

THE UNIVERSITY OF WESTERN AUSTRALIA

**LOT 4 UNDERWOOD AVENUE
SHENTON PARK
2007 DEVELOPMENT AND
CONSERVATION PROPOSAL**

ENVIRONMENTAL REVIEW REPORT

EPA ASSESSMENT NO. 1403

VERSION 4

JULY 2007

REPORT NO: 2006/263



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INVITATION

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

The University of Western Australia proposes to develop the north eastern portion of Lot 4 Underwood Avenue, Shenton Park for residential purposes. The total development area of Lot 4 is 33.4 hectares (ha), of which approximately 11.9ha of bushland will be retained for conservation and passive recreation, 13ha will be cleared for a residential subdivision and a further 8.5ha will continue to be used for University purposes but is set aside for future development and will be cleared and earth-worked as part of the residential subdivision. In accordance with the *Environmental Protection Act 1986*, this Environmental Review Report (ERR) has been prepared which describes this proposal and its likely effects on the environment. The ERR is available for a public review period of 4 weeks from Monday 16 July 2007, closing on Monday 13 August 2007.

Comments from government agencies and from the public will assist the EPA to prepare an assessment report in which it will make recommendations to government. If you are able to, the EPA would welcome electronic submissions in particular, emailed to the project assessment officer or via the EPA's website (see address below).

Where to get copies of this document

Printed copies of this document may be purchased for \$10.00 (including postage) or a CD-rom version may be provided free of charge from:

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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. Electronic submissions will be acknowledged electronically. The proponent will be required to provide adequate responses to points raised in submissions. In preparing its assessment report for the Minister for the Environment, the EPA will consider the information in submissions, the proponent's responses and other relevant information. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the *Freedom of Information Act 1992*, and may be quoted in full or in part in each report.

Why join a group?

If you prefer not to write your own comments, it may be worthwhile joining a group or other groups 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 ERR or the specific proposals. It helps if you give a reason for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable.

When making comments on specific proposals in the ERR:

- Clearly state your point of view;
- Indicate the source of your information or argument if this is applicable;
- 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 ERR;
- If you discuss different sections of the ERR, keep them distinct and separate, so there is no confusion as to which section you are considering;
- 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 13 August 2007.

The EPA prefers submissions to be sent electronically. You can either email the submission to the following address: submissions.eia@dec.wa.gov.au

Or use the submission form on the EPA's website: www.epa.wa.gov.au/submissions.asp and click on the EIA Assessment Submission option.

Alternatively, you can post your submission to:

The Chairman
Environmental Protection Authority
PO Box K822
PERTH WA 6842
Attention: Kirsty Quinlan

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1. INTRODUCTION

1.1 Background, Purpose and Scope

In 2001, The University of Western Australia (The University) prepared a development and conservation proposal for Lot 4 Underwood Avenue, Shenton Park (Figure 1). This proposal was for the subdivision of the eastern portion of the landholding encompassing approximately 33.38 hectares (ha), hereafter referred to as the Bulletin 1034 proposal. The proposal was referred to the Environmental Protection Authority (EPA) for assessment.

In Bulletin 1034, the EPA (2001) concluded that the *“8.5ha of bushland identified for bushland conservation is considered inadequate to protect the core (highest conservation value) area/s of the Bushplan site”* and *“that a larger area...but not substantially so, should be set aside for conservation”*. The Minister for the Environment received a number of appeals on the content of the EPA’s report and recommendations. In determining the appeals, under Section 43 of the *Environmental Protection Act 1986* (EP Act) the Minister referred the proposal back to the EPA on 9 July 2002, to more fully consider the area of native vegetation that should be conserved on the site. The Minister also requested the EPA to provide an update of the odour situation in its further report.

On 22 November 2002, The University entered into an agreement with the Water Corporation, EPA and the Western Australian Planning Commission (WAPC), which resulted in The University requesting that EPA Assessment 1403 relating to the Bulletin 1034 proposal, be suspended until further notice, and that a new proposal be prepared for the subject land. The power of the EPA to suspend the assessment is derived from section 40(3) of the EP Act.

Under section 43A of the EP Act, the EPA may consent to the proponent (in this case The University) changing the proposal without a revised proposal being referred to the EPA, if the EPA considers that the change is unlikely to significantly increase any impact that the proposal may have on the environment. In this case, the EPA agreed to consent to the proposal being changed pursuant to section 43A, as per its letter to Minter Ellison Lawyers dated 14 June 2007. The University has prepared a revised proposal (Figure 2) incorporating the EPA comments on the Bulletin 1034 proposal. The EPA has requested that The University prepare a report comparing the current proposal with the Bulletin 1034 proposal to identify whether there is a net benefit to the environment and to provide the opportunity for public comment.

This report has been prepared on behalf of The University to compare the current conservation and development proposal for the eastern portion of Lot 4 with the Bulletin 1034 proposal against relevant environmental factors. In relation to the environmental factor of odour, the Water Corporation and the University of Western Australia agree that there are no outstanding odour issues relating to the area of residential development shown on the revised proposal before the EPA for assessment.

2. CURRENT PROPOSAL

The current proposal by the University is to develop the north eastern portion of Lot 4 Underwood Avenue, Shenton Park for residential purposes. The total development area of Lot 4 is 33.38 hectares (ha), of which approximately 11.88ha of bushland will be retained for conservation and passive recreation, 13ha will be cleared for a residential subdivision and a further 8.5ha will continue to be used for University purposes but is set aside for future development and will be cleared and earth-worked as part of the residential subdivision. The retention of approximately 11.88ha for conservation and passive recreational purposes represents more than 35% of the total developable area of 33.38ha, which includes the area shown as future development in Figure 2.

This proposal represents an improvement of the original proposal assessed in Bulletin 1034. The current proposal incorporates the recommendations of the EPA in Bulletin 1034, embraces the underlying principles identified during the Shenton Park/Mt Claremont Structure Plan Charrette process initiated in 2001. Table 1 outlines the key characteristics of the development proposal.

**TABLE 1
KEY CHARACTERISTICS OF THE DEVELOPMENT PROPOSAL**

Element	Description
Proposal	<ul style="list-style-type: none"> • 13ha residential subdivision creating 163 single residential lots, in addition to 8 grouped housing sites that will yield approximately 105 dwelling units • 10ha for conservation • 1.88ha for Public Open Space • 8.5ha set aside for future development
Area (including Public Open Space and reserves)	Pt Lot 4 Underwood Avenue, Shenton Park comprises a total area of 33.38ha.
Area of Disturbance	The plan is to clear, subdivide and develop 13ha of the north east portion of the subject land. A further 8.5ha will be cleared and earth-worked as part of the subdivision, and is set aside for 'future development'.
Infrastructure	Roads within the subdivision. 1.5m wide footpath on at least one side of all internal roads, plus all cottage lots will have a 1.5m footpath adjoining them. Installation of sewerage connections, soak wells and swales.
Setbacks	5m wide landscape buffer on Underwood Avenue
Rehabilitation	Rehabilitation of 1.46ha of the proposed conservation area which is currently in a Degraded condition.

2.1 Conservation and Public Open Space Areas

It is proposed to retain two conservation areas (8ha and 2ha for a total of 10ha) joined by a vegetated Public Open Space (POS) area. The 10ha of bushland set aside for conservation is 1.5ha more than the original Bulletin 1034 proposal and represents an approximate 22% increase on the agreed 8.23ha Negotiated Planning Solution as depicted in Bush Forever (Government of Western Australia, 2000).

