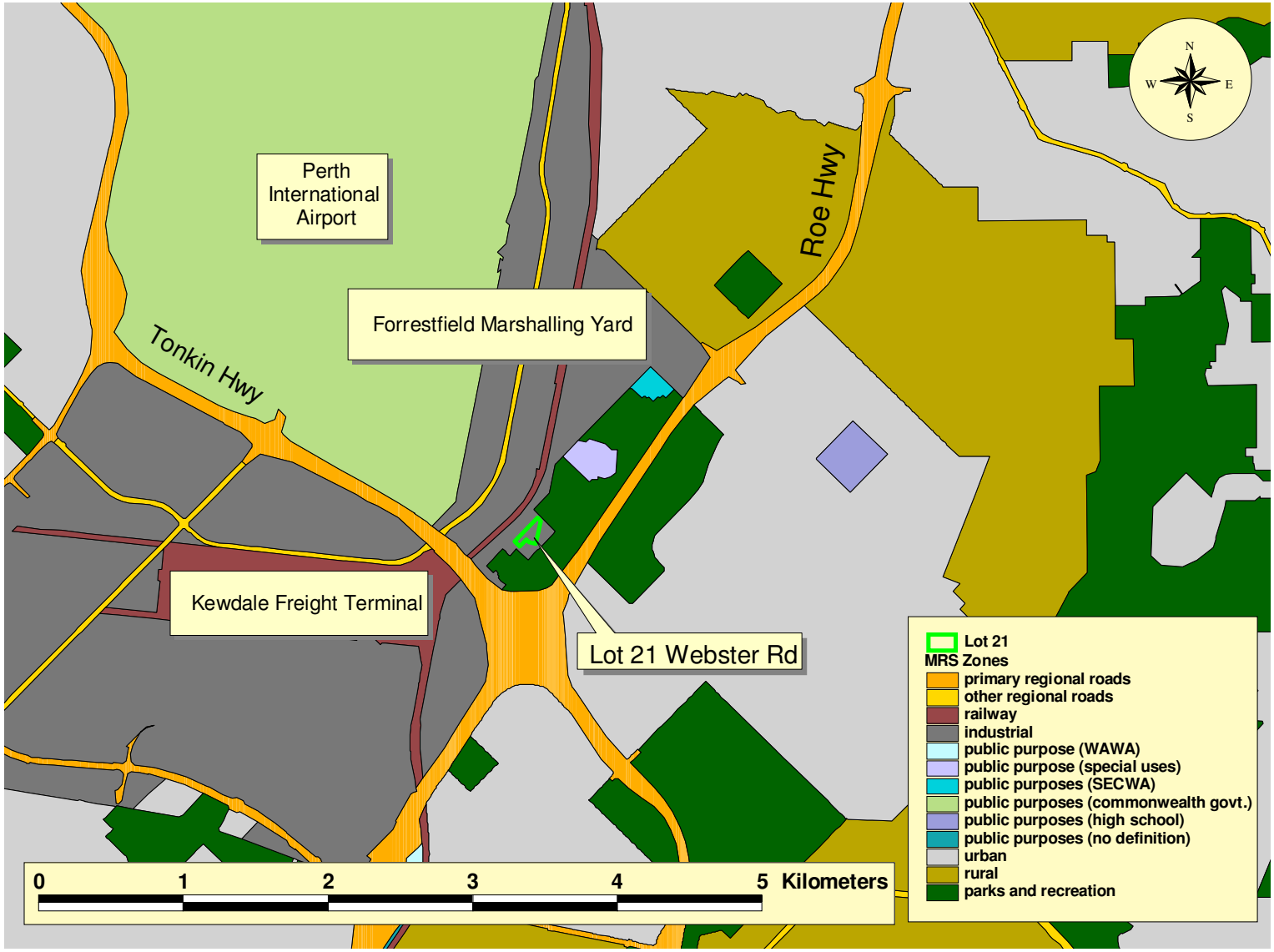
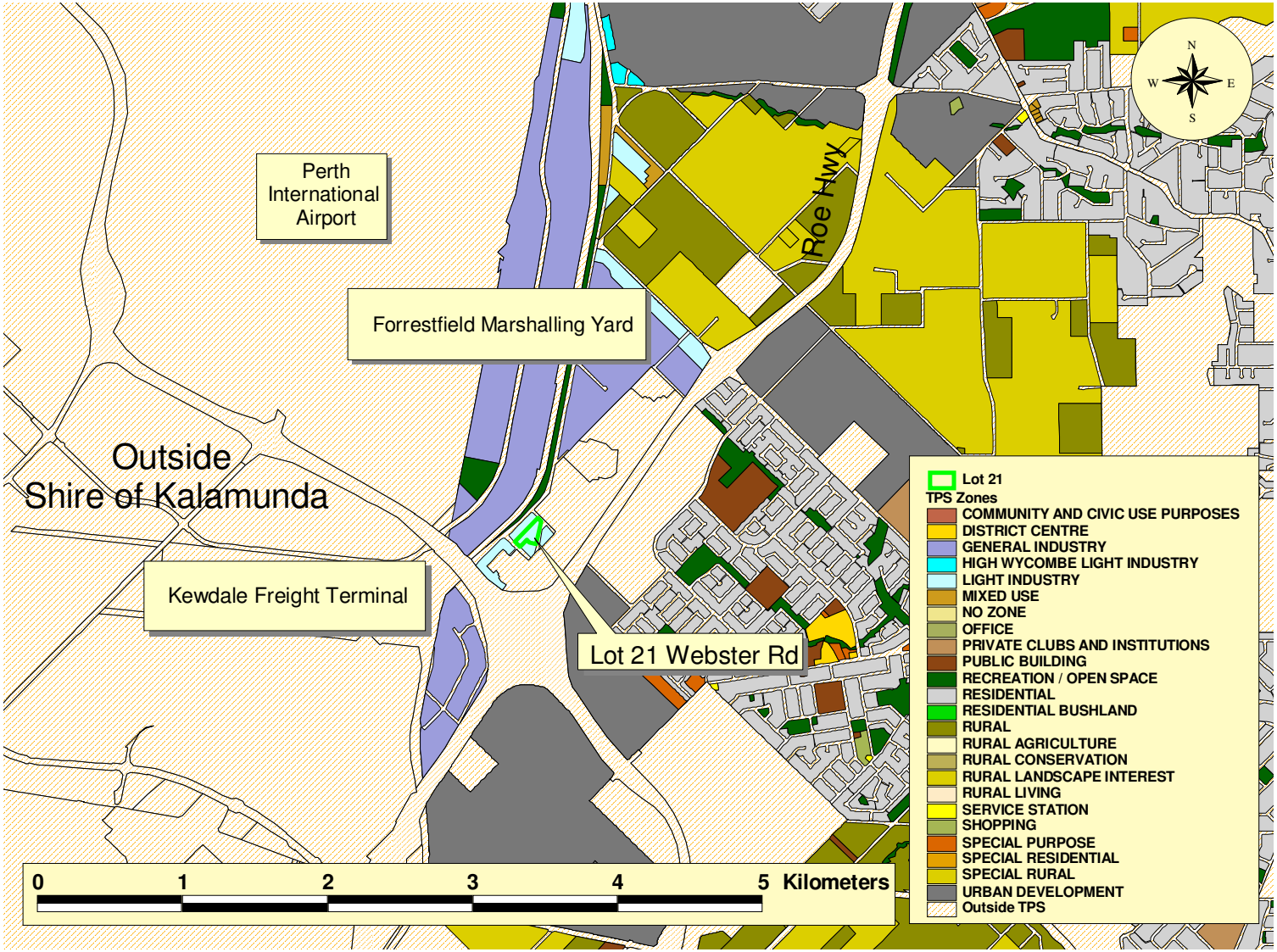


Figure 4 Shire of Kalamunda Town Planning Scheme (No 2) Zones



3.2 Zoning

Lot 21 is zoned under the Metropolitan Region Scheme (MRS) as *Industrial* and zoned under the Shire of Kalamunda's Town Planning Scheme (TPS) No. 2 as *Light Industrial*. The surrounding MRS zones are shown in Figure 3 and the TPS zones are shown in Figure 4.

Under the Town Planning Scheme, industry allowed to be developed on the site will be that:

- in which the processes carried on, the machinery used, and the carriage of goods and commodities to and from the premises will not cause any injury to or prejudicially affect the amenity of the locality by reason of the emission of noise, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, waste water, waste products, grit, oil, or otherwise; and
- the establishment of which will not or the conduct of which does not impose an undue load on any existing or projected service for the supply or provision of water, gas, electricity, sewerage facilities or any other like service.

3.3 History of Lot 21

Lot 21 has remained vacant and unfenced since its purchase by the proponents prior to it having been identified as containing significant bushland in the 1983 System 6 report by the Department of Conservation and Environment.

Lot 21 contains remnant bushland that was identified under the *System Six* report (Department of Conservation and Environment, 1981; 1983) as having conservation value as part of site M53. *System Six* was the first systematic study to identify areas of bushland, landscape and open space of regional significance in the Perth area. *System Six* made the following recommendations for site M53:

1. That the State Energy Commission, the W.A. Fire Brigades Board, the Main Roads Department and the Metropolitan Water Authority, in consultation with the Department of Conservation and Environment, manage the area so as to retain as much as possible of the natural vegetation; and
2. That the protection of the conservation value of natural vegetation on the privately owned freehold land be sought through planning procedures to be developed as recommended elsewhere in *System Six*.

Perth's Bushplan (Government of Western Australia, 1998) updated and continued the process initiated by *System Six* by identifying areas of regionally significant bushland and associated wetlands in the Perth area suitable for protection. Re-assessment of bushland areas listed in the *System Six* report, as part of *Perth's Bushplan*, resulted in several parcels of land including Lot 21 being excluded from the original *System Six* M53 site, which was proposed for reservation as Site 319 (Government of Western Australia, 1998). After a public review period of *Perth's Bushplan*, these excisions have remained in the final version of the report, *Bush Forever* (Government of Western Australia, 2000). It is understood the land was not included as part of Bush Forever Site 319 as it was isolated from the core conservation area of Site 319 by industrial zoned land and road infrastructure. *Bush Forever* recommended that Site 319 be reserved for Parks and Recreation. The boundaries of both the *Bush Forever* site 319 and the *System Six* site M53 on an aerial photograph layer are shown in Figure 5, while a close up aerial photograph is shown in Figure 6.

Figure 5 Bush Forever Site 319 and System Six Site M53 in relation to Lot 21

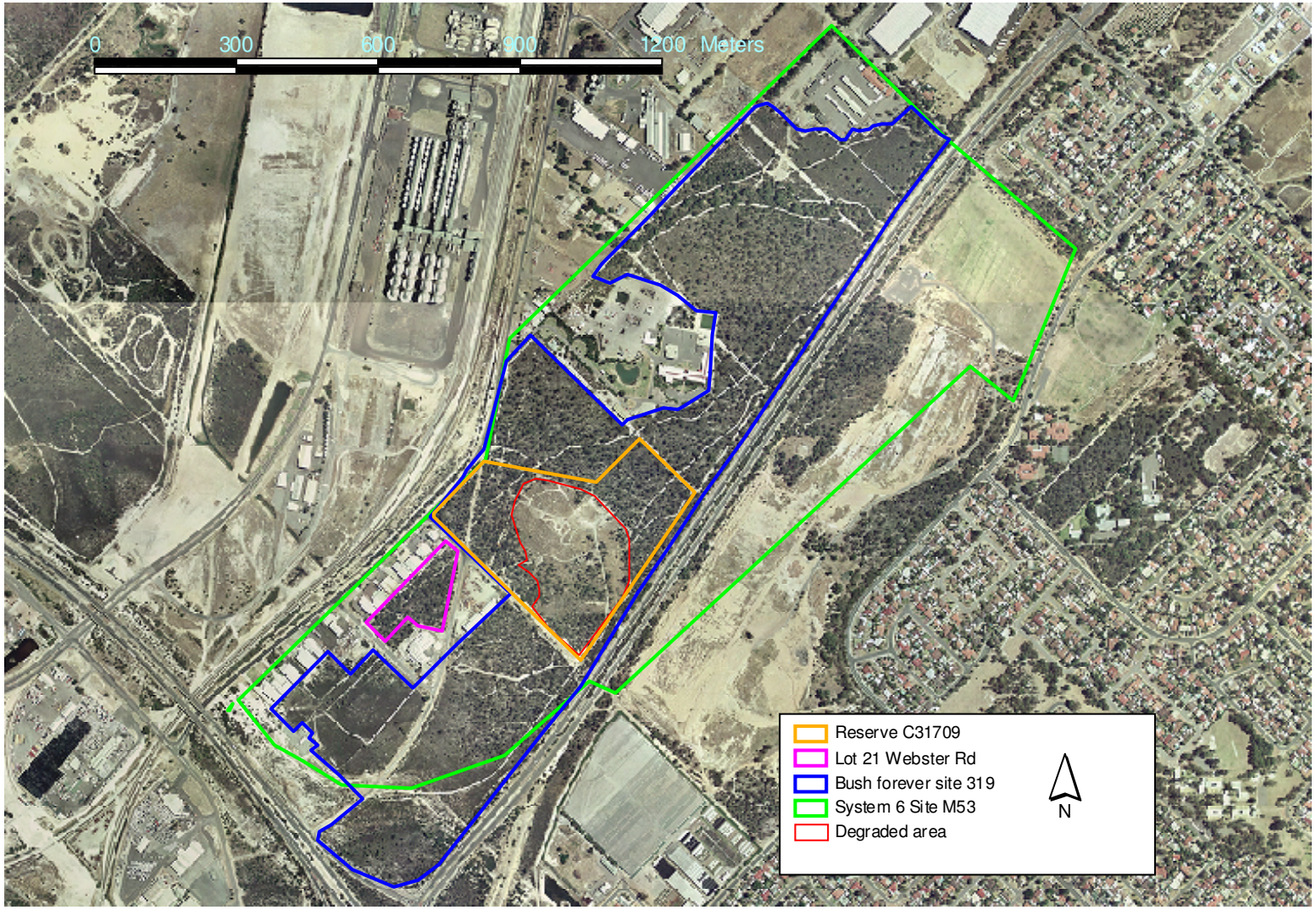
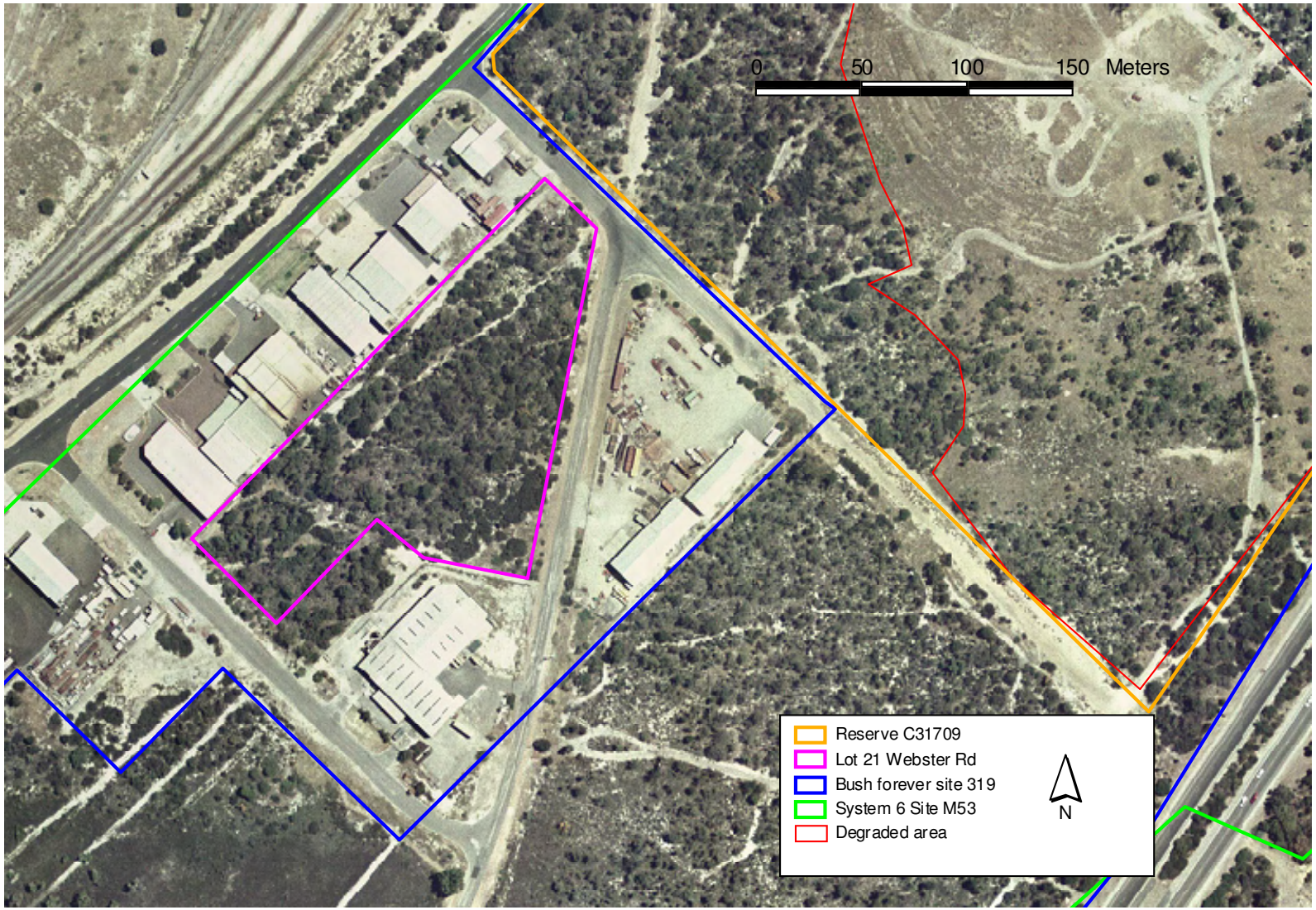


Figure 6 Aerial Photograph of Lot 21, Webster Road



When the proponent initially applied to subdivide the site for development, the EPA set the level of assessment as Informal Review with Public Advice (now referred to as 'Not Assessed – public advice given'). Three appeals were made against the EPA's decision in March 2000. In October 2000, the former Minister for the Environment upheld these appeals and directed the EPA to formally assess the proposal pursuant to Part IV of the *Environmental Protection Act 1986.*

Prior to the EPA setting the final level of assessment, Ecoscape, on behalf of the proponents, submitted a report outlining the proposal (Ecoscape, 2001) to the Department of Conservation and Land Management and the EPA for informal assessment. The EPA set the level of assessment at PER on the 30 July 2001, with a public review period of four weeks. After the level of assessment was set, and the EPA had received comments from the Department of Conservation and Land Management (DCLM), the EPA outlined the structure and contents that would be required for the PER in a letter dated 1 November 2001 (Appendix One).

