

**City of Wanneroo Town Planning Scheme  
No. 1, Amendment 787 - Primarily to Rezone  
the Yanchep/Two Rocks area from "Rural" &  
"Residential Development" to "Urban  
Development Zone", "Centre Zone" and  
"Industrial Development Zone"**

---

**City of Wanneroo**

**Report and recommendations  
of the Environmental Protection Authority**

**Environmental Protection Authority  
Perth, Western Australia  
Bulletin 959  
November 1999**

ISBN. 0 7309 8167 3  
ISSN. 1030 - 0120  
Assessment No.1136

**OFFICER: Cilla de Lacy**

**RELEASED DATE:  
12 November 1999**

**APPEALS DATE ENDS:  
26 November 1999**

## Summary and recommendations

The City of Wanneroo proposes to rezone the Yanchep/Two Rocks area to “Urban Development Zone”, “Centre Zone” and “Industrial Development Zone” from the current Town Planning Scheme (TPS) No. 1 zonings of primarily “Central City Area”, “Rural”, “Service Station”, “Special Zone (Additional Use) Video Hire” and “Residential Development”. This report provides the Environmental Protection Authority’s (EPA’s) advice and recommendations to the Minister for the Environment.

Section 48D of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposed scheme amendment and on the conditions and procedures to which the scheme amendment should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

### Relevant environmental factors

Although a number of environmental factors were considered by the EPA in the assessment, it is the EPA’s view that the following are the environmental factors relevant to the proposed Scheme Amendment which require detailed evaluation in the report:

- a) vegetation - potential for direct impacts on locally significant vegetation within the Amendment area including habitat loss, and potential indirect impacts on adjacent areas of regionally significant vegetation identified in draft *Perth’s Bushplan* (Government of Western Australia, 1998);
- b) stygofauna and troglobitic fauna - potential for adverse impacts on habitat areas of species of stygofauna and troglobitic fauna;
- c) groundwater quantity - potential for an excessive drawdown of the water table which could impact upon habitat areas of stygofauna and troglobitic fauna, regionally significant vegetation and karstic landforms;
- d) karst - potential for adverse impacts on karstic landforms;
- e) air quality - potential for emissions (noise, dust, odour) from the proposed industrial area to adversely impact upon the amenity of nearby residences;
- f) groundwater quality - potential for adverse impacts on habitat areas of species of stygofauna and troglobitic fauna, regionally significant vegetation, regional water supply and other uses;
- g) solid and liquid waste - potential for waste from proposed industrial area to adversely impact upon groundwater quality;
- h) unexploded ordnance - unexploded ordnance could potentially occur within the Amendment area posing a risk to residents; and
- i) Aboriginal Culture and Heritage - potential for adverse impacts on an archaeological site of Aboriginal significance.

### Conclusion

The EPA has concluded that Amendment 787 to the City of Wanneroo’s Town Planning Scheme No. 1 to rezone the Yanchep/Two Rocks area to “Urban Development Zone”, “Centre Zone” and “Industrial Development Zone” from the current TPS No. 1 zonings of “Central City Area”, “Rural”, “Service Station”, “Special Zone (Additional Use) Video Hire” and “Residential Development” can be implemented to meet the EPA’s objectives provided the conditions recommended in Section 4 and set out in Appendix 3 are imposed and enforced.

## Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the project being assessed is to rezone the Yanchep/Two Rocks area to “Urban Development Zone”, “Centre Zone” and “Industrial Development Zone” from the current Town Planning Scheme (TPS) No. 1 zonings of primarily “Central City Area”, “Rural”, “Service Station”, “Special Zone (Additional Use) Video Hire” and “Residential Development” (Figure 1).
2. That the Minister considers the report on the relevant environmental factors of vegetation, stygofauna and troglobitic fauna, groundwater quantity, karst, air quality, groundwater quality, solid and liquid waste, Unexploded Ordnance, Aboriginal Culture and Heritage as set out in Section 3.
3. That the Minister notes that the EPA has concluded that the EPA’s objectives can be met, provided the recommended conditions set out in Section 4 are incorporated by the Responsible Authority into the scheme and implemented at the appropriate level of planning.
4. That the Minister in consultation with the Minister for Planning imposes the conditions recommended in Appendix 3 of this report.
5. That the Minister notes that where any future development proposal complies with the Plans and raises no additional environmental factors, the development proposal will not normally be subject to further assessment under Part IV of the *Environmental Protection Act 1986*. However, future development proposals will still be subject to the normal development approvals process, including licensing and pollution control environmental conditions of the *Environmental Protection Act 1986* where applicable.
6. That the Minister notes that this amendment does not allow for the development of a marina nor does it give environmental approval for groundwater extraction. Any proposal/s for groundwater abstraction or the development of a marina should be referred to the EPA under Section 38 of the *Environmental Protection Act 1986* prior to approval being granted.

## Conditions

Having considered the information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the scheme amendment is approved. These conditions are presented in Appendix 3. Matters addressed in the conditions include the following:

- a) assessment of vegetation at the District Structure Planning (DSP) stage;
- b) preparation and implementation of a Vegetation and Fauna Management Plan at the Local Structure Planning (LSP) stage;
- c) preparation and implementation of a Drainage, Nutrient and Water Management Plan at the LSP stage;
- d) preparation of a Karst Management Strategy at the LSP stage to identify development constraints;
- e) seeking further advice and undertaking investigations where appropriate to develop a Stygofauna and/or Troglobitic Fauna Management Plan at the LSP stage;
- f) management of emissions (odour, noise, dust);
- g) preparation and implementation of a Solid and Liquid Waste Management Plan;
- h) preparation and implementation of a UXO Remediation Plan;
- i) preparation and implementation of an Aboriginal Culture and Heritage Management Plan; and
- (j) a general environmental review to be undertaken every five years.

# Contents

Page

<b>Summary and recommendations</b> .....	<b>i</b>
<b>1. Introduction</b> .....	<b>1</b>
<b>2. The proposed Scheme Amendment</b> .....	<b>3</b>
<b>3. Environmental factors</b> .....	<b>5</b>
3.1 Relevant Environmental Factors .....	5
3.2 Vegetation.....	5
3.3 Subterranean fauna .....	11
3.4 Groundwater quantity .....	16
3.5 Karst.....	17
3.6 Air quality.....	20
3.7 Groundwater quality.....	21
3.8 Solid and Liquid Waste .....	23
3.9 Unexploded Ordnance.....	24
3.10 Aboriginal Culture and Heritage .....	25
<b>4. Conditions</b> .....	<b>26</b>
4.1 Recommended conditions.....	27
<b>5. Other Advice</b> .....	<b>27</b>
<b>6. Conclusions</b> .....	<b>28</b>
<b>7. Recommendations</b> .....	<b>28</b>
<b>Tables</b>	
1. Summary of scheme amendment characteristics.....	4
<b>Figures</b>	
1. Proposed Scheme Amendment .....	2
2. System Six Areas and Bushplan Sites.....	8
3. Karstic landforms .....	12

## **Appendices**

1. List of submitters
2. References
3. Recommended Environmental Conditions
4. Summary of submissions and Responsible Authority's response to submissions
5. Identification of Relevant Environmental Factors and Summary of Assessment of Relevant Environmental Factors

## 1. Introduction

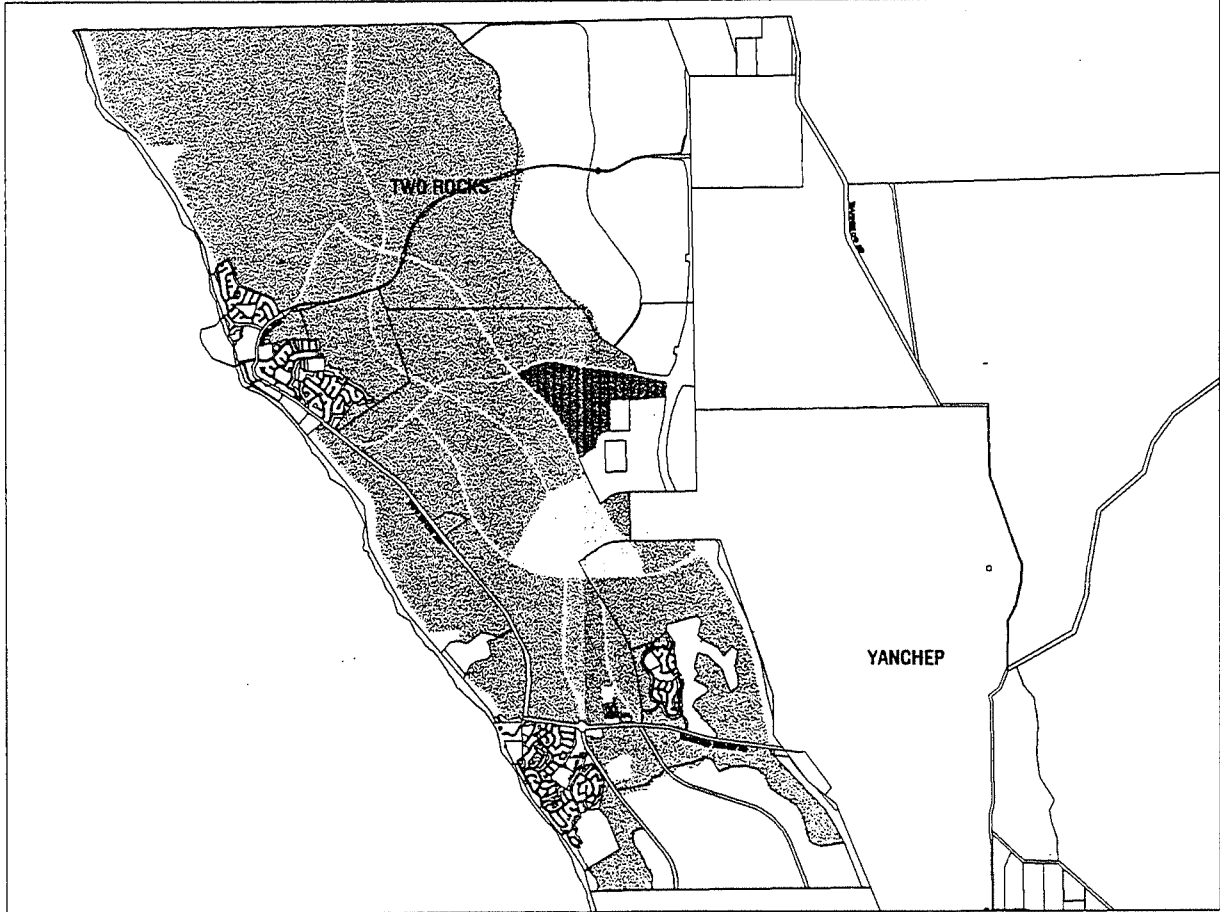
The City of Wanneroo, the Responsible Authority, proposes to rezone the Yanchep/Two Rocks area to “Urban Development Zone”, “Centre Zone” and “Industrial Development Zone” from the current Town Planning Scheme (TPS) No. 1 zonings of “Central City Area”, “Rural”, “Service Station”, “Special Zone (Additional Use) Video Hire” and “Residential Development” (Figure 1). This amendment was initiated to ensure that zoning of the Yanchep/Two Rocks area under the City of Wanneroo’s TPS No. 1 reflected the zonings already given statutory effect by gazettal in September 1996 of Amendment No. 975/33 to the Metropolitan Region Scheme (MRS).