The 1.88ha of POS is strategically located between Conservation Areas A and B. This in effect represents an addition to the conservation areas by virtue of the fact that this open space is predominantly vegetated with native species and will be managed in a way that recognises and enhances the adjacent conservation values while maximizing compatible passive recreational opportunities. It constitutes part of the future subdivisional open space requirement of the residential subdivision. It will perform both conservation and passive recreational functions with rehabilitation of degraded areas using locally native species and restoration of understorey species together with walk trails, tables and seating in a natural bushland setting. The POS is a critical element in the overall linkage objective as defined within the Shenton Park/Mt Claremont Structure Plan Charrette process initiated in 2001 and is an important recreational asset for those residents that will ultimately live within this residential estate. Included in the POS are the two important Jarrah trees (known as the interlocking Jarrahs).

The current proposal will result in 40% more bushland (including the POS area) being retained than the original Bulletin 1034 proposal, which retained 8.5ha of bushland.

2.1.1 Conservation Area A

Conservation Area A (refer to Figure 2) occupies a total area of 8ha and is located in the southeast corner of Lot 4 adjacent to Selby Street.

The vegetation of Conservation Area A (Figure 3) consists entirely of a Jarrah dominated Woodland with scattered Tuart and Marri trees over a lower tree canopy of *Banksia attenuata*, *B. menziesii* and *Allocasuarina fraseriana*. Typical taller shrub species include *Jacksonia furcellata*, *Hakea prostrata*, *Xanthorrhoea preissii* and *Macrozamia fraseri*. Common understorey species include *Gompholobium tomentosum*, *Hibbertia hypericoides*, *Acacia pulchella*, *Calytrix fraseri*, *Mesomelaena pseudostygia*, *Desmocladius flexuosus* and *Petrophile linearis*.

The bushland in Conservation Area A is mainly in Very Good to Good condition or better (Figure 4).

2.1.2 Conservation Area B

Conservation Area B (refer to Figure 2) occupies 2ha and is located in the western portion of the proposed developable area. Conservation Area B contains a greater variety of vegetation associations than Conservation Area A (Figure 3). It mostly comprises *Banksia menziesii* – *B. attenuata* woodland over *Allocasuarina fraseriana* and *Hakea prostrata*. In places, there is stunted Jarrah or emergent Tuart. Species common in the understorey of the *Banksia* Low Woodland include *Hakea prostrata* up to 2m and low shrubs of *Mesomelaena pseudostygia*, *Xanthorrhoea preissii*, *Petrophile linearis* and *P. macrostachya*. *Alexgeorgea nitens*, *Desmocladius flexuosus*, *Dryandra lindleyana* and several weed species dominate the ground cover. However, also protected in this area is Jarrah Open Woodland over *Banksia menziesii* Low Woodland and a *Eucalyptus decipiens* stand. Conservation Area B also protects a stand of *Eucalyptus decipiens*, which is not a Priority or Declared Rare Flora (DRF) species but is uncommon in the Perth Metropolitan Region, usually occurring in very small stands on shallow sand over limestone. Also protected in this conservation area are two populations of the Priority 3 species *Jacksonia sericea* that were not protected in the Bulletin 1034 proposal. As illustrated in Figure 3, these populations are located in the north west and centre of Conservation Area B.

The bushland in Conservation Area B is mapped mainly as Good to Very Good condition (Figure 4). The balance of Conservation Area B is mapped as Good.

2.1.3 Public Open Space

The central POS spine that links Conservation Areas A and B comprises of two vegetation associations, the Jarrah dominated Woodland with scattered Tuart and Marri trees over a lower tree canopy of *Banksia attenuata*, *B. menziesii* and *Allocasuarina fraseriana* and the Jarrah and Tuart Open Woodland over *Acacia saligna*, *A. rostellifera* and *Hakea prostrata* (Figure 3).

The vegetation condition in the POS area is variable and ranges from Good through to Degraded (Figure 4).

The central region of the POS area includes the highest point of the site at 44mAHD. This high point has been modified by partial clearing in the past and the installation of tracks and firebreaks.

The University is committed to rehabilitating the POS area and other weedy sections back to a Good to Very Good condition (Refer to Section 5.2). The University has demonstrated its ability to rehabilitate the site through its rehabilitation of two degraded sites on Lot 4 in 2004 and 2005. The results achieved to date at these two sites are provided in Appendix 1.

3. BULLETIN 1034 PROPOSAL

3.1 Background

The University has considered a number of options for the delineation of a conservation area at the Shenton Park landholding. The Bush Plan/Bush Forever process and community guided the preparation of the various proposals initially and with agency consultation resulted in a proposed 8.23ha Negotiated Planning Solution.

The proposal assessed by the EPA (Bulletin 1034) was formulated following a protracted planning and negotiation process as outlined below.

The University commissioned a preliminary environmental assessment of Lot 4 to determine if the environmental values of the site could be protected while meeting the objectives of Bush Forever (formerly Bush Plan) by retaining a representative portion of the bushland as part of a Structure Plan. The environmental assessment guided the preparation of an Outline Development Plan (ODP) that contained an 'L-shaped' area of bushland mapped as Very Good condition along Selby Street and Underwood Avenue. The University lodged a submission to the Ministry for Planning (now Department for Planning and Infrastructure) in 1999 delineating an area of bushland of high conservation value to be retained as Conservation Open Space in any future development on Lot 4. The Ministry for Planning agreed with the proposal and subsequently, in 2000 the Minister for Planning endorsed the agreed negotiated outcome. This proposal is shown in Bush Forever (Government of Western Australia, 2000) as the 8.23ha Negotiated Planning Solution for Lot 4.

Further discussions with the former Department of Environmental Protection (DEP) regarding the optimal shape of the conservation area identified that a reduced perimeter to area ratio would be preferred. This resulted in the formulation of a rectangular-shaped conservation area.

Further refinement of the conservation area was requested by the DEP following extensive consultation and site inspections with officers and the project team. During a site inspection, and subsequent meeting in May 2001 the DEP and EPA confirmed preference for a 'square' shaped conservation area. Correspondence was received from the EPA Chairman on 20 June 2001 indicating provisional support for the square reservation.

Consequently, a revised subdivision application was lodged in June 2001 followed by an ODP in September 2001 delineating the square conservation area encompassing 8.5ha in the south-eastern region of the site (Figure 1). The EPA assessed this application and Bulletin 1034 was released in November 2001.

3.2 Conservation Area

The proposed conservation area in the original proposal occupied a total area of 8.5ha and is located in the southeast corner of Lot 4 adjacent to Selby Street.

The vegetation of the conservation area consisted entirely of a Jarrah dominated Woodland with scattered Tuart and Marri trees over a lower tree canopy of *Banksia attenuata*, *B. menziesii* and *Allocasuarina fraseriana*. Typical taller shrub species include *Jacksonia furcellata*, *Hakea prostrata*, *Xanthorrhoea preissii* and *Macrozamia fraseri*. Common understorey species include *Gompholobium tomentosum*, *Hibbertia hypericoides*, *Acacia pulchella*, *Calytrix fraseri*, *Mesomelaena pseudostygia*, *Desmocladius flexuosus* and *Petrophile linearis*.

The bushland in the conservation area is mainly in Very Good to Good condition or better.

3.3 EPA Assessment of Bulletin 1034 Proposal

In relation to the conservation area, the EPA provided the following recommendation to the Minister for the Environment in Bulletin 1034:

‘That the Minister notes that the EPA has concluded that in its current form the proposed 8.5ha identified for bushland conservation is considered inadequate to protect the core (highest conservation value) area/s of the Bush Plan Site. The EPA is of the view that a larger area of the Bush Plan Site, but not substantially so, should be set aside for conservation.’

The particular issues that were raised by the EPA in its report and recommendations are summarised as follows:

- Impact on populations of *Jacksonia sericea*
- Impact on a population of *Eucalyptus decipiens*
- Ecological Linkage
- Tuart trees
- Size of the bushland conservation area

The Minister for the Environment received a number of appeals on the content of the EPA’s report and recommendations. In determining the appeals, the Minister forwarded the proposal back to the EPA to more fully consider the area of native vegetation that should be conserved on site.

