



Lot 1507 Eighty Road, Baldivis
Local Structure Plan



APPENDIX C

ENVIRONMENTAL ASSESSMENT REPORT



PARKLAND HEIGHTS

LOT 1507 SIXTY EIGHTY ROAD, BALDIVIS ENVIRONMENTAL ASSESSMENT REPORT



PARKLAND HEIGHTS

LOT 1507 SIXTY-EIGHT ROAD, BALDIVIS

ENVIRONMENTAL ASSESSMENT REPORT

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STATEMENT OF LIMITATIONS

Scope of Services

This environmental site assessment report (“the report”) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and ENV.Australia Pty Ltd (ENV) (“scope of services”). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on Data

In preparing the report, ENV has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report (“the data”). Except as otherwise stated in the report, ENV has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (“conclusions”) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. ENV will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to ENV.

Environmental Conclusions

In accordance with the scope of services, ENV has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

On all sites, varying degrees of non-uniformity of the vertical and horizontal soil or groundwater conditions are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results/samples are not totally representative of soil and/or groundwater conditions encountered. The conclusions are based upon the data and the environmental field monitoring and/or testing and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions. Also it should be recognised that site conditions, including the extent and concentration of contaminants, can change with time.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. ENV assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of ENV or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other Limitations

ENV will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

EXECUTIVE SUMMARY

This report has been prepared to support a new Local Structure Plan over the site (with the exception of the north-west portion – Stages 1 and 2, which is currently under development).

Historically, the site has been used as a pine plantation, leading to a degradation of its flora, vegetation and habitat values. Felling of the plantation onsite has left a largely denuded site, with very little in the way of environmental values.

The development of Lot 1507 Sixty Eighty Road, Baldivis in line with the new Local Structure Plan is unlikely to result in the loss of environmental value or assets in the region.

1 INTRODUCTION

ENV Australia Pty Ltd (ENV) was commissioned by Rockingham Park to provide an Environmental Assessment for Parkland Heights, Lot 1507 Eight Road, Baldivis (hereafter referred to as the 'site') (Figure 1). This report has been prepared to support a revised Local Structure Plan (Figure 2) for the site, with the exception of the north-west portion. This excluded portion of the site contains a display village and Stages 1 and 2, which have commenced development in line with current planning approvals.

This environmental assessment will give consideration to local, state and federal environmental policies, scheme requirements, land uses, heritage, acid sulfate soils, contaminated sites, hydrology, significant flora and fauna, plus the opportunities and constraints of the site in relation to the Local Structure Plan. The report will utilise a number of information sources including previous ENV onsite and desktop studies.

1.1 LOCATION

Lot 1507 Eighty Road, Baldivis is approximately 45km south of Perth CBD (Figure 1). The Baldivis area is characterised by the rapid expansion of residential developments coincided with areas of protected lakes, wetlands and native vegetation.

The site is framed by residential development to the north and east, Sixty-Eight Road and rural residential properties to the south and Eighty Road and rural properties to the west (Figure 1).

1.2 LAND USE

1.2.1 Historical

Historical aerials prior to 1953 show the site as containing undisturbed bushland. The first evidence of development outside the site is evident in 1963 with Sixty-Eight Road visible and the early stages of cultivation to the east and west. First development onsite is visible in the 1974 aerial photograph, with access roads/corridors through the site and early signs of pine plantation cultivation. The first market gardens are evident around this time to the east and west of the site. Through to 1983 there are no visible significant changes in development other than residential lots to the east of the site, and in 1994 further development to the south. In 2004 it is evident that areas have been logged within the site boundary and development has progressed in areas surrounding the site. It is also known that areas to the north of the site were historically used as a rifle range.

1.2.2 Current

The site has previously been utilised by the Forest Products Commission as part of their Peel B Plantation of *Pinus pinaster* (Maritime Pine). In mid 2010 the site underwent two

thinning operations and some selective harvesting/clearing and has recently been clear felled and a post-harvest burn was undertaken to facilitate future growth and development of the land for residential purposes (FPC 2010).

1.2.3 Potential Contamination

A search of the Contaminated Sites Register did not identify any known sites of contamination within or in areas surrounding the site (DEC 2010a).

A Freedom of Information (FOI) application submitted to the Department of Environment and Conservation, in October 2009, they did not identify licences, approvals, trade waste agreements, complaints, or any other records on additional databases relating to works onsite.

The presence of a rifle range in proximity to the site infers the potential of Unexploded Ordnance (UXO) however due to the small size and location of the range, the potential for UXO, lead and other heavy minerals on the site is considered to be extremely low.

The site has had an Environmental Management System in place for the past seven years. It is unlikely that there is any site contamination as the previous land uses are not listed by the DEC as a potential contaminating land use in the *Contaminated Sites Management Series* (DoE 2004b).

1.3 PLANNING FRAMEWORK

1.3.1 Metropolitan Region Scheme

The Metropolitan Region Scheme (MRS) is the statutory land use planning scheme for the Perth Metropolitan area. The MRS zones land, controls land development and reflects the agreed strategic direction for land with the area. It also acts as a catalyst for changing local planning controls and associated planning.

Aside from the future alignment of Nairn Drive, which is reserved as “Other Regional Road”, the site is zoned ‘Urban’ under the MRS, allowing development of the land for a range of urban purposes.

The site is surrounded by ‘Urban’ zoned land to the north and east, and ‘Rural’ zoned land to the south and west.

1.3.2 City of Rockingham Town Planning Scheme No.2 District Zoning Scheme

With the exception of the MRS road reserve, the site is zoned ‘Development’ under the City of Rockingham Town Planning Scheme (TPS) No.2. The purpose of this zone is to promote the coordination and planning of subdivision and development in an identified area.

2 SCOPE OF WORKS

2.1 OBJECTIVES

The purpose of this Environmental Assessment Report for Parkland Heights (Lot 1507 Sixty Eight Road, Baldivis) is to support the approval of a revised Local Structure Plan for the development (excluding those components of the site which are already under construction). The objectives are to:

- Evaluate and summarise the environmental conditions of the site;
- Identify any opportunities and/or constraints to development associated with the environmental conditions of the site; and
- To support the revised Local Structure Plan for the site and provide government agencies with sufficient information to assess the site.

2.2 PREVIOUS WORKS

Previous studies completed by ENV on the site include:

- Preliminary Site Investigation (2009);
- Preliminary Acid Sulphate Soils Investigation (2009); and
- Short Environmental Report (2010).

2.3 CURRENT WORKS

ENV is currently completing the following projects for the site:

- Acid Sulfate Soil Investigation and Dewatering Management Plan;
- Sustainability Initiatives for Parkland Heights; and
- Stage 1 Urban Water Management Plan.

3 GEOMORPHOLOGY, GEOLOGY AND SOILS

3.1 GEOMORPHOLOGY

The site is situated on the Swan Coastal Plain within the Spearwood Dune and Plain System which is characterised by low dunes and swales of yellowish-brown siliceous sands overlying Aeolian (wind blown) or marine limestone (Bolland 1998). The geomorphological classification of the site according to the Geological Survey of Western Australia (1985) is:

- ED – Degraded surface of eolian origin, Spearwood Dunes (Figure 4).

3.1.1 Topography

The topography of the site is undulating with elevated points reaching approximately 33 mAHD in the centre and east of the site, and low points in the south-east quadrant and the western boundary (reaching approximately 7 mAHD and 4 mAHD, respectively).

3.2 GEOLOGY

The geological classification of the site according to the *1:50 000 Environmental Geology Series, Rockingham part Sheets 2033 II and 2033 II* is:

- S7 – SAND – pale yellowish brown, medium to coarse grained, sub-angular quartz, trace of feldspar, moderately sorted, of residual origin (Figure 4).

Characteristics of this geology are described as moderate-high permeability, low corrosion potential, low-medium slope stability, high ease of excavation and low-medium bearing capacity (Geological Survey of Western Australia 1985).

3.3 SOILS

Churchward & McArthur (1978) identify the site as a Karrakatta Soil Unit, with an undulating landscape with deep yellow sands over limestone.

3.3.1 Acid Sulfate Soils

The DEC Acid Sulfate Soil (ASS) risk mapping shows the site as located in an area having “No Known Risk of ASS occurring within 3m of the natural soil surface (or deeper)” (Figure 5). However, an area mapped as Moderate to High ASS Risk occurring within 3m of the natural soil surface is located immediately to the north west of the site.

Most of the site is underlain by the Spearwood Dunes System, which forms higher ground sloping up from the low lying offsite area of higher ASS risk. A preliminary soil investigation combined with observations from hydrological investigation confirms that

most of Lot 1507, corresponding to a low ASS risk zone, is underlain by a deep sand sequence over Tamala Limestone.

In anticipation of the potential for disturbance of ASS on the westernmost part of the site, a preliminary ASS investigation involving the installation of four soil probe holes, conversion of one probe hole to a groundwater monitoring well, and collection of soil samples was conducted in October, 2009. The four soil probe holes ranged between 5m and 9m below ground level (BGL) and were located close to the north-west corner of the site, to assess the low lying soils adjacent to the offsite high ASS risk areas located offsite.

Soil samples from these soil probe holes were assessed, and of 29 samples, one sample marginally exceeded the DEC action criteria (0.03%S) with a result of 0.04%S. It was concluded that should future plans for the site involve dewatering or soil disturbance at or below the water table, additional testing and the preparation of an Acid Sulphate Soils and Dewatering Management Plan (ASSDMP) will be required.

Preliminary engineering design indicates that the only development activity with potential to disturb the groundwater is the establishment of a pump station approximately mid way along Eighty Road and with 500 metres of sewer extending northwards along Eighty Road. Maximum depth of excavations will be to approximately 5m below ground level and dewatering would be locally required. Sewer development further to the east within the higher terrain will not intersect the watertable and as such no dewatering will be required.