3.4 Proposed Sub-division Plan

At present there are no specific proposals for site development, other than to subdivide the Lot into seven lots. The proponent wishes to sub-divide Lot 21 into seven industrial lots and then on sell them. This requires clearance of all the bushland on Lot 21.

3.5 Benefits of Proposal and Offset

There are a number of benefits to the above proposal, for both the owners of Lot 21 as well as to the Water Corporation, the general public and the environment. The benefits outlined below are discussed in terms of the contribution of the proposal to the conservation and restoration of the whole of Reserve C31709, which is part of *Bush Forever* area.

The main benefit of this proposal is the assistance it provides to the long-term conservation of the Threatened Ecological Community (TEC) and Declared Rare and Priority Flora (DRPF) found on Lot 21 and in *Bush Forever* Site 319.

Lot 21 is privately owned, zoned *Industrial* and not subject to any bushland management measures. Whilst the site at present has conservation value, it will degrade without intensive management due to: its small size (1.84 ha); large interface with developed areas (approximately 600 m); and existing level of degradation including weed and *P. cinnamomi* dieback expression, approximately 600 m of informal tracks exist throughout the area, and approximately 0.51 ha of vegetation is in poor condition. There is also an infestation of *P. cinnamomi* in Lot 21 (Section 4.1.4), which may spread given the occurrence of *P. cinnamomi* susceptible species (Section 4.1.5) and tracks within the Lot. Without appropriate management, over time these factors will result in the degradation of vegetation communities and DRPF located in Lot 21.

In contrast, Reserve C31709 is relatively large, has good linkages to adjacent bushland, is already owned by the Crown and while not currently actively managed, it has been zoned for Parks and Recreation and included in *Bush Forever*. Although parts of both sites are

degraded, Reserve C31709 is more suitable for restoration and long-term conservation management of threatened species because of its tenure and size. However, continued degradation of Reserve C31709 in the absence of appropriate management will restrict its conservation potential. The proposed transfer of bushland elements from Lot 21 to Reserve C31709 will not only initiate restoration of the site, but will assist in ensuring future management of Reserve C31709's conservation values. This transfer will also offset the loss of bushland on Lot 21 with an improvement in the potential conservation of threatened flora species in Lot 21.

The specific benefits of the proposed arrangement, which primarily relate to the potential to rehabilitate part of Reserve C31709, are outlined below.

Bush Forever

The use of elements from Lot 21 to restore the rehabilitation site will assist in fulfilling the aims of *Bush Forever*, by promoting the long-term viability of the nearby 58 ha *Bush Forever* Site. In particular, the transfer of plant and soil material will help improve the condition of the site, of which approximately 3ha is cleared, and the conservation of DRPF found on the Water Corporation component of the *Bush Forever* site. The Water Corporation does not have any plans for restoring the bushland on Reserve C31709, and without active management, the values of the bushland which made it suitable for inclusion in *Bush Forever* are likely to diminish. Provision of materials for restoration of the site as part of this proposal would help prevent this from occurring.

Vegetation Condition

Many areas of Reserve C31709are weed infested and there is an accumulation of dumped rubbish. The vegetation condition of the site has consequently been degraded over time and approximately 3 hectares of the site are bare. The current proposal presents an opportunity to reverse this pattern, and improve the overall condition of vegetation on the chosen rehabilitation area and the overall Reserve. An improvement in the condition of the overall vegetation will increase its resilience to weed invasion and thereby improve the long-term viability of DRF and Priority Flora.

Seedbank

Soil in native bushland areas can contain a large viable seed bank. This may include seeds of Declared Rare and Priority species as well as more common species, and often the process of soil disturbance can be beneficial to seed germination, especially for orchids and *Acacia* species.

Although the clearing of Lot 21 will result in bushland being removed, it will also allow soil containing the seed bank to be used in the chosen rehabilitation site. This degraded area is unlikely to have a large viable native seed bank because of its long history of neglect and high incidence of weed invasion. The use of topsoil from Lot 21 will assist in replenishing the seedbank of the rehabilitation site, providing a seed source for the re-establishment and continued recruitment of vegetation in Reserve C31709.

The use of topsoil rather than obtaining seedlings is likely to provide a better result in the range of plants re-established and due to their proximity of Lot 21 the genetic integrity of Reserve C31709 will be maintained.

Long Term Management

While Reserve C31709 remains vested with the Water Corporation, it is unlikely any active management will occur on the site. Again, this will lead to further degradation of the site. This is undesirable as the site contains Rare and Priority flora as well as Threatened Ecological Communities. The current proposal provides an opportunity to initiate the restoration process, through provision of materials, which would perhaps not otherwise occur in the short-term. This may provide the impetus for the Water Corporation to undertake a rubbish removal process, and thereby provide the opportunity to relinquish the land and see the long-term management taken over by another agency consistent with the intentions of *Bush Forever*.

The combined effectiveness of the provision of local top-soil, seed banks and local provenance vegetation provides for a much higher likelihood that any restoration programme implemented would be a success.

Cost Effectiveness

The current proposal provides a nearby source of topsoil containing a native seed bank, as well as vegetation, timber and brush materials. This represents a cost effective method of bushland restoration as the materials would not have to be purchased. Additionally, the close proximity of Lot 21 to Reserve C31709 negates the need for high transport costs or top-soil storage.

3.6 Consideration of Alternative Options

Government Purchase

One alternative to developing the site would be for the Government to purchase Lot 21 from R. Peters and D. Papagioftsis. However, this will involve a cost to the Government, not only for the original purchase but also for the on-going management of the site. Negotiations were undertaken to ascertain to the Government's willingness to purchase the site, however no offer has been made.

Develop Without Offset Using *Bush Forever* Site 319

A second alternative is to develop the site without transferring the biologically valuable components of the bushland. This is environmentally undesirable and would result in a net loss of bushland and species in the area. It is also unlikely to receive public or government approval.

No Development

A third option is for the proponents to retain ownership of the site, without any development. This option is also environmentally undesirable. With no income being derived from the Lot, the proponents will not manage any of the biologically valuable components of the bushland. Given that the Lot is unfenced and used to access surrounding streets, it is likely that it will continue to degrade with increasing weed and dieback infestation and loss of understorey species and structure.

Preferred Option

None of the three above alternatives offer the economic and environmental benefits of developing Lot 21 and transferring vegetative and soil material to *Bush Forever* Site 319. The proposal to transfer the biologically valuable components of bushland from Lot 21 to Reserve C31709 will result in little, if any, net loss of biological values in the local area while allowing for development in the area. The proposal will also help improve the condition of a site recognised as being regionally significant under *Bush Forever* thereby enhancing its conservation value.

3.7 Legislative / Planning Context

3.7.1 Environment Protection and Biodiversity Conservation Act, 1999

The Commonwealth's *Environment Protection and Biodiversity Conservation (EPBC) Act, 1999* came into force in July 2000. The EPBC Act has provisions for the protection of threatened taxa and communities, although the focus is on actions that are of national environmental significance. Section 18 of the EPBC Act prohibits activities that has or will have a significant impact or that is likely to have a significant impact on a threatened species listed under the Act.

To minimise duplication of the environmental assessment and approval process under Commonwealth and State law, bilateral agreements are being negotiated between the Commonwealth and States or Territories. The Commonwealth and Western Australian government have entered into a bilateral agreement, which will come into the effect once the amendments to the Western Australian *Environmental Protection Act 1986* have been passed through parliament. These agreements allow the Commonwealth Environment Minister to recognise the assessment and/or approvals process of a State or Territory for a certain class of actions, avoiding the need for the Commonwealth to duplicate the assessment and/or approvals process.

3.7.2 Environmental Protection Act, 1986

This is the principal environmental management and pollution control legislation in Western Australia. The Department of Environmental Protection (DEP) has the responsibility of administering the Act, through environmental systems management, waste management, pollution prevention, evaluation of proposals and environmental policy coordination. The Act provides for the conservation, preservation, protection, enhancement and management of the environment, including the assessment of development proposals, which is undertaken by the EPA with assistance from DEP.

The EPA originally set the level of assessment for this proposal as 'Not Assessed – public advice' given (previously known as Informal Review with Public Advice). This level of assessment was appealed and the Minister for the Environment upheld the appeals and the EPA has subsequently set the level of assessment as a Public Environmental Review (PER).

3.7.3 Wildlife Conservation Act, 1950

State laws governing flora conservation are contained in the *Wildlife Conservation Act, 1950* and its Regulations, which are administered by the Department of Conservation and Land Management. Under the *Wildlife Conservation Act, 1950*, the Minister for the Environment may declare species of protected flora to be "Rare Flora" if they are considered to be in danger of extinction, rare or otherwise in need of special protection. Such species are referred to as Threatened Flora, and receive special management attention by the Department of Conservation and Land Management.

Those species listed as declared rare flora may not be taken without the specific written approval of the Minister for the Environment. This prohibition applies equally to both Crown and private land; to licensed and unlicensed persons; and to the owners and occupiers of land on which rare flora is found.

3.7.4 Town Planning and Development Act, 1928

The *Town Planning and Development Act, 1928* relates to the planning and development of land for urban, suburban and rural purposes. The proposed development is in accordance with the relevant Planning Schemes

3.7.5 Bush Forever

Bush Forever is a 10 year strategic plan to identify, protect and manage around 51 000 ha of regionally significant bushland, identified as *Bush Forever* sites, within the Perth Metropolitan Region. *Bush Forever* is the result of the Perth's Bushland Project, which is part of a process that began with recommendations for *System Six* in the 1970's. *Bush Forever* recommendations supersede the *System 6* recommendations for the Perth Metropolitan Region portion of the Swan Coastal Plain. *Bush Forever* aims to conserve, where possible, at least 10% of each of the original 26 vegetation complexes of the Perth Metropolitan Region portion of the Swan Coastal Plain, (Government of Western Australia, 2000). *Bush Forever* sites were selected using the following criteria:

- Representation of ecological communities;
- Diversity;
- Rarity;
- Maintenance of ecological systems or natural processes;
- Scientific or evolutionary performance;
- Protection of wetland, streamline, estuarine fringing vegetation and/or coastal vegetation; and
- Other values, e.g. historical or landscape – these did not determine regional significance alone, but contributed towards recognising the significance of particular areas of bushland.

3.7.6 Metropolitan Region Scheme

The Perth Metropolitan Region Scheme (MRS) has been prepared to control land use and development in the Perth Region. The scheme was established, and is amended and administered under the *Metropolitan Region Town Planning Scheme Act, 1959*. Under the MRS, land is classified into either reserves or broad zones and the development of land is controlled by the various measures provided for by the Scheme. Lot 21 is classified as *Industrial* under the MRS.

3.7.7 Shire of Kalamunda Town Planning Scheme

Town Planning Schemes set out the way land is to be used and developed within each local government's boundaries. They classify areas for land use and include provisions to coordinate land use and development in a locality. Lot 21 is classified as *Light Industrial* under the Shire of Kalamunda Town Planning Scheme.

4.0 Environmental Factors and Impacts

The following section describes the site-specific relevant environmental factors that the EPA requires to be addressed (Appendix One). A description of the characteristics of each factor as it occurs in Lot 21 and the area of the Water Corporation site to be rehabilitated using material from Lot 21 is provided. This is to allow an overall assessment of the impact of the proposal and whether the EPA objectives for each factor will be met.

Table 1 summarises the environmental factors relevant to this proposal, the EPA objective for that factor, the impacts of the proposal, management strategies to offset those impacts and whether the EPA objective will be met.

Table 1: Summary of environmental factors relevant to the proposal

Environmental Factor	EPA Objective	Existing Environment	Impacts of Proposal	Management measures	Predicted Outcome
Vegetation and Flora	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation	• Vegetation of Lot 21 and Reserve C31709 has been mapped as being of the Southern River Complex (Heddle *et al*., 1980), with mostly a *Eucalyptus marginata* (Jarrah) – *Allocasuarina fraseriana* (Sheoak) – *Banksia* species woodland present in Lot 21 • Lot 21 contains the Threatened Ecological Community (TEC) type 20a – *Banksia attenuata* woodland over species rich dense shrublands • *Bush Forever* Site 319 (which includes Reserve C31709) contains 3 TECs – types 2, 3a and 20a • Much of Lot 21 is considered to be in good condition, Reserve C31709 is fairly degraded • Lot 21 contains a small area of *Phytophthora cinnamomi* along the south-west boundary • Lot 21 contains 67 native plant taxa and 3 weed species	• Removal of all vegetation and flora from Lot 21 (1.84 ha)	• Develop a detailed Rehabilitation Plan which details the methods of clearing, transfer and rehabilitation to ensure maximise transfer success and minimise loss of vegetation components • Identify a rehabilitation site suitable in terms of similar vegetation • Transfer topsoil and brush material to offset loss from Lot 21 • Remove environmental weeds from Lot 21 and rehabilitation site • Transplant suitable species, e.g. *Xanthorrhoea preissii* • Monitor survival of transplants and germinants • Monitor soil conditions • Undertake weed management • Monitor development of vegetation community	EPA objective can be met
Declared Rare and Priority Flora	Protect Declared Rare and Priority Flora, consistent with the provisions of the *Wildlife Conservation Act 1950* and the *Environment Protection and Biodiversity Act 1999*	• Lot 21 contains the Declared Rare Flora, *Conospermum undulatum* and Priority 3 flora, *Isopogon drummondii* • *Bush Forever* site 319 contains two Declared Rare Flora, one Priority 1 flora, three Priority 3 flora and two Priority 4 flora	• Removal of significant flora from Lot 21	• Develop a detailed Rehabilitation Plan which details the methods of clearing, transfer and rehabilitation • Transfer individuals of *Conospermum undulatum* and *Isopogon drummondii* to rehabilitation site • Monitor success of transfer • Undertake remedial action if	EPA objective can be met

Environmental Factor	EPA Objective	Existing Environment	Impacts of Proposal	Management measures	Predicted Outcome
				required	
Fauna	Maintain the species abundance, diversity and geographical distribution of fauna	Based on the vegetation present in Lot 21 the following species may be present: • *Banksia attenuata* nectar attracts Honey Possums, Honeyeaters, Silvereyes, Wattlebirds, Carnaby's Black Cockatoo and the Red-capped Parrot • *Banksia menziesii* nectar attracts a number bird species, while seeds and cones attract weevil and moth larvae • *Banksia grandis* indirectly attracts Robins, Willie Wagtails, Black-faced Cuckoo-Shrikes and Bee-eaters, while its seeds and cones attract Carnaby's Black Cockatoo and weevil larvae • *Allocasuarina fraseriana* provides habitat for a number of invertebrates • *Tadarida australis* (White-striped Bat) may occur in the area Given the small size of the Lot, few of these species will reside in the Lot	• Removal of fauna habitat from Lot 21	• Transfer and re-establish components of fauna habitat in rehabilitation site	EPA objective can be met

4.1 Vegetation and Flora

4.1.1 Vegetation Communities

EPA Objective: Maintain the abundance, species diversity, geographic distribution and productivity of vegetation and flora.