4. ENVIRONMENTAL EVALUATION OF THE CONSERVATION AND PUBLIC OPEN SPACE AREAS

The following sections provide an environmental evaluation of the current proposal and compare this proposal with the original Bulletin 1034 proposal according to recognised criteria (i.e. Bush Forever¹).

An area of regionally significant bushland (Site 119) was identified on the site under the heading of a 'Negotiated Planning Solution' in Bush Forever mapping (Government of Western Australia, 2000). The selection criteria used to identify the regionally significant parcel at the site was that of '*representation of ecological communities*'. According to Bush Forever, other criteria used to determine the selection of regionally significant bushland areas, including diversity, rarity, maintaining ecological processes, scientific or evolutionary importance are not considered relevant to this area of bushland.

The evaluation of the conservation area in the following sections, however, does not exclude the other criteria listed under Bush Forever.

4.1 Representation of Ecological Communities

According to Bush Forever, the State Government's objective is to protect at least 10% of the original extent of each vegetation complex in the Perth Metropolitan Area and in at least five geographically distinct areas if possible. The Karrakatta Complex-Central and South has approximately 5.6% of its original extent with some level of existing protection (e.g. included within existing reserves). Implementation of Bush Forever initiatives will increase this figure by approximately 2.4% to bring the total to 8% of the original extent currently retained or proposed for retention. Outside the Perth Metropolitan Region, the amount of Karrakatta Central and South Vegetation Complex remaining is well over the 30% target set by the Government in non-urban areas.

In comparison with the original Bulletin 1034 proposal, the current proposal has a minor positive impact on the conservation status of the Karrakatta Central and South vegetation complex (Table 2).

TABLE 2
AREAS OF VEGETATION RETAINED IN PREVIOUS AND CURRENT PROPOSALS

Proposal	Area
Original Bulletin 1034 proposal	8.50ha
Current Proposal (excluding POS)	10.00ha
Current Proposal (including POS)	11.88ha

¹ Government of WA (2000) Bush Forever. Volume 1 – Policies, Principles and Processes.
Government of WA (2000) Bush Forever. Volume 1 – Policies, Principles and Processes – Appendix 3: Site Implementation Guidelines – Practice Notes.
Government of WA (2000) Bush Forever. Volume 2 – Directory of Bush Forever Sites.

4.2 Diversity

The current proposal contains a greater representation of vegetation associations of the Karrakatta Central and South Complex than the Bulletin 1034 proposal (five compared with one), as shown in Table 3. Consequently, it would be expected that the current proposal would also provide a greater diversity of flora and fauna.

**TABLE 3
AREA OF VEGETATION ASSOCIATIONS RESERVED IN PREVIOUS AND CURRENT PROPOSALS**

Vegetation Type	Original Bulletin 1034 Proposal	Current Proposal	
		Conservation Areas A and B	POS
<i>Jarrah/Banksia/Sheoak</i> Low Woodland	8.50ha	7.98ha	1.03ha
<i>Jarrah/Tuart</i> Open Woodland	-	-	0.72ha
<i>Banksia attenuata/B. menziesii</i> Woodland	-	1.57ha	-
<i>Banksia prionotes</i> Closed Scrub	-	-	-
<i>Eucalyptus decipiens</i> Low Woodland	-	0.1ha	-
<i>Jarrah over Banksia menziesii</i> Low Woodland	-	0.33ha	-
Cleared	-	0.005ha	0.14ha

In considering the regional significance of the vegetation, it is useful to compare the vegetation of the site to nearby reserves. The *Jarrah/Banksia* Woodland vegetation type of the conservation and POS areas (and balance of the subject land) are well represented at other local reserves and open spaces. Bold Park is composed of up to 70% (approximately 145ha) *Banksia* Low Woodland and Kings Park is composed predominantly of a mixed *Eucalyptus/Allocasuarina/Banksia* Open Woodland. *Jarrah* Woodlands are not as well represented locally, comprising only 2% (10ha) of the vegetation in Bold Park. Bush Forever (Government of Western Australia, 2000) identified that the vegetation associations present at the nearby Shenton Bushland (Bush Forever Site 218) are similar to those present on Lot 4 Underwood Avenue. Kings Park and Shenton Bushland both consist solely of Karrakatta Complex-Central and South.

The vegetation in the conservation and POS areas can also be categorised according to floristic community types (Gibson *et al.*, 1994). Floristic community types group vegetation with similar species composition rather than based on geomorphology and climate, as is the case with the Heddlé *et al.* vegetation complexes. All vegetation types in the conservation and POS areas belong to Floristic Community Type 28 - Spearwood *Banksia attenuata* or *B. attenuata - Eucalyptus* species woodlands. Within the local area, Floristic Community Type 28 is abundant at Kings Park and at Shenton Bushland and is common in other metropolitan reserves with Spearwood soil types.

Floristic Community Type 28 is not a Threatened Ecological Community at the state level (English and Blyth, 1997) or at the Commonwealth level.

The current proposal has a minor positive impact on the conservation status of floristic community types compared to the Bulletin 1034 proposal.

The current proposal retains representative examples of five of the six vegetation associations at the site and based on the general high quality of the bushland it can be expected that a significant proportion of the species recorded at the site occur in the conservation and POS areas.

In terms of fauna values, the principal habitat of the proposed Conservation Areas A and B (mixed *Eucalyptus/ Banksia* woodland) is consistent with the vegetation of the original Bulletin 1034 proposal. A key advantage of the current proposal over the original Bulletin 1034 proposal is that the current proposal incorporates a representative sample of most vegetation associations occurring over the balance of the site. However, it is anticipated that modifying the conservation areas from 8.5ha to 11.88ha would make little difference to the species of vertebrate fauna protected on the site, as species recorded previously are generally not habitat specific.

4.3 Rarity

In total, 149 species of vascular plants were recorded from the six principal vegetation associations identified at the site. Of the total species recorded, 112 are native to the site and 37 are introduced species not native to the area (includes native Australian species which are garden escapes). One species recorded at the site is listed as a Priority 3 species *Jacksonia sericea*. Although *Jacksonia sericea* is a Priority species it is not a species of high importance and has not been declared as rare. It is not uncommon in this locality and is present in significant numbers in nearby Bold Park, Kings Park and Shenton Bushland. The original Bulletin 1034 proposal did not include the main populations of this species on the site but committed to protecting some of the populations in open space within future developments. The current proposal retains the two largest populations of the Priority 3 species, representing protection of approximately 50% of the population present on Lot 4 rather than a commitment to protect some populations in POS in the future development of that area.

Eucalyptus decipiens is not a Declared Rare or Priority species and communities in which it is dominant are not Threatened Ecological Communities. However, stands of *Eucalyptus decipiens* are uncommon in the Perth Metropolitan Region. The original Bulletin 1034 proposal did not include the stand of this species but committed to protecting it in open space within future developments. The current proposal retains this small stand of *Eucalyptus decipiens* rather than a commitment to protect the area in future POS.

4.4 Maintaining Ecological Processes or Natural Systems

ATA Environmental has previously identified that the existing bushland at Underwood Avenue primarily provides (to an extent) ecological linkage with other nearby bushland areas, catering mainly for birds. The extent of surrounding development, particularly the existing road network, would prevent the movement of reptiles and amphibians.

The original Bulletin 1034 proposal only provides a link in part to Shenton Bushland located south of Lot 4. There is no westerly connection. The current proposal provides linkage functions to both the west and south.

4.5 Scientific or Evolutionary Importance

The original Bulletin 1034 proposal and the current proposal do not meet the criteria for identification as a site of scientific or evolutionary importance. However, current scientific research would be able to be maintained, as The University would retain ownership and management of the bushland.