It is considered that the limited potential for ASS disturbance in the low lying, westernmost part of the site can be effectively characterized and managed and otherwise poses no constraint on the development of the site.

4 HYDROLOGY

4.1 SURFACE WATER

The site is located within the Peel-Harvey Catchment. There are no ephemeral or permanent water bodies located within the site. There are no existing drainage lines within the site due to the high permeability of the Spearwood Sands at the site (Geological Survey of Western Australia 1985). The site is therefore dominated by infiltration, with little to no surface run-off except during extreme storm events.

Located 80 m west of the site is a Conservation Category Wetland (Outridge Swamp) and an associated Multiple Use category wetland. The 50m buffer to the Conservation Category wetland falls outside the subject site.

Lake Walyungup is also located 1.7 km north-west of the site.

4.1.1 Flooding

The flood potential for the site is very low due to relatively dry climatic conditions and highly permeable soils.

4.2 GROUNDWATER

4.2.1 Levels

The Second Edition of the Perth Groundwater Atlas (2004) indicates that the typical end of winter groundwater levels vary from 4 mAHD in the north east corner to 2 mAHD along the western boundary with groundwater flow typically to the south and south west (Figure 6) (DoE 2004a).

Monitoring

ENV installed five groundwater monitoring bores along the western and southern boundaries of the site (Figure 6). The bores have been monitored since the 28th October 2009 until most recently on the 11th November 2010. Department of Water (DoW) bores within 2 km of the site were also sampled; these being DoW 3012 and DoW 3011 to the south west and DoW 3034 and DoW 3033 to the south east.

Groundwater levels at MW1 to MW4 bores along the western boundary are on average approximately 2.4 mAHD, confirming Perth Groundwater Atlas data (DoE, 2004a). Depth to groundwater ranges from 9 m below ground surface level (MW4) to approximately 2 m below ground level (MW1 and MW3) due to the undulating topography of the site. Deeper ground level readings were taken at MW5 to the south of the site with an average of approximately 1.5 mAHD corresponding to approximately 5.5 m below ground surface level.

4.2.2 Quality

The groundwater monitoring program included regular sampling of physical parameters (acidity and electrical conductivity), measurements of Total Nitrogen and components of nitrogen and Total Phosphorus and a suite of heavy metals.

Physical Parameters

The pH across the bore locations was generally stable and neutral. Electrical conductivity levels were measured to be similar across all bores and of freshwater quality.

Nutrients

Groundwater below the site was generally found to have levels of Total Phosphorus (TP) exceeding the Long Term Swan-Canning Cleanup Program (SCCP) target of 0.1 mg/L (SRT 1999) with mean TP concentrations varying between 0.11 and 0.48 mg/L (Figure 6). However, PO₄ concentrations at all bores were negligible. Only MW4 was found to minimally exceed detection limits, which suggests that phosphorus in groundwater at the site exists predominantly in a particulate form, and is not available for uptake by plants, but is also unlikely to cause eutrophication.

Total Nitrogen (TN) concentrations exceeded the long-term SCCP target of 1 mg/L at all bores except MW5 (Figure 6). TN concentrations in MW1 were also found to equal or exceed the ANZECC Fresh Water Quality guidelines level of 1.2 mg/L (ANZECC & ARMCANZ 2000).

None of these groundwater results are unusual in highly disturbed environments.

Heavy Metals

Groundwater samples were analysed for Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Nickel (Ni), Zinc (Zn) and Mercury (Hg).

Mean Chromium (Cr), Copper (Cu) and Zinc (Zn) concentrations exceeded ANZECC Fresh Water Quality guidelines levels (95% level of protection) in bores (ANZECC & RMCANZ 2000). Mean Cadmium (Cd) concentrations exceeded ANZECC Fresh Water Quality guidelines (95% level of protection) in all bores except MW1. However, MW1 was also the only bore where mean Arsenic (As) and Nickel (Ni) concentrations did exceed the guidelines. Mean Lead (Pb) concentrations exceeded ANZECC Fresh Water Quality guidelines (95% level of protection) in two of the four bores sampled (MW1 and MW5).

Given the detection limit for Mercury (Hg) analysis (<0.0001 mg/L) was greater than the ANZECC guideline level (0.00006 mg/L), it is not possible to determine whether the ANZECC guideline level (95% level of protection) was exceeded. However, Hg mean concentrations were found to be below detection limits in all bores sampled.

5 FLORA AND VEGETATION

5.1 PROTECTION OF FLORA AND VEGETATION

Flora species are protected formally and informally by various legislative and non-legislative measures, which are as follows:

Legislative Protection

- *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*;
- *Wildlife Conservation Act 1950 (WA)*; and
- *Environmental Protection Act 1986 (WA)*.

Non-Legislative Protection

- Western Australian Department of Environment and Conservation ('DEC') Priority lists for flora and vegetation;
- Informal recognition of locally significant populations; and
- Levels of Assessment for Proposals Affecting Natural Areas Within System 6 Region and Swan Coastal Plain Portion of the System 1 Region.

A short description of these measures is given below, and definitions of the species conservation codes and ecological community categories they use, and those used by the DEC, are provided in Appendix A.

Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* ('the EPBC Act') aims to protect Matters of National Environmental Significance.

Under the EPBC Act, the Commonwealth Department of Sustainability, Environment, Water, Heritage and the Arts (SEWPaC) lists threatened species and Threatened Ecological Communities in certain categories determined by criteria set out in the Act (www.environment.gov.au/epbc/index.html).

The Act provides for substantial penalties for any unauthorised actions likely to adversely affect matters of national environmental significance. It also provides for a national environmental assessment and approvals process for proposed actions likely to affect the prescribed matters of national environmental significance. If a proposed action is approved subject to certain conditions, the proponent of the action does not contravene the EPBC Act if the action is carried out in accordance with the conditions imposed.

Projects likely to cause impacts on matters of national environmental significance (as defined in the EPBC Act) should be referred to the SEWPaC for assessment under the EPBC Act. Although the time taken for a proposal to be assessed may be considerable, there is considerable risk in not referring a project likely to affect matters of national environmental significance, as the Act provides for substantial penalties for unauthorised actions.

Wildlife Conservation Act 1950 (WA)

The DEC, lists flora taxa under the provisions of the *Wildlife Conservation Act 1950 (WA)* ('WC Act') as protected according to its need for protection (see Appendix A).

Flora species are given Declared Rare status when their populations are geographically restricted or are threatened by local processes. In addition, under the *WC Act*, by Notice in the Western Australian Government Gazette of 9 October 1987, all native flora (spermatophytes, pteridophytes, bryophytes and thallophytes) is protected throughout the State.

The Act makes it an offence to 'take' threatened species without an appropriate license. There are financial penalties for contravening the Act.

Environmental Protection Act 1986 (WA)

Declared Rare Flora (DRF) and Threatened Ecological Communities ('TECs') are given special consideration in environmental impact assessment and have special status as Environmentally Sensitive Areas ('ESAs') under the *Environmental Protection (EP) Act* and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

The protection of DRF and TECs is a 'clearing principle' for assessing applications for permits to clear native vegetation, where exemptions for a clearing permit under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA)* do not apply. There are substantial penalties (financial and/or imprisonment) for unlawfully damaging ESAs.

DEC Priority Lists

The DEC lists 'Priority' flora species that have not been assigned statutory protection under the *WC Act*, but which are under consideration for declaration as 'Rare Flora' under the Act. Species assessed as Priorities 1-3 (see Appendix A) are in urgent need of further survey, whilst Priority 4 species require monitoring every 5-10 years (see Appendix A for definitions).

In addition, the DEC maintains a list of Priority Ecological Communities ('PECs') which identifies those communities that need further investigation before possible nomination for TEC status (see below).

Although DEC Priority species and communities have no formal legal protection, they are under consideration for legislative protection. Sensitivities to harm to Priority species and communities can therefore be expected to be heightened.

Informal Recognition of Flora and Vegetation

Certain populations or communities may be of local significance or interest because of their patterns of distribution and abundance. For example, flora may be locally significant because they are range extensions to the previously-known distribution or are newly-discovered taxa (and therefore have the potential to be of more than local significance). In addition, many species are in decline as a result of threatening processes (primarily land clearing), and relict populations of such species assume local importance.

Despite the lack of any formal protection for species in this category, project proponents are strongly advised to be aware of and to be sensitive to community concerns as to locally significant species or communities.

5.2 BOTANICAL DISTRICT

The site is located within the Drummond Botanical subdistrict of the Darling Botanical district which is characterised as having the following vegetation:

“Mainly Banksia low woodland on leached sands with Melaleuca swamps where ill-drained; woodland of tuart (Eucalyptus gomphocephala), jarrah, (E. marginata) and marri (E. calophylla) on less leached soils.” (Itzstein-Davey 2003)

5.3 VEGETATION COMPLEX

Heddlé, Loneragan & Havel (1978) mapped the site as having the following vegetation complex:

- Karrakatta Complex (Central and South) – Predominantly Open Forest of *Eucalyptus gomphocephala* – *Eucalyptus marginata* and *Corymbia calophylla* and Woodland of *Eucalyptus marginata* – *Banksia* species.

5.3.1 Pre-European Extent

The Environmental Protection Authority’s (EPA) document *Levels of Assessment for Proposals Affecting Natural Areas Within System 6 Region and Swan Coastal Plain Portion of the System 1 Region* (EPA 2006) gives an estimate of the percentage of each complex that remains compared to its pre-European settlement extent, so an estimate of the scarcity of each complex can be determined.

The EPA recognises vegetation complexes that are not well represented in reserves as being significant. Vegetation complexes which have 10%-30% remaining may be

considered regionally significant. Proposals that would impact on a vegetation complex with 10% or less remaining are likely to be formally assessed by the EPA (EPA 2006).