Vegetation Community Description

Heddle *et al*. (1980) mapped the vegetation around Forrestfield, including Lot 21, as being of the Southern River Complex, which is commonly found at the interface between the Bassendean Dunes and the Pinjarra Plain. The Southern River Complex can be broadly described as open woodland of Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*) and *Banksia* species with fringing woodland of Flooded Gum (*E. rudis*) and Swamp Paperbark (*Melaleuca rhaphiophylla*) along creek beds.

Ecoscape undertook a general vegetation survey of Lot 21 in March 2001 and established two 10 x 10 m quadrats in September 2002. Because of the small area of the Lot, the whole Lot was traversed in March 2001 and vegetation community mapping was based on visual identification of vegetation communities (aided by aerial photography interpretation), with one main community identified. While Lot 21 is not wet enough to support a Flooded Gum-Swamp Paperbark community characteristic of the Southern River Complex, components of a Marri-Jarrah-Banksia community are present. The vegetation of Lot 21 is essentially a *Eucalyptus marginata* (Jarrah) – *Allocasuarina fraseriana* (Sheoak) – *Banksia* species woodland. The floristic composition of the Lot is discussed in Section 4.1.5.

The vegetation of *Bush Forever* Site 319, including Reserve C31709, adjacent to Lot 21 has also been identified as part of the Southern River Complex (Government of Western Australia, 2000).

Potential Impacts

The proposal will result in the 1.84 ha of bushland on Lot 21 being cleared. The vegetation on Lot 21 ranges from *Very Poor* to *Very Good – Excellent* (see Figure 7), with the majority of the site being in *Fair – Good* condition (0.82 ha)

Proposed Management

Prior to clearing the site of vegetation:

- A rehabilitation plan will be developed detailing hygiene, methods of clearing, transfer and rehabilitation to ensure maximise transfer success and minimise loss of vegetation components;
- A suitable rehabilitation site will be identified in accordance with the criteria set out in this proposal; and
- Environmental weeds will be sprayed at Lot 21 and the rehabilitation site.

The topsoil and brush material will also be transferred from Lot 21 to the identified rehabilitation site, as well as suitable species being transplanted. The areas mapped in Figure 7 as being in *Very Good – Excellent* condition and areas towards the *Good* end of the range within the *Fair – Good* category will provide materials for relocation, by using this vegetation the likelihood of introducing more weed seed to the rehabilitation site will be reduced. Monitoring of weeds, soil conditions, transplanted plants and germinants will be undertaken.

Proposed Outcome

The original extent of the Southern River complex on the Swan Coastal Plain/Perth Metropolitan Area was approximately 31,000 ha, of which 17% or 5,270 ha remains today (Government of Western Australia, 2000). *Bush Forever* has set a reservation target of 10% for each of the original 26 vegetation complexes of the Swan Coastal Plain portion of the Perth Metropolitan Area. Under *Bush Forever,* 10% of the original extent of the Southern River complex is proposed for protection. Clearing of the vegetation of Lot 21 will not therefore affect attainment of *Bush Forever*'s 10% target nor significantly alter the remaining amount of the complex. The transfer of material from Lot 21 to the rehabilitation site will aid in the regeneration and continued existence of this complex in *Bush Forever* Site 319. The proximity of the two areas minimises the impact on the geographical distribution of the vegetation community in Lot 21. The management measures outlined in Section 5.0 will apply best practice to maximise the potential to successfully re-establish the components of the community, minimising the risk of loss of species diversity. On balance, the EPA objective for this factor will be met.

4.1.2 Threatened Ecological Communities

EPA Objective: Maintain the abundance, species diversity, geographic distribution and productivity of vegetation and flora.

TEC Description

Ecoscape conducted a flora and vegetation survey of Lot 21 in September 2002, when most of the species present in the Lot were likely to be flowering. The survey was conducted in accordance with accepted methods for assessing the presence of TEC's. Two 10 x 10 m quadrats were placed in representative areas of the Lot, and all species present in the quadrats recorded. A search was also made around each quadrat for any additional species. The quadrat data was analysed using PATN against the original dataset of Gibson *et al.* 1994 to determine the occurrence of TECs. This analysis indicates that the vegetation composition within the two quadrats is consistent with that of Gibson *et al*'s. (1994) Floristic Community Type (FCT) 20a - *Banksia attenuata* woodland over species rich dense shrublands (Trudgen, M. *pers. comm*. October 2002). FCT 20a is listed as a Threatened Ecological Community (Government of Western Australia, 2000).

FCT type 20a - *Banksia attenuata* woodland over species rich dense shrublands is considered by the Western Australian Department of Conservation and Land Management to be endangered (Government of Western Australia, 2000). 'Endangered' is defined as "an ecological community which has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future" (Government of Western Australia, 2000). FCT 20a is not listed under the *Environment Protection and Biodiversity Conservation (EPBC) Act, 1999.*

FCT 20a is a component of the vegetation community 'Supergroup 3' as identified by Gibson *et al*. (1994). 'Supergroup 3' predominantly occurs on the Bassendean Dunes, but also extends onto the Pinjarra Plain and the Spearwood Dune systems (Gibson *et al*., 1994). FCT 20a occurs on the sandy soils near Koondoola and at the base of the Darling Scarp, in Forrestfield, which includes Lot 21 (Gibson *et al*., 1994). In the latter area, FCT 20a occurs across two landform units, the Southern River and the Karrakatta unit; as described in Section 4.1 the vegetation of Lot 21 lies within the Southern River unit. The vegetation of FCT 20a is dominated by *Banksia attenuata* or *Eucalyptus marginata – Banksia attenuata* woodlands, with a more diverse shrub layer than other *Banksia* woodlands (Gibson *et al*., 1994). Species used to infer FCT 20a are: *Alexgeorgea nitens*, *Daviesia nudiflora, Synaphea spinulosa, Hibbertia racemosa* and *Stylidium calcaratum.* Other shrub species typical of FCT 20a include: *Bossiaea eriocarpa; Conostephium pendulum; Hibbertia huegelii; Hibbertia hypericoides; Petrophile linearis; Scaevola repens* var. *repens;* and *Stirlingia latifolia* (Gibson *et al*., 1994).

Bush Forever Site 319 (including Reserve C31709) contains the following TECs (Government of Western Australia, 2000):

- *Banksia attenuata* woodland over species rich dense shrublands (FCT 20a);
- *Eucalyptus calophylla - Kingia australis* woodlands on heavy soils, Swan Coastal Plain (FCT 3a); and
- Southern wet shrublands, Swan Coastal Plain (FCT 2).

Community type 20a is described above.

Community type 3a - *Eucalyptus calophylla - Kingia australis* woodlands on heavy soils, is listed under the *Environment Protection and Biodiversity Conservation (EPBC) Act, 1999* as being Critically Endangered and a recovery plan has been produced for the community (English and Blythe, 2000). The community is a component of Gibson *et al*.'s (1994) vegetation 'Supergroup 1', which is restricted to the Pinjarra Plain and Ridge Hill Shelf. FCT 3a occurs on the wettest of the soils, and the highest rainfall sites of the group of Marri communities that occur on the heavy soils on the eastern side of the Swan Coastal Plain (Gibson *et al*., 1994). Occurrences may become inundated in the wetter months due to rainfall and surface flows because the community occurs mainly on soils that contain a clay layer that is quite impervious. There is approximately 83 ha of community type 3a remaining and the most significant threat to the community is clearing, although weeds, altered fire regimes, increasing salinisation and changes in hydrology also threaten this community (English and Blythe, 2000). It is not known if community type 3a is susceptible to dieback.

Plant communities that occur on heavy soils, especially in relatively flat areas, are generally not highly susceptible to *Phytophthora* (Helyar, 1994).

Community type 2 - Southern wet shrublands, is not listed under the *EPBC Act, 1999* but is listed informally in Western Australia as being endangered (Government of Western Australia, 2000). FCT 2 is comprised of small shrublands or open woodlands and is generally restricted to south of Busselton (Gibson *et al*., 1994). The community in *Bush Forever* Site 319 is the most northern occurrence of this FCT, is the only occurrence of the community in the Perth Metropolitan Area and the community is disjunct from the southern communities (Government of Western Australia, 2000). Shrub species typical of this community type include: *Calothamnus lateralis; Eutaxia virginata; Hakea ceratophylla; Hakea varia; Isopogon scaber; Kingia australis; Pericalymma ellipticum; Synaphea petiolaris;* and *Xanthorrhoea preissii*.

Reserve C31709 is generally fairly degraded and is unlikely therefore to contain any of the above TECs. Further site assessment to select a specific rehabilitation site, using the four criteria listed in Section 5.2.2, will involve targeted surveys to identify the occurrence and distribution of these TECs in Reserve C31709.

Potential Impacts

The removal of vegetation from Lot 21 will also remove the present Threatened Ecological Communities. Consideration of the impact of the proposal on TECs is relevant because of the presence of TECs in both the area to be cleared and *Bush Forever* Site 319. The removal of the present TEC's and their translocation may affect the survival of the community, which in turn will be significant to the overall biodiversity of the area. The proposed translocation management strategies outlined in Section 5.0 will reduce the risk of significantly altering the vegetation community structure and composition.

Proposed Management

The site chosen for rehabilitation will be a relatively degraded area and preferably be located adjacent to less disturbed vegetation to help consolidate the integrity of the existing vegetation, particularly that of TEC 20a. Existing vegetation will also assist in the natural regeneration of the site by providing a source of additional seed and vegetation material. In order to maximise the success of Threatened Ecological Communities being re-created on the rehabilitation site, the site will also be preferably located in a similar environment, particularly in terms of soil and hydrology, to that of Lot 21.

Proposed Outcome

Strategies are detailed in Section 5.0 to ensure the maximum potential to transfer all components of FCT 20a from Lot 21 to the selected rehabilitation site, minimising the risk of reducing species diversity. The proximity of the two areas minimises the impact on the geographical distribution of FCT 20a. Strategies are also discussed in Section 5.2.2 and Section 5.0 to ensure that the transfer of material will not damage or destroy any part of the

TECs present at the site. These strategies will apply best practice management in order to minimise environmental impact and meet EPA Objectives.

4.1.3 Bushland Condition

EPA Objective: Maintain the abundance, species diversity, geographic distribution and productivity of vegetation and flora.

Condition Description

The bushland condition of Lot 21 was mapped during March 2001 according to the categories shown in Table 2 and is depicted in Figure 7.

Table 2: Bushland condition scale used for mapping.

Very Good – Excellent	**Fair – Good**
• 80 – 100% Native Flora composition • Vegetation structure intact or nearly so • Cover/abundance of weeds less than 5% • Minor signs of disturbance	• 50 – 80% Native Flora composition • Vegetation structure modified or nearly so • Cover/abundance of weeds 5 – 20% • Disturbance influence moderate
Poor	**Very Poor**
• 20 – 50% Native Flora composition • Vegetation structure completely modified • Cover/abundance of weeds 20 – 60% • Disturbance incidence high	• 0 – 20% Native Flora composition • Vegetation structure disappeared • Cover/abundance of weeds 60 – 100% • Disturbance incidence very high

Adapted from Kaesehagen (1995).

The north-eastern portion of the lot has suffered from significant disturbance and was in *Very Poor* to *Poor* condition. Tracks through the lot and an area on the southern boundary were also in *Very Poor* condition. A central core area of bushland was in *Very Good – Excellent* condition, surrounded by a larger area of bushland in *Fair – Good* condition. Only areas with little or no weed invasion should be used to provide materials for transference to reduce the likelihood of introducing more weed seed to Reserve C31709. In the case of Lot 21 this will be those areas mapped as being in *Very Good – Excellent* condition and areas towards the *Good* end of the range within the *Fair – Good* category.

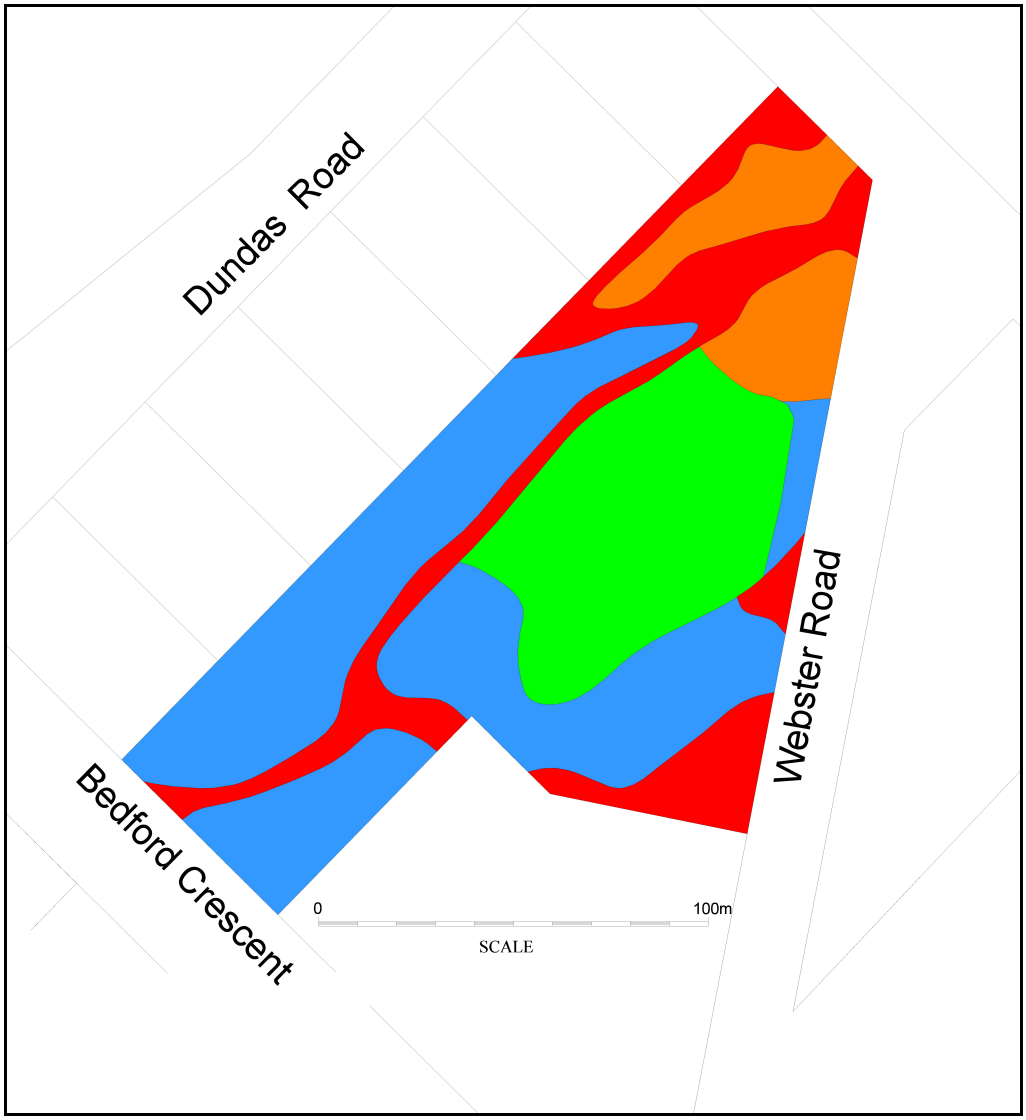


Figure 7 Bushland condition of Lot 21, Webster Road, Forrestfield.

Potential Impacts

Consideration of bushland condition is relevant to this proposal as 1 ha of relatively intact bushland (either *Fair – Good* or *Very Good – Excellent*) within the core of Lot 21 will be removed from the local area. Complete removal of vegetation from Lot 21 would remove areas that are considered to be in *Very Good – Excellent* condition. The proposed translocation of biologically valuable components from Lot 21 to the adjacent to Reserve C31709 has the possibility to create high quality bushland in degraded areas within Reserve C31709. The high quality of this core area of vegetation will contribute to the success of the relocation and rehabilitation program and increase the long-term viability of Reserve C31709.

Proposed Management

The vegetation of Lot 21 that has been determined as relatively intact bushland (either *Fair – Good* or *Very Good – Excellent*) will be the vegetation that is transferred to Reserve C31709. If the translocation management strategies, detailed in Section 5.0, are carried out correctly the transfer is more likely to be effective in re-establishing good condition bushland in the rehabilitation site.