4.6 General Criteria for the Protection of Wetland, Streamline and Estuarine Fringing Vegetation and Coastal Vegetation

This criterion is not relevant, because the subject land does not contain any of these features.

4.7 Other Criteria

Other criteria that are important or can add to the value of the bushland and enhance its contribution to Bush Forever not specifically addressed in the above criteria are addressed in the following sections.

4.7.1 Vegetation Condition

Vegetation condition was assessed using the condition rating scale of Keighery published in Bush Forever (Government of Western Australia, 2000). Keighery's condition rating scale ranges from Pristine (where the vegetation exhibits no visible signs of disturbance) to Completely Degraded (where the vegetation structure is no longer intact and without native plant species). A description of the vegetation condition ratings is presented in Table 4.

Vegetation condition as mapped by ATA Environmental is shown in Figure 4.

**TABLE 4
VEGETATION CONDITION RATING SCALE**

Code	Description
P	Pristine. Pristine or nearly so, no obvious signs of disturbance.
Ex	Excellent. Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species.
VG	Very Good. Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
G	Good. Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Deg	Degraded. Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
CD	Completely Degraded. The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.
C	Cleared. The area is totally devoid of native vegetation.

(Government of Western Australia, 2000)

The current proposal (including the POS area) protects the largest area of vegetation with a condition rating of Good or better (10.42ha) when compared with the original Bulletin 1034 proposal (8.32ha) (refer to Table 5). Excluding the POS area, the current proposal protects 9.7ha of vegetation classed as Good or better, which exceeds the entire area of vegetation proposed to be retained in the original Bulletin 1034 proposal.

TABLE 5
VEGETATION CONDITION OF RETAINED BUSHLAND IN BULLETIN 1034 PROPOSAL AND CURRENT PROPOSAL

Vegetation Condition	Original Bulletin 1034 Proposal	Current Proposal	
		Conservation Areas A and B	POS Area
Very Good	6.35ha	4.87ha	-
Very Good to Good	1.37ha	2.19ha	0.33ha
Good to Very Good	-	1.48ha	-
Good	0.6ha	1.16ha	0.39ha
Good to Degraded	0.18ha	-	0.63ha
Degraded to Good	-	0.12ha	-
Degraded	-	0.05ha	0.53ha

4.7.2 Aboriginal Significance

Previous consultation with indigenous people by The University has identified a preference for the retention of the elevated portion of the landscape with recognition for its indigenous heritage values. The current proposal retains this part of the landscape in the POS area whereas the original Bulletin 1034 proposal did not retain this landscape feature. The mature interlocking Jarrah trees will also be retained in the POS area.

There is an opportunity to acknowledge indigenous heritage through interpretive signage and other means.

4.7.3 Landscape Features

The POS area is a more aesthetic passive recreational area than previous reservations as it is located across the upland ridge with panoramic views including the City and to Bold Park.

4.7.4 Shape of Conservation Areas

The original Bulletin 1034 proposal is the most regular shape, which is generally more optimal in minimising degrading edge effects, compared to narrow, elongated shaped areas of bushland. The current proposal includes conservation areas that are divided into two regular shaped rectangular areas, one of 8ha (Conservation Area A) and the other of 2ha (Conservation Area B) with an inter-connecting POS area in between. If considered as two parcels, then each parcel is regular and meets desirable reserve shape criteria. However, if considered one 10ha parcel separated by POS then the shape is not as regular as the original proposal.

To retain an east-west linkage, the current proposal has connected the 2 regular-shaped Conservation Areas with an irregular-shaped area of POS. This has compromised the overall shape of the conservation and POS areas, making it less regular than the conservation area outlined in the Bulletin 1034 proposal. The EPA noted *“the prominent location and high visibility of the Tuart trees on the crest of the ridge is also likely to be a significant factor in maintaining the ecological linkage functions of the Underwood Avenue Bushland for the movement of birds through surrounding suburbs and bushland areas”*. The current proposal maintains an east-west linkage as well as retaining the Tuart trees on the crest of the ridge in the proposed POS area.

The University proposes that management of the POS area be for conservation and passive recreation activities that are consistent with the conservation intent. The POS will be rehabilitated to improve its vegetation condition in accordance with the preliminary management measures outlined in section 5.

The perimeter to area ratio for the original Bulletin 1034 proposal was 135m/ha (the smaller the number the better from a reserve design viewpoint). The perimeter to area ratio for the two separate parcels of bushland in the current proposal are 144m/ha for Conservation Area A and 286m/ha for Conservation Area B. Direct comparison of perimeter to area ratios for different sized areas of bushland is strictly not statistically valid, hence the relatively large number for Conservation Area B. Furthermore, in terms of reserve size, all configurations on the subject land are relatively small, and regardless of shape would require intensive management to maintain biodiversity values.

5. PROPOSED MANAGEMENT OF BUSHLAND AND PUBLIC OPEN SPACE AREAS

5.1 General

The University commits to preparing a management plan for the conservation and POS areas. The University will retain ownership and manage the conservation areas in conjunction with an appropriate body. The University proposes that the POS area is vested with the local authority, however discussions on this matter are yet to take place. The University is willing to enter into a Memorandum of Understanding with the local authority to assist in the on-going management of the POS area.

The retention of bushland in an urban setting will provide an important function of improving the community's appreciation and understanding of the local bushland flora, vegetation and associated fauna. In this way, while conservation of the flora and fauna values of the bushland will be the management priority, the bushland will also function as an educational resource for the local and broader community.

On this basis, the objectives of the conservation areas will be to:

- Ensure the native flora, vegetation and fauna values are maintained and protected through appropriate management of the site;
- Improve community awareness and appreciation by utilising the conservation area for educational purposes consistent with maintaining the conservation value of the bushland; and
- Maintain linkages with other nearby bushland areas.

The POS area will provide the local community with opportunities for passive recreation in a manner that will not further degrade existing conservation values. This area is currently degraded in part and establishment of the POS will involve retention of any native trees and understorey species, where appropriate, and establishment of grass and installation of seating and tables. The balance of the POS area will be rehabilitated and managed for conservation purposes.

The following sections provide an overview of the key environmental strategies that will be addressed in a Management Plan for bushland and POS areas. The primary aim of the Management Plan will be to maintain the conservation value of the bushland following development of the adjacent land for residential purposes.

5.2 Rehabilitation

The upland region of the POS area has been somewhat degraded through past land use activities that have resulted in the loss of native vegetation and allowed subsequent weed invasion. This area will require rehabilitation to restore and maintain a bushland ecosystem to ultimately promote natural regeneration by reducing or eliminating disturbance factors such as weed invasion, fire, pests, and disease.

While it is anticipated that the bushland may change over time because of subtle changes in climatic conditions and natural events such as fire, it is anticipated that the natural plant community will regenerate naturally and will be resilient if managed properly.

The rehabilitation and restoration of degraded areas within the conservation area will involve two main processes:

1. Removal and prevention of the disturbances that lead to the deterioration of the bushland such as weed control, control of access, fires; and
2. Implementation of revegetation techniques such as brush/mulch application, direct seeding and tube or seedling planting.

The implementation of revegetation works may not be required in areas which regenerate well naturally, however, parts of the POS area are currently degraded and will therefore require assistance to restore the natural bushland.

A management plan for the conservation and POS areas will be prepared and will describe in detail the guidelines for the implementation of restoration measures, including species selection, planting densities, protection measures, and timing of works.

5.2.1 Weed Control

The introduction and spread of weeds in bushland areas presents a major threat to biodiversity including the loss of native floristic diversity, vegetation structure and native fauna habitat. In addition, the prevalence of weeds in bushland areas increases the threat of fire. The control of weeds in the conservation and POS areas will form an important component of the rehabilitation strategy and will be the focus of primary works in the area.