The proposed amendment was referred by the City of Wanneroo to the EPA under Section 48A of the *Environmental Protection Act 1986*. The EPA subsequently set the level of assessment for the proposed scheme amendment at formal Environmental Review (ER) principally because the land abutted a substantial area of regionally significant vegetation [System Six Areas M2 (Coastal Strip from Two Rocks to Burns Beach) and M3 (Yanchep National Park)], and given the size of the development, indirect impacts need to be managed. These two areas contain regionally significant bushland identified in draft *Perth’s Bushplan* and M3 contains over 100 limestone caves several of which provide habitat for the “Critically Endangered” aquatic root mat communities (subterranean fauna) as identified in the report “Identifying and conserving threatened ecological communities (TEC’s) in the South West Botanical Province” (English and Blyth, 1997). Other issues considered when setting the level of assessment included:

- the potential for karstic landforms and associated subterranean fauna to occur within the Amendment area;
- the Amendment area falls within the Perth Coastal Underground Water Pollution Control Area (UWPCA), a Proclaimed Priority 3 water supply area;
- the potential for Unexploded Ordnance (UXO) to occur in the area presenting a significant risk to future Urban use of the area; and
- the potential for impacts to occur on future residents in the area from gaseous emissions, noise, odour and dust associated with the development of an Industrial Development zone close to an Urban Development zone.

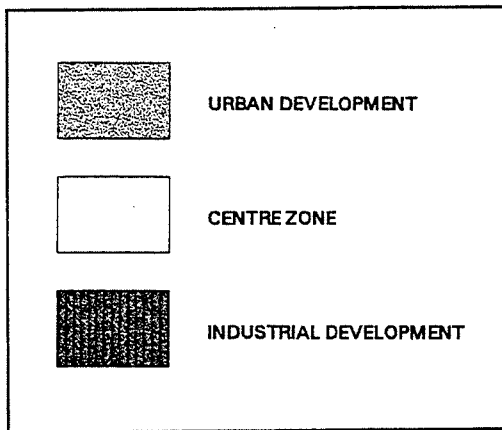
The EPA recognises that the proposed amendment will facilitate the development over 30 years of a \$12 billion satellite city incorporating 55,000 new homes for up to 150,000 people over a landholding of approximately 4000ha. Planning is also underway to attract industries such as telecommunications, information technology and science and research to the development area with the aim of creating 50,000 jobs. Therefore, the EPA considers that it is important for the development to be environmentally sustainable in the long-term which requires an integrated approach to planning and environmental management in the Amendment area. This report forms part of this integrated approach as it identifies the relevant environmental factors which require management throughout the planning process to ensure that the development is environmentally sustainable.

The EPA believes that this process allows for a greater level of detailed investigation to be undertaken with regard to environmental impacts associated with development before decisions are made about the environmental acceptability of proposed scheme amendments. In completing these investigations at this early stage of planning, the EPA believes that the ability for environmentally sustainable development to be achieved is increased. However, this process is only in its infancy and therefore needs to be monitored to ensure that the aim of achieving and maintaining environmentally sustainable development is realised. The EPA also recognises that as scientific research continues and environmental management techniques evolve it is important to review decisions and improve the environmental management of development. Therefore, whilst this report details the management requirements for each of the relevant environmental factors to ensure that the potential impacts of the development are



**SCHEME AMENDMENT**

**Legend**



**Scale 1:110,000**

*Figure 1. Proposed Scheme Amendment.*



minimised at this time, it also details the review process to be incorporated into the scheme to ensure ongoing improvements in environmental management occur. This review process is designed to ensure that the environmental assessment of scheme amendments is achieving sustainable development and the development continues to be environmentally sustainable.

In compiling this report, the EPA has considered the relevant environmental factors associated with the scheme amendment, issues raised in public submissions, specialist advice from the Department of Environmental Protection (DEP) and other government agencies, the Responsible Authority's response to submissions and the EPA's own research and expertise.

Further details of the proposed scheme amendment are presented in Section 2 of this report while Section 3 discusses environmental factors relevant to the scheme amendment. The Conditions and procedures to which the scheme amendment should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 provides the EPA's Other Advice, Section 6 presents the EPA's Conclusions and Section 7, the EPA's Recommendations.

A list of people and organisations that made submissions is included in Appendix 1. References are listed in Appendix 2, and recommended environmental conditions and Responsible Authority's commitments are provided in Appendix 3.

Appendix 4 contains a summary of the public submissions and the Responsible Authority's responses. The summary of public submissions and the Responsible Authority's responses is included as a matter of information only and does not form part of the EPA's report and recommendations. The EPA has considered issues raised in public submissions when identifying and assessing relevant environmental factors.

Appendix 5 contains Table 2 which identifies the relevant environmental factors and Table 3 which summarises the assessment of the relevant environmental factors.

## **2. The proposed scheme amendment**

The Amendment area consists of the Yanchep/Two Rocks area, approximately 4,000ha in size, and located about 50km north of Perth (Figure 1). The Scheme Amendment area is generally bounded by a Coastal Foreshore Reserve and the Indian Ocean to the west, Eglinton to the south, the Yanchep National Park and Regional Open Space to the east and the Wilbinga Crown Land and Caraban Management Priority Area (part of State Forest No. 65) to the north. Currently the land is used predominantly for rural activities aside from residential development at the Two Rocks and Yanchep townsites, as well as a Service Station on Yanchep Beach Road. The land is part of the extensive Yanchep/Two Rocks area landholding owned by Tokyu Corporation Pty Ltd.

Pursuant to Section 35A of the *Metropolitan Region Town Planning Scheme Act 1959* the City of Wanneroo has sought the rezoning of the Yanchep/Two Rocks area in response to the gazettal in September 1996 of the St Andrews MRS Amendment (No. 975/33). This MRS amendment rezoned land in the Yanchep/Two Rocks area largely to reflect those recommendations defined in the adopted Yanchep Structure Plan (Department of Planning and Urban Development, 1993). The TPS amendment does not, however, include all areas subject to this MRS amendment as it excludes areas designated for open space, public utilities and transport corridors under the MRS amendment as well as areas proposed for reservation under the MRS because these areas are automatically reserved in the City of Wanneroo's TPS No. 1 pursuant to Section 35A (1) of the *Metropolitan Region Town Planning Scheme Act, 1959*.

The details of City of Wanneroo TPS No. 1, Amendment No. 787 (Figure 1) are:

- a) to rezone the portion of the Yanchep-Two Rocks area zoned "Central City Area" on the Metropolitan Region Scheme, being portions of Pt Lot 8 and Pt Lot M1689 from "Rural" and "Residential Development" to "Centre Zone";
- b) rezone the portion of the Yanchep-Two Rocks area zoned "Industrial" on the Metropolitan Region Scheme being portion of Pt Lot M1689 from "Rural" to "Industrial Development Zone"; and

- c) rezone Lots 1, 101, 102, 103, Pt Lot 8, Lot 12, Pt Lot 9, Pt Lot M1689, Lot 200, lot 201, Reserve 41479, Lot 16, lot 8, Portion Lot 35, lot 1011 and Pt Lot M1688, being those portions of the Yanchep-Two Rocks area which are zoned "Urban" or "Urban Deferred" under the Metropolitan Region Scheme and zoned "Rural", "Service Station", "Special Zone (Additional Use) Video Hire" and "Residential Development" under City of Wanneroo Town Planning Scheme No. 1 to "Urban Development Zone".