In Western Australia 29.5% of the Karrakatta Complex (Central and South) is estimated to remain (EPA 2006). However it should be noted that due to use as a pine plantation and subsequent clearing, the vegetation on the site is Degraded to Completely Degraded.

5.4 DESKTOP SEARCH

On 16 July 2009 a request for a database search was submitted to the DEC to obtain a list of Declared Rare and Priority Flora species and TECs/ PECs in the area surrounding the site. The search was within coordinates from 382761mE, 6422270mN to 391938mE, 6414550mN (Zone 50, GDA94).

A database search of the area resulted in two DRF species (*Caladenia huegelii* and *Diuris micrantha*) and 13 Priority Flora species being identified as potentially occurring in the area.

The database search determined that two TECs and three PECs are known to occur within the search area. The TECs are:

- **SCP19a** Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (listed as a Critically Endangered Threatened Ecological Community under State and Federal legislation); and
- **SCP19b** Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (listed as a Critically Endangered Threatened Ecological Community under State and Federal legislation).

See Appendix D for the DEC database search results, and details of the PECs.

5.5 FIELD SURVEY

On the 9 October 2009 an ENV botanist visited the site collecting flora and vegetation information.

5.5.1 Flora

The survey identified 22 families, 35 genera and 40 taxa onsite, including 18 introduced flora species. (See Appendix E for the flora list). However subsequent clear felling of the site by the Forest Products Commission is expected to have reduced the number of species currently present on the site.

5.5.2 Protected Flora

No Endangered or Vulnerable species pursuant to the EPBC Act, no Declared Rare Flora pursuant to the WC Act, no Priority Flora species or any locally significant species were located during the field site survey.

5.5.3 Introduced Flora

There were 18 species of introduced flora identified during the survey, they are listed below with their ratings and criteria according to the Environmental Weed Strategy for Western Australia (CALM 1999) (refer to Appendix C for the ranking criteria).

Table 1: Weed species identified during the field survey

Taxon	Common Name	Criteria			
		Rating	Invasiveness	Distribution	Impacts
<i>*Bromus diandrus</i>	Great Brome	High	Yes	Yes	Yes
<i>*Ehrharta calycina</i>	Veld Grass or Perennial Veld Grass	High	Yes	Yes	Yes
<i>*Euphorbia terracina</i>	Geraldton Carnation Weed	High	Yes	Yes	Yes
<i>*Lagurus ovatus</i>	Hares Tail Grass	High	Yes	Yes	Yes
<i>*Lupinus cosentinii</i>	Sandplain Lupin	High	Yes	Yes	Yes
<i>*Pelargonium capitatum</i>	Rose Pelargonium	High	Yes	Yes	Yes
<i>*Romulea rosea</i>	Guildford Grass	High	Yes	Yes	Yes
<i>*Arctotheca calendula</i>	Cape Weed	Moderate	Yes	Yes	-
<i>*Avena barbata</i>	Bearded Oat	Moderate	Yes	Yes	-
<i>*Carpobrotus edulis</i>	Hottentot Fig	Moderate	Yes	Yes	-
<i>*Lolium rigidum</i>	Annual Rye Grass	Moderate	Yes	Yes	-
<i>*Pinus pinaster</i>	Pinaster Pine	Moderate	Yes	Yes	-
<i>*Trifolium campestre</i>	Hop Clover	Moderate	Yes	Yes	-
<i>*Ursinia anthemoides</i>	Ursinia	Moderate	Yes	Yes	-
<i>*Lupinus angustifolius</i>	Narrowleaf Lupin	Mild	Yes	-	-
<i>*Phytolacca octandra</i>	Ink Weed	Mild	Yes	-	-
<i>*Raphanus raphanistrum</i>	Wild Radish	Mild	Yes	-	-
<i>*Lupinus luteus</i>	Yellow Lupin	Low	-	-	-

No Declared Plant species under the *Agriculture and Related Resources Protection Act 1976* were found during the site survey.

5.5.4 Vegetation

The site consisted of one main vegetation unit at the time of the flora and vegetation survey:

Vegetation Unit 1 Open Woodland of *Eucalyptus gomphocephala*, *Eucalyptus marginata* and **Pinus pinaster* over *Acacia saligna*, *Jacksonia furcellata* and *Xanthorrhoea preissii* over weeds.

However, as shown in Figure 7, clear felling of the site by the Forest Products Commission has resulted in the site containing only vegetation which is Degraded to Completely Degraded.

5.5.5 Floristic Community Types

Of the 11 Floristic Community Types identified in the Karrakatta – Central and South Complex, the following are relevant to the subject site:

- SCP21a – Central *Banksia attenuata* – *Eucalyptus marginata* woodlands; and
- SCP28 – Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus* woodlands

No further analysis of the site's floristic data against FCTs SCP21a and SCP28 was conducted due to the degraded nature of the site. SCP21a and SCP28 are well reserved and are at 'low risk' and therefore no TECs or PECs were present in the subject site even prior to the site being cleared.

5.5.6 Vegetation Condition

The area of natural remnant vegetation onsite was considered to range from Completely Degraded to Degraded condition on the Bush Forever condition scale. Refer to Figure 7 for mapped area and Appendix F for Bush Forever condition scales.

The site is in a degraded state due to a variety of factors, including land clearing, rubbish dumping, pine plantation logging and weed infiltration.

6 FAUNA

6.1 PROTECTION OF FAUNA AND FAUNA HABITAT

Fauna species, their habitat, and fauna ecological communities are protected formally and informally by various legislative and non-legislative measures, which are outlined below. Species listed under these acts and non-legislative measures are considered 'conservation significant' in this assessment.

Legislative Protection

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Wildlife Conservation Act 1950* (WC Act); and
- *Environmental Protection Act 1986* (EP Act).

Non-Legislative Protection

- DEC Priority lists; and
- Informal recognition of fauna species of interest.

A short description of these legislative and non-legislative measures is given below, and definitions of the species conservation codes and ecological community categories they use, and those used by the DEC, are provided in Appendix B.

Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act aims to protect matters of national environmental significance, which are detailed in Appendix B. Under the EPBC Act, the Commonwealth Department of Environment, Water, Heritage and the Arts (DEWHA) lists protected species and Threatened Ecological Communities (TEC's) (DEWHA 2009a) by criteria set out in the act (Commonwealth of Australia 2007). Species are considered to be conservation significant if they are listed as Threatened (ie, Vulnerable, Endangered etc), or Migratory.

Migratory bird species protected as Migratory under the EPBC act include those listed under international migratory bird agreements relating to the protection of birds which migrate between Australia and other countries, for which Australia has agreed. This includes the: Japan-Australia Migratory Bird Agreement (JAMBA); China-Australia Migratory Bird Agreement (CAMBA); Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA); and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Some marine fauna species or terrestrial fauna species that use marine habitats are listed as Marine under the EPBC Act. These species are only considered conservation significant when a proposed development occurs in a Commonwealth marine area (i.e. any Commonwealth Waters or Commonwealth Marine Protected Area). Outside of such areas the *EPBC Act* does not consider these species to be matters of national environmental significance, so are not protected under the act. As such species only listed as Marine under the *EPBC Act* have not been considered to be conservation significant in this assessment.

Wildlife Conservation Act 1950

The DEC lists taxa under the provisions of the WC Act as protected and are classified as Schedule 1 to Schedule 4 according to their need for protection (see Appendix B). The *Wildlife Conservation Act 1950* makes it an offence to 'take' threatened species without an appropriate licence. There are financial penalties for contravening the WC Act.

Environmental Protection Act 1986

Significant habitat necessary for the maintenance of indigenous fauna species to Western Australia as well as TEC's are given special consideration in environmental impact assessment, and areas covered by TEC's have special status as Environmentally Sensitive Areas (ESA's) under the *EP Act*, and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

The protection of 'significant habitats' in terms of such indigenous Fauna species to Western Australia and TEC's is a 'clearing principle' for assessing applications for permits to clear native vegetation, where exemptions for a clearing permit under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply. There are substantial penalties for unlawfully damaging ESA's.

DEC Priority Lists

The DEC produces a list of Priority species that have not been assigned statutory protection under the *WC Act*. Priority Fauna are under consideration as 'Scheduled' fauna, but are in urgent need for further survey or require regular monitoring, and although not currently threatened may become so in the future. Appendix B provides definitions of Priority codes.

In addition, the DEC maintains a list of Priority Ecological Communities which identifies those communities that need further investigation before possible nomination for TEC status.

Although DEC Priority species and communities have no formal legal protection, they are under consideration as 'Scheduled' taxa under the *WC Act* or as ESA's under the *EP Act*. Sensitivities to impact on Priority species or communities can therefore be expected to be heightened.

Informal Recognition of Threatened Fauna

Certain populations or communities may be of local significance or interest because of their patterns of distribution and abundance. For example, fauna may be locally significant because they are range extensions to the previously known distribution or are newly discovered taxa (and therefore have the potential to be listed as threatened in the future). In addition, many species are in decline as a result of threatening processes, and relict populations of such species may assume local importance.

6.2 DESKTOP SEARCH

A search of the EPBC Act Protected Matters Search Tool (2010) identified a total of 20 terrestrial species of conservation significance potentially occurring within 10km of the site. Of these the following species of conservation significance have the potential to occur on the subject site:

- *Calyptorhynchus banksii naso* (Forest Red-tailed Black-Cockatoo) - Vulnerable - Species or species habitat may occur within area;
- *Calyptorhynchus baudinii* (Baudin's Black-Cockatoo, Long-billed Black-Cockatoo) – Vulnerable - Species or species habitat likely to occur within area;
- *Calyptorhynchus latirostris* (Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo) – Endangered - Breeding likely to occur within area;
- *Synemon gratiosa* (Graceful Sun Moth) - Endangered - Species or species habitat may occur within area;
- *Bettongia penicillata ogilbyi* (Woylie) - Endangered - Species or species habitat known to occur within area;
- *Dasyurus geoffroii* (Chuditch, Western Quoll) - Vulnerable - Species or species habitat likely to occur within area;
- *Phascogale calura* (Red-tailed Phascogale) - Endangered - Species or species habitat may occur within area; and
- *Setonix brachyurus* (Quokka) – Vulnerable - Species or species habitat may occur within area.

