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APPENDIX 1

EPA Advice and Recommendations on MRS Amendment 1152/41 Jindee 12 May 2008

Environmental Protection Authority

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Your Ref 809-2-30-13 Pt 1
Our Ref CRN221515
Enquiries Gary Williams

Att: Anthony Muscara

SCHEME AMENDMENT TITLE:	**Metropolitan Region Scheme Amendment 1152/41 Jindalee (Jindee) Foreshore Rationalisation**
LOCALITY:	**City of Wanneroo**
RESPONSIBLE AUTHORITY:	**Western Australian Planning Commission**
LEVEL OF ASSESSMENT:	**Scheme Amendment Not Assessed - Advice Given Under Section 48a(1)(A) (no appeals)**

Thank you for your letter of 26 March 2008 referring the above proposed scheme amendment.

After consideration of the information provided by you, the Environmental Protection Authority (EPA) considers that the proposed scheme amendment should not be assessed under Part IV Division 3 of the *Environmental Protection Act 1986* (EP Act) but nevertheless provides the following advice and recommendations.

ADVICE AND RECOMMENDATIONS

1. Environmental Issues

- Remnant vegetation
- Regional vegetation values (ecological linkages)
- Fauna
- Sustainability

2. Advice and recommendations regarding Environmental Issues

Remnant vegetation & fauna
The EPA supports Metropolitan Region Scheme Amendment 1152/41 on the basis that the two areas of Parks and Recreation (P&R) reserve are being provided to offset the area of foreshore P&R reserve (Bushforever Site no. 397) proposed to be zoned Urban. The two P&R reserves will be linked with native vegetation retained on private lots. The linkage is to ensure that the ecological function of the eastern portion of P&R is retained. Without the vegetated linkage the EPA does not consider the proposed P&R to be an adequate offset for the reduce foreshore reserve.

The EPA acknowledges that the proposed P&R reserves provide an inland conservation area in addition to a foreshore conservation area. This increases the number of vegetation assemblages and fauna habitats to be conserved. The inland P&R reserve also improves the viability of retaining the upland area surrounding the Trig Point.

The EPA understands that the area of P&R being provided as an offset does not include 2ha of P&R that would have been used as car parking on the foreshore reserve.

The EPA is satisfied that there are no Declared Rare Flora or Threatened Ecological Communities[1] on Lot 10. Priority flora species do occur on Lot 10 including the areas to be reserved as P&R.

Sustainability
The EPA is aware that the rationalisation of P&R boundaries is part of the landowners efforts to develop a coastal node and an innovative coastal community that implements a range of sustainability principles (RPS, 2007). The environmental sustainability principles that the EPA recommends be incorporated in the Jindalee development are:

- Maximise ability to use public transport and to walk and cycle (reduce reliance on fossil fuels and reduce air emissions);
- Implement best practice energy efficient housing and use of alternative energy;
- Retention of the natural landform;
- Implement best practice in water sensitive urban design.

It is expected that the City of Wanneroo will include provisions in its District Planning Scheme requiring the implementation of these principles.

3. Environmental Issues not assessed

Without limiting the EPA's discretion under section 38 5(e) of the EP Act to require the referral of proposals arising from the scheme amendment and your discretion, as the responsible authority, under section 48I of the EP Act to refer proposals arising from the scheme amendment, the EPA advises that the following environmental issues are not assessed:

- Regional vegetation values (ecological linkages)

The issue of ecological linkage has been deferred to ensure that an adequate mechanism is put in place during later stages of planning that will retain and protect the vegetation between the foreshore and inland area of P&R.

4. Advice and recommendations regarding Environmental Issues not assessed

Sufficient information is not available at this stage regarding the nature of the impacts on the environment arising from the implementation of the scheme amendment. Accordingly, the EPA advises that the environmental issues listed in paragraph 3 above are not assessed and recommends further consideration of the need to assess proposals arising from the scheme amendment when more information is available, for example, subsequent rezoning, preparation of a Development Guide Plan, Structure Plan, Outline Development Plan, Subdivision or development.

5. General Advice

- For the purposes of Part IV of the *EP Act*, the scheme amendment is defined as an assessed scheme amendment. In relation to the implementation of the scheme amendment, please note the requirements of Part IV Division 4 of the *EP Act*.
- There is no appeal right in respect of the EPA's decision on the level of assessment of scheme amendments.
- A copy of this advice will be sent to the relevant authorities and will be available to the public on request.

Yours faithfully

C J Murray
A/DIRECTOR
ENVIRONMENTAL IMPACT ASSESSMENT

12 May 2008

cc: Department for Planning & Infrastructure

1. It was thought that there maybe FCT 26a on Lot 10, however, Weston (2008) has concluded that there are probably not TEC's on Lot 10. The results indicate that they are closest to FCT 24 and they are closer to FCT's 24,26b and 29a that they are to FCT 26a.

References

Weston, A (2008) - *Determination of likely presence or absence of floristic community type (TEC/FCT) 26A in Lot 10 (Jindee) Jindalee.*

RPS (2007) -*Jindee MRS Amendment Report 3: Bushforever site 397: Statement of Environmental Effects.*

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APPENDIX 2

Regulating Framework for Jindee

PROCESS

The regulatory framework for Jindee comprises three interrelated tiers of provisions and controls:

- DPS 2;
- CDC; and
- TAPs.