Proposed Outcome

The overall aim of this proposal is to offset the loss of this good condition bushland in Lot 21 through transfer of the biologically valuable component of the bushland to the rehabilitation site, to help improve the overall condition of bushland at Reserve C31709. Implementation of the rehabilitation and ongoing management strategies (Section 5.0) will ensure that this transfer is effective and there will be no net loss of bushland condition over the long-term. The strategies outlined in Section 5.0 will apply best practice management in order to minimise environmental impact and meet EPA Objectives.

4.1.4 *Phytophthora cinnamomi* (Dieback)

EPA Objective: Maintain the abundance, species diversity, geographic distribution and productivity of vegetation and flora.

Current Infestation

Phytophthora species are water-borne pathogens (water mould) that can kill a wide selection of plant species of the southwest Western Australia (Glevan Dieback Consultancy Services, 2002). Glevan Dieback Consultancy Services undertook a *Phytophthora* species dieback assessment of Lot 21 in August 2002. This assessment suggested a small infestation had occurred near Bedford Crescent. Plant deaths observed in this area included: *Eucalyptus marginata; Banksia attenuata; Xanthorrhoea preissii;* and *Stirlingia latifolia*. Disease impact within this infestation is moderate. Scattered *Banksia* deaths and stressed mature *Eucalyptus marginata* were observed throughout Lot 21 but are thought to be drought related rather than being due to *Phytophthora* infestations.

Dead *X. preissii* and *B. attenuata* trees were sampled near Bedford Crescent for laboratory analysis. These samples confirmed the presence of *Phytophthora cinnamomi*. The extent of *Phytophthora* infestation in Lot 21 is shown on Figure 8 and was marked in the Lot.

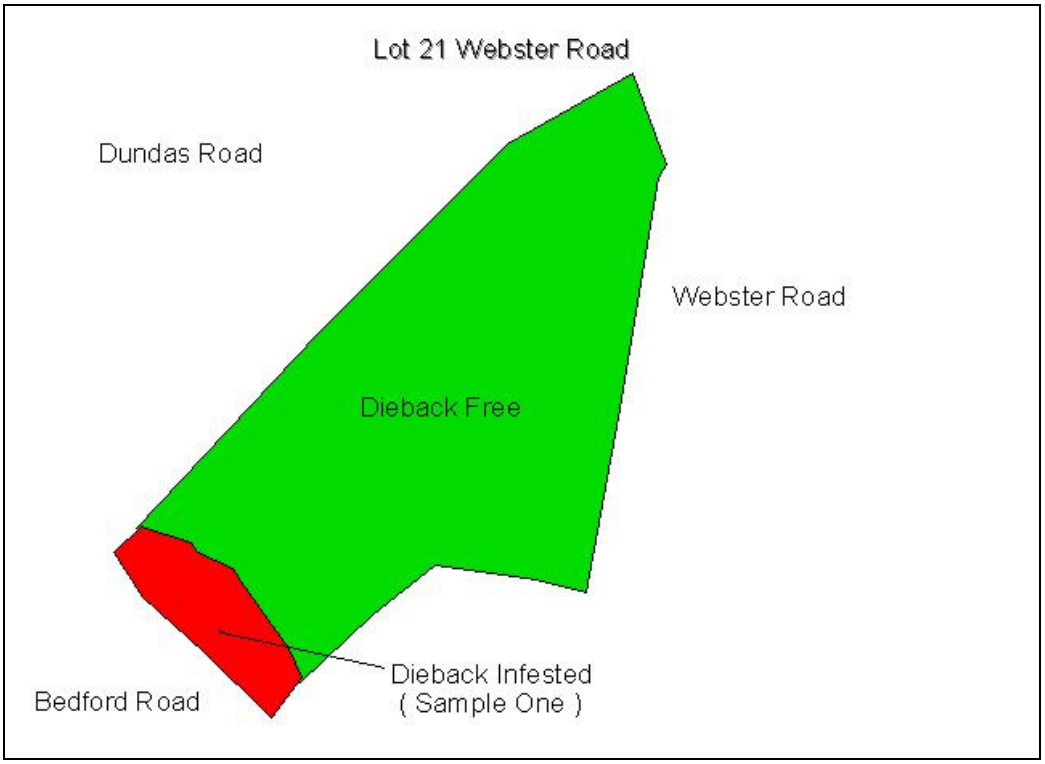


Figure 8 Location of* Phytophthora *dieback infested area of Lot 21.

Potential Impacts

There is a risk of introducing *Phytophthora* dieback during transfer of vegetation from Lot 21 to Reserve C31709. If dieback was introduced to Reserve C31709 with vegetation transferred from Lot 21 the abundance, diversity, distribution and abundance of the vegetation will be affected. Vegetation from the dieback infested area will not be used for translocation, therefore the risk of spreading it is greatly reduced and the vegetation will be protected.

Proposed Management

To minimise the risk of introducing dieback into Reserve C31709, the dieback infested area near Bedford Road will be excluded from the transfer of material. (This is discussed in further detail in Section 5.3.1.) Vegetation within a 10 metre buffer from the infested area will also be excluded from transfer.

Proposed Outcome

Exclusion of dieback infested areas of Lot 21 will ensure that the EPA objective for vegetation will be met. The exclusion of dieback infested soil and vegetation from the rehabilitation site is a best practice measure that minimises adverse environmental impacts.

4.1.5 General Flora

EPA Objective: Maintain the abundance, species diversity, geographic distribution and productivity of vegetation and flora.

Existing Environment

Ecoscape undertook two flora surveys of Lot 21. In March 2001, a general survey of the Lot was made, with dominant and co-dominant species present recorded. In September 2002, two 10 x 10 m quadrats were established, with all flora present recorded. The two surveys recorded a total of 70 plant taxa, including three weed species, the DRF *Conospermum undulatum* and the Priority Three flora *Isopogon drummondii* (Table 3).

The three weed species present in Lot 21 are mostly confined to the edges of the Lot and along tracks. Within the *Fair – Good* and *Very Good – Excellent* areas of the Lot there are only a few isolated pockets of weeds.

Table 3: Flora taxa recorded from Lot 21 during March 2001 and September 2002 survey.

Species	Family	Status
Acacia willdenowiana	Mimosaceae	
Adenanthos cygnorum	Proteaceae	
Alexgeorgea nitens	Restionaceae	
Allocasuarina fraseriana	Casuarinaceae	
Allocasuarina humilis	Casuarinaceae	
Amphipogon turbinatus	Poaceae	
Anigozanthos manglesii	Haemodoraceae	

Species	Family	Status
Astroloma stomarrhena	Epacridaceae	
Banksia attenuata	Proteaceae	
Banksia grandis	Proteaceae	
Banksia menziesii	Proteaceae	
Baumea juncea	Cyperaceae	
Bossiaea eriocarpa	Papilionaceae	
**Briza maxima*	Poaceae	Weed
Burchardia umbellata	Colchicaceae	
Caladenia paludosa	Orchidaceae	
Calectasia narragara	Dasypogonaceae	
Conospermum acerosum subsp. *acerosum*	Proteaceae	
Conospermum undulatum	Proteaceae	DRF
Conostephium pendulum	Epacridaceae	
Conostephium preissii	Epacridaceae	
Conostylis aculeata	Haemodoraceae	
Conostylis juncea	Haemodoraceae	
Conostylis setigera subsp. *setigera*	Haemodoraceae	
Conostylis setosa	Haemodoraceae	
Cyathochaeta avenacea	Cyperaceae	
Cyathochaeta equitans	Cyperaceae	
Dampiera linearis	Goodeniaceae	
Dasypogon bromeliifolius	Dasypogonaceae	
Dasypogon obliquifolius	Dasypogonaceae	
Daviesia decurrens	Papilionaceae	
Desmocladus fasciculatus	Restionaceae	
Drosera erythrorhiza subsp. *erythrorhiza*	Droseraceae	
Drosera menziesii subsp. *penicillaris*	Droseraceae	
**Ehrharta calycina*	Poaceae	Weed
Eucalyptus marginata	Myrtaceae	
Gompholobium confertum	Papilionaceae	
Gompholobium tomentosum	Papilionaceae	
Hemiandra linearis	Lamiaceae	
Hibbertia hypericoides	Dilleniaceae	
Isopogon drummondii	Proteaceae	Priority 3
Jacksonia floribunda	Papilionaceae	
Johnsonia pubescens subsp. *pubescens*	Anthericaceae	
Lepidosperma scabrum	Cyperaceae	
Leptomeria pauciflora	Rutaceae	
Leptomeria preissiana	Santalaceae	
Leucopogon conostephioides	Epacridaceae	
Leucopogon sprengelioides	Epacridaceae	
Lyginia barbata	Restionaceae	
Lyginia imberbis	Restionaceae	
Lysinema ciliatum	Epacridaceae	
Macarthuria australis	Molluginaceae	
Mesomelaena pseudostygia	Cyperaceae	
Monotaxis grandiflora	Euphorbiaceae	
Nuytsia floribunda	Loranthaceae	
Patersonia occidentalis	Iridaceae	
Persoonia saccata	Proteaceae	
Petrophile linearis	Proteaceae	
Philotheca spicata	Rutaceae	

Species	Family	Status
Pityrodia bartlingii	Lamiaceae	
Pterostylis sp.	Orchidaceae	
**Ricinus communis*	Euphorbiaceae	Weed
Schoenus sp.	Cyperaceae	
Scholtzia involucrata	Myrtaceae	
Stirlingia latifolia	Proteaceae	
Stylidium brunonianum	Stylidiaceae	
Stylidium dichotomum	Stylidiaceae	
Stylidium piliferum	Stylidiaceae	
Synaphea petiolaris	Proteaceae	
Synaphea spinulosa	Proteaceae	
Xanthorrhoea preisii	Xanthorrhoeaceae	

Bush Forever indicates that 223 native plant taxa have been recorded from Site 319 (Government of Western Australia, 2000).

Potential Impacts

Consideration of the floristic composition of vegetation in Lot 21 is relevant to this proposal so as to identify what species will be removed through the clearance of the Lot. It is also relevant in that identifying the flora of Lot 21 will assist in matching the vegetation of Lot 21 to a suitable rehabilitation site. Identification of flora from Lot 21 will also enable objectives to be created that measure the success of the translocation and rehabilitation.

Proposed Management

Strategies are detailed in Section 5.0 to ensure the maximum potential to transfer all components of the vegetation of Lot 21, either through the topsoil, use of brush material or transplanting of suitable species.

Proposed Outcome

By ensuring the maximum potential to transfer all vegetation components, the abundance and geographic distribution of the local vegetation will be maintained. By translocating as many different species as possible species diversity and productivity will be maintained on the rehabilitated site. The translocation of vegetation is a best practice measure that minimises environmental impact. Thus, the EPA objective can be met.

4.1.6 Declared Rare and Priority Flora

EPA Objective: Protect Declared Rare and Priority Flora, consistent with the provisions of the *Wildlife Conservation Act 1950* and the *Environment Protection and Biodiversity Conservation Act 1999*.

Existing Environment

A search of the Department of Conservation and Land Management's Threatened (Declared Rare) Flora Database and the Western Australian Herbarium Specimen Database was undertaken for records of Declared Rare and Priority Flora species in the vicinity of Lot 21.

The search returned 32 species of threatened taxa that could potentially be present within the Lot (Table 3). All of the Declared Rare Flora within the vicinity of Lot 21 are listed under the *EPBC Act, 1999* as either endangered or vulnerable.

Of the 32 threatened taxa which could potentially occur in Lot 21, Ecoscape's March 2001 and September 2002 surveys identified one Declared Rare Flora (DRF), *Conospermum undulatum* and one Priority 3 species, *Isopogon drummondii* from Lot 21 (Table 4). DRF are taxa that are extant and considered likely to become extinct or rare and therefore in need of special protection, while Priority 3 taxa are those species known from several populations (generally >5), and these populations are not believed to be under immediate threat.

Around 170 individuals of *Conospermum undulatum* and around 100 *Isopogon drummondii* plants were recorded from Lot 21. All locations or populations[1] of *Conospermum undulatum* and *Isopogon drummondii* within Lot 21 were recorded using a Global Positioning System (GPS) unit.

Eight of the species listed in Table 2 have been found within the adjacent *Bush Forever* Site 319 (Government of Western Australia, 2000). Both *Conospermum undulatum* and *Isopogon drummondii* are known to occur in Site 319, with *C. undulatum* known to occur in the Water Corporation part of Site 319. The population of *C. undulatum* found on the whole of the *Bush Forever* Site 319 is much larger than that found in Lot 21.

[1] Defined as a clump of individuals within a circle of a 5 m radius.

Table 4: Declared Rare and Priority Flora species in the vicinity of Lot 21.
Source: Department of Conservation and Land Management.

Species	Status		Recorded from Lot 21	Recorded from Site 319
	DCLM	EPBC Act		
Caladenia huegelii	Rare	Endangered		
Conospermum undulatum	Rare	Vulnerable	Yes	Yes
Diuris purdiei	Rare	Endangered		
Dryandra mimica	Rare	Endangered		
Macarthuria keigheryi	Rare	Endangered		Yes
Tetraria australiensis	Rare	Vulnerable		
Thelymitra stellata	Rare	Endangered		
Calandrinia sp.Kenwick (GJ Keighery 10905)	Priority 1			
Schoenus pennisetis	Priority 1			Yes
Astroloma foliosum	Priority 2			
Byblis lindleyana	Priority 2			
Leucopogon glaucifolius	Priority 2			
Aotus cordifolia	Priority 3			
Haemodorum loratum	Priority 3			
Isopogon drummondii	Priority 3		Yes	Yes
Lambertia multiflora var *darlingensis*	Priority 3			Yes
Leucopogon glaucifolius	Priority 3			
Nemcia acuta	Priority 3			
Olax scalariformis	Priority 3			
Platysace ramosissima	Priority 3			
Schoenus benthamii	Priority 3			Yes
Thysanotus anceps	Priority 3			
Baeckea sp.Darling Range (RJ Cranfield 1673)	Priority 4			
Conostephium minus	Priority 4			Yes
Grevillea thelemanniana	Priority 4			
Lasiopetalum bracteatum	Priority 4			
Schoenus benthamii	Priority 4			
Stachystemon axillaris	Priority 4			
Synaphea acutiloba	Priority 4			
Templetonia drummondii	Priority 4			
Verticordia lindleyi subsp *lindleyi*	Priority 4			Yes
Villarsia submersa	Priority 4			

Category	Definition
Declared Rare	Taxa that are extant and considered likely to become extinct or rare and therefore in need of special protection (Schedule 1) or taxa that are presumed to be extinct in the wild and therefore in need of special protection (Schedule 2).
Priority 1	Taxa which are known from one or a few (<5) populations which are under threat.
Priority 2	Taxa which are known from one or a few (<5) populations, at least some of which are not believed to be under immediate threat.
Priority 3	Taxa which are known from several populations, at least some of which are not believed to be under threat.
Priority 4	Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.

As part of the assessment of Reserve C31709 to locate a specific rehabilitation site, targeted surveys for Declared Rare and Priority Flora known to occur in Lot 21 and *Bush Forever* Site 319 will be undertaken.

Information of the two threatened taxa known to occur in Lot 21 is presented below.

***Conospermum undulatum* – Declared Rare Flora**

Conospermum undulatum (Wavy-leaved Smokebush), a member of the Proteaceae family, was regarded as a synonym of Tree Smokebush (*Conospermum triplinervium*) but has recently been reinstated as a separate species (Brown *et al*., 1998). Wavy-leaved Smokebush is an erect, compact shrub between 0.6 and 2 m tall, with distinctive wavy edged leaves. Plants usually flower from May to October (Paczkowska and Chapman, 2000). Wavy-leaved Smokebush is regionally restricted, occurring over a 14 km range in suburban Perth, between High Wycombe (a few kms north of Lot 21) and Martin (Brown *et al*., 1998). It grows on sand and sandy clay soils, often over laterite, on flat or gently sloping sites in the foothills of the Darling Scarp. It is usually found in Banksia and Eucalypt woodlands over heath, often with *Isopogon drummondii*, *Hakea conchifolia* and *Lambertia multiflora* (Brown *et al*., 1998). Gibson *et al*. (1994) indicate that *C. undulatum* is confined to Floristic Community Type 20a – *Banksia attenuata* woodlands over species rich dense shrublands.

Although listed as a Declared Rare species and as being Vulnerable under the *EPBC Act*, 1999, Wavy-leaved Smokebush is relatively abundant within its restricted range (Brown *et al*., 1998). There are around 21 extant populations of the species, with significantly more sub-populations (Nicole Willers, *pers. comm.* Sept. 2002). Estimates of the number of individual plants remaining vary considerably however. Brown *et al*. (1998) indicates that 8,000 plants have been recorded from private and Shire land within its known distribution, while correspondence from the Department of Conservation and Land Management indicates that 6,000 plants remain (Nicole Willers, DCLM Swan Region*, pers. comm.* Sept. 2002). Based on the latter figure, the population of *C. undulatum* in Lot 21 comprises around 2.8% of the remaining individuals.