6.3 FIELD SURVEY

No fauna surveys have been completed on the site however a Black Cockatoo Site assessment was completed on the 6th of October 2010, and involved a site reconnaissance to assess the foraging and breeding potential for Black Cockatoos.

Only the areas of native remnant vegetation were surveyed during the Black Cockatoo assessment.

6.3.1 Black Cockatoo Species

Population

During the survey, foraging evidence of the Forest Red-tailed Black Cockatoo was also recorded and was considered to be recent.

Habitat

At the time, the site consisted of an overstorey of Jarrah and Pine trees which is known habitat for Black Cockatoos with no midstorey and an understorey of introduced grasses. The majority of the site (pine plantation) has previously been cleared and no remnant vegetation is present, hence no assessment can be made of these areas.

Within the limited areas of remnant vegetation onsite there were potential foraging resources identified, such as *Eucalyptus marginata* (Jarrah). However, only four Jarrah trees were identified across the entire site. Majority of the remaining remnant vegetation onsite was considered to be in Degraded condition due to weed invasion, rubbish dumping and cleared tracks.

During the survey four future breeding habitat trees (which had a diameter at breast height of greater than 50 cm) were identified, however this is below the DEC guideline of three or more mature breeding trees per 0.5 ha and hence the site is not considered as likely to be a preferred site for future breeding.

The Forest Products Commission has felled and removed the pine plantation and a post-harvest burn was undertaken, therefore it is unlikely that any significant Black Cockatoo habitat will remain onsite.

6.3.2 Graceful Sun Moth

No Graceful Sun Moth or *Lomandra* surveys have been completed on this site.

The Flora and Vegetation Assessment completed in 2009 (ENV) did not identify any *Lomandra* species onsite and hence there is very limited chance of Graceful Sun Moth species occurring onsite.

6.3.3 Woylie, Red-tailed Phascogale, Chuditch and Quokka

No fauna assessment has been completed onsite.

Due to ENV's extensive experience with fauna surveys in the Perth Metropolitan Region and the degraded nature of the site, it is considered extremely unlikely that the Woylie (*Bettongia penicillata ogilbyi*), Red-tailed Phascogale (*Phascogale calura*), Chuditch

(*Dasyurus geoffroii*) and/or Quokka (*Setonix brachyurus*) will be located on the subject site.

7 KEY OPPORTUNITIES AND CONSTRAINTS

7.1 CULTURAL HERITAGE

There are no listed Aboriginal Heritage or European Heritage sites within the site.

7.2 LAND USE

The previous land use was a Pine Plantation, which has recently been felled. Surrounding land is currently being utilised for urban development. Hence the proposed development of the site will not be constrained by previous or surrounding land uses.

7.3 GEOMORPHOLOGY, GEOLOGY AND SOILS

The geology of the site (S7 – Sand) is characterised by a low corrosion potential, low-medium slope stability, high ease of excavation and a low-medium bearing capacity; characteristics that will not constrain development of the site.

7.3.1 Acid Sulfate Soils

The DEC map the site as having “No Known Risk of ASS occurring within 3m of the natural soil surface (or deeper).” There is a limited potential for ASS disturbance along the low lying western boundary of the site however this can be effectively characterised and managed. Hence posing no constraints on the development of the site.

7.4 HYDROLOGY

7.4.1 Surface Waters

There are no permanent or ephemeral water bodies, or existing drainage lines onsite and a low potential for flooding due to relatively dry climatic conditions and highly permeable soils.

7.4.2 Groundwater

Groundwater levels are greater than 1.2 mBGL across most of the site meaning fill will not be required site to manage groundwater levels at the site, except possibly in isolated areas around public open space and other low points. Subsoil drainage is not considered necessary to manage groundwater levels at the site.

7.5 FLORA AND VEGETATION

7.5.1 Protected Flora

No Endangered or Vulnerable species pursuant of the EPBC Act , no Declared Rare Flora pursuant to the WC Act, no Priority Flora species or any locally significant species were located during the field site survey. ENV considers is unlikely that any flora species of significance are present within the site due to the degraded condition of the site and as the field survey was conducted at the appropriate time of the year (in spring when most taxa are identifiable) and none were recorded.

7.5.2 Introduced Flora

During the site survey 18 species of introduced flora species were identified, none were Declared Plant species by the Agriculture and Related Resources Act. If areas of native remnant vegetation are to be retained in the proposed development a weed management strategy should be implemented to target the weed species identified and prevent their spread.

7.5.3 Vegetation

Vegetation Complex and Condition

The site is mapped as the Karrakatta Complex – Central and South, which on the Swan Coastal Plain is estimated to have 29.5% of its pre-European extent. This complex remains above the 10% pre-European native retention extent threshold set by the EPA for constrained areas.

The native remnant vegetation on site is considered to be in Completely Degraded to Degraded condition due to weed invasion, rubbish dumping, public access, land use as a pine plantation, and recent clear-felling.

Therefore vegetation retention is not a critical issue on site.

Floristic Community Types

The site has the potential to contain 2 FCTs; SCP21a – Central *Banksia attenuata* – *Eucalyptus marginata* woodlands, and SCP28 – Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus* woodlands. However, due to the degraded nature of the site ENV is unable to determine which FCT is more likely to be present.

Both FCTs are well reserved and are at ‘low risk’ of being cleared to critical levels, hence will not pose a constraint to development of the site.

7.6 FAUNA

7.6.1 Protected Fauna

There has been no fauna assessment (with the exception of a Black Cockatoo assessment) completed for the site, however due to the lack of vegetation and site degradation it is considered highly unlikely that any species of conservation significance will be affected by the proposed development.

7.6.2 Habitat

The Forest Products Commission has utilised the site for a Pine Plantation, with limited areas of remnant vegetation remaining. In 2010 the pine plantation was felled and a post-harvest undertaken, along with further clearing activities.

Although the vegetation remaining consists of a sparse overstorey of Jarrah and Pine trees (known habitat for Black Cockatoos), no midstorey exists and the understorey is comprised of introduced grasses. The vegetation condition onsite ranges from Degraded to Completed Degraded.

Due to the degradation onsite, clearing activities and lack of native remnant vegetation the habitat is considered of low value to any fauna that may have utilised the site.

7.7 NOISE

The potential impacts from construction noise and final road noise from the proposed development is considered to be minimal and not to disturb the surrounding land uses.

8 MANAGEMENT AND CONCLUSIONS

ENV considers it unlikely that the development will be constrained by the environmental conditions of the site due to the degradation of the site and the lack of native remnant vegetation.

Very few environmental factors on the site require management during the development process. The following will be considered through the development of the site:

- Stormwater and groundwater management strategies will be implemented to ensure groundwater quality is managed and nutrient and heavy metal concentrations are reduced; and
- Where trees occur in areas of public open space, and bulk earthworks allow, they will be retained and protected.

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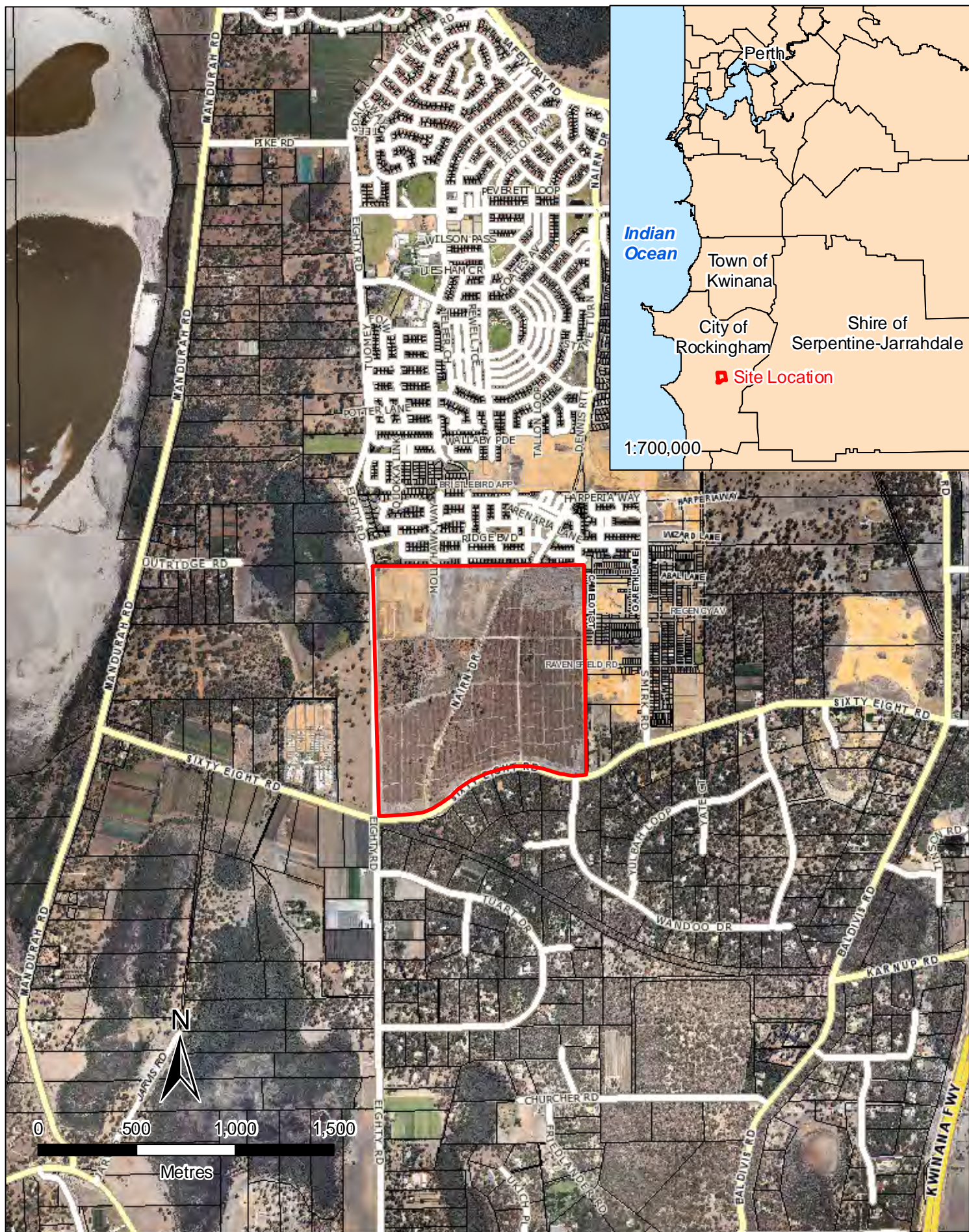
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FIGURES



CLIENT

Rockingham Park Pty Ltd

AUTHOR:

K. Thomson

DRAWN

S. Rho

SCALE

1:25,000 @ A4 GDA 94 MGA 50

JOB NO.