A number of weeds are present in the conservation area including invasive grasses (Perennial Veldt Grass, Buffalo Grass and Couch Grass), tuberous/cormous species (Freesia, Gladiolus), herbs (Pigface, Geranium and Lupin) and woody plants (Geraldton Wax).

Many of these species were introduced to the bushland as garden escapes or from the dumping of garden rubbish in the surrounding area prior to the installation of the boundary fence. Some weeds such as Ursinia and Gladiolus have been introduced by wind-borne seed and have become established in already degraded areas of the bushland such as along tracks and firebreaks.

The most effective method of keeping weeds out of the conservation area will be to control and prevent the source of invasion. For example, prevent dumping of garden refuse, keep irrigated lawns away from the bushland and minimise disturbance by installing fewer tracks and firebreaks.

In most instances, it is not possible, nor desirable, to remove all weeds initially as the factors contributing to weed invasion will be continually operating. Therefore, for a successful weed control program it will be important to re-weed the site on a regular basis. The program should focus on implementing the following principles:

- Work from areas in good condition towards weed infested areas;
- Ensure minimal disturbance to soil and vegetation;
- Let the rate of regeneration of native plants determine the rate of weed removal (as appropriate); and
- Implement a long-term maintenance program to monitor weed control methods and native flora regeneration.

The following management recommendations are proposed for bushland areas:

- The control of invasive weeds should be a major priority in the management of the conservation area.
- Investigate the feasibility and implications of extending the native understorey layer to the road kerbing so that the road acts as a firebreak.
- Grassed areas adjacent to the conservation area should be reticulated in such a manner that water does not impinge on the bushland area.
- Weed control programs should not be undertaken in isolation but as a component of a vegetation rehabilitation program.

5.3 Fire Management

The protection of life, property and environmental and community values in the bushland will be the important components of fire management within the proposed development area.

The incidence and impact of potential unplanned fires in the conservation area will be reduced by maintaining a strategic fire access system and implementing measures to control weeds which contribute to a high fuel load (such as Grass species – Veldt Grass). Fire control measures within the conservation area and surrounding development will comply with WAPC and FESA guidelines in “Planning for Bush Fire Protection” (WAPC and FESA, 2001).

In addition, early detection of fires and rapid attack will play an important role in fire control in the conservation area. Importantly, no burning for fuel reduction purposes will be undertaken in the bushland area.

5.4 Access

Access within bushland areas will be managed with designated paths designed to protect conservation values. The installation of paths in bushland areas requires careful consideration as too many paths can cause problems such as fragmentation of bushland and increase the boundary to area ratio. Consequently, heavily disturbed edges are open to weed invasion and may result in the loss of sensitive native species found within the bushland.

Following the fencing of the site in 1995, the establishment of informal paths and tracks in the bushland has been significantly reduced. However, a number of tracks have been cleared in and around the bushland to allow vehicle access for fire and maintenance purposes.

The maintenance of conservation values will require that some of the more appropriately aligned tracks are formalised for pedestrian access and those that are surplus to these requirements be rehabilitated.

All paths which are to be maintained and upgraded in the conservation area will be sealed with crushed limestone to a width of 2m and enclosed with pine bollards to prevent further establishment of informal tracks.

5.4.1 Fencing

To ensure that the environmental values of the conservation areas are maintained in the long-term, a 1.5m high pine post and ring-lock fence and 2.0m high cyclone fence will be installed at the periphery of the bushland areas. The 1.5m high fence will be along the boundaries between the bushland areas and future residential areas.

The construction materials will be selected to ensure that the fence prevents uncontrolled access and is aesthetically pleasing in areas adjacent to residential areas.

Gates will be installed at appropriate locations to provide pedestrian access but prevent entry by bicycles and trail bikes. Lockable gates will be installed where appropriate to provide vehicle access for maintenance and emergency purposes.

5.4.2 Interpretative Signage

Interpretive signage will be installed at key locations in bushland areas to provide the local community and visitors with information relating to the natural environment, orientation and to advise of user restrictions.

Interpretive signage will be an important mechanism in influencing the level of interest and involvement of the community in enhancing the value of the area.

Interesting and informative signage may be installed which provides straightforward information and diagrams describing native fauna, the attributes of native flora, and vegetation patterns.

5.5 Stewardship and Public Participation

5.5.1 Working Groups

Local community interest in the management and appreciation of urban bushland parcels is evidenced by the number of established working groups associated with nearby bushland remnants.

The contribution to generating community interest and enthusiasm in bushland protection and management, brought about by existing community groups or the formation of new groups, is strongly encouraged by The University.

5.5.2 Research Opportunities

As opportunities arise, The University anticipates opportunities to encourage research relevant to the management of the proposed conservation areas. Research may be linked to current studies in this area being undertaken at The University or through other agencies.

Research may include determining and updating methods of weed control, fire management, replanting techniques and identification of appropriate genetic sources of seeds or seedlings to be used in re-vegetation programs. Another element, which will require continued research, will include determining the impact of access on the vegetation and fauna habitats in the conservation area.

5.5.3 Schools

The conservation areas in the current proposal are located in proximity to five schools including Jolimont Primary, Rosalie Primary, Floreat Park Primary, John XXIII College and Shenton College. Some of these schools may have already commenced projects to rehabilitate local bushland areas or

established nurseries to grow local native seedlings and may prefer to utilise other local bushland areas such as Bold Park and Kings Park, which can adequately accommodate educational activities without significant disturbance to the bushland.

The University will however, encourage educational use of the conservation areas on the basis that it does not conflict with the conservation objectives of the bushland.

Activities to promote the conservation area to schools and other institutions may include the following:

- Utilise the conservation area as the focus of demonstrating the theoretical and practical aspects of bush regeneration.
- Provide expert advice and guidance to school groups during theoretical and practical exercises.

5.5.4 Heritage Groups

The University will discuss the management and rehabilitation of the POS and bushland areas with the Nyungah Circle of Elders to ensure any proposals do not conflict with the recognised heritage values of the site.

6. CONCLUSIONS

The current proposal includes two areas of bushland totalling 10ha set aside for conservation purposes and an inter-connecting vegetated POS area covering approximately 1.9ha. The current proposal results in a significantly improved conservation outcome when compared with the original Bulletin 1034 proposal because it:

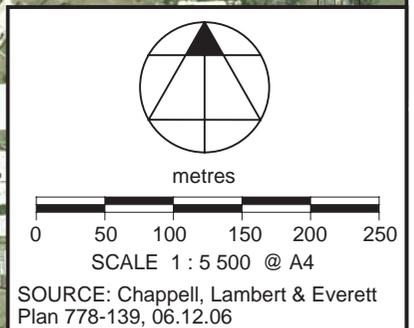
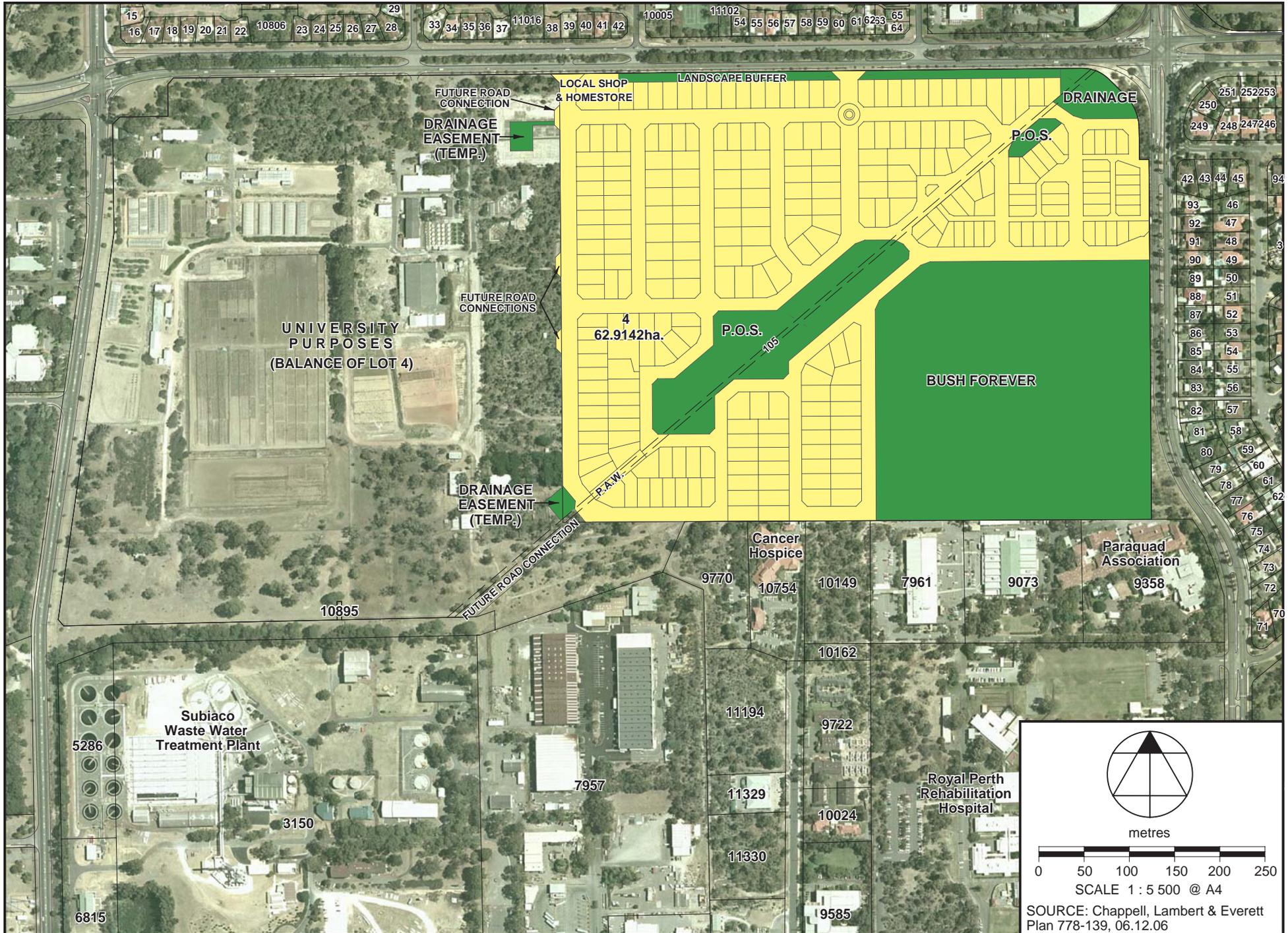
- Provides for the protection of a larger area of native vegetation than the original Bulletin 1034 proposal;
- Increases the biodiversity in terms of increased number of vegetation associations and fauna values;
- Offers improved opportunities for linkages to Shenton Bushland and Bold Park;
- Protects two populations of the Priority 3 species *Jacksonia sericea*;
- Allows for immediate protection of the *Eucalyptus decipiens* stand; and
- Provides better social amenity with the most elevated portion of the site protected in Public Open Space.

The University will prepare a management plan for Conservation Areas A and B and the POS area, demonstrating its commitment to protecting the area for conservation purposes with some passive recreational use. As a part of implementing the management plan, The University will rehabilitate portions of the Conservation Area and POS areas, further increasing the ecological value of the area.

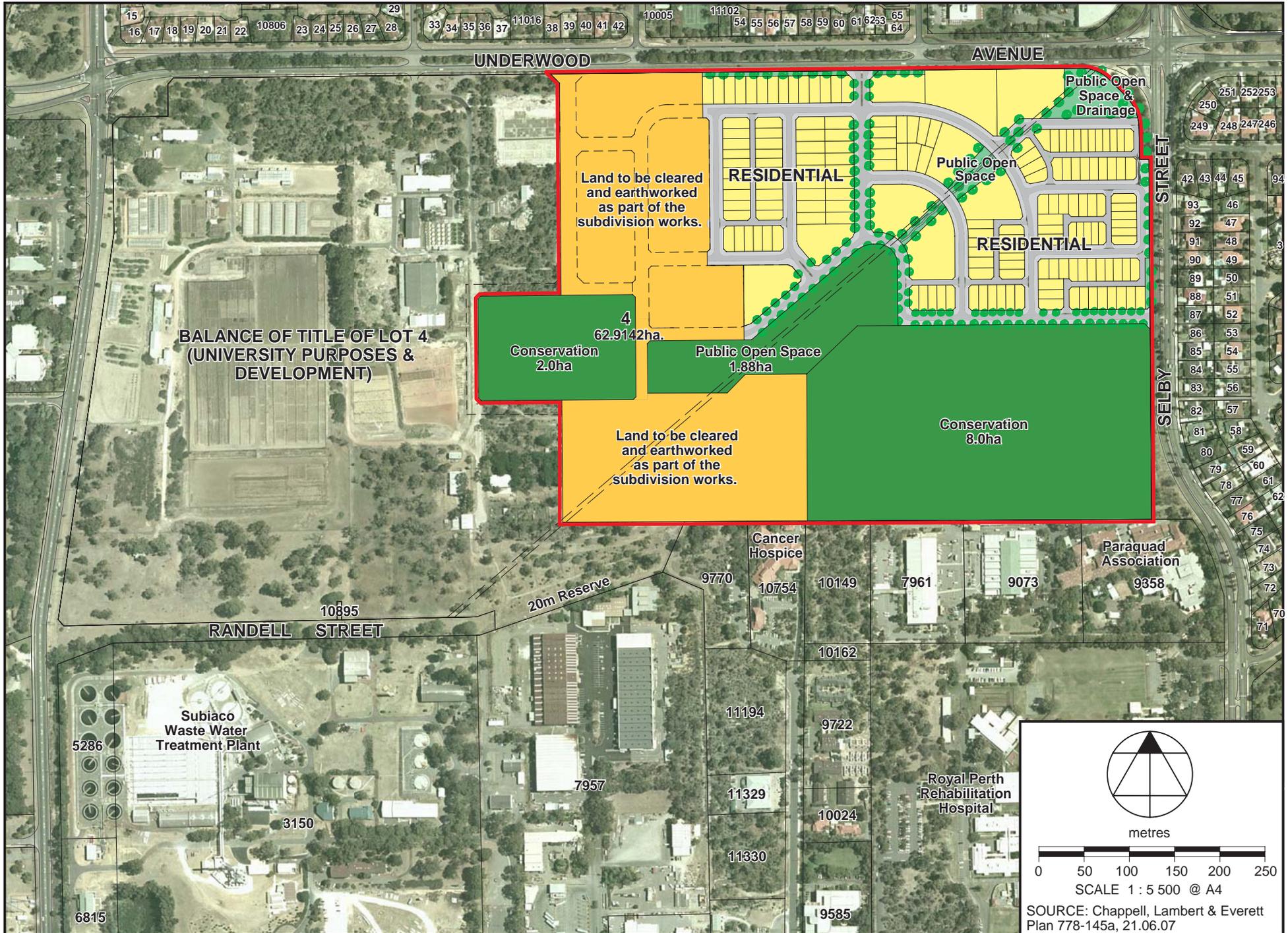
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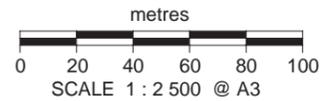
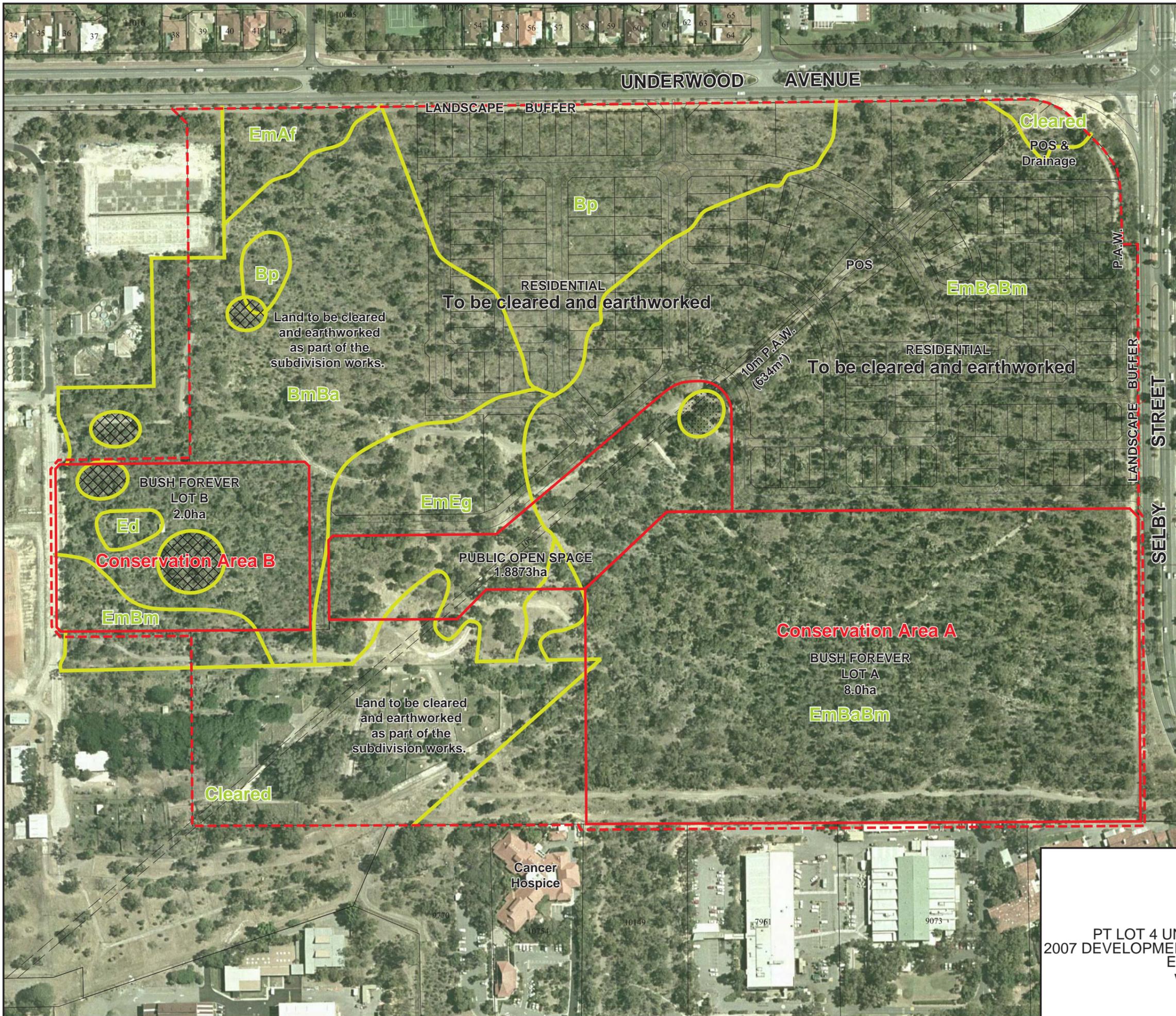
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FIGURES