Most known occurrences of Wavy-leaved Smokebush are from private and Shire land; no populations occur in any conservation reserves (Brown *et al*., 1998; DCLM correspondence). Land clearing, uncontrolled fires and invasive weeds threaten the long-term survival of many populations (Brown *et al*., 1998).

***Isopogon drummondii* – Priority Three**

Isopogon drummondii is a member of the Proteaceae family. *I. drummondii* is an erect, lignotuberous shrub that grows 0.4 to 1 m high and flowers from February to June. *I. drummondii* occurs on the Geraldton Sandplains, Swan Coastal Plain and in the Jarrah Forest (Paczkowska and Chapman, 2000). Marchant *et al*. (1987) indicates that *I. drummondii* is mainly distributed between Mundaring and Serpentine, on the Darling Scarp and eastern side of the Swan Coastal Plain. Elsewhere, *I. drummondii* is recorded only from near Jurien Bay. Sainsbury (1987) suggests that the species is restricted to small pockets at the foot of the Darling Scarp near Perth, and northwards to Mogumber and Cockleshell Gully, near Jurien. *I. drummondii* probably occurs mainly on sandy soils (Marchant *et al*., 1987), in low woodlands and sandheaths (Sainsbury, 1987).

There are 31 populations of *I. drummondii* recorded (Nicole Willers, DCLM Swan Region, *pers comm.* August 2002). Some of these populations are historical Western Australian Herbarium records, with no current population information. There are approximately 6,500 plants known from locations in the Moora District and Swan Region, with most of these plants occurring around Forrestfield, Dandaragan, Lesmurdie, Kalamunda, Boonanarring and Midland (Nicole Willers, DCLM Swan Region, *pers comm.* August 2002).

Potential Impacts

Consideration of the EPA objectives for Declared Rare and Priority Flora is relevant to this proposal because Declared Rare and Priority Flora occur in Lot 21. Clearance of the Lot without the translocation to the adjacent Water Corporation site would mean the loss of a number of plants of both *Conospermum undulatum* and *Isopogon drummondii*. By transferring specimens of these species, environmental impact can be minimised.

Proposed Management

Viable individuals of the DRF *Conospermum undulatum* and Priority 3 species, *Isopogon drumondii* will be transferred to Reserve C31709. (Further detail on this is provided in Section 5.3.1.)

Proposed Outcome

Some individuals may be lost, either because they are not suitable for transfer or the transfer is unsuccessful. This loss will be minimised as much as possible and will not significantly affect the conservation status of either species. Both species have other populations in the local area (e.g. Site 319, surrounding suburbs), with *Conospermum undulatum* abundant in the local area and neither species is unique to Lot 21. In addition, the transfer of plants will improve the viability and conservation of populations of these species in the adjacent *Bush Forever* Site 319 through consolidating and increasing the size of existing populations and the provision of additional reproductive material. Transference of individuals of both species is a best practice measure that minimises adverse environmental impacts and the EPA objective for Declared Rare and Priority Flora can be met.

4.2 Fauna

***EPA Objective**:* Maintain species abundance, diversity and geographical distribution of fauna.

Existing Environment

A list of fauna species that have potential to be associated with the site was determined from published lists and consultation with relevant experts (Appendix Three). Discussed below is the provision of fauna habitat in Lot 21, and the mammal, reptilian or bird species that may occur in the site.

Fauna Habitat

The plant communities present in Lot 21 could provide a range of habitats for different fauna. Honeyeaters, Silvereyes, Wattlebirds, Carnaby's Black Cockatoo and the Red-Capped Parrot. *Banksia menziesii* (Firewood Banksia) nectar attracts the Western Spinebill, the Red Wattlebird, the Little Wattlebird, Singing Honeyeaters, Brown Honeyeaters and New Holland Honeyeaters, whereas the seeds and cones attract weevil larvae and moth larvae. Insects on the flowers of *Banksia grandis* (Bull Banksia) attract Robins, Willie Wagtails, Black-Faced Cuckoo-Shrikes and Bee-eaters, the seeds and cones attract Carnaby's Black Cockatoo and weevil larvae, the nectar attracts Honeyeaters and the flower spikes are used by burrowing moth larvae (Powell, 1990).

Allocasuarina fraseriana (Common Sheoak) provides good habitat for a variety of invertebrates, such as three species of jewel beetle, long-horned beetles, twig-mound ants, sap-sucking bugs, weevils, native cockroaches and crickets, and the seeds are eaten by ring-neck parrots (Powell, 1990).

The Jarrah Leaf Miner, found on *Eucalyptus marginata* (Jarrah) provides food for and attracts pardalotes, thornbills, parrots, wasps, ants, beetles and earwigs. The leaves are used by the Red-Legged Weevil and sawfly larvae (spitfire) (Powell, 1990).

Mammals

The site is unlikely to support persistent and/or large mammal populations because of its size. However, the site does contain areas of bushland in good condition and so provides the necessary habitat. Most of the mammal species listed in Appendix 3 are dependent upon intact native vegetation, except for the Western Grey Kangaroo *(Macropus fuliginosus)* which will forage in cleared areas.

The Priority 4 mammal, the Quenda (*Isoodon obesulus fusciventer*) favours heathland and woodland with a dense understorey to provide protection from introduced predators such as the European Fox and Domestic Cat. Quenda have been known to occur on the adjacent Bush Forever site (Government of Western Australia, 2000), Perth Airport (Tingay, Alan and Associates, 1997) and Hartfield Park (Harvey *et al.,* 1997) located approximately 1.5 km away It may therefore also be present at Lot 21.

The White-striped Bat (*Tadarida australis*) is common in the urban area and will make use of unnatural features such as buildings for roosting. Introduced mammal species also rely on native vegetation for shelter and food, but generally make greater use of disturbed areas than the native mammals. Species such as the European Rabbit and House Mouse tend to be favoured by the degradation of native vegetation (Bamford, 2000).

Reptiles and Amphibians

Although reptiles have been found to persist in small pockets of remnant vegetation for decades (How and Dell, 1990), linkage with adjacent areas to the west and east will be beneficial. Lot 21 is separated from Reserve C31709 by a road, but movement between the sites is possible. Frogs are most likely to occur in areas where the understorey vegetation and soil surface are undisturbed, although they will readily travel across disturbed ground (Bamford, 1995).

Harvey *et al.* (1997), found four species of frogs *(Crinia georgiana, C. insignifera Heleioprus eyrei* and *Pseudophryne guentheri)* and eleven species of reptiles consisting of the gecko *Diplodactylus spinigerus;* the legless lizard *Pletholax gracilis;* the dragon lizard *Pogona minor;* the skinks *Bassiana trilineata, Cryptoblepharus plagiocephalus, Ctenotus fallens, C. leseurii, Lerista elegans, Menetia greyii, Tiliqua rugosa;* and the blind snake *Ramphotyphlops australis.*

A review of recent surveys of rare and endangered flora and fauna in Perth Airport (Tingay, Alan and Associates, 1997) found that the Priority 4, Keeled Legless Lizard *(Plethorax gracilis)* has been recorded. A survey of Hartfield Park Reserve (approximately 1.5 km from Lot 21) also found the Keeled Legless Lizard (Harvey, *et al.,* 1997). The distribution of this species is confined to the coastal sand plain along the central coast of Western Australia between Eneabba and Jandakot (Tingay, Alan and Associates). Priority 4 species are described as 'taxa in need of monitoring'

How and Dell (1994) found a positive relationship between remnant size and the diversity of snake species within urban bushland remnants in Perth. The rehabilitation of Reserve C31709 (part of *Bush Forever* Site 319), a much larger remnant than Lot 21 should improve habitat value for snakes.

Birds

Carnaby's Black Cockatoo *(Calyptorhynchus latirostris)* is classified as Endangered under the Federal *Environmental Protection and Biodiversity Conservation Act, 1999* (EPBC Act) and is classified as Threatened (Endangered) under the Western Australian *Wildlife Conservation Act, 1950.* While the clearing of Lot 21 may reduce habitat for this species, due to this species' high mobility, the rehabilitation of a corresponding area of Reserve C31709 (part of *Bush Forever* Site 319) should result in no net habitat loss for this species.

The priority 4 Dusky Moorhen *(Gallinula tenebrosa)* has previously been found in Perth Airport (Tingay, Alan and Associates, 1997) and may also occur in Lot 21.

The mobility of most bird species allows movement across sites in a short time scale. Therefore, a wide range of bird species found to occur on the Swan Coastal Plain could occur on Lot 21 at any given time. This could include species that reside on the site, species that are passing through and species that include the site in their regular movements, such as birds of prey.

Potential Impacts

Clearing of Lot 21 will result in the removal of fauna habitat and consequently any fauna present will move from the site. Although Lot 21 is small and unlikely to support a large range of native fauna, vegetation elements which support native fauna are present in Lot 21 and therefore, consideration of fauna is relevant to this proposal.

Proposed Management

Rehabilitation of vegetation on Reserve C31709 will provide additional fauna habitat, and therefore fauna abundance and diversity, moreover the larger size of Reserve C31709 is likely to provide habitat for a greater diversity of fauna species than Lot 21.

Vertebrate fauna species with poor dispersal capabilities will be trapped and relocated to Bush Forever Site 319. This will be undertaken in conjunction with the Department of Conservation and Land Management.

Proposed Outcome

The loss of fauna habitat is balanced by the expected improvement in fauna habitat, and therefore fauna abundance and diversity, on the adjacent Reserve through the rehabilitation of the site using material from Lot 21. Given the close proximity of the two sites there will be no significant effect on fauna distribution. Providing improved fauna habitat and translocating fauna components are best practice measures that minimise adverse environmental impacts. The EPA objective for fauna conservation can therefore be met.

4.3 Conservation Values

***EPA Objective**:* No objective set.

Lot 21 was included in *System Six* as part of site M53 (Department of Conservation and Environment, 1983), and at that time there was little development in the surrounding area. The sections of M53 which were noted as being of particular significance, such as the swamp flats at the junction of Hardey and Maida Vale Roads, did not fall on Lot 21 (previously Lot 40). Since that time, a number of light industries have been established adjacent to Lot 21.

Re-assessment of the bushland areas listed in the *System Six* report, as part of *Perth's Bushplan*, resulted in a parcel of land containing Lot 21 being excluded from proposed reservation. After a public review period of *Perth's Bushplan*, these excisions have remained in the final version of the report, *Bush Forever* (Government of Western Australia, 2000).

Lot 21 contains vegetation of the Southern River Complex (Heddle *et al*., 1980), which has been heavily cleared, is known to contain populations of Declared Rare and Priority flora and may provide habitat for a range of fauna, although none are listed as being of significance. Much of the bushland is in relatively good condition and plant communities of the eastern side of Swan Coastal Plain are resistant to weed invasion. The Lot therefore has value as a remnant bushland area, however it is understood that this area is isolated from the core conservation area covered by Bush Forever Site 319 by industrial zoned land and road infrastructure.

5.1 Definition of Translocation Objective

The success of the proposal can only be measured if clear objectives are set prior to works being undertaken (Bullock, 1998). Broadly, there are two different types of objectives:

- **Preservation** -which is the perpetuation of all taxa of a community from the original area; or
- **Mitigation** - which is the preservation of the more important plant species such that the translocated community resembles the pre-translocated state.

Bullock (1998) indicates that, based on translocations in Britain, there is a risk of not meeting a preservation-type aim because of the difficultly in ensuring that all components (plants, animals, fungi) are translocated. The mitigation aim sets a more realistic criterion for success which can be achievable (Bullock, 1998).

In the context of the current proposal the aim of the transfer is to reconstruct the key botanical components and ecological characteristics of the original bushland. In particular, the key components in terms of the structure and species density typical of the Southern River Complex and FCT 20a – *Banskia attenuata* woodlands over species rich dense shrublands will form the focus on the translocation aim.

The proposal involves the wholesale removal of the vegetation community at Lot 21, with its re-establishment at the adjacent Reserve. Correct relocation procedures need to be followed in order to meet the EPA objectives of maintaining the abundance, species diversity, geographic distribution and productivity of vegetation, flora and fauna and to protect declared rare and priority flora. Significant changes in community composition following transfer largely result from: poor preparation of the receptor site; sufficient depth of material being translocated; environmental differences between the original and receptor site; and different management of receptor site compared with the original (Bullock, 1998).

The following section provides information on the methods for transferring material from Lot 21 to the rehabilitation site (see Section 5.1.1), and the ongoing management requirements for the rehabilitation site to maximise the potential for the transfer to be successful.

A more detailed Rehabilitation Plan for the project will be developed if the proposal is approved. This plan will identify a specific area for rehabilitation, which will be selected following site surveys and assessment of the four criteria outlined in Section 5.2.2.

5.2 Selection of Translocation Site

5.2.1 Selection of Reserve C31709

This PER addresses the impacts of the proposed clearing of Lot 21 in the context of the potential to improve the sustainability, value and return for management effort of the Water Corporation site. The plan to offset the loss of bushland on Lot 21 by transferring the biologically valuable components of the bushland on Lot 21 to the adjacent Reserve, which forms part of *Bush Forever* Site 319 (see Figure 5), forms an integral part of the proposal. The aim of this plan is to balance the loss of bushland from Lot 21 by enhancing the value, and contributing to the long-term viability, of Reserve C31709 and the viability of the *Bush Forever* Site 319. The intrinsic values of the *Bushland Forever* site, including threatened ecological communities and declared rare and priority flora, will therefore be increased. The bushland on Lot 21 is not sustainable in the long term without significant management input because of its small size (1.84 ha), its surrounding land-use (industry) and the likelihood of continued disturbance, spread of weeds and dieback over time. In comparison, Reserve C31709 is much larger (13 ha) and is therefore more sustainable with less management required. Reserve C31709 is also part of a larger *Bush Forever* site, which has reserved for Parks and Recreation in the MRS. Although this does not give it security of tenure, it does provide some measure of protection and planning provision for the area. For these reasons it is more appropriate that management efforts focus on Reserve C31709 than Lot 21. The benefits of the proposal are outlined further in Section 3.5.

The proposal has received 'in principle' support from the Bush Forever Office of the Department of Planning and Infrastructure and the Water Corporation (Appendix Two).

Bush Forever Site No. 319 was included in *Bush Forever* under the following categories (Government of Western Australia, 2000):

- Representation of ecological communities of the eastern side of the Swan Coastal Plain;
- Diversity;
- Rarity;
- Scientific or evolutionary importance; and
- General criteria for the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation.

Site 319 contains three Threatened Ecological Communities as well as 17 species of Priority Flora, as well as an unusual combination of rare, uncommon and restricted floristic community types (Government of Western Australia, 2000).

The Water Corporation part of Site 319 is approximately 13 ha in size (Site 319 is around 58 ha in size in total),. Reserve C31709 has not been formally managed since the decommissioning of the waste-water treatment plant in 1981 and access is only partially restricted through fencing. As a result, there is a large volume of rubbish on-site (car bodies, building rubble, garden waste, furniture etc.) and Reserve C31709 is considerably more degraded than the remainder of Site 319. For Reserve C31709 to fulfil its conservation role as part of *Bush Forever* Site 319, restoration and rehabilitation is required.

Site 319 as a whole has been reserved for *Parks and Recreation*. Therefore, a whole-of-government approach (as recommended in *Bush Forever*) can be applied to the restoration process. This may allow for co-operation between the Shire of Kalamunda, the Water Corporation, the WA Planning Commission and the Department of Conservation and Land Management (DCLM) for the development of an area of passive/active recreation (landscaped open space) in the central degraded area of Reserve C31709, with restoration of the surrounding bushland areas for passive recreation purposes and conservation. The materials, which would be available as a result of clearing Lot 21, would allow for restoration of degraded areas within the bushland.

5.2.2 Criteria to Select a Rehabilitation Area within Water Corporation Site

Within Reserve C31709, some areas are more degraded than others, as can be seen from (Figure 5). Lot 21 is small in size (1.84 ha) and the amount of material that will be produced from the clearing will be insufficient to help rehabilitate all degraded areas of Reserve C31709. Therefore, a section of Reserve C31709 will need to be selected to receive the Lot 21 material. The following criteria will be primarily used to select a specific rehabilitation site within this area:

1. **Level of degradation** – More degraded sites will be targeted to maximise the potential gains from transferring material, and minimise disturbance to less degraded areas (particularly Threatened Ecological Communities within Reserve C31709). Less degraded areas would receive greater benefit from less intensive rehabilitation techniques, such as targeted weeding to promote native bush regeneration. Although the degraded site will be the focus of the transfer of material, restoration of this degraded area will benefit the entire site by increasing the populations of species present and reducing the bushland's perimeter to area ratio (which will reduce weed invasion along edges).