There are small areas of remnant vegetation within the Amendment area which are of sufficient size and quality to be regarded as being locally significant but not regionally significant. However, the Amendment area is surrounded by regionally significant vegetation identified in draft *Perth's Bushplan* (Government of Western Australia, 1998). Approximately 6% or 245ha of land within the area is within the zone of karstic terrain (20ha) or potential karstic terrain (225ha). These areas are restricted to the eastern part of the Amendment area. The Amendment area is also located within the Perth Coastal (Priority 3) UWPCA.

The main characteristics of the proposed scheme amendment are summarised in Table 1 below. A detailed description of the scheme amendment is provided in Sections 1 and 2 of the ER (Shire of Wanneroo, 1999).

**Table 1 - Summary of key proposal characteristics**

<b>Element</b>	<b>Description</b>
Total area of land	approximately 4,000 hectares
Existing land uses	rural activities, residential development, service station
Existing zoning in the City of Wanneroo's Town Planning Scheme No. 1	"Rural", "Residential Development", "Service Station", "Special Zone (Additional Use) Video Hire"
Proposed scheme modifications	City of Wanneroo TPS No. 1, Amendment No. 787 proposes to: <ul style="list-style-type: none"> <li>• rezone the majority of the Yanchep/Two Rocks area to "Urban Development Zone"; and</li> <li>• rezone two other minor areas to "Centre Zone" and "Industrial Development Zone"</li> </ul>
Groundwater	The Amendment area falls within the Perth Coastal (Priority 3) UWPCA
Karstic terrain	Approximately 6% or 245ha of the Amendment area consists of karstic terrain (20ha) or potential karstic terrain at depth (225ha).
Vegetation	The Amendment area is surrounded by regionally significant vegetation identified in draft <i>Perth's Bushplan</i>
Proposed environmental management measures	<ul style="list-style-type: none"> <li>• Drainage, Nutrient and Water Management Plan;</li> <li>• Vegetation and Fauna Management Plan;</li> <li>• Stygofauna and Troglotic Fauna Management;</li> <li>• Karst Management;</li> <li>• Solid and Liquid Waste Management Plan;</li> <li>• Unexploded Ordnance Management; and</li> <li>• Aboriginal Culture and Heritage Management.</li> </ul>

### **3. Environmental factors**

#### **3.1 Relevant environmental factors**

Section 48D of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposed amendment and on the conditions and procedures to which the scheme amendment should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Having considered appropriate references, public and government submissions and the Responsible Authority's response to submissions, it is in the EPA's opinion, that the following are the environmental factors relevant to the proposed amendment:

- a) vegetation - potential for indirect impacts on adjacent areas of regionally significant vegetation identified in draft *Perth's Bushplan* (Government of Western Australia, 1998);
- b) stygofauna and troglobitic fauna - potential for adverse impacts on habitat areas of species of stygofauna and troglobitic fauna;
- c) groundwater quantity - potential for an excessive drawdown of the water table which could affect habitat areas of stygofauna and troglobitic fauna, regionally significant vegetation and karstic landforms;
- d) karst - potential for adverse impacts on karstic landforms;
- e) air quality - potential for emissions (noise, dust, odour) from the proposed industrial area to adversely impact upon the amenity of nearby residences;
- f) groundwater quality - potential for adverse impacts on habitat areas of species of stygofauna and troglobitic fauna, regionally significant vegetation, regional water supply and other uses;
- g) solid and liquid waste - potential for waste from proposed industrial area to adversely affect groundwater quality;
- h) unexploded ordnance - unexploded ordnance could potentially occur within the Amendment area posing a risk to residents;
- i) Aboriginal Culture and Heritage - potential for adverse impacts on an archaeological site of Aboriginal significance; and

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the ER document and the submissions received, in conjunction with the Amendment characteristics and alternative approval processes which ensure that the factors will be appropriately managed. On this basis, the EPA considers other issues raised in the submissions do not require further evaluation by the EPA. The identification process is summarised in Table 2 (Appendix 5).

The land subject to this assessment is within the area affected by the City of Wanneroo Town Planning Scheme No. 1, Amendment No. 787.

The relevant environmental factors are discussed in Sections 3.2 to 3.11 of this report and are summarised in Table 3 (Appendix 5).

#### **3.2 Vegetation**

##### **Description**

Vegetation within the Amendment area consists of two systems; the Guilderton System and the Spearwood System (Beard, 1979). Within each of these systems there are two vegetation alliances which have been further subdivided into vegetation types. Principally the remnant vegetation within the Amendment area consists of the Old Quindalup Dune Heath vegetation type (Alliance B of the Guilderton System) and the Limestone Heath vegetation type (Alliance C

of the Spearwood System). The floristic communities identified within these vegetation types in the Amendment area include:

- 26a *Melaleuca huegelii* - *M. acerosa* shrublands of limestone ridges;
  - 26b Woodlands and mallees on limestone;
  - 28 Spearwood *Banksia attenuata* or *B. attenuata-Eucalyptus* woodlands;
  - 29a Coastal shrublands on shallow sands;
  - 29b *Acacia* shrublands on taller dunes; and
- S7, S11, S13, S14 (the Strand), S15 (recent Quindalup divisions).

The vegetation within the Amendment area ranges in condition from Undisturbed (a small portion in the northeastern corner of the Amendment area which shows no signs of impact caused by human activities) through to Degraded (the majority of the area ie. approximately 60%, which is completely or almost completely without native species in the structure of the vegetation) (Alan Tingay & Associates, 1992; Trudgen, 1990; and CALM, 1989). These areas provide an occasional habitat for two species of threatened fauna these being the Short-billed Black Cockatoo (*Calyptorhynchus latirostris*) (Schedule 1) and the Peregrine Falcon (*Falco peregrinus*) (Schedule 4). These two species are listed "in need of special protection" under the provisions of the *Wildlife Conservation Act 1950*. Therefore, the protection of areas of locally significant vegetation is important to avoid habitat loss for these two species.

There are no Threatened Ecological Communities (TEC's) within the Amendment area, however, there are three vegetation communities within the Amendment area ie 26a, 29a and 29b which have been recommended for listing as TEC's (Weston and Gibson, 1997).

System Six Area M1 occurs in the northern half of the Amendment area. This area was recognised as containing vegetation of significant conservation value, some of it in a fragile state (Department of Conservation and Environment, 1983) (Figure 2). The M1 area has since been reassessed in 1992 by Alan Tingay & Associates as part of planning studies for the Yanchep/Two Rocks area. The assessment concluded that a significant portion of the area supported vegetation in a significantly disturbed condition and that a larger area of higher quality vegetation existed immediately north of the M1 area. This portion of land to the north at Wilbinga has been identified as Bushplan Site No. 406 (Government of Western Australia, 1998) given its higher conservation values making it a suitable replacement for M1. This issue is discussed in further detail later.

A very small portion of the vegetation on the western boundary of the Amendment area is within System Six Area M2, "Coastal Strip from Two Rocks to Burns Beach". M2 contains fragile sand dunes which are important wildlife habitats and include special features such as limestone pinnacles, a freshwater swamp and the wreck of the Alkimos (Department of Conservation and Environment, 1983) (Figure 2). Two species of Priority 3 Flora also occur within this area, these being *Conostylis pauciflora* subsp. *euryrhipis* and *Stylidium maritimum*. (Government of Western Australia, 1998). The M2 area has also been reassessed through the Yanchep Coastal Planning Strategy (1993) which assisted in the identification of the Foreshore Reserve and Regional Open Space allocation during the more detailed planning associated with Amendment No. 975/33 to the MRS (which was initiated in 1996 to give effect to planning proposals for the Yanchep/Two Rocks area). This boundary results in a modification to the M2 area which has been reflected in Site No. 397 in draft *Perth's Bushplan*. (Government of Western Australia, 1998). This issue is discussed in further detail later.

Almost parallel on the eastern boundary, a portion of the vegetation is within System Six Area M3, "Yanchep National Park" which includes wetlands (eg Loch McNess containing approximately 55ha of open water) and karstic (more than 100 limestone caves) features of regional significance (Figure 2). More than 90% of the vegetation within the M3 area is in Very Good to Excellent condition consisting of, in particular, Northeastern *Banksia attenuata* - *B. menziesii* woodlands, *Melaleuca huegelii* - *M. acerosa* shrublands of limestone ridges and Woodlands and mallees on limestone (Government of Western Australia, 1998). This area was also reassessed in 1992 when M1 was reassessed. This assessment recommended that the

undisturbed and slightly disturbed vegetation within the M3 area be retained in M3 while the remainder be released for urban development. This recommendation was reflected in the Yanchep Structure Plan (Jones Lang Wootton, 1992) which the EPA gave general endorsement to in October 1992. The M3 area, therefore, has been modified and is now recognised as Bushplan Site No. 288. This issue is discussed in further detail later.

The Amendment area is surrounded by areas of regionally significant vegetation identified in the recently released draft *Perth's Bushplan* (Government of Western Australia, 1998) which is an update of *The Darling System - System 6* report (Department of Conservation and Environment, 1983) (Figure 2). On the eastern boundary of the Amendment area there are two Bushplan sites (No.'s 288 and 284), on the southern boundary there is Site No. 289, on the western boundary there is Site No. 397 and on the northern boundary there is Site No. 406. Both Site No.'s 288 ("Yanchep National Park and Adjacent Bushland") and 397 ("Coastal Strip from Wilbinga to Mindarie") are recognised as amended versions of System Six Areas M3 and M2 (described above) respectively.