PT LOT 4 UNDERWOOD AVE, SHENTON PARK
2007 DEVELOPMENT & CONSERVATION PROPOSAL:
ENVIRONMENTAL REVIEW REPORT
BULLETIN 1034 PROPOSAL
FIGURE 1





LEGEND

- - - Boundary of Subject Land
- Subdivision Detail
- Conservation and POS Area Boundaries
- Vegetation Association Boundary
- Interlocking Jarrah trees
- Approximate location of *Jacksonia sericea* (Priority 3) populations

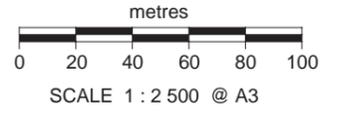
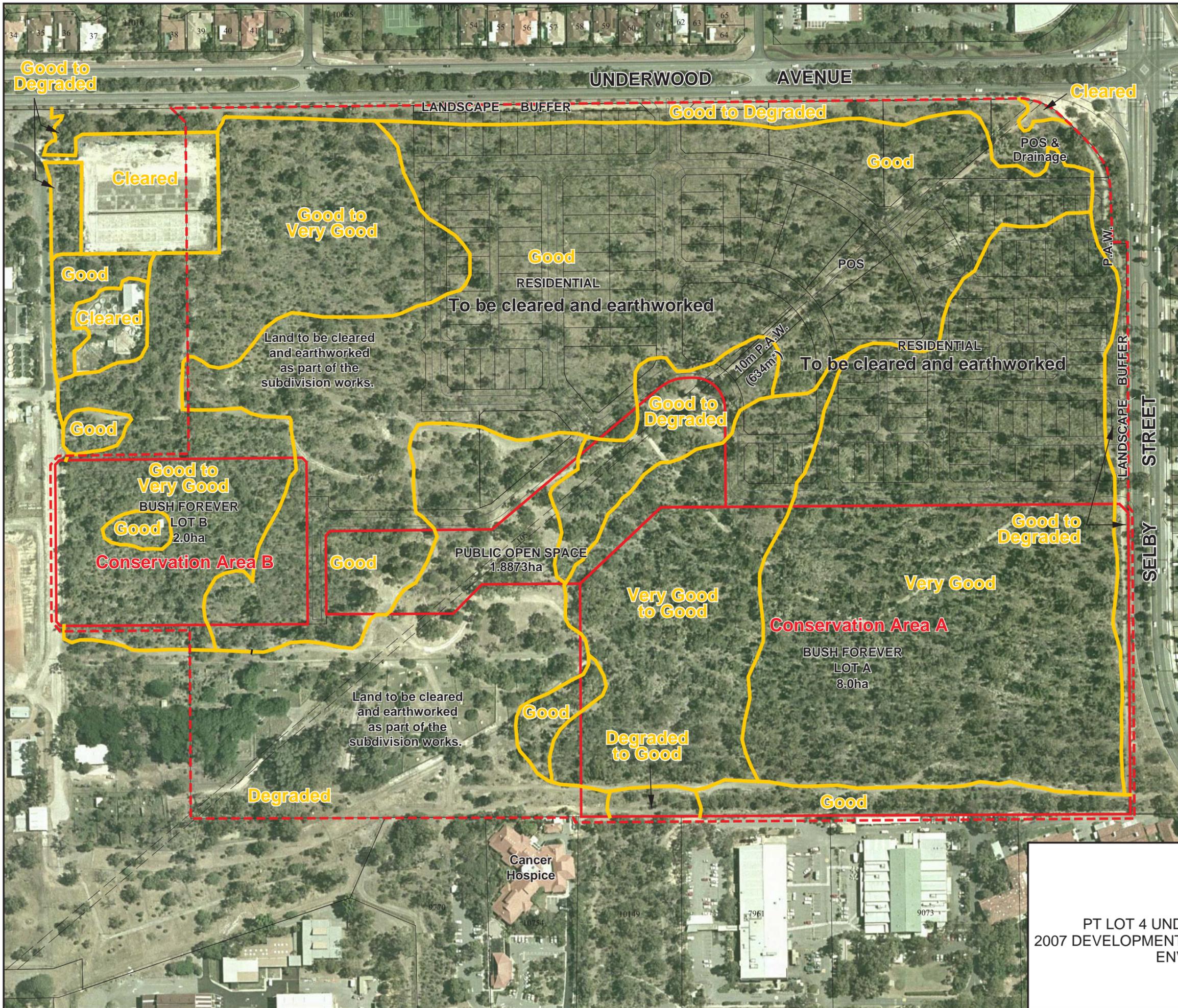
VEGETATION ASSOCIATIONS