2. **Similarity of receiving environment to Lot 21** – the transfer of material needs to occur into a similar environment (particularly in terms of vegetation, soils and hydrology) to maximise the chances of successfully reconstructing the Lot 21 community and minimise the risk of disrupting or altering in some way the composition or structure of an existing, but floristically different, community. The Threatened Ecological Community (TEC) 20a '*Banksia attenuata* woodland over species rich dense shrublands' occurs in Lot 21 and Site 319. Locating a rehabilitation site near occurrences of this community in Reserve C31709 will be therefore preferable. Soils and hydrology will need to be assessed to ensure that the receiving site is similar to Lot 21.

3. **Proximity to less disturbed vegetation** - working within the requirements to transfer the material from Lot 21 into similar vegetation, the rehabilitation site will preferably be located adjacent to less disturbed vegetation. This provides an opportunity to help consolidate the integrity of the existing vegetation within Reserve C31709, particularly that of TEC 20a, and provide additional seed and vegetation reproduction material to assist in the natural rehabilitation of other parts of Reserve C31709.

4. **Provision of suitable environments for the Declared Rare and Priority Flora of Lot 21** – the Declared Rare Flora, *Conospermum undulatum*, and the Priority Flora, *Iosopogon drummondii*, occur in Lot 21. To maximise the chances of successfully re-establishing and transplanting these species their environmental preferences, particularly soil type, will form part of the selection criteria.

If this proposal is approved, surveys of Reserve C31709 will be undertaken to identify areas that meet these criteria. Following this, a specific area suitable for rehabilitation will be located.

The environmental factors and impacts relevant to this proposal are discussed in Section 4.0. Further details on the proposed methods of transfer, rehabilitation methods and ongoing management procedures required to ensure successful rehabilitation are discussed below.

5.3 Clearing Lot 21

5.3.1 Dieback Area

Soil, brush and plant material from the area within Lot 21 adjacent to Bedford Road infested with *Phytophthora* will not be transferred to the rehabilitation site, and site clearing will be conducted as a 2 stage operation (with diseased and disease-free areas dealt with separately) to minimise the risk of spreading the pathogen (Section 4.1.4).

The area of infestation has been marked (using tape) along the active disease edge. Glevan Dieback Consultancy (2002) recommends a buffer of 10 m into the healthy vegetation for any soil or vegetation moving operation. This is to allow for incipient disease, which is pathogen that may be present in the soil but is not yet expressed in the vegetation.

All demarcated boundaries are valid for 12 months. After 12 months they will need to be redetermined to accommodate any possible spread of the disease.

The issue of dieback is discussed in more detail below under each relevant section.

5.3.2 Weed Removal

Control of all weeds at Lot 21, to reduce the likelihood of introducing and spreading weeds in the rehabilitation site, is impracticable. Rather, efforts will be focused on removing any invasive or environmental weeds present. The control of such weeds is important to the long term survival of bushland, since they reduce native plant regeneration and the survival of flora and fauna (DCLM, 1999).

Western Australian weeds have been given a priority rating of high, moderate, mild or low, based on their invasiveness, distribution and environmental impact (DCLM, 1999). The three weed species known to occur in Lot 21 were rated as follows:

- *Ehrharta calycina* (Veld Grass) – high: should be prioritised for control and/or research;
- *Briza maxima* (Blowfly Grass) – moderate: if funds available control and/or research should be undertaken, should be monitored; and
- *Ricinus communis* (Castor Oil Bush) – low: low level of monitoring required.

Based on these ratings, *Ehrharta calycina*, in particular and *Briza maxima* will be the focus of weed control in Lot 21 prior to clearing and transfer of material to the rehabilitation site. *E. calycina* can be controlled using spot or blanket spraying with fusilade or similar herbicides (Dixon and Keighery, 1995). Spraying will be limited to spot sprays where possible. Small infestations can be removed by hand, using a knife to cut the culms close to the roots. *Briza maxima* is easy to control with hand weeding, direct application of herbicide and spot or blanket spraying with Sertin or similar herbicides (Dixon and Keighery, 1995). Hand weeding is often an effective method of control when dealing with small infestations (Dixon and Keighery, 1995) or when removing weeds from around threatened plant populations (DCLM, 1999). Both situations occur in Lot 21. Hand weeding will be therefore the preferred method of weed removal in Lot 21, although some spot spraying may also be necessary. Non-selective herbicides will be used with extreme caution to prevent inadvertent spraying of native plants, particularly Declared Rare and Priority Flora.

5.3.3 Transplanting Vegetation

Successful translocation of native flora species can be difficult. *Conospermum undulatum*, for example, is difficult to successfully transplant. However, given the threats to *C. undulatum* and *Isopogon drummondii*, and need to protect these species from further loss (see Section 4.1.6) translocation of these species from Lot 21 to the rehabilitation site will be attempted. To this end, all known locations or populations of *C. undulatum* and *I. drummondii* within Lot 21 have been recorded, from which individuals suitable for transplanting will be selected. Lot 21 will also be assessed to determine whether other plant species could be salvaged intact for relocation, such as specimens of *Xanthorrhoea preissii* (Balga). Prior to clearing, plants suitable for transfer will be identified and marked, and a qualified contractor employed to carry out the translocation.

The most important factors for successful transplanting include:

- Transferring plants when they are actively growing. Once transplanted they quickly put roots into the soil;
- Transferring plants when the soil is moist, which maintains a soil packet around the roots;
- Planting during wet periods to ensure sufficient water availability for growth; and
- Removing weeds to reduce competition (Buchanan, 1999).

These general principles, as well as those contained in The Australian Network for Plant Conservation's (1997) *Guidelines for the Translocation of Threatened Plants in Australia*, will be followed for the transfer of plants from Lot 21 to the rehabilitation site. Advice will also be sought from the Western Australian Threatened Species and Communities Unit of the Department of Conservation and Land Management on the best approach to translocating specific species to ensure as successful a transfer as possible.

In addition, specific factors that will be considered as part of the translocation include:

- Transplants will be planted into suitable growing sites within the rehabilitation site, for example sandy or sandy-clay soils that *Conospermum undulatum* prefers, to maximise their survival chances.
- Planting will aim to mimic natural establishment patterns by planting in clumps on raised mounds etc, with irregular spacings (see Scheltema and Reid, 1995). Both *C. undulatum* and *Isopogon drummondii* occur in clumps in Lot 21. Planting in clumps also reduces competition from weeds.
- Larger plants, such as Balgas, will be transplanted using specialised equipment and on a one by one basis. Each plant will be removed from Lot 21 and transferred directly into a prepared hole to maximise survival chances (Ecoscape, 1998).
- Plants will be prepared for transference if required. For example, Balgas can be cut back, the flowering stem removed and watered prior to removal to improve the chances of successful transplantation (Ecoscape, 1998).

Management strategies required post-translocation are discussed in Section 5.5.

The genera *Conospermum, Isopogon* and *Xanthorrhoea* all have species known to be affected by *Phytophthora* species, including *P. cinnamomi* (Kilgour, 2000), which is present in Lot 21. To reduce the risk of introducing dieback to the rehabilitation site, individuals of *C. undulatum, I. drummondii* and *X. preissii* located within the dieback infested section of Lot 21, including the 10 m buffer, will not be transferred. These individuals will be removed and disposed of in an appropriate manner by a qualified contractor.

5.3.4 Tree Removal

It will not be possible to translocate the mature *Eucalyptus marginata* (Jarrah) trees on Lot 21 because of their size. Prior to clearing, large Jarrah trees within the Lot will be assessed to determine whether they contain millable timber. If so, this timber will be salvaged and purchased by mill operators for production of furniture or other small-scale works. Funds obtained from this will be used to help resource the transfer of material and rehabilitation programme. If the limbs or trunks of any trees on the site contain substantial hollows that could provide habitat for ground-dwelling fauna such as lizards and snakes, these logs will be salvaged and transferred to the rehabilitation site as fauna habitat.

Jarrah trees located within the *Phytophthora* dieback infested section of Lot 21, including the 10 m buffer, will not be used to provide fauna habitat in Reserve C31709.

5.3.5 Topsoil Removal and Transfer

Although transplantation of vegetation will be undertaken, the use of topsoil and brush material (see below, Section 5.3.6) is likely to be most effective at transferring the biological components of Lot 21 to the rehabilitation site. Topsoil is an important source of seeds, propagules and organic matter, and for some plants may be the only means of re-establishment (Buchanan, 1989; Rokich *et al*., 2000), as well as containing organic matter. The correct removal and transfer of topsoil is, therefore, a particularly important aspect of the proposed transfer and rehabilitation process. The transfer of topsoil from Lot 21 will contribute significantly to improving the vegetation structure, diversity and condition of the rehabilitation site and will aid in minimising the loss of biologically valuable components from Lot 21. Importantly, the topsoil from Lot 21 will contain seeds of *Conospermum undulatum* and *Isopogon drummondii*, increasing the opportunities to regenerate these DRPF at the rehabilitation site.

Only topsoil from areas within Lot 21 that are in *Fair – Good* and *Very Good - Excellent* condition, with a low proportion of weed species present and no evidence of dieback, will be used. Weed infested topsoil in *Poor – Very Poor* areas of Lot 21, or areas identified as being infested with dieback, will be stripped and disposed of in an approved manner.

Most of the soil seed bank is contained within the first 100 mm of soil (Rockich *et al*., 2000). It is proposed that the top 100 mm of soil be removed from Lot 21 and spread to an even depth over the rehabilitation site. Rockich *et al.* (2000) indicates that topsoil should be spread to a maximum depth of 2 cm. Deeper than this and seedling emergence is significantly reduced. Stockpiling, even for short periods, reduces seedling recruitment and species richness (Rockich *et al*., 2000). To avoid the need for stockpiling the soil, during which seed and reproductive organs will deteriorate, soil removal and transfer will be carried out in one action. This is reasonable and practicable given the close proximity of Lot 21 to the rehabilitation site. To maximise germination and successful establishment from the topsoil, the soil needs to be moist for several weeks (Buchanan, 1989). Transfer will not occur therefore until late May to June, or several weeks after the autumn rains have begun to ensure the soil is wet.

Smoke provides one of the most important cues for breaking dormancy in many species and some form of smoke treatment can be very effective at improving germination rates and assisting restoration efforts (Roche *et al*., 1997; Lloyd *et al*., 2000). For example, application of smoke to undisturbed Jarrah forest led to a 48-fold increase in number of germinants (Roche *et al*., 1997). Similarly, Lloyd *et al*. (2000) found smoke treatment, using concentrated smoke products, doubled species richness compared with untreated controls. This suggests that some form of smoke treatment could substantially increase germination from the transferred topsoil, thereby maximising the chances of re-establishing as broad a range of species as possible. Lloyd *et al.* (2000) indicates that aerosol smoke and smoke water are not suitable for broad-scale application, such as that required for this proposal. Rather concentrated smoke products (commercially available as Regen 2000 Direct), produced by the combustion of wood materials and liquefaction of the smoke produced, provide the necessary benefits without the need for high volumes (Lloyd *et al*., 2000). Concentrated smoke products can be applied as a mist spray, with application occurring in autumn to coincide with the natural start of germination. Staff of Kings Park Botanic Gardens will be consulted to finalise the details for this process.

5.3.6 Brush Material

Brushing protects young plants and bare surfaces from erosion, helps retain soil moisture and reduces seed predation, while also providing seed and aiding the establishment of young plants (Buchanan, 1989; Ecoscape, 2001). Brushing can also act as a deterrent to pedestrians (Oma *et al*., 1992).

Suitable brush material will be collected from Lot 21 by a specialist contractor and transferred directly to the rehabilitation site. The material will not be mulched, but will be cut into reasonable sizes. To reduce the risk of providing fuel material for fires, some material will be guillotined to provide tritter, which is part way between brush and mulch. Tritter allows the brush material to lie flatter and interlock more, reducing the level of aeration (an important component of fire initiation) (Ecoscape, 2001). Brush and tritter material will be spread carefully to ensure existing plants, particularly Declared Rare and Priority Flora if present, are not trampled.

As with the other biological components that will be transferred, brush material from within the *Phyophthora* dieback infested area, including the 10 m buffer, of Lot 21 will not be used.

5.4 Preparation of the Rehabilitation Site

The rehabilitation site will need to be prepared to receive material from Lot 21. This will include weed and rubbish removal and selection of sites for dumping of bulk material (eg soil stock piles). The removal of badly weed infested topsoil will also be considered during the development of the rehabilitation plan, but is not considered fully here. Some parts of the plan will need to be in place prior to Lot 21 being cleared and the transference of material, for example removal of rubbish and weed management. A detailed rehabilitation plan will be prepared if this proposal is accepted; information below provides an indication of details to be covered in the plan. It is noted that There is a large volume of rubbish on Reserve C31709 in general, including car bodies, building rubble, garden waste and old furniture. This will need to be removed by the Water Corporation prior to rehabilitation proceeding.

5.4.1 Weed Removal

The lack of management of Reserve C31709 and public access has resulted in areas of high weed infestation. Complete removal and control of weeds from the rehabilitation site is impracticable. A more appropriate objective of weed management in the site is to identify problem and aggressive weeds, undertake control to limit their environmental impacts and in some instances, eradicate if possible. The overall aim of weed management will be to facilitate the re-introduction and establishment of native vegetation, which will over time replace the weed community. Weed control will also be carefully managed to ensure that in itself it does not create disturbed sites ideal for re-infestation. Detailed weed management and control strategies will be developed as part of the rehabilitation plan if this proposal is accepted. The emphasis of the plan will be on the identification of the major and/or aggressive environmental weeds, as defined by DCLM (1999), present in the rehabilitation site and their appropriate control strategy, including requirement for follow-up weeding and maintenance. A general outline of the control methods and principles likely to be used is presented below.

Weeds can be controlled using biological control, removal by hand or by using herbicides (Dixon and Keighery, 1995; DCLM, 1999). Hand weeding is often an effective method of control when dealing with small infestations (Dixon and Keighery, 1995) or when removing weeds from around threatened plant populations (DCLM, 1999). Manual control is however expensive and care needs to be taken to avoid major soil disturbance (DCLM, 1999). The use of hand weeding in the rehabilitation site will be investigated during the development of the weed management plan and will be targeted particularly around known locations of threatened flora and communities.

Biological control is not particularly common, but may be available for some weed species. Herbicides are more appropriate for major weed infestations and provide an economic and quick method of weed control (Dixon and Keighery, 1995). However, there is a risk of water and soil pollution with the use of herbicides and non-target species may be inadvertently killed depending on the method of herbicide application (DCLM, 1999). Herbicide use will be restricted as much as possible during the control of weeds in the rehabilitation site and wherever possible herbicides with the least environmental impact will be used. In addition, herbicides that inhibit the growth of native vegetation (e.g. Ally®/Brushoff®, Glean®, Frenock®, Garlon® 480, Velpar®, Grazon®; Dixon and Keighery (1995)) and therefore slow the process of restoration will not be used.

Department of Conservation and Land Management (1999), and information contained in the associated Weedbase database, provide details on a number of weed control methods, with recommendations on the most appropriate technique in different environments. These recommendations will be utilised during the development of the weed control program. A complete weed species list for the site is not available and will need to be compiled prior to weed control being undertaken. Given that *Briza maxima* (Blowfly Grass), *Ehrharta calycina* (Veld Grass) and *Ricinus communis* (Castor Oil Plant) are present in Lot 21, it is likely that they will also occur in the rehabilitation site. The methods to remove these species from Lot 21 (Section 5.3.2) will be employed at the rehabilitation site, and will target *B. maxima* and *E. calycina* because of their rating (moderate and high, respectively). It is unlikely that *R. communis* will be actively controlled, given its low priority rating. It is expected that over time the abundance of this weed will be reduced through the regeneration of native vegetation. Other serious or environmental weeds will be removed if required by their priority rating in an appropriate manner. Weed species present in the rehabilitation site which are not listed as priorities for control will only be controlled if they represent a localised problem.

5.4.2 Soil Softening

The removal of rubbish and weeds may result in some localised areas of compacted soil in the rehabilitation site. These areas will need to be 'softened' (not compacted) to allow air, water, roots and seed to penetrate the soil (Buchanan, 1989). There are several methods of reducing soil compaction, from hand digging where plants are to be planted through to ripping over a larger area. The need and method of soil softening will be determined once rubbish and weeds have been removed from the rehabilitation site. Soil softening will occur prior to the transfer of material from Lot 21.