DPS 2
The DPS 2 requires that the CDC and TAPs be prepared and adopted prior to subdivision and development of land within the Jindee Smart Growth zone, giving head of power to these subsequent tiers of planning.

The DPS also prescribes specific development control provisions and standards that may be refined and applied through the CDC and TAPs. The Scheme allows the CDC and/or TAPs to vary any standard or requirement of the Scheme and for the varied standard or requirement to have the same force and effect as if it were a provision of the Scheme.

In this way, each approval process builds on the level of detail approved in the previous process to allow certainty of outcome within the approvals, whilst maintaining a degree of flexibility to accommodate necessary changes brought about by a deepening project understanding.

CDC
The role of the Jindee CDC within this context is to provide the overarching framework for subdivision and set out controls to inform the preparation of TAPs. These controls are set out under Part 2 of the CDC in the Regulating Plan, Urban Standards, Architectural Standards, Thoroughfare Standards, Car Parking Strategy and Landscape Standards and are described adjacent. In a notable departure from conventional practices, the provisions contained in Part 2 bring all of the relevant disciplines together, including engineering, landscape, environmental, planning and architecture. By adopting a holistic approach, the CDC is able to coordinate all of the elements of the built environment to create meaningful environments reflective of their position within the Transect. Proposed variances to the provisions of the approved Jindee CDC are to be considered by the City of Wanneroo on a case-by-case basis in accordance with DPS 2 provisions.

TAPs
The TAPs are to refine the CDC to reflect the detailed planning and design of defined precincts. Their purpose is to demonstrate that the lots are capable of subdivision and development in accordance with the CDC and to provide the basis for obtaining subdivision and development approval. An important role of the TAP is to further inform preferred architectural and landscape standards in response to specific site conditions and as required by the Jindee CDC.

By resolving the design detail up front through the CDC and TAPs, a high level of predictability is able to exist at the subdivision and development phases, enabling reduced approval timeframes for conforming subdivision and development proposals.

REGULATING PLAN

The Regulating Plan consists of the following plan series:
1. Transect Plan – shows Transect zones, civic spaces and thoroughfare network
2. Control Plan – identifies special requirements that regulate locations where:
- private buildings including shopfronts, arcades and galleries are either required/recommended;
- control frontages (build-to-lines) are required to enhance corner and edge conditions;
- terminating vistas are required; and
- passages & paths are required/recommended.

These controls will be further refined and detailed in the TAPs developed for precincts within Jindee.
3. Typology Plan – shows the types of buildings that m ay be built on each lot.
4. Open Space Calculations Plan - shows the open space areas that will be allocated to satisfy the WAPC's public open space requirements

URBAN STANDARDS

Regulates those aspects of private buildings which affect the public realm. The standards contain a range of building types that vary according to Transect Zone. The standards for each building type define the streetscape and building function and aim to encourage provisions of building types and frontage elements to encourage social interaction.
The Building Function element of the Urban Standards is a table that describes the uses permitted in each Transect Zone. The functions include the classification of Residential, Lodging, Office, Retail, Manufacturing and Civic, with an emphasis on encouraging mixed use activity. Base car parking requirements are correlated to these various uses in the Car Parking Strategy.
Urban Standards are to be further refined in the TAPs prepared on a precinct by precinct basis for Jindee.

ARCHITECTURAL STANDARDS

A matrix of text that specifies the materials and configurations permitted for walls, attachments, roofs and openings intended to produce visual compatibility amont the building types. The standards relate to the vernacular and contemporary building traditions of the region, thus inheriting a suitable response to climate and contemporary techniques. Because urban quality is enhanced by architectural harmony but is not dependent on it, the provisions of the architectural standards may range from liberal to strictly deterministic.
These Standards also include a visual synoptic survey of its elements from local, regional, national and global best practice of Traditional Town Planning to be used as relevant precedents for the development of Jindee and they may form the basis for a more elaborate document to become the Design Guidelines.

THOROUGHFARE STANDARDS

A matrix of drawings, specifications and dimensions that assemble vehicular and pedestrian ways into thoroughfare typologies, specialised in both character and capacity. Vehicular lanes, footpaths, planters, street trees and street lights are specified for each typology. The thoroughfare typologies support the Transect range from natural to urban and are assigned to appropriate locations within the Transect.

LANDSCAPE STANDARDS

Allocates civic space types and the intended landscape treatments that will be applied to these species. The standards also contain a selection of plant species chosen in response to local soil and climatic conditions that support the Jindee vision for the public and private realms. Species selected from this list will be allocated in the Landscape Masterplan to the public realm, including thoroughfares and civic spaces, in a manner that responds to exposure zones, whilst supporting the natural to urban Transect and creating an ecosystem harmonious with the region. Complementing the Landscape Standards will be a series of codes for private gardens that address basic design issues, including climate, species selection and wall and fence types.

CAR PARKING STRATEGY

A Strategy that enables a flexible approach to the provision of car parking throughout Jindee. Allows for a range of alternative approaches to car parking provision including containment of car parking within lots in accordance with base parking standards; calculation and allocation of car parking to parking precincts; transfer of car parking rights between lots and functions/uses; reciprocal car parking arrangements between uses/functions; and cash-in-lieu of car parking.