10.229

DATE

30-03-2011

Site Location

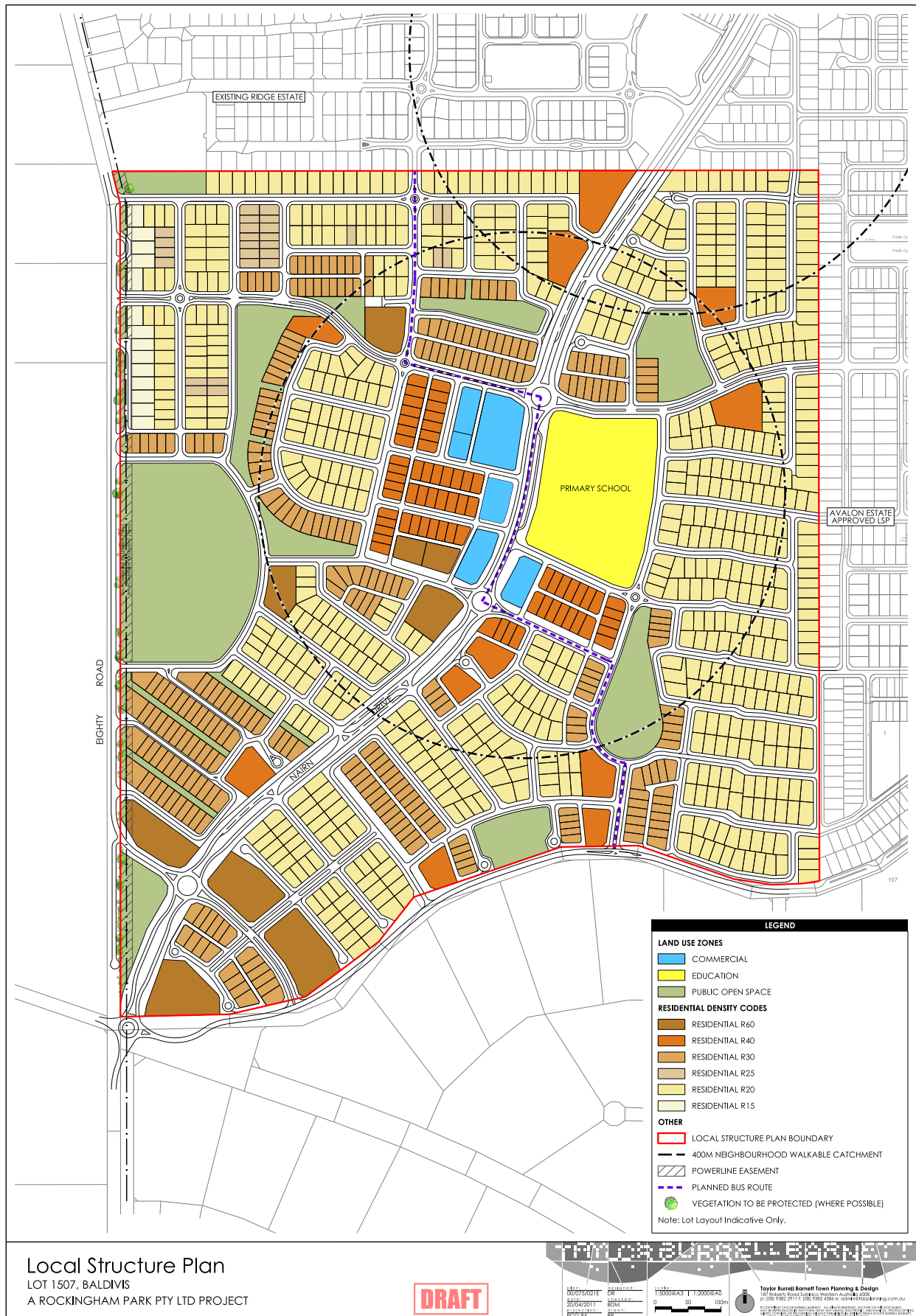
Parkland Heights

Lot 1507 Sixty Eight Road Baldvis

Environmental Assessment

FIGURE 1





CLIENT
 Rockingham Park Pty Ltd

AUTHOR:
 K. Thomson

SCALE
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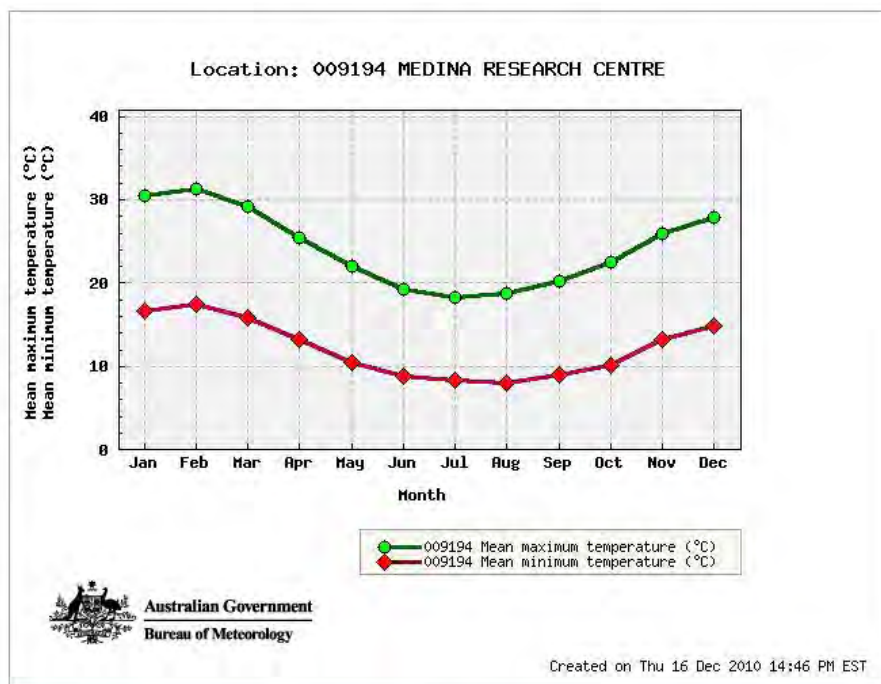
DRAWN
 S. Rho