The features of the other three Bushplan Sites ie No. 284 ("South-west link from Wilbinga to Yanchep National Park"), No. 289 ("Ningana Bushland, Yanchep/Eglinton") and 406 ("The Wilbinga - Caraban Bushland") include:

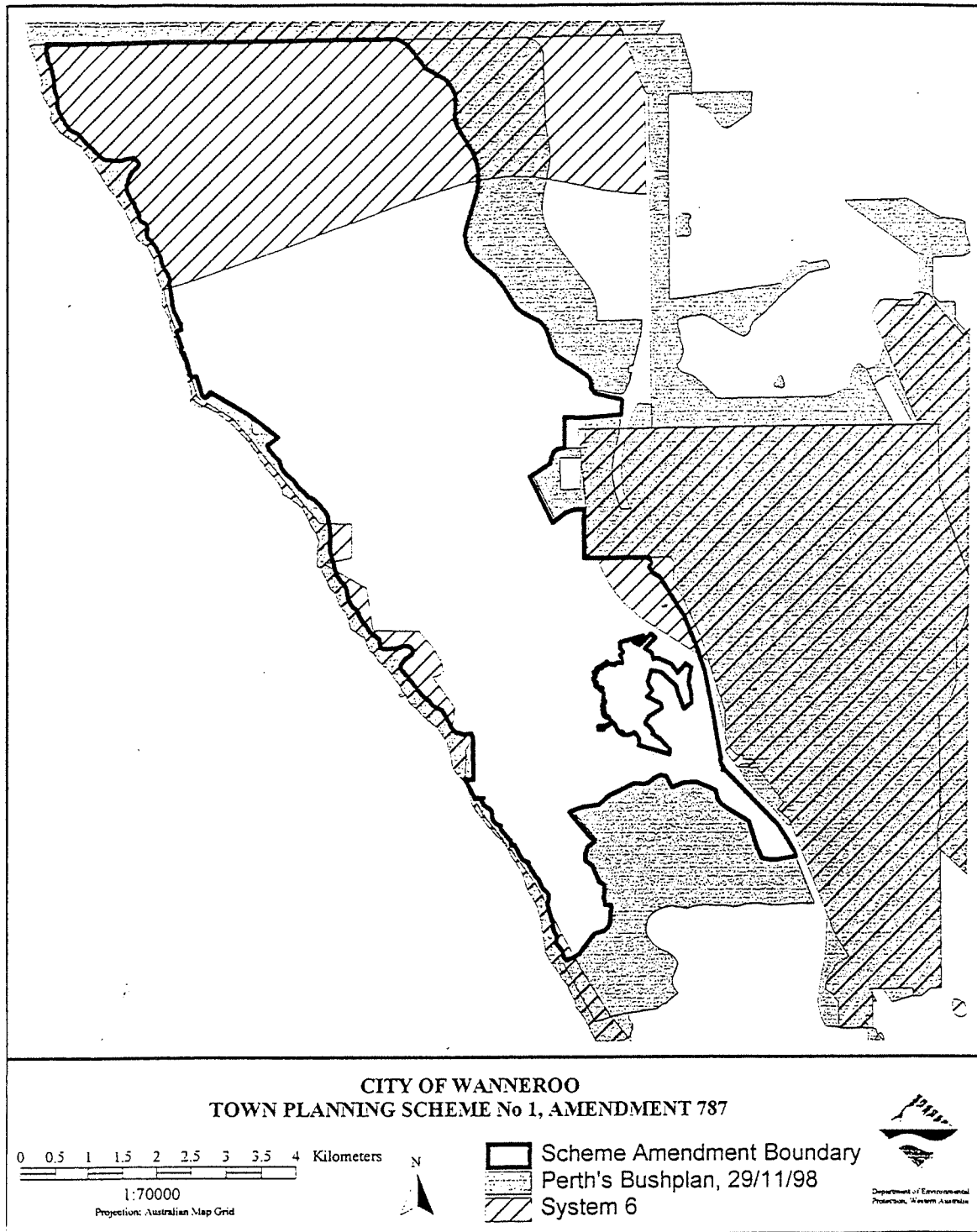
- **South-west link from Wilbinga to Yanchep National Park (Site No. 284)**
  - > 75% of the vegetation is in Very Good to Excellent condition;
  - includes, in particular, Woodlands and mallees on limestone, Spearwood *Banksia attenuata* - *Eucalyptus* woodlands and *Acacia* shrublands on taller dunes; and
  - this site also supports populations of the Declared Rare Flora (DRF), *Eucalyptus argutifolia*, which is protected under the provisions of the *Wildlife Conservation Act 1950* (Government of Western Australia, 1998).
- **Ningana Bushland, Yanchep/Eglinton (Site No. 289)**
  - > 60% of the vegetation is in Excellent to Very Good condition;
  - includes, in particular, *Eucalyptus gomphocephala* Open Woodland to Woodland, *Banksia attenuata* and *B. menziesii* Low Woodland, Open to Closed Low Heaths and *Spinifex longifolius* and *S.hirsutus* Grassland; and
  - as with System Six Area M2, this site also supports the Priority 3 Flora *Conostylis pauciflora* subsp. *euryrhipis* and *Stylidium maritimum*. (Government of Western Australia, 1998).
- **The Wilbinga - Caraban Bushland**
  - consists of at least nine regional floristic groups (including some of those above), one of which (limestone floristic community type 26a) has been recommended as a TEC; and
  - supports populations of the Declared Rare Flora (DRF), *Eucalyptus argutifolia*, which is protected under the provisions of the *Wildlife Conservation Act 1950* (Government of Western Australian, 1998).

## Assessment

The area considered for assessment of this factor is the Swan Coastal Plain.

The EPA's environmental objective for this factor is maintain the abundance, species diversity, geographic distribution and productivity of vegetation.

In December 1994 the EPA provided Section 16 advice to the State Planning Commission on the Central Coast Regional Strategy (State Planning Commission, 1994). In this advice the



**Figure 2. System Six Areas and Bushplan Sites.**

EPA recognised that the Wilbinga land had greater environmental and landscape attributes than the M1 area. Therefore, the Wilbinga area could be set aside for conservation as a replacement for the M1 area without compromising the conservation values sought to be protected by the System 6 recommendation M1 (EPA, 1994). However, the EPA also sought a high level of certainty that the land at Wilbinga would be retained primarily for conservation before it would be prepared to recommend to Government that M1 is not required for conservation (EPA, 1994). Subsequent to this the then Minister for the Environment indicated his intention to proceed with the conservation of Wilbinga and instructed the DEP to "ensure that the relevant portion of the Wilbinga land is included in the System 6 update" (EPA, 1996). Therefore, the relevant portion of the Wilbinga land has been included in draft "*Perth's Bushplan*" (Site No. 406) (Government of Western Australia, 1998). In 1998 Cabinet agreed that the Wilbinga area would form an important coastal component of the proposed "Gnangara Park" (discussed below) and as such would be managed for conservation (CALM, 1999).

The recommendation for System Six Area M2 involves seeking identification through the planning process of foreshore areas of regional significance, with appropriate vesting of these areas to protect conservation values (EPA, 1996). To identify open space of regional significance the Yanchep Coastal Planning Strategy was prepared in 1993. The recommendations from this Strategy were used to identify the Foreshore Reserve and Regional Open Space allocation which were delineated during the more detailed planning associated with Amendment No. 975/33 to the MRS (which was initiated in 1996 to give effect to planning proposals for the Yanchep/Two Rocks area). The Foreshore Reserve boundary was defined based on physical attributes, conservation values and potential recreational demand and was agreed to by the landowners and the WAPC as part of the MRS Amendment (Shire of Wanneroo, 1999). This boundary results in a modification to the M2 area which has been reflected in Site No. 397 in draft *Perth's Bushplan*. (Government of Western Australia, 1998).

Vegetation surveys undertaken of System Six Area M3 in 1992 by Alan Tingay & Associates identified that a portion of this area had either been cleared of most native vegetation or supported vegetation which was significantly disturbed. Based on this assessment it was recommended that the undisturbed and slightly disturbed vegetation within the M3 area be retained in M3 while the remainder be released for urban development. This recommendation was reflected in the Yanchep Structure Plan (Jones Lang Wootton, 1992). At its meeting of 8 October 1992 the EPA gave general endorsement to this recommendation in the (then) proposed Yanchep Structure Plan given that the Structure Plan proposed extensions to existing "Parks and Recreation" reservations including, in particular, an east-west green belt on the southern boundary linking with Eglinton (Bushplan Site No. 289) and a north-south linear open space link of high conservation value between Yanchep National Park and Wilbinga immediately north (Bushplan Site No. 284) (EPA, 1996). The EPA noted that this would provide a net gain for conservation. The M3 area, therefore, has been modified and is now recognised as Bushplan Site No. 288.

Therefore, while the Amendment area does not contain vegetation of regional significance it does contain vegetation of local significance (as described above), which provides wildlife habitat but does not currently support populations of DRF or Priority flora.