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APPENDIX 3

Vegetation and Fauna Assessment

LOT 10 JINDEE
VEGETATION AND FLORA SURVEY

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1.0 INTRODUCTION

1.1 Objectives

This survey project addresses requirements for flora and vegetation surveys of Jindee (Lot 10 Jindalee).

The specific objectives of the survey project are to:

1. Provide accurate descriptions of flora, floristic community types and vegetation units, and their condition, of the study area, and estimates of the type and size of the areas to be impacted, based upon desktop analyses and field surveys,

2. Determine the presence of Declared Rare Flora (DRF), endangered, priority and other significant species, Threatened Ecological Communities (TEC) and other significant vegetation units.

3. Provide a vegetation map of the area showing vegetation communities, any DRF flora, and any TEC or other significant vegetation,

1.2 Location

Lot 10 Jindalee is shown on Sheet No. SWAN 10 000 BG35/1.4, Locality Quinns Rocks, Alkimos, Mindarie (Valuer General's Office Perth). It is 112.2947 hectares in area and is situated on the northern coastline of Perth in the City of Wanneroo. It is west of the northern suburb of Butler, separated from it by Marmion Avenue.

The total study area varies in length and width, but its longest part is approximately 2.5 km long, east to west, and its widest part is approximately1.5 km wide, north to south.

1.3 Level of Survey

The EPA's Guidance No. 51 (Environmental Protection Authority 2004) was used in the planning and design of the project and in the presentation and preparation of the reports. As the anticipated scale and nature of the impact on native vegetation and flora in Lot 10 will be High, rather than Low or Moderate, a 3-stage Level 2 Survey, as described on Page 39 of Guidance No. 51, was undertaken. In determining the level of impact

anticipated, the loss/clearing of over 10ha of vegetation on the Swan Coastal Plain was taken into account. This impact is defined in Table 3 (Page 42) of Guidance 51 as being High.

A Level 2 survey consists of three or, in some situations and areas, four stages. The first two stages constitute a Level 1 survey. The required three stages of a Level 2 survey are:

- Background research or ‘desktop’ study,
- Reconnaissance survey, and
- Detailed survey.

The fourth Level 2 stage is Comprehensive survey, which involves surveying both the locality and parts of the local area at the same intensity as required in a Detailed survey, but more structured, over a longer term and with multiple visits.

2.0 METHODS

2.1 Preparation for Field Work

Preparation for field work entailed:

- finding existing vegetation descriptions and maps and flora lists for the study area and the general area; and
- preparing tables of significant flora to be searched for during field work.

Methods and representative sites for field work were initially chosen during this preparation stage.

2.2 Flora

Lists of flora covering the study area and nearby areas were used to get an appreciation of the types and range of plants which might be found in the study area. These lists include ATA Environmental (2003, 2004), Trudgen and Keighery (1990a) and Griffin and Trudgen (1994).

Appendix B has tables that list Declared Rare Flora, Priority Flora and other significant flora with distributions that may include the general area and descriptions of how the tables were compiled. The tables give information about conservation codes and, for Declared Rare and Priority Flora, distributions, localities, growth forms, habitats and flowering times. During preparation of the tables, herbarium specimens in the Western Australian Herbarium of taxa (species, subspecies) listed in the tables were examined for familiarisation with their appearance, habitats, distribution and flowering times.

2.3 Field Work

2.3.1 Flora Survey

The survey was carried out in late 2004, with four 10x10m plots set up and recorded on the 7th and 8th of October and revisited in early summer on the 20th and 21st of December. Five releves were also recorded during the October visits. It is estimated that close to 100% of the flora in the plots were recorded during the two visits, with the

possible exception of early flowering species. Figure 1 highlights the location of these plots and releve points.

Recognising that there can be changes to the schedule of flora with special conservation value over time, further investigation and verification of Declared Rare and Priority Flora for the site was also undertaken in September 2005, to ensure that this report utilises the most up to date information from CALM.

It is estimated that close to 100% of the flora in the plots were recorded during the two visits, with the possible exception of early flowering species.

On the first visit to the study area plots were established at sites chosen from aerial photography. Releves were also described in other vegetation communities. All species in plots were recorded and specimens taken of all species for confirmation of identification. GPS points were fixed using the GDA94 datum, and digital photographs were taken of each plot.

Specimens collected were dried and identifications confirmed by reference to standard texts (eg. *Marchant* et al, 1987), comparison with specimens held in the Western Australian Herbarium and discussion with other botanists.

On the second visit to the plots, all flora was recorded and species not collected previously were collected along with some specimens of previously recorded species.

The vegetation component is based on descriptions of vegetation at the sites chosen, and is representative of vegetation in the study area. Not all the variations in vegetation across the entire study area have been described, but sufficient have been to allow assessment of the vegetation within the existing coastal reserve, proposed Regional Open Space (ROS) areas and the east-west link between these ROS areas.

The vegetation map was produced using existing vegetation mapping of the area (Weston 1998), incorporating updated vegetation mapping from this survey. This has led to a simplified map compared with Dr. Weston's. The mapping has been simplified to represent different interpretations of community definition Vegetation community definition can vary between botanists, and Trudgen (1999) makes a good point of this when he says "definition of individual plant communities, particularly in the absence of a detailed regional study, is a matter of professional opinion" (Trudgen, 1999, P13). The

main criterion is that an individual plant community should be a basic unit with a recognisable structure and composition, but variation needs to be recognised.