PROJECTION
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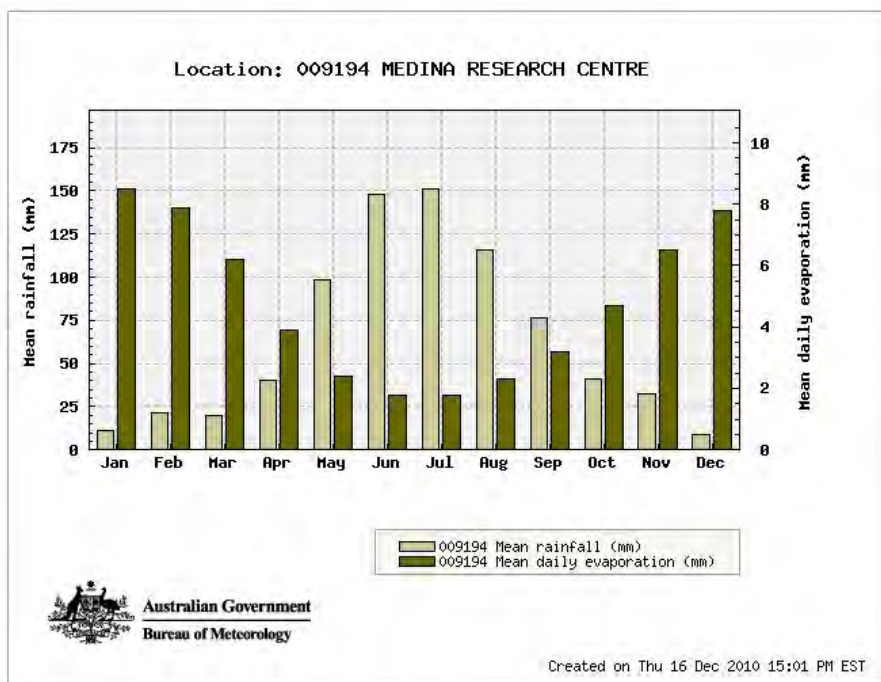
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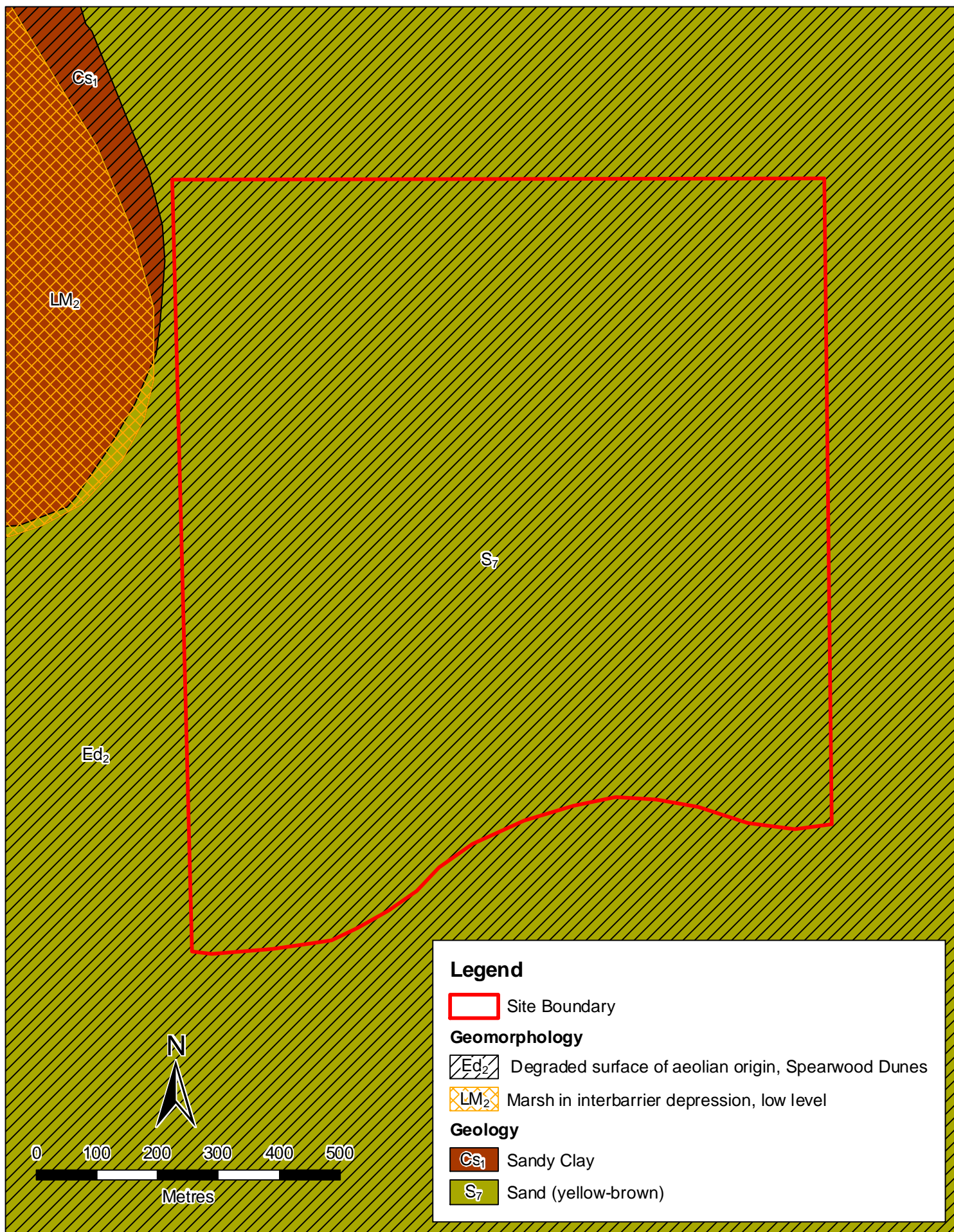
Local Structure Plan
 Parkland Heights
 Lot 1507 Sixty Eight Road Baldvis
 Environmental Assessment



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean maximum temperature (°C) for years 1983 to 2010	30.4	31.3	29.2	25.5	22.0	19.3	18.2	18.7	20.2	22.5	25.9	27.9	24.3	24
Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean minimum temperature (°C) for years 1983 to 2010	16.7	17.4	15.8	13.2	10.5	8.9	8.3	8.0	9.0	10.2	13.3	14.9	12.2	24



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean rainfall (mm) for years 1983 to 2010	11.0	21.1	19.7	40.3	98.1	147.7	151.2	115.6	76.1	41.4	32.4	9.1	770.7	28
Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean daily evaporation (mm) for years 1983 to 2010	8.5	7.9	6.2	3.9	2.4	1.8	1.8	2.3	3.2	4.7	6.5	7.8	4.7	27



CLIENT
Rockingham Park Pty Ltd

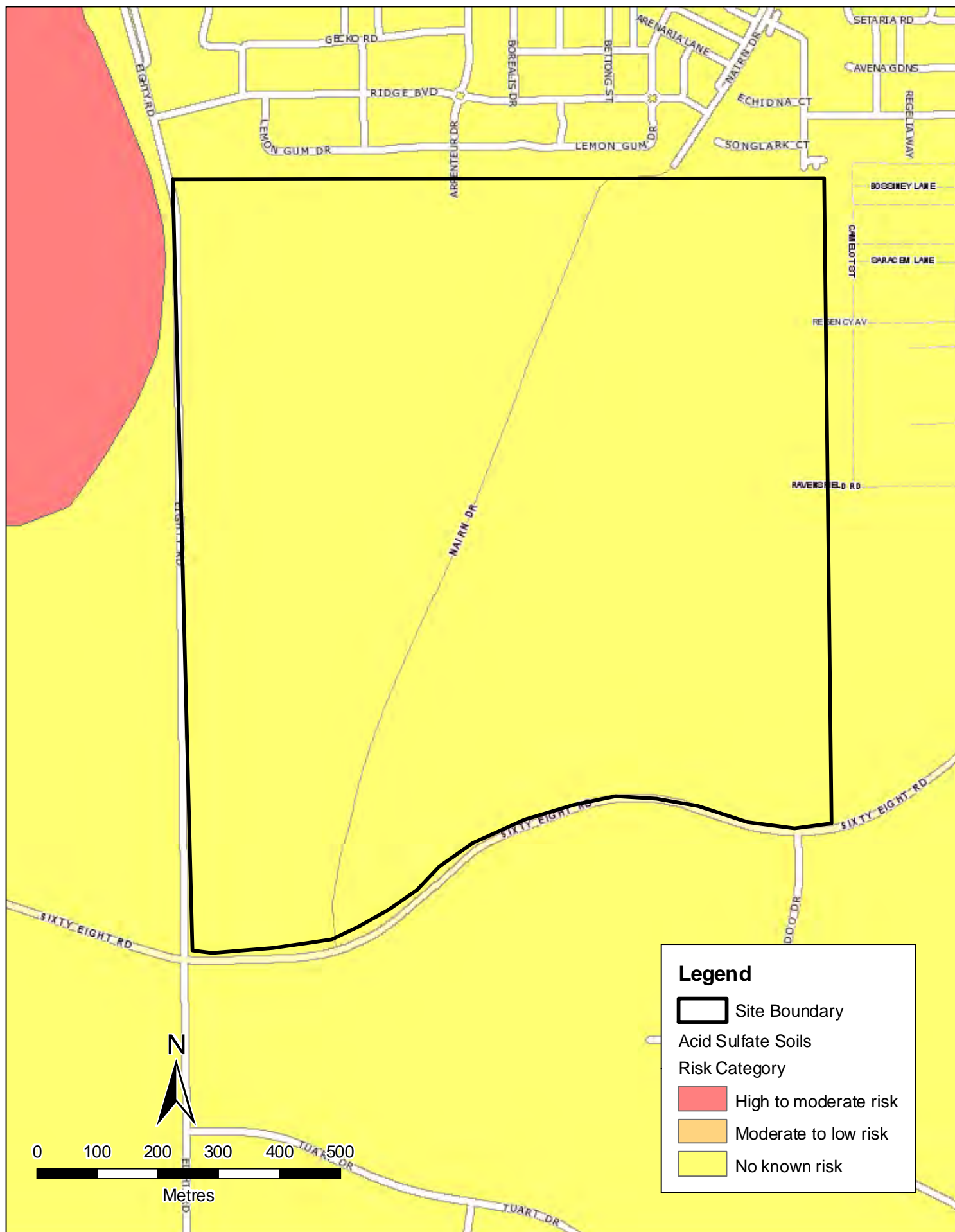
AUTHOR: K. Thomson **DRAWN:** S. Rho

SCALE 1:8,000 @ A4 **PROJECTION** GDA 94 MGA 50

JOB NO. 10.229
DATE 30-03-2011

Geomorphology and Geology
Parkland Heights
Lot 1507 Sixty Eight Road Baldivis
Environmental Assessment