The vegetation within the Amendment area is also found in surrounding Bushplan Sites numbers 284, 288, 289, 397 and 406. All of these sites are reserved for P&R in the MRS except for Site No. 406 which is within State Forest No. 65 and is managed by the Department of Conservation and Land Management (CALM). In 1996 Cabinet approved the concept of the development of "Gnangara Park" which will ultimately result in State Forest No. 65 being managed for conservation purposes by CALM following an amendment to the Metropolitan Region Scheme (MRS) to rezone the areas within the Park to Parks & Recreation (P&R) (CALM, 1999).

The urbanisation of approximately 4000ha of land will impact directly on areas of vegetation within the Amendment area due to the need for clearing. There is also the potential for indirect impacts on the adjacent Bushplan sites. These impacts may include recreational activities, intrusion by domestic pets, weed invasion, an increase in the frequency of fires, litter, rubbish dumping, removal of firewood and impacts on water quality and water table levels.

To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve the assessment of Local Vegetation at the District Structure Planning (DSP) stage and the development of a Vegetation and Fauna Management Plan at the Local Structure Planning (LSP) stage. The assessment will identify areas of vegetation which are locally significant and this information will be used when developing the DSP, in order to optimise the value of the vegetation retained in Public Open Space (POS) areas. Consultation will be undertaken at this stage with CALM.

The Vegetation and Fauna Management Plan will be prepared and implemented by the subdivider at the LSP stage. The specifics of this Plan include:

- assign proposed uses for each significant area of retained vegetation;
- preserve rare flora;
- maintain linkages to other areas of vegetation;
- maintain the fauna habitat value;
- describe controls over public access;
- describe management procedures for control of weeds and exotic species;
- describe management procedures to protect fauna during and following development; and
- address landscape strategies to ensure they are compatible with the management of adjacent reserves.

The Department of Conservation and Land Management (CALM) as manager of the adjacent Yanchep National Park and State Forest No. 65 did not comment on this proposed scheme amendment. However, the Urban Bushland Council raised the following concerns:

- vegetation identified as not being “severely disturbed” or “degraded” (including ecological communities 26a, 29a and 29b) should be retained for conservation and wildlife habitat value (including the provision of wildlife corridors);
- the vegetation conditions ratings used in the ER were not accurate;
- what is “locally significant” was not defined adequately;
- provenance seed for rehabilitation was not going to be used; and
- management of indirect impacts associated with the amendment on the adjacent conservation areas was not adequate.

To address these concerns the DEP negotiated with the Responsible Authority and the landowner following the public comment period to revise the Responsible Authority’s Environmental Management Recommendations to be incorporated into the scheme. Firstly, these modifications entail the requirement for the DEP, CALM and relevant community groups to be consulted at the DSP stage and the LSP stage with regards to the management of vegetation. Secondly, the Vegetation and Fauna Management Plan be modified to address the following:

- description of vegetation and vegetation values;
- the definition and retention of “locally significant” areas of vegetation within the Amendment area with consideration to the creation of vegetation corridors to facilitate the movement of fauna and floristic genepools;
- management of indirect impacts on the adjacent Parks and Recreation (P&R) areas to the satisfaction of relevant State Agencies through appropriate subdivision design (eg. roads abutting P&R areas);



- clear delineation of significant areas of vegetation to be preserved through use of dual use paths, roads and the like;
- details on vegetation maintenance arrangements - including weed control and consideration of the use of provenance seed for rehabilitation;
- fire management;
- control of off-road vehicle use and dumping of rubbish;
- enhancement of community awareness of bushland protection; and
- allocation of responsibilities and identification of timing for the implementation of the Vegetation Management Plan.

### **Summary**

Having particular regard to the:

- a) values inferred in System Six Areas M1 being replaced at Wilbinga which has higher conservation value;
- b) EPA's previous endorsement of modifications to the System Six Areas M2 and M3 based on detailed vegetation analyses undertaken in 1993 and 1992 respectively;
- c) adjacent areas supporting regionally significant vegetation either reserved as P&R in the MRS or proposed for inclusion in "Gnangara Park" which will be established and managed by CALM;
- d) identification of "locally significant" vegetation providing wildlife habitat, and three ecological communities recommended for listing as "Threatened" within the Amendment area;
- e) identification of a species of DRF adjacent to the Amendment area; and
- f) Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;

it is the EPA's opinion that the Amendment is capable of being managed to meet the EPA's objective for vegetation subject to an assessment of vegetation at the District Structure Planning stage, and the preparation and implementation of a Vegetation and Fauna Management Plan at the Local Structure Planning stage.

## **3.3 Subterranean Fauna**

### **Description**

Troglobitic fauna are obligatory cave dwellers which show significant eye and pigment reduction as they are obliged to live in the deep zone (Gillieson, 1996). These creatures are terrestrial and may also inhabit interstitial and fissure habitats in the rock (Humphreys, 1993). For aquatic organisms there is a parallel classification. Stygofauna are those highly specialised animals living entirely in the groundwater environment and, therefore, absent in surface waters (Gillieson, 1996). Given the identification of approximately 225ha of potential karst at depth within the Amendment area, and 20ha of definite karst (but no identified caves) within the Amendment area (Figure 3) it is possible that these areas may be inhabited by troglobitic fauna and/or stygofauna.

The EPA identified stygofauna and troglobitic fauna as a relevant environmental factor principally for two reasons. Firstly, troglobitic fauna are obliged to live in the deep zone in caves where there is no light and for this reason have a limited habitat, also cave environments are highly susceptible to disturbance which impacts directly upon troglobitic fauna diversity. Secondly, studies of the stygofauna in Yanchep National Park have found abundant and diverse

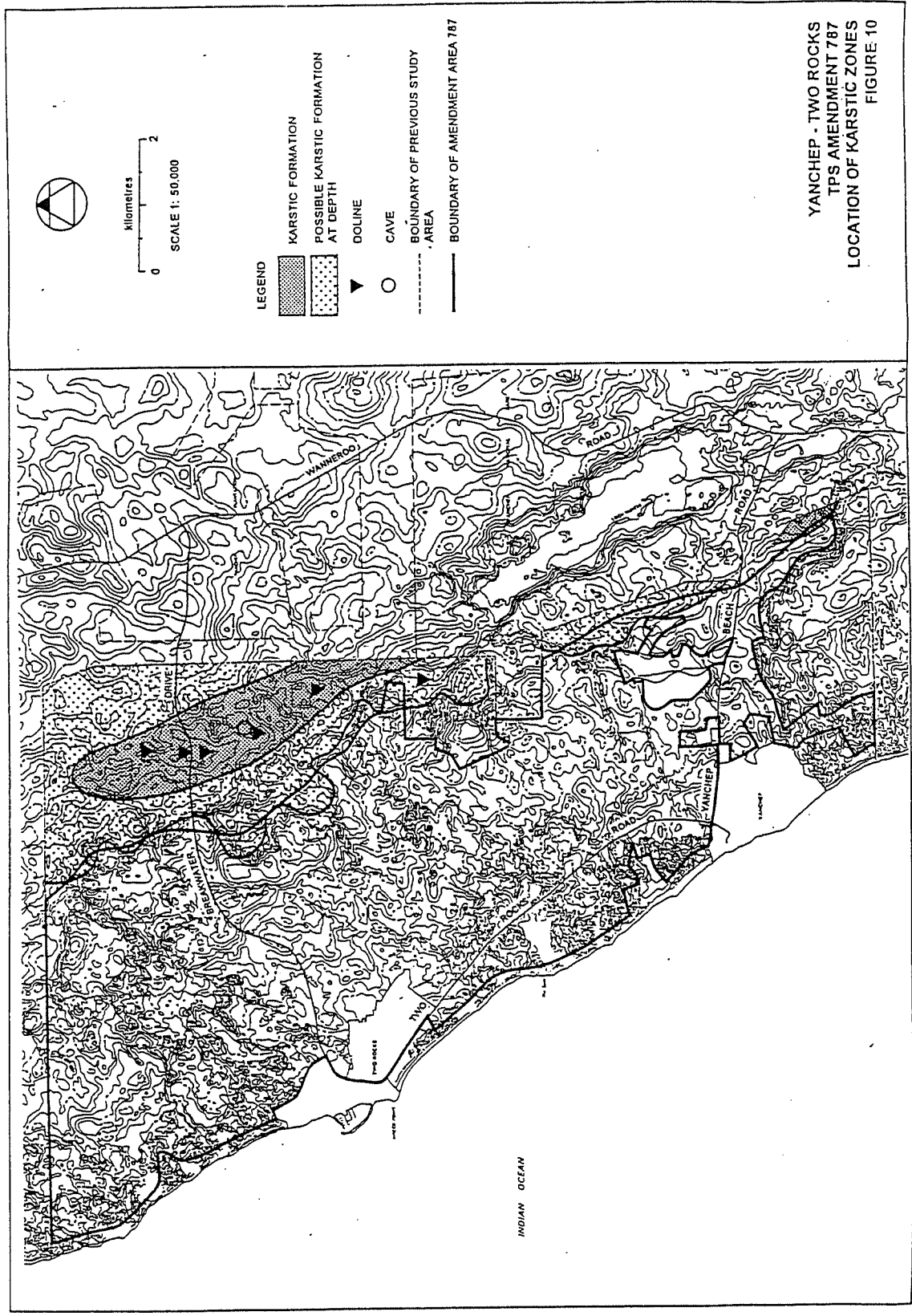


Figure 3. Karstic landforms.

stygo fauna communities occurring in the root mats (of overlying Tuart woodlands) which in turn occur in the epiphreatic streams that intersect karst formations (karst wetlands) in the Yanchep National Park area [Jasinka *et al* (1996), Jasinka and Knott (1991) and Jasinka (1990)]. These aquatic root mat communities of caves in the Swan Coastal Plain have been identified as Critically Endangered in a report by English and Blyth (1997). These communities may occur within the Amendment area as it is immediately west of Yanchep National Park and subterranean aquifer water of the Gngangara Mound (immediately east of the Amendment area) may be expected to have radial flow (ie. directly towards the Indian Ocean) which may result in some subterranean connectivity with the groundwaters of Yanchep National Park.