2.3.2 DRF and Priority Flora Survey

Prior to any field work being undertaken, a search was requested of databases held by the Department of Conservation and Land Management. The databases searched were the *Western Australian Herbarium Specimen* database, and CALMs *Threatened (Declared Rare) Flora* and *Declared Rare and Priority Flora* databases, for the coordinates 31 36 00 -31 41 00 E, 115 39 29 – 115 45 00 N. Taxa of interest from the resulting lists were examined in the Reference Herbarium of the WA Herbarium to familiarise the searchers with their appearance. A list of the potential Declared Rare Flora (DRF) species and Priority Flora species or subspecies which may occur in the study area is provided in Section 3.3 of this report.

Transects were walked approximately east to west across the site at a distance of 20-40m apart depending on the vegetation structure and visibility. Areas of dense scrub were avoided after initial forays, as it was found that little understorey occurred in these thickets, and searching was difficult because of their density.

Initially, it was planned to record a GPS point for every Priority species found, but due to the large number of one priority taxon this soon became impractical. Instead, for this taxon, GPS points were recorded at significant points along the transect, and a tally made of specimens observed between the two points. Other priority species found were recorded with a number of specimens observed at a particular GPS point.

2.4 Data Analysis

All plot and releve data was analysed by EA Griffin and Associates, using the PATN suite of multivariate analysis programs, against the data used by Gibson *et al* (1994) to establish Floristic Community Types on the Swan Coastal Plain. Two analyses were carried out, one with the releve data and one without.

2.5 Limitations

Due to the proposed land exchange for ROS under the Metropolitan Region Scheme, targeted plots and releves on the vegetation and flora were established in the current Regional Open Space (Bush Forever Site 397) and within the southern portion of the site, which contains the areas proposed for regional open space (Figure 1).

Because of the timing of the survey, it is possible that some earlier flowering ephemeral species were missed. However, it was noticed during a flora survey of an area adjacent to the north (M Henson *pers comm*) that some annual species were present and flowering earlier than usually expected (for example, *Trachymene pilosa*). This was perhaps due to mild winter conditions and may have resulted in some early-flowering species being missed in this study (although the *Trachymene* itself was still present in all plots and nearly all releves). The number of sites chosen precludes the species list being regarded as complete for this area.

3.0 RESULTS

3.1 Landforms

McArthur and Bartle (1980) is a 1:25 000 scale map of landforms and soils on the Swan Coastal Plain. The landforms and soils shown in the study area are mainly Quindalup Dune System units, with smaller areas of Spearwood Dune System units mainly on the eastern side.

There are small areas of two Spearwood units: Kls – bare limestone and shallow brown sandy soils over limestone – and Ky - Karrakatta sand (yellow phase), often with limestone within two metres of the surface. The Ky unit corresponds more or less to the Banksia woodland of Trudgen and Keighery (1990), and the Kls unit corresponds more or less to their Limestone heath. These Karrakatta units correspond to the current Cottesloe Central and South units.

There are four Quindalup units in the study area: Q2, Q4, Qp and Qs. The Qp unit is of nearly flat or gently undulating landscapes with deep calcareous sands overlying limestone, sometimes/often with steep Q3 parabolic dunes around them. Qs is of shallow calcareous soil over limestone, similar in fact to the Kls unit previously mentioned. The Q2 unit is the second-oldest phase, with some development towards a soil profile. The Q4 unit is the youngest phase, characterised by little soil development (undifferentiated) and a suite of pioneer plant species. This is usually the closest unit to the beach.

3.2 Flora

A total of 83 taxa from 40 different Families were collected from the four plots and five releves described during this survey (see Appendix C), of which twenty-two were introduced species and sixty-one were native species. Bush Forever (Government of Western Australia, 2000) records 83 native taxa and 27 weed taxa from Bush Forever Site 397 which forms the western-most part of the study area.

3.2.1 Regional Context

In comparison, Trudgen and Keighery (1990) found a total of 188 native species on the Quindalup and Cottesloe-Central and South dune Complexes at Alkimos, just north of

Jindalee. Griffin (1993) recorded 313 native taxa from 545 coastal sampling sites between Geraldton and Swanbourne. Trudgen (1988) recorded 305 native taxa from an undisclosed number of sampling sites on the coast of Mandurah, and 119 from the Leschenault Peninsula (Trudgen 1984).

All of these study areas are larger than the Jindee area, covering a greater number of habitats with a greater number of survey sites, so it is not surprising that greater numbers of taxa were recorded. However, given the smaller size of the Jindee study area, the number of taxa collected here appears comparable.

3.2.2 Native Flora

Of the native species fifteen (in eight families) are monocotyledons and forty (from twenty-three families) are dicotyledons. Of the monocotyledons, the *Cyperaceae* had the most species (four). The Families of dicotyledons with most representation were the *Papilionaceae* (six), *Asteraceae* (five) and *Myrtaceae* and *Mimosaceae* (four).