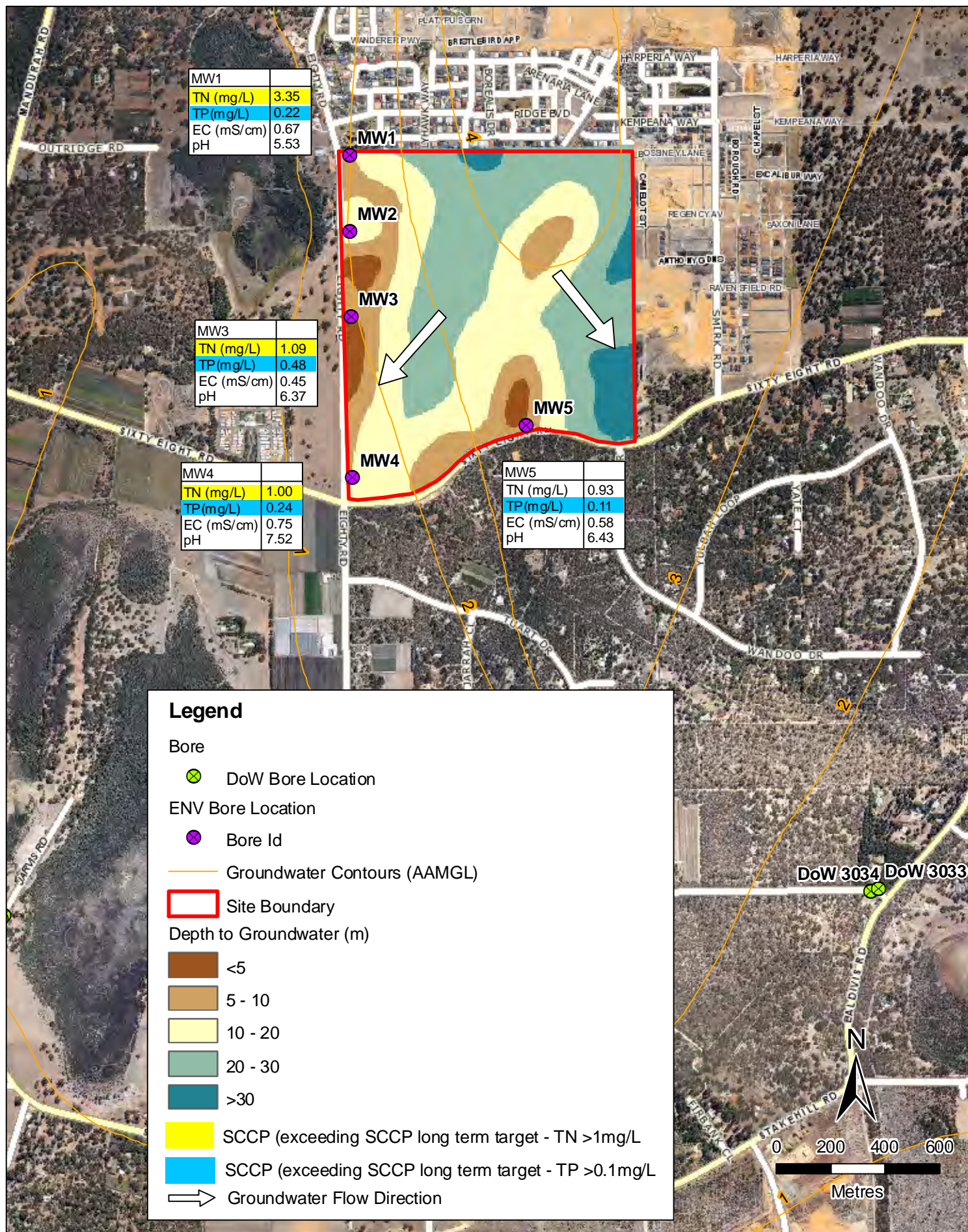
FIGURE 4



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DRAWN: S. Rho
SCALE: 1:8,000 @ A4
PROJECTION: GDA 94 MGA 50

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 10.229
DATE
 30-03-2011

Acid Sulfate Soils
 Parkland Heights
 Lot 1507 Sixty Eight Road Baldvis
 Environmental Assessment



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Rockingham Park Pty Ltd

AUTHOR: K. Thomson
DRAWN: S. Rho

SCALE 1:18,000@ A4
PROJECTION GDA 94 MGA 50

JOB NO. 10.229
DATE 30-03-2011

Groundwater
Parkland Heights
Lot 1507 Sixty Eight Road Baldivis
Environmental Assessment

FIGURE 6



CLIENT
Rockingham Park Pty Ltd

AUTHOR: K. Thomson **DRAWN:** S. Rho

SCALE 1:8,000 @ A4 **PROJECTION** GDA 94 MGA 50

JOB NO. 10.229
DATE 30-03-2011

Vegetation Condition

Parkland Heights
Lot 1507 Sixty Eight Road Baldviss
Environmental Assessment

FIGURE 7

APPENDIX A

DEFINITIONS OF DECLARED RARE / PRIORITY / THREATENED FLORA AND THREATENED / PRIORITY ECOLOGICAL COMMUNITIES

APPENDIX A

DEFINITIONS OF DECLARED RARE / PRIORITY / THREATENED FLORA AND THREATENED / PRIORITY ECOLOGICAL COMMUNITIES

A1: Categories of Declared Rare and Priority Flora

Conservation Code	Category
X	Declared Rare Flora - Presumed Extinct Taxa Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
R	Declared Rare Flora - Extant Taxa “Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such”
P1	Priority One - Poorly Known Taxa “Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as ‘rare flora’, but urgently need further survey.”
P2	Priority Two - Poorly Known Taxa “Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as ‘rare flora’, but urgently need further survey.”
P3	Priority Three - Poorly Known Taxa “Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as ‘rare flora’ but need further survey.”
P4	Priority Four - Rare Taxa “Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.”

Source: Department of Environment and Conservation (2009). *Western Australian Flora Conservation Codes*. Department of Environment and Conservation, Perth, Western Australia. Online: <http://florabase.calm.wa.gov.au>.

A2: Categories of Threatened Flora Species

Category Code	Category
Ex	Extinct Taxa which at a particular time if, at the time, there is no reasonable doubt that the last member of the species has died.
ExW	Extinct in the Wild Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered Taxa which at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	Endangered Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
V	Vulnerable Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	Conservation Dependent Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Source: *Environment Protection and Biodiversity Conservation Act 1999*

A3: Definitions of Threatened Ecological Communities

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B);

- A) Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats **or**
- B) All occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria (A, B or C):

- A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and **either or both** of the following apply (i or ii)
 - i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 5 years)
 - ii) modification throughout its range is continuing such that in the immediate future (within approximately 5 years) the community is unlikely to be capable of being substantially rehabilitated.
- B) Current distribution is limited, and **one or more** of the following apply (i, ii or iii):
 - i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 5 years)
 - ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
 - iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes
- C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the immediate future (within approximately 5 years)

Endangered (EN)

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will

be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria (A, B or C):

- A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and **either or both** of the following apply (i or ii)
 - i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years)
 - ii) modification throughout its range is continuing such that in the short term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated.
- B) Current distribution is limited, and **one or more** of the following apply (i, ii or iii):
 - i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years)
 - ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
 - iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes
- C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the short term future (within approximately 10 years).

Vulnerable (VU)

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria (A, B or C):

- A) The ecological community exists largely as modified occurrences which are likely to be capable of being substantially restored or rehabilitated.
- B) The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
- C) The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Source: Department of Environment and Conservation (2009). *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*. Department of Environment and Conservation, Perth, Western Australia. Online: www.naturebase.net/

A4: Definitions of Priority Ecological Communities

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly known ecological communities Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly known ecological communities. Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.

Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

- (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or;
- (ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;
- (iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.

- (a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.
- (b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
- (c) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Source: Department of Environment and Conservation (2009). *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*. Department of Environment and Conservation, Perth, Western Australia. Online: www.naturebase.net/

APPENDIX B

DEFINITIONS OF CONSERVATION CODES FOR FAUNA OF CONSERVATION SIGNIFICANCE

APPENDIX B

DEFINITIONS OF CONSERVATION CODES FOR FAUNA OF CONSERVATION SIGNIFICANCE

B1: Environment Protection and Biodiversity Conservation Act 1999 (Cth): Threatened Species and Threatened Ecological Communities Codes

The *EPBC Act* prescribes seven matters of national environmental significance:-

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance;
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

Species in the categories ExW, CE, E, V and M (see below), and Threatened Ecological Communities in the CE and E categories are protected as matters of national environmental significance under the *EPBC Act*.

Category	Code	Category
Extinct	Ex	Taxa for which there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	ExW	Taxa known to survive only in cultivation, in captivity or as a naturalised population well outside its past range; or not recorded in its known and/or expected habitat at appropriate seasons anywhere in its past range despite exhaustive surveys over a timeframe appropriate to its life cycle and form.
Critically Endangered	CE	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	E	Taxa not critically endangered and facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Vulnerable	V	Taxa not critically endangered or endangered and facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	CD	Taxa which are the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within five years.

Category	Code	Category
Migratory	Mi	<p>Taxa that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations, that are included in an international agreement approved by the Minister for the Environment, Heritage and the Arts and that have been placed on the national List of Migratory Species under the provisions of the EPBC Act. At present there are four such agreements:</p> <ul style="list-style-type: none"> the Bonn Convention the China-Australia Migratory Bird Agreement (CAMBA) the Japan-Australia Migratory Bird Agreement (JAMBA) the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)
Marine	Ma	<p>Taxa protected in a Commonwealth Marine Protected Area by virtue of section 248 of the <i>EPBC Act</i>. These taxa include certain seals, crocodiles, turtles and birds, as well as various marine fish.</p> <p>Commonwealth marine areas are matters of national environmental significance under the <i>EPBC Act</i>.</p> <p>An action will require approval if the:</p> <ul style="list-style-type: none"> action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant impact on the environment, or action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant impact on the environment in a Commonwealth marine area¹ <p>The Commonwealth marine area is any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone and/or over the continental shelf of Australia, that is not State or Northern Territory waters.</p> <p>The Commonwealth marine area stretches from 3 to 200 nautical miles (approximately 5-370 km) from the coast. Marine protected areas are marine areas which are recognised to have high conservation value.</p>

B2: Western Australian Threatened Fauna Categories

Wildlife Conservation Act 1950 (WA)

Category	Code	Description
Schedule 1	S1	Rare or likely to become extinct.
Schedule 2	S2	Presumed extinct.
Schedule 3	S3	Birds subject to an agreement between the governments of Australia and Japan, the People's Republic of China & the Republic of Korea relating to the protection of migratory birds and birds in danger of extinction.
Schedule 4	S4	Other specially protected fauna.