5.4.3 Dieback Management

The introduction and/or spread of dieback in the rehabilitation site will reduce the chances of successful transfer and restoration and reduce the existing values of *Bush Forever* Site 319, given that species in Lot 21 and Site 319 are susceptible to *Phytophthora* dieback. Dieback management procedures, including hygiene procedures for contractors and equipment, will be in place during all operations to minimise the potential for this to occur. In addition, for some species which are translocated from Lot 21 to the rehabilitation site it may be appropriate to spray with phosphite to boost their resistance to dieback. This approach will be discussed with the Department of Conservation and Land Management as part of the development of the rehabilitation plan.

The optimal time for translocating material will be during autumn, a time of year when dieback is more readily spread. The risk of introducing dieback from Lot 21 to the rehabilitation site will be greatly reduced by not transferring the known area of dieback (plus its 10 m buffer) and clearing the site as a two-stage operation (Section 5.3.1). Depending on the timing of the clearing, a further survey to confirm the limit of infestation will be undertaken (Section 4.1.4).

5.5 Post Transfer Management

Following the transfer of material from Lot 21 to the rehabilitation site, some management will be required to maximise the chances of the transfer and rehabilitation process being successful. If the transfer and rehabilitation process is successful the abundance and diversity of the local flora and fauna will be maintained, thus meeting the EPA objectives. This management will focus on the survival of transplants, maintaining soil moisture and limiting the re-invasion of weeds. Specific management strategies will be developed as part of the Rehabilitation Plan.

5.5.1 Monitoring Survival of Transplants and Germinants

The health of individual plants which are transferred from Lot 21 to the rehabilitation site and those which germinate from the transferred topsoil and brush material will be monitored and remedial action taken if required. Appropriate monitoring and management of soil moisture and weed re-invasion will contribute greatly to the survival of transplants and germinants.

5.5.2 Soil Moisture

Soil moisture will be monitored for the first year to ensure that the soil is suitably moist to aid seed germination, seedling establishment and growth, and the survival of transplants. While the transfer of plant material, topsoil and seed to the rehabilitation site will preferably occur in the wet winter months, variation in weather conditions may mean some watering is required within the first year. To encourage development of deep root systems, if watering is required it will be infrequent and extended.

The transfer of brush material to the rehabilitation site will assist in maintaining soil condition (Buchanan, 1989).

5.5.3 Weed Management

On going weed control at the rehabilitation site will be undertaken for at least one year following the transfer of material (Buchanan, 1989). This is needed while seeds germinate

and reproductive structures sprout to establish native vegetation. A lack of follow-up weed management will negate the efforts undertaken to rehabilitate the site using material from Lot 21. Depending on the level of re-invasion, weed management at the rehabilitation site will focus on removing weeds from an area around each transplant and emergent seedlings. The transfer of brush material from Lot 21 will also assist in reducing the likelihood of weed re-invasion.

5.6 On-going Management

Currently, the Water Corporation is responsible for Reserve C31709, which forms part of *Bush Forever* Site 319 and includes the rehabilitation site. Reserve C31709 has not been formally managed since the decommissioning of the waste-water treatment plant in 1981 and access is only partially restricted through fencing. The Department of Conservation and Land Management has indicated to the Department of Land Administration, in a letter to Ecoscape (dated 24 September 2001), that they would 'in principle' take on the Management Order for Reserve C31709 if Water Corporation first rehabilitated degraded areas of the reserve and provide boundary fencing.

5.6.1 Monitoring of Community Development

Following the transfer and rehabilitation programme, monitoring will be necessary to determine whether an appropriate community is developing, in the context of the surrounding vegetation and the vegetation that had been present in Lot 21. In particular, the assessment will need to consider the structure and species density typical of the Southern River Complex and FCT 20a – *Banskia attenuata* woodlands over species rich dense shrublands, although the focus will be on ensuring that key components of these communities are represented. Advice will be sought from the Department of Conservation and Land Management, particularly the Western Australian Threatened Species and Communities Unit, and the Botanic Gardens and Parks Authority, in this regard.

The assessment of community development will need to occur after sufficient time has elapsed for a reasonable number of plants to establish to provide enough information on the likely structure and composition of the vegetation community at the rehabilitation site. It is expected that this assessment will not be possible until 5 years after the transfer of material, with possibly a second assessment after 10 years. Some planting or seed sowing may be necessary to introduce key species that have failed to establish following the transfer of material. The assessment will be the responsibility of the agency in which the land is vested.

6.0 Environmental Management Commitments

Table 5 provides a list of Environmental Management Commitments that the proponents are willing to implement in order to minimise the environmental impacts of clearing the vegetation of Lot 21. Details of the rehabilitation plan can be seen in Section 4.0.

Table 5: Management Commitments

No.	Topic	Actions	Objectives	Timing	Advice from
1	Flora Management	Undertake initial weed control at Lot 21 and rehabilitation site in Location 11026.	Reduce weeds at rehabilitation site and reduce weeds transferred between sites	autumn	WATSCU[1] DCLM[2] BGPA[3] Water Corp.
2	Flora Management	Prepare a detailed Rehabilitation Plan. For Location 11026 details will be included for: 1) the location and extent of the rehabilitation area; 2) hygiene measures; 3) spreading of topsoil and tritter; *4)* post-transfer management of *Conospermum, Isopogon & Xanthorrhorea;* 5) the establishment of an access track; 6) first year weed control, monitoring of plant establishment, weed invasion and disease assessment; and 7) supplementary works as required in the first year such as further weed control, seeding and watering. For Lot 21 details will be included for: 1) methods of removal and transfer of *Conospermum, Isopogon & Xanthorrhorea*; 2) hygiene measures; 3) clearing procedures, including removal of topsoil and chipping of vegetative material for use at Location 11026	Ensure the successful translocation of plants from Lot 21 and rehabilitation of a portion of Bush Forever Site 319.	Prior to clearing of Lot 21. Transfer of vegetation late autumn / early winter.	DCLM WATSCU BGPA Water Corp.
3	Flora Management	Implement Rehabilitation Plan referred to in Commitment 1.	Achieve the objectives of Commitment 1.	For 1 year after translocation	DCLM WATSCU BGPA

1.West Australian Threatened Species and Communities Unit 2 Department of Conservation and Land Management 3 Botanic Gardens and Parks Authority

7.0 Conclusions

Lot 21 is privately owned by R. Peters and D. Papagioftsis and is located at 92 Bedford Crescent in the suburb of Forrestfield in the Shire of Kalamunda. The proponents wish to sub-divide Lot 21 into a number of industrial lots which would require clearance of all the bushland on the Lot.

An integral part of the proposal is to offset the loss of 1.84 ha of bushland on Lot 21 by transferring the biologically valuable components of the bushland on Lot 21 to the adjacent Reserve (C31709), which forms part of *Bush Forever* Site 319. This PER addresses the impacts of the proposed clearing of Lot 21 in the context of the potential to improve the sustainability, value and return for management effort of the adjacent Reserve (C31709). The plan aims to balance the loss of bushland from Lot 21 by enhancing the value, and contributing to the long-term viability, of the larger 13 ha Reserve (C31709). The main benefit of this proposal is the assistance it provides to the long-term conservation of the Threatened Ecological Communities and Declared Rare and Priority Flora (DRPF) found on Lot 21 and in *Bush Forever* Site 319.

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Appendix One:
EPA Guidelines for PER

Lot 21 Webster Road, Forrestfield: Public Environmental Review

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Your Ref
Our Ref 150881
Enquiries Kathy Choo

Dear David

PUBLIC ENVIRONMENTAL REVIEW DOCUMENTATION - INDUSTRIAL SUBDIVISION OF LOT 21 WEBSTER ROAD & BEDFORD CRESCENT, FORESTFIELD (ASSESSMENT NO. 1386)

The purpose of this letter is to finalise documentation requirements for release of the Public Environmental Review (PER) for the above assessment.

The document for public review can be based on the previous Environmental Assessment report, although a number of modifications are required in order to address the comments received by the Department of Conservation and Land Management (CALM) (see Attachment 1) and the Department of Environmental Protection (DEP) on the report and to meet the Environmental Protection Authority's (EPA) general requirements for PERs. The EPA is aware that Ecoscape have also received some preliminary comments from CALM in a letter dated 24 September 2001, therefore, please note that these comments have also been considered and highlighted by the EPA for incorporation in the final environmental review document. An overview of the structure and modifications required are provided below.

General Objectives of the Environmental Review

The objectives of the environmental review are to:

- place this proposal in the context of the local and regional environment;
- adequately describe all components of the proposal, so that the Minister for the Environment and Heritage can consider approval of a well-defined project;
- provide the basis of the proponent's environmental management program, which shows that the environmental impacts resulting from the proposal, including cumulative impact, can be acceptably managed;
- communicate clearly with the public (including government agencies), so that the EPA can obtain informed public comment to assist in providing advice to government; and
- provide a document which clearly sets out the reasons why the proposal should be judged by the EPA to be environmentally acceptable.

These general objectives should be considered in making the necessary modifications to the documentation.

Contents and Structure of the Public Environmental Review

The document for public review should be structured as follows:

Public Submissions

The first page of the document must be an invitation to make a submission. Its purpose is to explain what submissions are used for and to detail why and how to make a submission. An example of this has been attached for your information (see Attachment 1), please note that the parts in square brackets are to be amended to apply to each specific proposal.

1. Executive Summary

The PER document should include an executive summary, which summarises the key elements of the proposal, the environmental impacts and how these impacts will be managed.

2. Introduction

This section should provide a general background to the proposal and the environmental review process.

3. Proposal

The PER document should provide a comprehensive description of the proposal, specifically:

- its location (address and certificate of title details where relevant);
- a description of the background and history for the subject area should be provided;
- justification and objectives for the proposed development;
- proposed subdivision plan;
- the legal framework, including existing zoning and environmental approvals, and decision making authorities and involved agencies;
- reference to past consideration of the subject land not being included within *Bush Forever* should also be addressed; and
- consideration of alternative options.

The Minister's statement will bind the proponent to implementing the proposal in accordance with any technical specifications and key characteristics[1] in the environmental review document. It is important therefore, that the level of technical detail in the environmental review, while sufficient for environmental assessment, does not bind the proponent in areas where the project is likely to change in ways that have no environmental significance.

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[1] Changes to the key characteristics of the proposal following final approval would require assessment of the change and can be treated as non-substantial and approved by the Minister, if the environmental impacts are not significant. If the change is significant, it would require assessment under section 38 or section 46. Changes to other aspects of the proposal are generally inconsequential and can be implemented without further assessment. It is prudent to consult with the Department of Environmental Protection about changes to the proposal.

4. Description of Environmental Factors

The EPA believes the site-specific relevant environmental factors for the proposal are as follows:

- **Vegetation**, with the EPA objective being - Maintain the abundance, species diversity, geographic distribution and productivity of vegetation.
- **Flora**, with the EPA objective being - Protect Declared Rare and Priority Flora, consistent with the provisions of the *Wildlife Conservation Act 1950*, and the *Environment Protection and Biodiversity Act 1999.*
- **Fauna**, with the EPA objective being - Maintain the species abundance, diversity and geographical distribution of fauna.

This section should be structured as a discussion under each environmental factor addressing the following:

- a description of where this factor fits into the broader environmental / ecological context (only if relevant - may not be applicable to all factors);
- a clear definition of the area of assessment for this factor;
- the EPA objective for this factor;
- a description of what is being affected - why this factor is relevant to the proposal;
- a description of how this factor is being affected by the proposal - the predicted extent of impact;
- a straightforward description or explanation of any relevant standards / regulations / policy where relevant; and
- environmental evaluation - does the proposal meet the EPA's objective as defined above;

The existing Sections 2.0 and 3.2 of the Environmental Assessment report can be used as the basis for this section of the PER. However, the key changes required relate to describing in further detail the conservation values of the bushland in relation to vegetation, flora, fauna, linkage and regional and local significance. This is particularly important in order to provide a clear understanding of the conservation values of the site so that the acceptability of the proposed offset approach can be properly considered.

Other specific changes and additional information based on CALM's and DEP's comments are to be incorporated as follows:

- *2.1 Vegetation and 2.2 Threatened Ecological Community:* CALM have advised that Community Type 20a – *Banksia attenuata* woodlands over species rich dense shrublands is present. However, the Environmental Assessment report has not identified this, therefore, the PER will need to address this matter in further detail and clarify whether the vegetation present is Community Type 20a.
- *2.4 Flora:* Taking into consideration that *Bush Forever* Site No. 319 contains a number of listed significant flora and that only two of these were listed in Ecoscape's field survey and that 35 plant species were identified on the whole block, further detail on the extent and season of collecting is required. Further discussion regarding the extent of the populations and the regional significance of the declared rare flora *Conospermum undulatum* and priority 3 flora *Isopogon drummondii* on Lot 21, and how the proposed subdivision will impact on these floras in a regional context needs to be provided.

5. Environmental Management

This section should demonstrate that the proposed environmental offsets will ensure that there is no net loss in conservation values and that the environmental management to be undertaken will ensure that the EPA's objectives are met. This should be achieved through stronger substantiation of the benefits that will arise through the proposed environmental management plan/restoration plan in terms of offsetting the values lost through the proposed subdivision. Specific comments on the details to be provided in this section based on the feedback received from CALM are as follows:

- *3.3 Proposed Land Use:* As you are aware, CALM have indicated to the Department of Land Administration that it would accept the Management Order for Reserve C31709 'in principle', provided that the Water Corporation rehabilitate the degraded areas within the reserve and provide boundary fencing. This needs to be highlighted in the PER. The likely long-term management responsibility for the reserve should be addressed.

- *4.0 Methods for Clearing and Bush Restoration:* Further detail on the key elements of the proposed restoration strategy needs to be provided, the following comments should be incorporated, but not be limited to this:
    - Stronger justification for the acceptability of the loss in the declared rare flora *Conospermum undulatum* and Priority 3 flora *Isopogon drummondii* is required, as well as further detail on how the objectives and key elements of the plan will work towards protecting and improving the viability of these flora on the proposed restoration site.
    - It is recommended that the restoration of the reserve go beyond what is presently being proposed, for example weed management, bush regeneration, etc. should be incorporated and addressed further in this section.
    - It may be best to utilise the material obtained from the good quality bushland of the subject area to rehabilitate tracks and small areas of degradation on Water Reserve C31709 and Welfare Reserve 37997.
    - Clearer identification of similar vegetation types from Lot 21 to the reserves to ensure that material transferred is kept within the same community type is required.
    - Dieback samples from Lot 21 should be collected and analysed to assess the risk of dieback spread in any operational activities.
    - The removal of any invasive weeds should be removed from Lot 21 before clearing and removal of material.
    - It is recommended that material not be mulched, instead it would be preferable that brush material be transferred directly to the track and areas identified for rehabilitation. In addition, protection of the material transferred should be achieved through fencing and removal of rubbish and aggressive weeds from the sites identified to be rehabilitated. This should be undertaken before transfer of the material.

6. Environmental Management Commitments

It is accepted practice for a list of key commitments to be attached to the Minister for the Environment and Heritage's Ministerial Statement for the proposal. There is an expectation that the proponent implements all the commitments, as part of their commitment to good environmental management.

The draft commitments provided with your letter of 6 April 2001 require some modifications to ensure that they adequately reflect the comments provided on the Environmental Management section of the PER. In addition, it is important to ensure that the commitments are auditable and, therefore, proponents are advised to follow the format explained in Attachment 3.

References and Appendices

Lastly, there should be the inclusion of References and Appendices at the end of the PER document.

I trust that the comments provided above is sufficient and will aid you in progressing the preparation of the environmental review document. Furthermore, it is strongly recommended that during this period you closely liaise with Kathy Choo, the DEP's assessment officer for the project, to ensure that the EPA is satisfied with the standard of the environmental review document when releasing for public review.

If you have any further questions or concerns, please do not hesitate to Kathy Choo on 9222 7050.

Yours sincerely

Libby Mattiske
DEPUTY CHAIRMAN

(in the absence of the Chairman, under approved delegation)

Enc

cc Brook & Marsh – Allan Marsh

- 1 NOV 2001

Appendix Two:
'In principle' Comments

Lot 21 Webster Road, Forrestfield: Public Environmental Review

WITHOUT PREJUDICE

WATER CORPORATION
ABN 28 003 434 917

Your Ref 805-2-1-40-319
Our Ref 10F03937
Enquiries Adam Roebuck
Direct Tel 9420 3356
9420 3797 Fax

RECEIVED
04 OCT 2002

629 Newcastle Street
Leederville 6007
Western Australia

PO Box 100
Leederville WA 6902

Telephone (08) 9420 2420
Facsimile (08) 9420 3200

Email
watermail@watercorporation.com.au

Website
www.watercorporation.com.au

3 October 2002

Ms E Bamforth
Department of Planning & Infrastructure
469 Wellington Street
PERTH WA 6000

Dear Ms Bamforth

Lot 21 Bedford Road, Forrestfield & Water Corporation land on Bush Forever sites

Thank you for forwarding a copy of David Nunns' 9 August 2002 letter addressed to Ecoscape regarding the proposed rehabilitation.