3.2.3 Introduced Flora

Twenty-seven per cent of the flora collected in this survey was introduced. In comparison, Trudgen and Keighery recorded 16% introduced species at Alkimos fifteen years earlier, Trudgen (1988) recorded 8.5% alien taxa at Mandurah and 32% on Leschenault Trudgen (1984). A recent survey at Alkimos (2004-5) recorded 30% introduced species (Dr AS Weston, *pers.comm*). These figures may show an increase in infestation over time (from 16% to 30% at Alkimos) especially if the earlier work is assumed to be more thorough. Based on these studies, the percentage of introduced species at Jindalee does not appear to be unusually high.

3.2.4 DRF and Priority Flora

The Department of Conservation and Land Management (CALM) Rare and Priority Flora Database lists one Declared Rare Flora (DRF) species and five Priority Flora species or subspecies which may occur in the study area:

- *Astroloma microcalyx* (Priority 3)
- *Comesperma acerosum* (Priority 3)
- *Conostylis pauciflora* subsp. *euryrhipis* (Priority 3)
- *Eucalyptus argutifolia* (DRF)

- *Jacksonia sericea* (Priority 4)
- *Stylidium maritimum* (Priority 3)

No DRF were recorded within the site. However, the following Priority Flora were recorded within the site.

Conostylis pauciflora

Conostylis pauciflora has two subspecies; subspecies *euryrhipis* (P3) and subspecies *pauciflora* (P4). Examination of the literature showed that ssp *pauciflora* was thought to only occur near Dawesville, and ssp *euryrhipis* north of Perth, although recently a collection determined as ssp *pauciflora* from the north of Perth has been lodged at the WA Herbarium (Department of Conservation and Land Management, 2005).

The characters used to distinguish between the two subspecies are based mainly on size, of leaves in particular and this is a character that may be open to interpretation because of variation. Consequently, determination of which *Conostylis* subspecies was present was not possible with complete certainty.

Conostylis is thought to hybridise within the genera and *C. pauciflora* itself is thought to be a hybrid between *C. aculeata* and *C. candicans* (Marchant *et al* 1987), and specimens collected during this survey appeared to have characters not attributed to either of the *C. pauciflora* subspecies.

Notwithstanding the almost total identification of *Conostylis pauciflora* north of Perth as ssp. *euryrhipis*, the specimens examined from the site appeared to have more in common with ssp. *pauciflora*.

Bennett (2004) apparently had this same problem at the Alkimos site north of Jindee, as did Weston (2005), who resorted to using the specific epithet rather than defining to subspecies.

A total of 5916 individuals were observed across the site during this search, however this number should not be taken as absolute as it was difficult to accurately record every single individual. Some were observed to be not in flower, and others that were clumped together may have been recorded as one instead of a number of individuals. It is also possible that both subspecies of *Conostylis pauciflora* were present.

This taxon was mainly observed along the ridges, slopes and shallow swales within the site and was found within both areas proposed for regional open space.

Conostylis bracteata

This Priority three taxon was found in the stands of Banksia woodland on the eastern edge of the site. 117 individuals were observed during this search, with some occurring within the proposed eastern regional open space. This taxon is a new record for the area as it did not show on the database searches.

3.2.5 Other Significant Flora

Two other significant flora species are mentioned in *Bush Forever*. These are; *Melaleuca cardiophylla* (significant, found in Releves JinR1, 2 and 3) and *Grevillea preissii* (typical Tamala limestone taxa). *Grevillea preissii* was not recorded from any of the sites from this study, but its presence in Bush Forever Site 397 is recorded in *Bush Forever* (Government of Western Australia, 2000).

3.3 Vegetation

3.3.1 Vegetation Units

The vegetation of the study area is varied considering the size of the area surveyed, reflecting the topography, distance inland and soils found. The vegetation survey was restricted to areas within the current regional open space (Bush Forever 397) and the southern portion of the site.

Five vegetation units were sampled during the survey (Figures 1 and 2). Structural Classes and Condition Scales are taken from Bush Forever (2000, Volume 2, Tables 11 and 12. See Appendix D). Almost all units suffer from severe localised disturbance in the form of tracks.

MhSp

Melaleuca huegelii, Spyridium globulosum Closed Heath on shallow limestone.

Condition: Excellent.

This unit was found at the northern end of the current regional open space above limestone cliffs, with exposed limestone and limestone rocks at the surface. It is in excellent condition possibly due the fact that access, both pedestrian and vehicular, is difficult.

1) Showing lack of understorey and rabbit

2) Showing density of shrub layer presence (burrow on left).

McSp

Melaleuca cardiophylla, Acacia rostellifera, Spyridium globulosum, Olearia axillaris, Acacia saligna Closed Tall Scrub/Closed Heath in swales and lower slopes.

Condition: Good-Very Good

This unit contains largely one stratum of vegetation between 1m and 2m (higher in parts), with some open areas. Because of the density (up to 100%) there is little scope for understorey, and what exists is impacted by rabbits. In density and structure it appears similar to post-fire regrowth but the open patches possibly indicate greater maturity or different origin.

This unit occurred in the south-east corner of the site, in both the existing coastal regional open space and the proposed regional open space. Releves JinR1, JinR2, JinR3.