In the Yanchep region, significant populations of stygo fauna have generally only been found where a substantial root mat exists within the epiphreatic streams (karst wetlands - where groundwater intersects karst) in caves (E. Jasinka, *pers. comm.*). These root mats provide a constant and abundant primary food source for the micro ecosystems and generally occur only where Tuart (*Eucalyptus gomphocephala*) Woodlands coincide with karstic formations. This is one of the five factors which control the development of root mats in caves (Jasinka, 1997). These being:

1. Presence of trees above caves. Root mats in Australia are related to a number of species of trees, including *Eucalyptus gomphocephala*, *Casuarina* spp., *Corymbia calophylla*, *Agonis flexuosa* and *Ficus* spp.
2. Cavernous rock with fissures or solution channels, ie rock penetrable by roots.
3. Depth to cave waters of <30m, reflecting the limit to which tree roots can penetrate substrates.
4. Arid conditions in the cave atmosphere and soil above the cave for extended periods of the year.
5. Permanent streams or pools in caves.

An assessment of the vegetation within the Amendment area has indicated that none of the areas of karst or potential karst coincides with the small areas of Tuart woodland which exist within the Amendment area.

An assessment of the karstic areas within Lots 201 and 202 Breakwater Drive (to the east of the Amendment area) for subterranean fauna which has recently been undertaken (as part of the work required for an Environmental Review of the proposed rezoning of the area from "Rural" to "Rural Community") identified only two species of stygo fauna within the lots and these appeared to be not restricted to the root mat habitats. The species were sampled from groundwater samples taken from both within and surrounding the Amendment area.

Sampling of the one confirmed cave within Lot 202 identified that there very few roots and none extended to near the bottom of the cave. There were also no streams within the cave and no root mats. No species of stygo fauna and/or troglobitic fauna were identified within the cave and given these conditions it is likely that the cave would support only a limited assemblage of subterranean fauna. The other unconfirmed cave was not surveyed given the unstable nature of the sediments, however, based on the site's conditions it would not be expected to support a significant assemblage of subterranean fauna.

Therefore, based on these results and the work undertaken by Jasinka (1997) it is unlikely that stygo fauna and/or troglobitic fauna are present within the Amendment area. If they are present they are likely to be of restricted assemblage and the stygo fauna specie are unlikely to be restricted to root mat habitats.

### **Assessment**

The area considered for assessment of this factor is the chain of caves on the Swan Coastal Plain.

The EPA's environmental objective for this factor is:

- i) Ensure that stygofauna and troglobitic fauna are adequately protected, in accordance with the *Wildlife Conservation Act 1950*; and
- ii) Maintain the abundance, diversity and geographical distribution of stygofauna and troglobitic fauna.

The EPA recognises that stygofauna and troglobitic fauna are restricted to living within karstic environments and that only 20ha, or about 0.5% of the Amendment area has been identified as a karstic zone, and 225ha or 5.5% could potentially be karstic (Figure 3). The EPA also recognises that no specific surveys of these areas for stygofauna or troglobitic fauna were undertaken as part of the assessment process. However, the EPA considers that it is unlikely that there is a significant assemblage of stygofauna and/or troglobitic fauna within the Amendment area because of the following:

- lack of suitable karstic terrain and only limited possible karstic phenomena at depth in a restricted portion of the Amendment area;
- an absence of Tuart woodlands in karstic areas in the Amendment area (Tuarts are associated with providing root mat habitat in karstic environments for stygofauna of the critically endangered "Aquatic Root Mat Community of Caves of the Swan Coastal Plain");
- a survey of an adjacent area (Lots 201 and 202 Breakwater Drive, to the immediate east of the Amendment area) which includes more pronounced karstic areas (including caves and dolines) only found two species of stygofauna and no species of troglobitic fauna; and
- a relatively deep water table, between 10m and 50m (depth to cave waters needs to be less than 30m for root mat habitat formation, reflecting the limit to which tree roots can penetrate substrates);

In previous assessments of karstic environments in the Cape Range Karst Province in Exmouth the EPA has considered that the impact on water quality and water table levels of mining (EPA, 1997a), water extraction (EPA, 1997b) and residential development (EPA, 1996a) would significantly affect the habitat of stygofauna and troglobitic fauna. The EPA considers that these two issues, and cave sedimentation which may smother cave fauna, (Gillieson, 1996) also need to be considered in this assessment even though it is unlikely that there is a significant assemblage of stygofauna and/or troglobitic fauna within the Amendment area it is recognised that there may still be a small population.

The proposed extension of the coastal borefield is over 2km west of the areas of possible, and known, karst at depth. Therefore, given that Tingay (1991) predicted maximum drawdowns of 0.1m at 1km from the borefield the effect of drawdowns on the area that may support stygofauna and troglobitic fauna is negligible as seasonal variations will exceed the impacts from the drawdowns. Therefore, the EPA considers that given this and the advice of Dr Brenton Knott (UWA Zoology department) that a 0.1 m drop 2km from potential karst areas is acceptable given that the stygofauna species which may occur within the Amendment area would most likely not be restricted to root mat habitats, that extraction for water supply will have a minimal impact upon stygofauna and troglobitic fauna.

In previous assessments the EPA has recognised that there is some uncertainty with regards to the sensitivity of stygofauna and troglobitic fauna to increases in the levels of nutrients or other contaminants in the groundwater (EPA, 1996a). However, the EPA considers that given the following:

- depth to groundwater within the Amendment area is between 10m and 50m;
- some of the soils within the Amendment area have high Phosphorus Retention Indices (PRI's) of 10 or greater;
- the Amendment area will be deep seweraged;

- management of drainage will be as per the Water Sensitive Urban Design (WSUD) guidelines and through a Drainage, Nutrient and Water Management Plan (DNWMP) prepared by the landowner; and
  - management of nutrients associated with fertilisers will be addressed by the DNWMP;
- the potential for nutrient enrichment of groundwater will be minimised.

To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which include:

- the preparation of a Drainage, Nutrient and Water Management Plan by the subdivider at the LSP stage to the requirements of the Responsible Authority and on the advice of the DEP, Water and Rivers Commission and the Water Corporation. The specifics of this plan include:
  - maintaining water quality levels compliant with the minimum requirements of the protection of a Priority 3 Groundwater Source Protection Area;
  - best practice Water Sensitive Urban Design principles are incorporated to maximise on-site water infiltration generally; and
  - development of monitoring and contingency measures.
- at the DSP level, the developer reviewing existing geotechnical information and undertaking further site investigations to confirm the nature and extent of karst landform;
- at the LSP level the subdivider shall undertake detailed geotechnical investigations in areas of karst and potential karst, and no development will be permitted on areas immediately over large karstic structures unless approved by a qualified geotechnical consultant and environmental scientist; and
- if studies in relation to karst and water indicate the likelihood of significant stygofauna assemblages being present in or immediately adjacent to the Amendment area then the subdivider would be required to implement a monitoring program to assess the nature and extent of any population. These monitoring studies will be completed prior to finalisation of the Local Structure Plan.

The Australian Speleological Federation and the Western Australian Speleological Group raised concerns that the Amendment area was not surveyed for stygofauna and troglobitic fauna and that it is not correct to assume that management for stygofauna will also pertain to the protection of troglobitic fauna.

The EPA recognises that the Amendment area has not been surveyed for stygofauna and troglobitic fauna. However, the EPA considers that based on the conditions described above the presence of stygofauna and/or troglobitic fauna within the Amendment area is expected to be low. However, the EPA notes that the DEP has negotiated with the Responsible Authority and the landowner following the public comment period to modify the Environmental Management Recommendations to include:

- the subdivider is to seek advice from relevant scientific experts at the LSP stage during the preparation of the Drainage, Nutrient and Water Management Plan and the undertaking (if necessary) of investigations and monitoring programs of stygofauna and/or troglobitic fauna populations within the Amendment area;
- a Stygofauna and/or Troglobitic Fauna Management Plan will be developed at the LSP stage to the requirements of Council on advice from the DEP, CALM and relevant scientific experts. This plan will include management strategies for the protection of stygofauna and/or troglobitic fauna within the Amendment area.; and

- a Karst Management Strategy shall be prepared at the LSP stage to the requirements of council on the advice of the DEP, Water and Rivers Commission, and relevant scientific experts. The Strategy will include detailed geotechnical investigations in areas of karst or potential karst. No development will be permitted on areas immediately over large karstic structures unless approved by a qualified geotechnical consultant and environmental scientist and agreed to by the City of Wanneroo.

The EPA also considers that on the advice of Dr Brenton Knott, stygofauna are the most sensitive of the two to environmental disturbance, therefore the management of stygofauna can also be applied to the management of troglobitic fauna.