The Corporation supports in principle the proposal by Ecoscape on behalf of its client.

Further discussions are required between all parties to ensure an equitable outcome can be achieved. I look forward to direct participation in this process.

Yours sincerely

per Adam Roebuck
Manager, Portfolio Performance
Corporate Real Estate Branch

cc: Louise Cullen – Ecoscape – PO Box 50 North Fremantle WA 6159

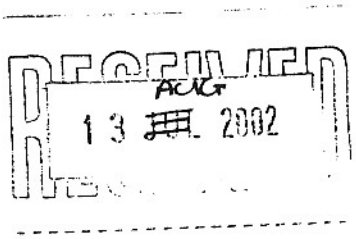
MMR6785

5006

Department for Planning and Infrastructure
Government of Western Australia

Environmental Planning - Bush Forever

Your ref:
Our ref: 805-2-1-40-319
Enquiries: Emma Bamforth - (08) 9264 777



9 August 2002

Louise Cullen
Ecoscape
PO Box 50
NORTH FREMANTLE WA 6159

Dear Louise

Lot 21 Bedford Rd, Forrestfield and WaterCorp land in Bush Forever Site 319

Thank you for your letter dated 8th July 2002 and subsequent meeting on 31st July 2002 with Emma Bamforth from the Bush Forever Office, regarding Lot 21 Bedford Rd, Forrestdale and the Bush Forever Site No 319 - Dundas Road Forrestfield.

As outlined in your letter and discussed further at the meeting, I understand that you are seeking "in principle" support for a proposal to rehabilitate a degraded area of bushland in Bush Forever Site 319, owned by Water Corp, with vegetative material being cleared from Lot 21 Bedford Road which lies adjacent to the Bush Forever site.

As discussed at our meeting, for such a proposal to be approved by the Bush Forever Office, the following detailed information would be required:

- a rehabilitation plan providing details on the type and condition of the vegetation to be cleared or transplanted from Lot 21;
- the boundary of the area within Bush Forever Site No 319 to be rehabilitated and a description of the type and condition of the vegetation at this location;
- a description of the techniques to be used for the translocation and rehabilitation; and
- details of the ongoing management measures that will be implemented to ensure successful rehabilitation of the degraded area within the Bush Forever Site.

As discussed, due to the presence of a number of Threatened Ecological Communities (TEC's) within the Bush Forever Site 319, it is recommended that you liaise with CALM to determine whether any TEC's are present within the area proposed for rehabilitation.

The above advice is subject to the necessary approvals from decision making bodies and the landowners. From recent discussions, I understand that the Department of Environmental Protection has advised that the proposed industrial development on Lot 21 requires formal assessment. The information listed above could therefore be included as part of the environmental assessment for the proposed development of Lot 21.

Albert Facey House, 469 Wellington Street, Perth, Western Australia 6000
Tel: (08) 9264 7777 Fax: (08) 9264 7566 TTY: (08) 9264 7535 Infoline: 1800 626 477
corporate@planning.wa.gov.au http://www.dpi.wa.gov.au
ABN 40 996 710 314

The Bush Forever Office does however provide in principal support for the proposed rehabilitation and would welcome the opportunity to comment on any draft rehabilitation plans that are prepared.

I trust this advise satisfies your recent inquiry. Should you require any additional information, please do not hesitate to contact Emma Bamforth on 9264 7772.

Yours sincerely

DAVID NUNN
DIRECTOR ENVIRONMENTAL PLANNING

K:\ENV\Emma\Bush Forever Site Folder\BF 319\Ecoscape proposed rehab L1 Aug 02.dot
Albert Facey House, 469 Wellington Street, Perth, Western Australia 6000
Tel: (08) 9264 7777 Fax: (08) 9264 7566 TTY: (08) 9264 7535 Infoline: 1800 626 477
corporate@planning.wa.gov.au http://www.dpi.wa.gov.au
ABN 40 996 710 314

Attachment 1

DEPARTMENT OF
Conservation
AND LAND MANAGEMENT
Conserving the nature of WA

Phone:
Fax:
Email:

Your Ref
Our Ref 17/11
Contact Paul Brown Ph: 9474 7031

CEO
Department of Environmental Protection
Westralia Square
141 St Georges Terrace
PERTH WA 6000

Attention: Darren Walsh

ENVIRONMENTAL ASSESSMENT – LOT 21 WEBSTER RD, FORRESTFIELD

The Department has been asked by DEP for its 'in principle' comments on the proposed industrial development on Webster Road, Forrestfield. This issue has been discussed between Darren Walsh and Paul Brown from this office. This Department's initial comments are provided below. It is this Department's view that the proposal be assessed formally through the EPA process.

Conservation Values of the Site

Although the block is small (1.84 ha) it has significant conservation values:

- Some 60 plants of the estimated 4,000 plants of the DRF *Conospermum undulatum* - a regionally restricted species not currently occurring on a conservation reserve.
- Priority 3 *Isopogon drummondii*.
- TEC Community Type 20a *Banksia attenuata* woodlands over species rich dense shrublands. A community of the eastern side of the Swan Coastal Plain and ranked by WATSCU as vulnerable.
- This block contains plant communities representative of the eastern side of the Swan Coastal Plain that are floristically diverse and as a unit heavily cleared. Many significant flora species are reported from these communities. The field survey from Ecoscape for the proponent indicates 35 plant species from the block – this is exceptionally low and indicates limited or out of season (non-spring) plant collections.
- The majority of the block is in very good to good condition with an intact understorey and overstorey with few aggressive weeds present. These diverse plant communities of the eastern side of the Swan Coastal Plain are very resistant to weed invasion and other degradation. Some rubbish and small areas on the edge are degraded.

SWAN REGION: Technology Park, 20 Dick Perry Avenue, Kensington, Western Australia 6151
Phone: (08) 9368 4399 Fax: (08) 9368 4299 Website: www.naturebase.net
Postal Address: PO Box 1167, Bentley Delivery Centre, Bentley, Western Australia 6983

174733

- It forms an indirect linkage with the WAPC lands (which were acquired for conservation purposes) to the south and the bulk of M53 to the north (Attachment 3). However it is very small, surrounded by industrial buildings with roads separating it from the other M53 bushland.
- Quenda are extremely common in the western section of M53 (Bush Forever Site 319) and could occur on this block.

This informal response supports the verbal comments by Paul Brown, from my this office, to DEP that the number of conservation values on this small block would indicate that the Department could not support the development. The presumption by the proponent that it will get approval appears optimistic until the EPA assessment has been completed.

This Department will make formal comments when the DEP ask us during the assessment of the proponent's submission and environmental report.

Preliminary discussions with Neil Robertson from the Ministry for Planning indicate that Lot 21 is not included in the current Bush Forever Site 319 "Planning Control Area", so can not be purchased by WAPC. Although the proponents consultants have indicated that they would be interested in the State purchasing the block at the right price.

Conclusion

1. This Department will take a nature conservation focus in its comments to this proposal. The nature conservation values of the block are high given its small size.
2. Given the history and values of this site, formal assessment and consideration of the proposal by the EPA is appropriate.
3. Further enquires on possible purchase by WAPC should be undertaken

Rob Towers
Acting Regional Manager

24 September 2001

Appendix Three:
Fauna That May Occur in Lot 21

Based on a search of the literature, the habitat types in Lot 21 and discussions with relevant experts the following fauna may occur in Lot 21. Sources include Bamford (2000), Tingay, Allan and Associates (1997), Harvey *et al.* (1997) [site HF], and How and Dell (1994) [Site PA and M1].

Bird Species That May Occur in Lot 21

Taxonomic nomenclature for birds follows that of Blakers *et al*. (1984).

Taxonomic Name	Common Name
Accipitridae (kites, hawks and eagles)	
Elanus axillaris	Black-Shouldered Kite
Accipiter fasciatus	Brown Goshawk
Elanus notatus	Black-shouldered Kite
Accipiter cirrhocephalus	Collared Sparrowhawk
Aquila audax	Wedge-tailed Eagle
Hieraaetus morphnoides	Little Eagle
Petroicidae (Robins)	
Petroica goodenovil	Red-capped Robin
Falconidae (falcons)	
Falco longipenni s	Australian Hobby
Falco berigora	Brown Falcon
Falco cenchroides	Nankeen Kestrel
Turnicidae (button-quails)	
Turnix varia	Painted Button-quail
Charadriidae (lapwings and plovers)	
Vanellus tricolor	Banded Lapwing
Columbidae (pigeons and doves)	
Columba livia	Rock Dove (feral pigeon)
Phaps chalcoptera	Common Bronzewing
Ocyphaps lophotes	Crested Pigeon
Streptopelia chinensis	Spotted Turtle-Dove
Streptopelia senegalensis	Laughing Turtle-Dove
Cacatuidae (cockatoos)	
Cacatua roseicapilla	Galah
Calyptorhynchus latirostris	Carnaby's Black Cockatoo
Psittacidae (lorikeets and parrots)	
Trichoglossus haematodus	Rainbow Lorikeet
Glossopsitta porphyrocephala	Purple-crowned Lorikeet
Neophema elegans	Elegant Parrot
Barnardius zonarius	Australian Ringneck (twenty-eight)

Taxonomic Name	Common Name
Purpureicephalus spurius	Red-capped Parrot
Cuculidae (cuckoos)	
Cuculus pallidus	Pallid Cuckoo
Cuculus pyrrhophanus	Fan-tailed Cuckoo
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo
Chrysococcyx lucidus	Shining Bronze-Cuckoo
Podargidae (frogmouths)	
Podargus strigoides	Tawny Frogmouth
Halcyonidae (forest kingfishers)	
Todiramphus sanctus	Sacred Kingfisher
Dacelo novaeguineae	Laughing Kookaburra
Meropidae (bee-eaters)	
Merops ornatus	Rainbow Bee-eater
Maluridae (fairy-wrens)	
Malurus splendens	Splendid Fairy-wren
Pardalotidae (pardalotes)	
Pardalotus punctatus	Spotted Pardalote
Pardalotus striatus	Striated Pardalote
Gerygone fusca	Western Gerygone
Acanthiza apicalis	Inland Thornbill
Acanthiza inornata	Western Thornbill
Acanthiza chrysorrhoa	Yellow-rumped Thornbill
Meliphagidae (honeyeaters)	
Anthochaera carunculata	Red Wattlebird
Anthochaera chrysoptera	Little Wattlebird
Manorina flavigula	Yellow-throated Miner
Lichenostomus virescens	Singing Honeyeater
Meliphaga viriscens	Singing Honeyeater
Melithreptus brevirostris	Brown-headed Honeyeater
Lichmera indistincta	Brown Honeyeater
Phylidonyris novaehollandiae	New Holland Honeyeater
Phylidonyris nigra	White-cheeked Honeyeater
Phylidonyris melanops	Tawny-crowned Honeyeater
Epithianura albifrons	White-fronted Chat
Acanthorhynchus superciliosus	Western Spinebill
Petroicidae (Australian robins)	
Petroica multicolor	Scarlet Robin
Melanodryas cucullata	Hooded Robin
Neosittidae (sittellas)	
Daphoenositta chrysoptera	Varied Sittella
Pachycephalidae (whistlers)	
Pachycephala pectoralis	Golden Whistler
Pachycephala rufiventris	Rufous Whistler
Dicruridae (flycatchers)	
Grallina cyanoleuca	Magpie-lark
Rhipidura fuliginosa	Grey Fantail
Rhipidura leucophrys	Willie Wagtail

Taxonomic Name	Common Name
Campephagidae (cuckoo-shrikes)	
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Lalage sueurii	White-winged Triller
Artamidae (woodswallows)	
Artamus cinereus	Black-faced Woodswallow
Artamus cyanopterus	Dusky Woodswallow
Cracticus torquatus	Grey Butcherbird
Gymnorhina tibicen	Australian Magpie
Corvidae (ravens and crows)	
Corvus coronoides	Australian Raven
Motacillidae (pipits and true wagtails)	
Anthus novaeseelandiae	Richard's Pipit
Hirundinidae (swallows)	
Hirundo nigricans	Tree Martin
Hirundo ariel	Fairy Martin
Hirundo neoxena	Welcome Swallow
Dicaeidae (Mistletoebirds)	
Dicaeum hirundinaceum	Mistletoebird
Sylviidae (Warblers, Songlarks)	
Acrocephalus stentoreus	Clamorous Reed Warbler
Cincloramphus mathewsi	Rufous Songlark
Cincloramphus cruralis	Brown Songlark
Zosteropidae (white-eyes)	
Zosterops lateralis	Silvereye

Mammal Species That May Occur in Lot 21

Taxonomic nomenclature for mammals follows that of Strahan (1983).

Taxonomic Name	Common Name
Tachyglossidae (echidnas)	
Tachyglossus aculeatus	Echidna
Peramelidae (Bandicoots)	
Isoodon obesulus	Southern Brown Bandicoot
Phalangeridae (possums)	
Trichosurus vulpecula	Brush-tailed Possum
Macropodidae (kangaroos and wallabies)	
Macropus fuliginosus	Western Grey Kangaroo
Mollosidae (mastiff bats)	
Tadarida australis	White-striped Bat
Mormopterus planiceps	Little Mastiff-bat
Vespertilionidae (ordinary bats)	
Chalinolobus gouldii	Gould’s Wattled Bat
Chalinolobus morio	Chocolate Wattled Bat
Vespedalus (Eptesicus) regulus	
Nyctophilus geoffroyi	Lesser Long-eared Bat
Nyctophilus gouldii	Gould’s Long-eared Bat
Nyctophilus major	Greater Long-eared Bat
Muridae (rats and mice)	

Mus musculus	House Mouse
Rattus rattus	Black Rat
Leporidae (rabbits and hares)	
Oryctolagus cuniculus	European Rabbit
Canidae (foxes and dogs)	
Vulpes vulpes	European Red Fox
Felidae (cats)	
Felis catus	Feral Cat

Reptile and Amphibian Species That May Occur in Lot 21

Taxonomic nomenclature for mammals follows that of Bush *et al.* (1995).

Taxonomic Name	Common Name
Myobatrachidae (ground frogs)	
Crinia glauerti	Glauert's Froglet
Crinia insignifera	Sandplain Froglet
Heleioporus eyrei	Moaning Frog
Limnodynastes dorsalis	Pobblebonk
Myobatrachus gouldii	Turtle Frog
Psuedophryne guentheri	Guenther's Toadlet
Hylidae (tree frogs)	
Litoria moorei	Motorbike Frog
Gekkonidae (geckoes)	
Diplodactylus alboguttatus	White-spotted Ground Gecko
Phyllodactylus marmoratus	Marbled Gecko
Strophurus spinigerus ssp. *spinigerus*	Southern Spiny-tailed Gecko
Pygopodidae (legless lizards)	
Aprasia repens	Sand-Plain Worm-Lizard
Delma fraseri	Fraser's Legless Lizard
Delma grayii	Gray's Legless Lizard
Lialis burtonis	Burton's Legless Lizard
Pygopus lepidopodus	Common Scaleyfoot
Pletholax gracilis	Keeled Legless Lizard
Agamidae (dragon lizards)	
Pogona minor	Western Bearded Dragon
Tympanocryptis adelaidensis	Sandhill or Heath Dragon
Varanidae (monitors)	
Varanus gouldii	Gould's Sand Goanna
Varanus tristis	Black-tailed Monitor
Scincidae (skink lizards)	
Bassiana trillineata	South-western Cool Skink
Cryptoblepharus plagiocephalus	Fence Skink
Ctenotus fallens	West Coast Ctenotus
Ctenotus gemmula	Jewelled Ctenotus
Ctenotus impar	South-western Odd-striped Ctenotus
Ctenotus leseurii	Western Limestone Ctenotus
Egernia napoleonis	Salmon-bellied Skink
Hemiergis quadrilineata	Two-toed Earless Skink
Lerista elegans	West Coast Four-toed Lerista
Lerista lineopunctulata	West Coast Line-Spotted Lerista
Menetia greyii	Dwarf Skink
Morethia lineoocellata	West Coast Morethia
Morethia obscura	Dusky Morethia
Tiliqua rugosa	Bobtail
Typhlopidae (blind snakes)	
Ramphotyphlops australis	Southern Blind Snake
Boidae (pythons)	

Morelia spilota imbricata	South-West Carpet Python
Elapidae (front-fanged snakes)	
Drysdalia coronata	Crowned Snake
Neelaps bimaculatus	Black-naped Snake
Pseudonaja affinis	Dugite
Rhinoplocephalus gouldii	Gould's Snake
Simoselaps bertholdi	Jan's Bandy-Bandy
Notechis coronatus	Tiger Snake
Vermicella semifasciata	Bandy-Bandy
Simoselaps semifasciatus	Half-ringed Snake