AsLSg

Acacia saligna, Spyridium globulosum, Olearia axillaris Shrubland/Open Shrubland over *Pelargonium capitatum, Melaleuca systena* Open Low Heath over *Lomandra maritima* Sedgeland.

Condition: Very Good.

This unit occurs on slopes in the current regional open space and the proposed regional open space located in the eastern portion of the site. Examination of aerial photography shows it is common on slopes throughout Lot 10.

Ef

Eucalyptus foecunda Closed Shrub Mallee over *Acacia saligna* Shrubland over *Scaevola ?globulifera* Low Shrubland over **Anagallis arvensis* Herbland.

Condition: Very Good. Burnt over last 2-3 yrs and still regenerating. Photo taken 9/1/06.

This unit occurs in the proposed ROS located in the eastern portion of the site. Found in Releve JinR4.

XpAs

Xanthorrhoea preissii, Spyridium globulosum, Acacia saligna Tall Open Scrub/Open Heath over *Leucopogon propinquus, Melaleuca systena* Open Shrubland over *Lomandra maritima, Lepidosperma squamatum* Open Sedgeland.

Condition: Very Good

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This unit occurs in the proposed Regional Open Space located within the eastern portion of the site. Plot Jin4.

Vegetation Communities described during fieldwork but not sampled (Figure 1)

AsMsSc

Acacia saligna Shrubland over *Melaleuca systena, Alyogyne huegelii, Scaevola ?globulifera* Low Open Heath/Open Heath over *Conostylis pauciflora* subsp. ? Very Open Herbland.

This unit occurs partly within the proposed regional open space located within the south-eastern portion of the site.

B

Banksia attenuata, B. menziesii Low Woodland over *Dryandra sessilis, Macrozamia riedlei* Scattered Shrubs over *Rhagodia baccata, Hibbertia hypericoides, Leucopogon polymorphus* Low Open Shrubland.

This unit occurs partly within the proposed regional open space located within the eastern portion of the site.

B1

Banksia attenuata, Banksia menziesii Low Woodland over **Trachyandra divaricata* Closed Herbland.

D

Dryandra sessilis Closed Tall Scrub over *Macrozamia riedlei* Scattered Shrubs over *Hibbertia hypericoides, Jacksonia calcicola* Low Shrubland.

DsSg

Dryandra sessilis Shrubland to Tall Closed Scrub over *Xanthorrhoea preissii* Scattered Shrubs over *Jacksonia calcicola, Hibbertia hypericoides, *Pelargonium capitatum* Low Open Shrubland over *Trachymene pilosa, *Anagallis arvensis, *Arctotheca calendula* Herbland.

This unit occurs within the current regional open space and the areas proposed as regional open space.

Mixed

Acacia truncata, A. cochlearis, Spyridium globulosum, Olearia axillaris Closed Shrubland over *Lepidosperma gladiatum* Sedgeland/Open Sedgeland with lianes of *Hardenbergia comptoniana*. Contains a variety of shrubs and herbaceous plants.

This unit occurs within the current regional open space and is impacted in large part by tracks causing severe localised disturbance. The condition of the vegetated parts is generally Very Good to Excellent.

P

Pyrosere communities, consisting largely of *Dryandra sessilis, Acacia pulchella, Hibbertia hypericoides* Closed Heath/Closed Low Heath.

Sg

Spyridium globulosum Closed/Open Heath over **Trachyandra divaricata, Trachymene pilosa, Conostylis pauciflora* ssp. ? Herbland.

This unit occurs within the current regional open space.

3.3.2 Floristic Community Types

The most accurate way to determine which floristic community types occur in the Metropolitan Region of the Swan Coastal Plain is to select, sample and analyse Gibson-type, 10 m by 10 m quadrats using the techniques described by Gibson *et al*. (1994) and Keighery (1994). An essential component of these techniques is the compilation of a complete list of species for each quadrat based upon correctly identified plant specimens. This often requires sampling the quadrat more than once.

It should be possible, however, according to *Bush Forever* (Government of Western Australia 2000, Volume 2, p. 487), to infer which floristic community types, at least of the original 43 described by Gibson *et al.* (1994), occur in a study area. Inferences of which FCTs occur in particular Bush Forever sites have been made from “information on the floristics of the area and the area’s geographic location” (Government of Western Australia 2000, Volume 2, p. 487).

The floristic community approach to vegetation classification and description gives equal weight to all vascular plant species in plant community sampling quadrats (or

plots). These plots are, in the case of Swan Coastal Plain floristic surveys, 10m by 10m squares. The presence or absence of individual species in the quadrats is, with the aid of computerised multivariate analysis techniques (specifically, PATN software), used to define floristic community types (FCTs; or other groupings), which are based on shared species and groups of species having high frequencies of co-occurrence, and on absence of species. An essential prerequisite of this method is a complete list of correctly identified species for each plot.

Gibson *et al*. (1994) used analyses of 509 southern Swan Coastal Plain survey quadrats to define 43 FCTs. Subsequent analyses of 613 other quadrats led to 23 additional FCTs being defined, mainly in the Perth Metropolitan Region (*Bush Forever* 2000, Volume 2, pp. 27-31).