### **Summary**

Having particular regard to the:

- fact that only 0.5% of the Amendment area has been identified as a karstic zone and 5.5 % has been identified as potentially karstic;
- troglobitic fauna and the critically endangered “Aquatic Root Mat Communities of caves of the Swan Coastal Plain” (includes species of stygofauna) are restricted to these environments;
- absence of Tuart woodlands associated with karst in the Amendment area and the relatively deep water table; both essential criteria for critically endangered root mat communities;
- lack of surface water within the Amendment area (surface waters are important in Yanchep National Park for serving as conduits for possible colonisation of the subterranean world); and
- Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;

it is the EPA’s opinion that the Amendment is capable of being managed to meet the EPA’s objective for stygofauna and troglobitic fauna, subject to seeking further advice and undertaking investigations where appropriate to develop a Stygofauna and/or Troglobitic fauna Management Plan and preparation of a Karst Management Strategy to identify development constraints.

## **3.4 Groundwater quantity**

### **Description**

Three main aquifers underlie the Amendment area, these being the Tamala Limestone superficial aquifer, and the confined aquifers of the Leederville Formation and Yarragadee Formation. The Tamala Limestone is the shallowest and most productive of the three aquifers. This aquifer is recharged directly from rainfall across the Amendment area or flows from the Gnangara Mound to the east. The aquifer rises to about 50m above sea level and extends to about 30m below. The range in seasonal water levels varies throughout the Amendment area from 0.48m to less than 0.2m near the coast. The throughflow of groundwater to the coast in the superficial aquifer is estimated to be approximately 365ML/yr for each kilometre of coastline (Shire of Wanneroo, 1999).

The Water Corporation plans to extract water from this aquifer beneath the Amendment area for public supply purposes. Extraction is expected to be derived from three clusters and three production bores to be developed as an extension of those lying south of the Amendment area in the Quinns and Eglinton areas (Water Authority of Western Australia, 1990). These bores will be incorporated into areas of Public Open Space (a 1ha reserve) within the Amendment area to minimise the possibility of contamination affecting the supply bores. Water will initially be treated at the bore site within these 1ha reserves. Groundwater extraction within the Amendment area is not being assessed as part of this Environmental Review. Future proposals to extract

groundwater should be referred to the EPA under Section 38 of the Environmental Protection Act 1986.

### **Assessment**

The area considered for assessment of this factor is the Amendment area.

The EPA's environmental objective for this factor is maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.

Submissions received in relation to the management of this factor raised concerns about the following:

- inadequacy of the hydrological study and that further modelling should be undertaken using more site-specific data;
- the need for a water balance to be undertaken for the Amendment area using the 'urban development model';
- that a water monitoring program should be implemented following development; and
- water extraction should be managed to maintain water table levels within natural fluctuations.

The WC has also advised the EPA that they:

- currently hold the operating licence for this area from the Office of Water Regulation and, as such, developers should liaise with the Corporation regarding the provision of water to the Amendment area; and
- operate water production bores within the Amendment area and each has individual wellhead protection zones, and that future landuses within these zones must be in accordance with the relevant guidelines.

### **Summary**

Having particular regard to:

- a) a lack of information provided to the EPA at this stage to determine if groundwater quantities at the proposed extraction rate can be adequately managed;

it is the EPA's opinion that groundwater extraction (groundwater quantity) should be a deferred factor and assessed after further investigations have been undertaken.

## **3.5 Karst**

### **Description**

Karstic terrain is commonly characterised by closed depressions, subterranean drainage and caves. This terrain is formed principally by the solution of the rock, most commonly limestone (Gillieson, 1996). More specifically, groundwater seeps along fractures and other zones of weakness gradually creating sizeable passages. These passages may not have entrances to the surface as dissolution generally takes place beneath the ground. In temperate climates studies have shown that two thirds or more of the total limestone solution takes place at the soil-rock interface where waters percolate through the soil into the rock mass (Hamilton-Smith *et al.*, 1998).

There are limited environments in which karstic areas are found in WA. Karstic areas are also formed by a complex interplay of geologic, pedologic (soil), climatic, topographic, hydrologic, biologic and temporal factors which contributes to the limited capacity of these areas to cope with disturbance. As discussed in Section 3.2, caves in the Swan Coastal Plain also support

aquatic root mat communities which have been identified as Critically Endangered in the report "Identifying and conserving threatened ecological communities (TEC's) in the South West Botanical Province" (English and Blyth, 1997).

At Yanchep, the limestone formation is a thin veneer over a permeable sand formation (Bastian, 1996). The limestone/sand interface slopes westwards, to eventually lie below sea level at or near the coastline. Radial drainage off the Gnangara Mound (an aquifer of water in the sand formation) results in a westwards flow towards the Indian Ocean where it intersects the limestone because it goes beneath sea level at the coast. This intersection results in the formation of caves whereas to the east the water table level in the sand formation lies beneath the base of the limestone and, therefore, there is no intersection and, hence, no caves (Bastian, 1996).

The zone along which the groundwater first makes contact with the limestone is referred to as the "Cave Source Zone". This zone fluctuates in accordance with the seasonal water table fluctuations in the sand formation (Bastian, 1996). Therefore, the Cave Source Zone may be defined as the zone between the mean annual high and low contact lines of the water table within the limestone formation, and is the area where cave formation begins (Bastian, 1996).

Generally, the formation of caves at Yanchep begins when surface water enters the limestone principally through active dolines in shallow valleys. This water then flows through the joints and fissures which over time forms caverns and voids. These caverns eventually collapse with the limestone eroding away. At this point a spring occurs and beyond the spring point the stream flows through karstic terrain where the limestone has been removed, and into Loch McNess (Alan Tingay & Associates, 1998).

Two types of suspected karstic structures occur in the Yanchep area; small scale features and massive collapse features. Small scale features observed on the surface include small cavities, fissures and solution pipes which are considered to be characteristic of the entire Tamala Limestone formation and are not indicative of a zone of karstic phenomena. Massive collapse features, however, include karstic terrain such as caves and dolines. These massive collapse features appear to be confined to an interdunal depression within the Tamala Limestone. This depression represents a probable zone of karst which extends through Yanchep National Park in a north-westerly direction into the Wilbinga area (north of the Amendment area).

The probable extent of the known karstic zone is presented in Figure 3. Areas that may have karstic features at depth but where there is no surface expression are also shown on this figure. Although karstic features are shown as a defined zone it is probable that they have a greater extent and occur at depth in areas to the east and to the west of this zone. As discussed in Section 3.2, approximately 225ha of the Amendment area exhibits the potential for karst at depth while less than 20ha has been identified as a definite karstic zone.

Within the interdunal depression to the east of the Amendment area there is a cave of significant size which is elongate and approximately 10m in depth (Figure 3). This cave may possibly be connected to other cavities. Within this same depression there are also a number of dolines (Figure 3). One of these is active and has increased in size over a number of years.

## **Assessment**

The area considered for assessment of this factor is the chain of caves on the Swan Coastal Plain.

The EPA's environmental objective for this factor is maintain the environmental, scientific, cultural and recreational values of karst landforms.

The EPA recognises that only 20ha, or about 0.5% of the Amendment area has been identified as a karstic zone and that 225ha or 5.5% could potentially be karstic. There have been no caves identified within these areas but one has been identified to the east of the Amendment area within a depression which also contains a number of dolines (or surface expressions of a collapse at depth), one of which is active and has increased in size over a number of years.



The EPA considers that karstic areas have environmental, scientific, cultural and recreational values but also that the active use of such areas may pose a risk to development due to the potential for collapse or subsidence. Surveys of the Amendment area have identified that the karst and potential karst areas fall into the low and very low risk category. The EPA recognises that these karstic areas are a complex interplay of various factors which have been mentioned above and as such, impacts on vegetation, water quality and water table levels will impact upon karstic terrain. A number of these impacts have been discussed in Section 3.3.

To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve:

- at the DSP level, the developer shall review existing geotechnical information and undertake further site investigations to confirm the nature and extent of karst landform; and
- at the LSP level the subdivider shall undertake detailed geotechnical investigations in areas of karst and potential karst, and no development will be permitted on areas immediately over large karstic structures unless approved by a qualified geotechnical consultant and environmental scientist.

Submissions raised concerns about the following:

- the impact of fire on karstic areas;
- development of the proposed water treatment plant should not be in karstic areas;
- the need for further surveys of the karstic areas (particularly given that the cave adjacent to the Amendment area is 30m deep, which makes it highly significant);
- the inclusion of the karst areas into the P&R land to the east of the Amendment area; and
- that caves within the Amendment area which have not yet been visited by the public should be carefully entered by experienced persons before the entrances are enlarged creating degradation of the cave environment.

To address these concerns the DEP negotiated with the Responsible Authority and the landowner following the public comment period to revise the Responsible Authority's Environmental Management Recommendations to go into the scheme. Firstly, fire management will be addressed in the Vegetation and Fauna Management Plan. Secondly, a Karst Management Strategy will be prepared by the subdivider at the LSP stage to the requirement of Council on the advice of the DEP, WRC and relevant scientific experts to avoid development over high risk karst areas (including caves) subject to further assessment by a geotechnical engineer and environmental scientist.