B3: Department of Environment and Conservation Fauna Priority Codes

Category	Code	Description
Priority 1	P1	Taxa with few, poorly known populations on threatened lands.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4	P4	Taxa in need of monitoring: not currently threatened or in need of special protection, but could become so. Usually represented on conservation lands.
Priority 5	P5	Taxa in need of monitoring: not considered threatened, but the subject of a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

APPENDIX C

ENVIRONMENTAL WEEDS AND DECLARED PLANT CATEGORIES

APPENDIX C

ENVIRONMENTAL WEEDS AND DECLARED PLANT CATEGORIES

C1: Criteria used for Ranking Environmental Weeds

The Environmental Weed Strategy for Western Australia (CALM 1999) contains criteria for the assessment and ranking of weeds in terms of their environmental impact on biodiversity. These criteria are as follows:

- **Invasiveness** – ability to invade bushland in good to excellent condition or ability to invade waterways. (Score as yes or no).
- **Distribution** – wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world. (Score as yes or no).
- **Environmental Impacts** – ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community. (Score as yes or no).

The rating of each weed is determined by the following scoring system:

- **High** - a weed species would have to score yes for all three criteria. Rating a weed species as high would indicate prioritising this weed for control and/or research i.e. prioritising funding to it.
- **Moderate** - a weed species would have to score yes for two of the above criteria. Rating a weed species as moderate would indicate that control or research effort should be directed to it if funds are available, however it should be monitored (possibly a reasonably high level of monitoring).
- **Mild** – a weed species scoring one of the criteria. A mild rating would indicate monitoring of the weed and control where appropriate.
- **Low** – a weed species would score none of the criteria. A low ranking would mean that this species would require a low level of monitoring.

Source: Department of Conservation and Land Management (1999). *Environmental Weed Strategy for Western Australia*. Department of Conservation and Land Management, Perth, Western Australia.

C2: Standard Meanings of Declared Plant Categories

P1

Prohibits movement.

The movement of plants or their seeds is prohibited within the State.

This prohibits the movement of contaminated machinery and produce including livestock and fodder.

P2

Aim is to eradicate infestation.

Treat all plants to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.

P3

Aims to control infestation by reducing area and/or density of infestation.

The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.

Treat to destroy and prevent seed set all plants:

- * Within 50m inside of the boundaries of the infestation;
- * within 50m of roads and high water mark on waterways;
- * within 50m of sheds, stock yards and houses.

Treatment must be done prior to seed set each year.

Properties with less than 20ha of infestation must treat the entire infestation.

Additional areas may be ordered to be treated.

P4

Aims to prevent infestation spreading beyond existing boundaries of infestation

The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.

Treat to destroy and prevent seed set all plants:

- * within 50m inside of the boundaries of the infested property for one-leaf and 20m for two-leaf;
- * within 50m of roads and high water mark on waterways;
- * within 50m of sheds, stock yards and houses.

Treatment must be done prior to seed set each year. Properties with less than 20ha of infestation must treat the entire infestation.

Additional areas may be ordered to be treated.

Special considerations.

In the case of P4 infestations where they continue across property boundaries there is no requirement to treat the relevant part of the property boundaries as long as the boundaries of the infestation as a whole are treated. There must be agreement between neighbours in relation to the treatment of these areas.

P5

Aims to control infestations on public lands.

Source: Department of Agriculture and Food (2008). *List of Declared Plants*. Department of Agriculture and Food, Western Australia. Online: <http://www.agric.wa.gov.au/>.

APPENDIX D

DEPARTMENT OF ENVIRONMENT AND CONSERVATION DATABASE SEARCH RESULTS

APPENDIX D

DEPARTMENT OF ENVIRONMENT AND CONSERVATION DATABASE SEARCH
RESULTS

D1: Declared Rare and Priority Flora

FAMILY	TAXA	Conservation Status Code	
		STATE	FEDERAL
MIMOSACEAE	<i>Acacia benthamii</i>	2	Not Listed
PAPILIONACEAE	<i>Aotus cordifolia</i>	2	Not Listed
APONOGETONACEAE	<i>Aponogeton hexatepalus</i>	4	Not Listed
EUPHORBIACEAE	<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	3	Not Listed
RUTACEAE	<i>Boronia juncea</i> subsp. <i>juncea</i>	1	Not Listed
ORCHIDACEAE	<i>Caladenia huegelii</i>	R	Endangered
CYPERACEAE	<i>Cyathochaeta teretifolia</i>	3	Not Listed
PAPILIONACEAE	<i>Dillwynia dillwynioides</i>	3	Not Listed
ORCHIDACEAE	<i>Diuris micrantha</i>	R	Vulnerable
SAPINDACEAE	<i>Dodonaea hackettiana</i>	4	Not Listed
GOODENIACEAE	<i>Goodenia filiformis</i>	3	Not Listed
PAPILIONACEAE	<i>Jacksonia sericea</i>	4	Not Listed
CYPERACEAE	<i>Schoenus capillifolius</i>	3	Not Listed
STYLIDIACEAE	<i>Stylidium ireneae</i>	4	Not Listed
STYLIDIACEAE	<i>Stylidium longitubum</i>	3	Not Listed

D2: Threatened and Priority Ecological Communities

- SCP19a** Sedgeland in Holocene dune swales of the southern Swan Coastal Plain (listed as a Critically Endangered Threatened Ecological Community under State and Federal legislation);
- SCP19b** Woodlands over sedgeland in Holocene dune swales of the southern Swan Coastal Plain (listed as a Critically Endangered Threatened Ecological Community under State and Federal legislation);
- SCP21c** Low lying *Banksia attenuata* woodlands or shrublands (listed as a Priority 3 Ecological Community under State legislation);
- SCP24** Northern Spearwood shrublands and woodlands (listed as a Priority 3 Ecological Community under State legislation); and
- SCP25** Southern *Eucalyptus gomphocephala*-*Agonis flexuosa* woodlands (listed as a Priority 3 Ecological Community under State legislation).

APPENDIX E

FLORA SPECIES LIST

APPENDIX E

FLORA SPECIES LIST

* denotes foreign introduced species

? indicates that this taxa is likely, however, insufficient taxonomic features were present for full and definitive identification. The question mark is placed before the item which is uncertain.

Abbreviations:

- sp.: species (singular)
- var.: variety
- spp.: species (plural)
- ms: manuscript name (unpublished)
- subsp.: subspecies

FAMILY	TAXA		CONS. CODE
ZAMIACEAE	<i>Macrozamia</i>	<i>riedlei</i>	
PINACEAE	* <i>Pinus</i>	<i>pinaster</i>	
POACEAE	* <i>Avena</i>	<i>barbata</i>	
	* <i>Ehrharta</i>	<i>calycina</i>	
	* <i>Bromus</i>	<i>diandrus</i>	
	* <i>Lagurus</i>	<i>ovatus</i>	
	* <i>Lolium</i>	<i>rigidum</i>	
CYPERACEAE	<i>Gahnia</i>	<i>trifida</i>	
ANARTHRIACEAE	<i>Lyginia</i>	<i>imberbis</i>	
XANTHORRHOEACEAE	<i>Xanthorrhoea</i>	<i>preissii</i>	
HAEMODORACEAE	<i>Conostylis</i>	<i>aculeata</i> subsp. <i>aculeata</i>	
	<i>Phlebocarya</i>	<i>ciliata</i>	
IRIDACEAE	* <i>Romulea</i>	<i>rosea</i>	
CASUARINACEAE	<i>Allocasuarina</i>	<i>fraseriana</i>	
PROTEACEAE	<i>Banksia</i>	<i>attenuata</i>	
	<i>Banksia</i>	<i>grandis</i>	
	<i>Grevillea</i>	<i>vestita</i> subsp. <i>vestita</i>	
AMARANTHACEAE	<i>Ptilotus</i>	<i>polystachyus</i>	
PHYTOLACCACEAE	* <i>Phytolacca</i>	<i>octandra</i>	
AIZOACEAE	* <i>Carpobrotus</i>	<i>edulis</i>	
MOLLUGINACEAE	<i>Macarthuria</i>	<i>australis</i>	
BRASSICACEAE	* <i>Raphanus</i>	<i>raphanistrum</i>	
MIMOSACEAE	<i>Acacia</i>	<i>pulchella</i>	
	<i>Acacia</i>	<i>saligna</i>	
PAPILIONACEAE	<i>Daviesia</i>	<i>divaricata</i> subsp. <i>divaricata</i>	
	<i>Hardenbergia</i>	<i>comptoniana</i>	
	<i>Jacksonia</i>	<i>furcellata</i>	
	* <i>Lupinus</i>	<i>angustifolius</i>	
	* <i>Lupinus</i>	<i>cosentinii</i>	
	* <i>Lupinus</i>	<i>luteus</i>	
	* <i>Trifolium</i>	<i>campestre</i>	
GERANIACEAE	* <i>Pelargonium</i>	<i>capitatum</i>	
EUPHORBIACEAE	* <i>Euphorbia</i>	<i>terracina</i>	
VIOLACEAE	<i>Hybanthus</i>	<i>calycinus</i>	
MYRTACEAE	<i>Eucalyptus</i>	<i>gomphocephala</i>	
	<i>Eucalyptus</i>	<i>marginata</i>	
ASTERACEAE	* <i>Arctotheca</i>	<i>calendula</i>	
	<i>Olearia</i>	<i>axillaris</i>	
	<i>Senecio</i>	<i>condylus</i>	
	* <i>Ursinia</i>	<i>anthemoides</i>	

APPENDIX F

BUSH FOREVER CONDITION SCALE

APPENDIX F

BUSH FOREVER CONDITION SCALE

Condition Scale Code	Condition Scale
P	Pristine (1) Pristine or nearly so, no obvious signs of disturbance
E	Excellent (2) Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
VG	Very Good (3) 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 (4) Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
D	Degraded (5) 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 (6) 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 comprising weed or crop species with isolated native trees or shrubs.

Source: Government of Western Australia (2000). *Bush Forever Volume 2: Directory of Bush Forever Sites*. Department of Environmental Protection, Perth, Western Australia.