Bush Forever lists six Spearwood Dunes FCTs and nine Quindalup Dunes FCTs. The Spearwood Dunes FCTs are FCT 24, FCT 25, FCT 26a, FCT 26b, FCT 27 and FCT 28. The Quindalup Dunes FCTs are FCT 29a, FCT 29b, FCT 30a2, FCT 30c2, FCT 30b, FCT S11, FCT S12, FCT S13 and FCT S14. *Bush Forever* does not indicate which of these FCTs may be restricted to one dune type or the other.

The Department of Conservation and Land Management (CALM) has been identifying and informally listing Threatened Ecological Communities (TECs) for the past eight years. The TEC list is derived in part from vulnerable Gibson *et al.* (1994) vegetation communities for the Swan Coastal Plain, and from additional threatened communities throughout Western Australia.

Of the listed TECs, 19 have been endorsed by the Director of Nature Conservation as Critically Endangered, 11 as Endangered, 19 as Vulnerable, and two as presumed totally destroyed. The remainder are either awaiting endorsement as threatened or are allocated to one of five priority lists.

Data collected from the four quadrats and the five releves was analysed by EA Griffin and Associates using the PATN suite of programs for multivariate analysis (CSIRO 1987), and their report is included as Appendix A. Using a selection of the programs available, data was compared against the data collected and analysed by Gibson *et al* (1994) to establish relationships to the Swan Coastal Plain Floristic Community Types (FCTs). Two analyses were carried out, one with the releve data included and one without it.

Griffin's analysis shows the quadrats as grouping together with Floristic Community Type 29a, although they are closer to each other than to any of the Gibson *et al* sites. Griffin points out the absence of a number of ephemeral genera that are not on the species list that could reasonably be expected to occur. The inclusion of these species, however, may not change the grouping except to draw the Jindalee quadrats closer to other sites.

Bush Forever infers the presence of FCTs 29a and 29b in the study area, and this study confirms that FCT 29a, Coastal shrublands on shallow dunes from Supergroup 4; Uplands centred on Spearwood and Quindalup Dunes, is present and appears to encompass all the vegetation in the study area.

Gibson *et al* (1994) list FCTs 29a and 29b as both being 'poorly reserved and susceptible'. However, these FCTs are not listed on the Department of Conservation and Land Management's TEC Database or the Commonwealth's TEC list.

3.3.3 Vegetation Complexes

Heddle *et al*. (1980) identified and mapped large scale repeating patterns in native vegetation for the entire Darling System of the south- west of Western Australia. The vegetation was grouped into "Complexes" which reflect the influence of landform, soil type and climate. This work shows the study area as supporting remnants belonging to the Cottesloe Complex – Central and South and Quindalup Complex.

Vegetation of the Cottesloe Complex – Central and South is characterised by a closed heath on limestone areas with shrubs such as *Melaleuca huegelii*, *Acacia* species, *Grevillea thelemanniana* and *Trymalium ledifolium*. The deeper sands support a mosaic of Tuart, Jarrah and Marri. Banksia species are also common.

Quindalup Complex is a coastal dune complex consisting mainly of the strand and fore-dune alliance, and the mobile and stable dune alliance. Local variations include low closed forest of *Melaleuca lanceolata* – C*allitris preissii* and the closed scrub of *Acacia rostellifera*.

Assessments made in 1998 and quoted in *Bush Forever* (Government of Western Australia, 2000) estimated that some 36% and 47.6% respectively of the original extent of these vegetation complexes remained uncleared at that time. These figures would

have included the remnants mapped for the study area, and give an indication of the significance of the remnants.

Bush Forever (Government of Western Australia, 2000) indicates that the Quindalup Complex and Complex – Central and South have 19.5% and 17.7% proposed protection respectively, which meets the target 10% for complexes within the Swan Coastal Plain portion of the Perth Metropolitan Region. Table 1, below highlights the original extent, remaining areas and the reservation status of these vegetation complexes.

Table 1 Conservation Status of Vegetation Complexes in the Jindalee Study Area (Source: Bush Forever Vol.1 p 83)

Vegetation Complex	Original Extent	Area Remaining (% original extent)	Area currently reserved (% original extent)	Area reserved or proposed for reservation (% original extent)
Quindalup Complex	24 381 ha	11 598 (47.6)	3 527 (14.5)	4 756 (19.5)
Cottesloe Complex; Central and South	34 439 ha	12 362 (36)	5 289 (15.4)	6 085 (17.7)

In 1993 the International Union for the Conservation of Nature (IUCN) recommended that "protected areas cover at least 10 percent of each biome by the year 2000" (IUCN, 1993). A Biome is "a major biotic community characterised by the dominant forms of plant life and the prevailing climate" (http://www.hyperdictionary.com) such as Savannah or Tropical Rainforest. Each Biome will contain a diversity of habitat and vegetation types within it, and these units are at a much broader level then the Complexes or Floristic Community Types referred to in this report.

By this measure of 10%, the reservation of the dune Complexes displayed in the table above appears to be adequate, although protection of larger units such as Vegetation Complexes does not necessarily confer protection on smaller component units such as Floristic Community Types. The Environmental Protection Authority, in its Position Statement No. 2 (EPA, 2000) recommends retention of 30% of each ecological community as an appropriate target. As Table 1 shows, the remaining extent of both Complexes present is above this threshold value (in 2000).