- BmBa** Banksia Low Woodland, including *Banksia menziesii* and *B. attenuata* over *Allocasuarina fraseriana* and *Hakea prostrata*
- EmEg** Jarrah (*Eucalyptus marginata*) and Tuart (*E. gomphocephala*) Open Woodland over *Acacia saligna*, *A. rostellifera* and *Hakea prostrata*
- EmBm** Jarrah Open Woodland over *Banksia menziesii* Low Woodland
- EmBaBm** Jarrah Low Woodland over *Banksia attenuata*, *B. menziesii* and *Allocasuarina fraseriana* Low Woodland
- EmAf** Jarrah Woodland over *Allocasuarina fraseriana*
- Bp** *Banksia prionotes* Thicket with *B. menziesii* and *B. attenuata*
- Ed** *Eucalyptus decipiens* Very Open Tree Mallee
- Cleared** Cleared

SUBDIVISION SOURCE: Chappell, Lambert & Everett
Plan 778-121L, 06.12.06



PT LOT 4 UNDERWOOD AVE, SHENTON PARK
2007 DEVELOPMENT & CONSERVATION PROPOSAL:
ENVIRONMENTAL REVIEW REPORT
VEGETATION ASSOCIATIONS
FIGURE 3



LEGEND

- - - - Subject Land Boundary
- — — — Subdivision Detail
- — — — Conservation and POS Area Boundaries
- — — — Vegetation Condition Boundary

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

- Pristine** Pristine or nearly so, no obvious signs of disturbance (Not Applicable)
- Excellent** Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species (NA)
- Very Good** Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
- Good** Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing
- Degraded** Degraded. Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing
- CD** Completely Degraded. The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs (NA)

SUBDIVISION SOURCE: Chappell, Lambert & Everett Plan 778-121L, 06.12.06



PT LOT 4 UNDERWOOD AVE, SHENTON PARK
2007 DEVELOPMENT & CONSERVATION PROPOSAL:
ENVIRONMENTAL REVIEW REPORT
VEGETATION CONDITION
FIGURE 4

APPENDICES

APPENDIX 1
REHABILITATION RESULTS

ATA ENVIRONMENTAL

APPENDIX 1
REHABILITATION RESULTS
ATA ENVIRONMENTAL

In 2004, The University commenced rehabilitation of an area on Lot 4 that was mapped as 'Degraded'. In 2005, an additional area mapped as 'Degraded' was also rehabilitated.

Rehabilitation involved a seed collection program from Lot 4 involving Aboriginal people and supervised by contract seed pickers. The seed collection program involved educating participants about collection methods, plant species, seed storage and plant propagation.

2004 Rehabilitation

A 0.92ha area within disused animal pens was selected as the first site to be rehabilitated. The site was fenced and had existing irrigation and was in a highly degraded condition. The past land use involving repeated grazing has ensured that the seed store within this site has been substantially depleted and as such, natural regenerative processes were anticipated to be limited. The area also had a very high density of weeds from a variety of species.

Similar pens containing extensive weeds adjacent to the 2004 rehabilitation site are shown in Plate 1. Significant weed control was undertaken on this site prior to revegetation occurring. Plate 2 shows the site prior to planting. The 0.92ha areas was then planted with seedlings grown from the seed collected on site earlier in the year and supplemented by other species, which either were not collected or had unviable seed. Altogether 11,692 seedlings from 29 native species were planted in spring 2004.

Following planting, the rehabilitation area received regular watering over the first summer, which assisted plant establishment. Regular watering also encouraged weed growth, which was monitored and periodically controlled. In densely planted areas, weed species have largely been suppressed. The area is not currently irrigated.

Plate 3 shows the site approximately 1 year after planting. Plates 4 and 5 show the site two years after planting in October 2006. An assessment of the site in on 30 October 2006 identified successful establishment and growth of a number of species. The most common species present in the rehabilitation area are listed in Table 1.

TABLE 1
2004 REHABILITATION ASSESSMENT RESULTS

Common native species	Height (m)
<i>Acacia rostellifera</i>	2 – 2.5
<i>Allocasuarina fraseriana</i>	1
<i>Banksia attenuata</i>	0.3 – 0.4
<i>Banksia grandis</i>	0.8
<i>Banksia menziesii</i>	0.6
<i>Banksia prionotes (less common)</i>	0.5 – 1
<i>Eucalyptus decipiens</i>	3
<i>Eucalyptus gomphocephala (Tuart)</i>	4
<i>Gompholobium tomentosum</i>	0.6
<i>Hakea prostrata</i>	1
<i>Hardenbergia comptoniana</i>	Groundcover
<i>Kennedia prostrata</i>	Groundcover
<i>Phyllanthus calycinus</i>	1
Common weed species	
<i>Ehrharta calycina</i> (Veldt Grass)	
<i>Euphorbia terracina</i> (Geraldton Carnation Weed) – occurs mostly at eastern end	
<i>Sonchus oleraceus</i> (Sow Thistle)	
<i>Trifolium campestre</i> and other spp. (Clover)	

Initial irrigation has undoubtedly promoted rapid growth of several species including *Acacia rostellifera*, *Eucalyptus gomphocephala* and *E. decipiens*.

2005 Rehabilitation

The 2005 rehabilitation site has been treated a little differently to the 2004 rehabilitation site in that it has not be irrigated and the site was ripped prior to planting. In addition, the area was revegetated with a different species composition. The density of overstorey species was reduced, in particular some *Eucalyptus* species and *Acacia* species.

Plate 6 shows the site just after planting in 2005. Plate 7 shows the same site in October 2006. The reduction in weeds present at this site is probably due to the absence of regular watering and controlled spraying. Growth rates are satisfactory given the absence of regular watering and a species composition that includes a greater proportion of slower growing species. Common species in the rehabilitation area are listed in Table 2.

TABLE 2
2005 REHABILITATION ASSESSMENT RESULTS

Common native species	Height (m)
<i>Acacia cyclops</i>	0.3
<i>Acacia pulchella</i>	0.5
<i>Allocasuarina fraseriana</i>	0.3
<i>Allocasuarina fraseriana</i>	1
<i>Eucalyptus gomphocephala</i> (Tuart)	0.3
<i>Eucalyptus marginata</i>	0.3
<i>Gompholobium tomentosum</i>	0.4
<i>Hakea prostrata</i>	0.4
<i>Hardenbergia comptoniana</i>	Groundcover
<i>Kennedia prostrata</i>	Groundcover
Common weed species	
<i>Avena fatua</i> (Oats)	
<i>Conyza bonariensis</i> (Fleabane)	
<i>Ehrharta calycina</i> (Veldt Grass)	

Summary of Rehabilitation Results

The results achieved to date for the two areas rehabilitated in 2004 and 2005, demonstrate that The University has made significant progress towards rehabilitating degraded land. Further efforts will concentrate on adding a greater variety of understorey species to the rehabilitation areas. Weeding will continue to remain a management priority. Selected thinning of *Eucalyptus gomphocephala* and possibly *Acacia rostellifera* may be required in the next few years to achieve a more natural density.



Plate 1

Former animal pen adjacent to 2004 rehabilitation site. Note extent of weed invasion.



Plate 2

2004 rehabilitation site prior to planting.



Plate 3
2004 rehabilitation site one year after planting.



Plate 4
2004 rehabilitation site two years after planting.



Plate 5
2004 rehabilitation site two years after planting.



Plate 6
2005 rehabilitation site just after planting.



Plate 7
2005 rehabilitation site one year after planting.