4.0 CONCLUSION

The vegetation within the proposed and existing regional open space at Jindee was surveyed in October and late December 2004, and the results analysed using PATN multivariate analysis software. Further investigation and verification of Declared Rare and Priority Flora for the site was undertaken in September 2005.

No Declared Rare Flora was found during the survey. As discussed in further detail in Section 3.3 of this report Priority species, *Conostylis pauciflora* subsp. *pauciflora* (P4) and/or *Conostylis pauciflora* subsp. *euryrhipis (P3)* and C*onostylis bracteata (P3)* was recorded within the site, which included the areas proposed for regional open space. Priority Taxa are considered to have been adequately surveyed and, whilst being rare, are not threatened by any identifiable factors.

Analysis of the collection data shows the vegetation grouping with Floristic Community Type (FCT) 29a. The presence of this FCT is inferred in *Bush Forever* (Government of Western Australia, 2000) as present in the area. While Gibson *et al* (1994) lists this FCT as 'poorly reserved and susceptible', efforts to increase the reservation status of Vegetation Complexes on the Swan Coastal Plain (for example *Bush Forever*) have resulted in greater security (see Table 1). FCT 29a is not listed on State or Commonwealth Threatened Ecological Community databases.

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FIGURE 1

Vegetation Map of Lot 10 Jindee

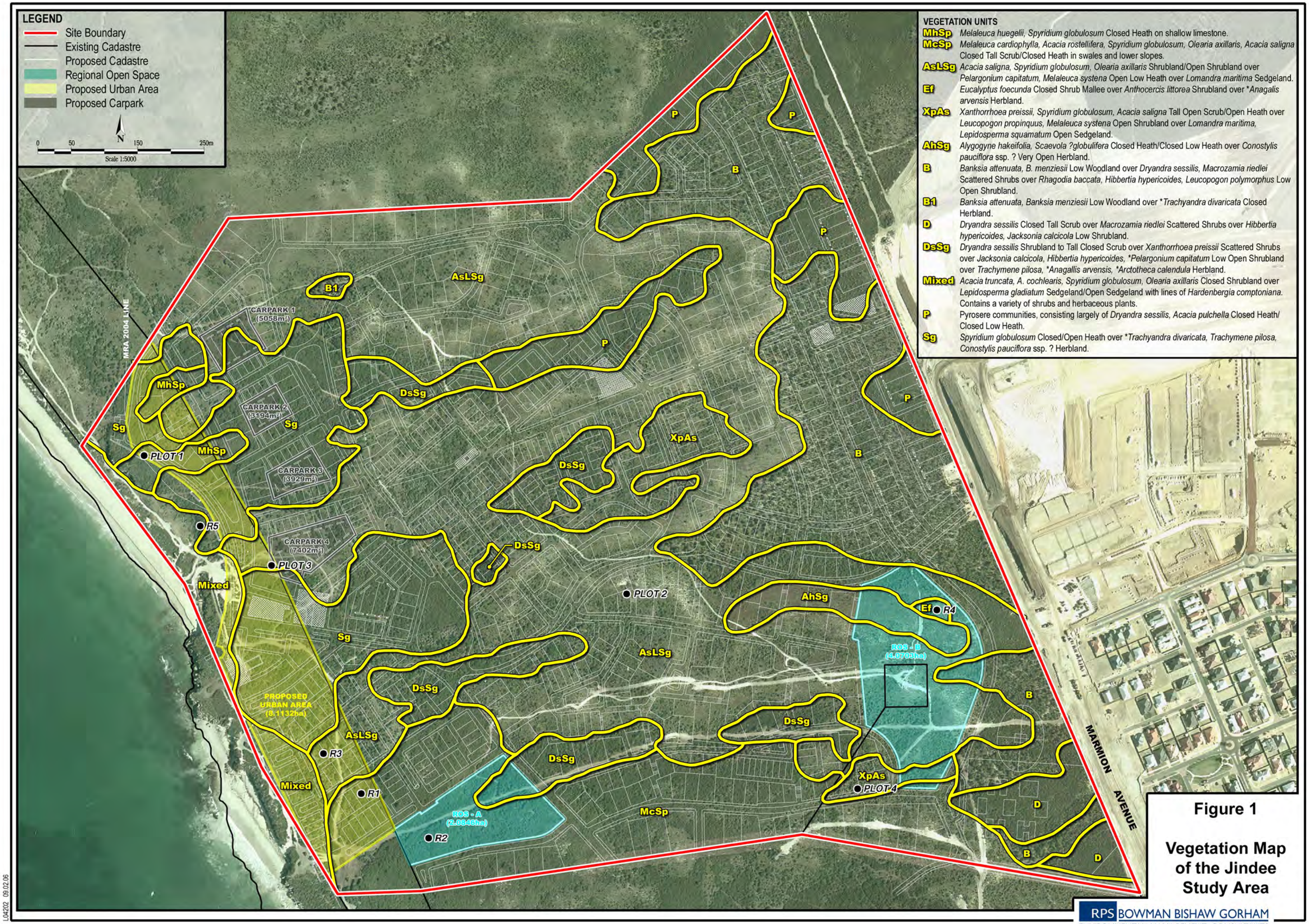

Figure 1

Vegetation Map of the Jindee Study Area

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