The EPA also considers that further surveys of the karstic and potentially karstic areas will be undertaken at the DSP stage and the LSP stage as per the Responsible Authority's Environmental Management Recommendations. Further to this the development of the Karst Management Strategy and other management plans proposed for the protection of vegetation, stygofauna and troglobitic fauna will provide protection for the karstic areas, reservation in the MRS is not necessarily required.

### ***Summary***

Having particular regard to:

- only 0.5% of the Amendment area being karstic and 5.5% being potentially karstic;
- the presence of caves and dolines to the immediate east of the Amendment area but not within the Amendment area;
- the fact that the Amendment area only includes low risk and very low risk karst areas; and

- Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;

it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective for this factor.

### 3.6 Air Quality

#### Description

There are no existing significant sources of air pollution within the existing Amendment area because the area is undeveloped. The Amendment proposes to establish an Industrial Development Zone adjacent to an Urban Development Zone. The proposed Industrial Development Zone has the potential to result in particulate and gaseous emissions, odour and noise that may adversely affect nearby future residents as areas of urban development are proposed adjacent to the industrial area. Also adjacent to the proposed industrial area are areas of high conservation significance including Yanchep National Park, which support significant flora and fauna. These areas may potentially be affected by industrial emissions if they are not appropriately managed. The Amendment area is and will be affected by regional air quality issues such as photochemical smog and haze.

#### Assessment

The area considered for assessment of this factor is the Amendment area.

The EPA's environmental objective for this factor is ensure that gaseous, particulate, odour and noise emissions do not adversely affect the environment or health, welfare and amenity of nearby residents by meeting the statutory requirements (including Section 51 of the *Environmental Protection Act 1986*) and acceptable standards.

The EPA recognises that the proposed Industrial Development Zone, which will be adjacent to the proposed Urban Development Zone, will support mainly light and service industries which are considered to be generally compatible with urban development. The EPA also recognises that the planning and development of these potential industrial landuses will be managed through a number of statutory and non-statutory mechanisms to ensure that potential impacts on future residents are minimised.

The EPA also recognises that the proposed urbanisation of nearly 4000ha will contribute to the emission of a range of gases that can cause a deterioration in air quality at a regional level. The management of regional air quality is being addressed through the EPA's assessment of the Metropolitan Transport Strategy and work undertaken by the Air Quality Coordinating Committee to produce the draft Perth Air Quality Management Plan.

There were no submissions received in relation to the management of this factor.

The EPA is satisfied that a number of statutory and non-statutory mechanisms exist to manage pollution from the Industrial Development Zone. However, it is necessary for an Environmental Condition to go into the Scheme which addresses the following:

At the **District Structure Planning stage**, the landowner shall take account of:

- The EPA's draft policy for Industrial - Residential Buffer areas (Separation distances).
- Statement of Planning Policy No. 4 (State Industrial Buffer Policy).

At the **Local Structure Planning stage**, the landowner shall ensure land use compatibility between the industrial zone and surrounding land uses. The landowner shall take account of:

- EPA's Interim guidance on Air Quality Impacts from Development Sites.
- Environmental Protection (Noise) Regulations 1997.
- Codes of Practice.

Development Applications within the industrial zone shall be assessed by the Responsible Authority with regard to compliance with government policies in relation to buffer zones.

### **Summary**

Having particular regard to the:

- proposed development of industry adjacent to urban areas;
- industrial development zone mainly supporting light and service industries which are generally compatible with urban development;
- statutory and non-statutory mechanisms which exist to manage pollution from industrial landuses such as:
  - EPA's draft policy for Industrial - Residential Buffer areas (Separation distances);
  - EPA's Interim guidance on Air Quality Impacts from Development Sites;
  - Works Approval and licensing through Part V of the Environmental Protection Act 1986 ;
  - Environmental Protection (Noise) Regulations 1997;
  - Statement of Planning Policy No. 4 State Industrial Buffer Policy 1997;
  - Codes of Practice;
  - the Structure Planning process;
  - subdivision design; and
  - conditions on development applications;

it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective for air quality.

## **3.7 Groundwater quality**

### **Description**

Within the Amendment area the depth to groundwater varies between 10m and 50m depending on topographic elevation, therefore, it is not considered to be shallow. However, groundwater within the Amendment area is considered to be vulnerable to contamination due to the unconfined sand aquifer which allows rapid infiltration of surface runoff. Groundwater flow in the region is also moving away from the Gnangara Mound towards the ocean.

The Amendment area lies within the Perth Coastal (Priority 3) Underground Water Pollution Control Area (UWPCA). Priority 3 areas are defined to minimise the risk of pollution to the water source and are declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments (Water and Rivers Commission, 1998).

The Water Corporation currently draws water from the superficial aquifer for public supply and proposes to continue this practice in the future. Chemical analysis of groundwater from existing production bores indicates the concentration of potential contaminants is within the range recommended by the relevant guidelines for drinking water (Alan Tingay & Associates, 1992).

## **Assessment**

The area considered for assessment of this factor is the Perth Coastal (Priority 3) UWPCA.

The EPA's environmental objective for this factor is to minimise the risk of pollution to the water source for drinking purposes.

The EPA considers that the proposed development of urban, commercial and industrial areas may potentially pollute groundwater within the Amendment area. The EPA also recognises that the types of industrial landuses proposed for the Industrial Development Zone are mainly light and service industries which are not an incompatible use within a P3 UWPCA but are a restricted use. Therefore, these uses may be compatible with the management objectives of the priority classification, with appropriate site management practices. These practices will be managed through a number of statutory and non-statutory mechanisms to ensure that potential impacts on groundwater quality are minimised.

To manage the potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve:

- the preparation of a Drainage, Nutrient and Water Management Plan by the subdivider at the LSP stage to the requirements of the Responsible Authority and on the advice of the DEP, Water and Rivers Commission and the Water Corporation. The specifics of this plan in relation to the protection of a P3 UWPCA include:
  - maintaining water quality levels compliant with the minimum requirements of the protection of a Priority 3 Groundwater Source Protection Area;
  - best practice Water Sensitive Urban Design principles are incorporated to maximise on-site water infiltration generally; and
  - development of monitoring and contingency measures
- at the DSP stage the developer shall ensure that there is provision for deep sewerage.

The Water and Rivers Commission (WRC) has advised that development will need to conform with the minimum requirements for development in a P3 UWPCA. In this respect the EPA notes that the Drainage, Nutrient and Water Management Plan will be prepared to meet these requirements to the satisfaction of the Responsible Authority and on the advice of the DEP, Water and Rivers Commission and the Water Corporation. The EPA also recognises that the proposed industrial lots will be connected to the deep sewerage system for the disposal of appropriate wastes, however, other industrial wastes which are not permitted to be disposed of in the deep sewerage system will be contained and disposed to a licensed waste management facility.

Therefore, the EPA considers that the Responsible Authority's Environmental Management Recommendations (to be applied as environmental conditions) will adequately manage the potential impact of development on groundwater quality beneath the Amendment area.

## **Summary**

Having particular regard to the:

- Amendment area being within a P3 UWPCA; and
- Environmental Management Recommendations proposed by the Responsible Authority;

it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective for groundwater quality.

### 3.8 Solid and Liquid Waste

#### Description

There are no significant sources of solid and/or liquid waste within, or immediately surrounding, the Amendment area. However, the development of significant urban areas and an industrial estate within the Amendment area will result in the creation of substantial quantities of liquid and solid wastes. Waste materials from the industrial landuses could impact on the environment if they are inappropriately managed.

#### Assessment

The area considered for assessment of this factor is the Amendment area

The EPA's environmental objective for this factor is wastes should be contained and isolated from groundwater and surface surrounds.

The EPA recognises that the development of the Industrial Development Zone will focus on light and service industries which have a minimal potential for the production of hazardous wastes.

To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve the subdivider at the LSP stage ensuring that the lots within the Industrial Development Zone will be connected to the deep sewerage system.

There were no submissions received in relation to this factor.

The EPA considers that it is possible that some of the industrial wastes may not be suitable for disposal in the sewerage system. Therefore, the EPA has negotiated with the Responsible Authority to revise the Environmental Management Recommendations (to be applied as environmental conditions) described above to the following:

The landowner is to ensure that lots within the industrial zone are connected to the deep sewerage system for the disposal of appropriate liquid wastes as approved by the relevant Government Agency/ies. A Solid and Liquid Waste Management Plan will be produced at the **Local Structure Planning stage** to the requirements of the Responsible Authority on the advice of the Department of Environmental Protection. The report will detail:

- the identification of the environmental outcome to be achieved through the implementation of this plan; and
- options for recycling, and appropriate storage and disposal options for liquid and solid wastes from industry.

#### Summary

Having particular regard to the:

- light and service industries proposed for the industrial area having minimal potential for the production of hazardous wastes; and
- Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;

it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective for this factor.

### **3.9 Unexploded Ordnance**

#### **Description**

Some areas of the North West Corridor have previously been used by the Australian and Allied defence forces for military exercises. Therefore, there is a potential for unexploded ordnance (UXO) to be present within the Amendment area. A total of 12 live bombing, gunnery and artillery ranges were used within the Yanchep/Two Rocks area between the 1940's and 1970's.

Numerous reports of findings of live high explosive UXO near Two Rocks coastal village were received during the 1960's, 1970's and 1980's according to the UXO Unit of the Fire and Emergency Services Authority (FESA). Field validation studies in parts of the Amendment area conclude that further UXO is likely to be present. There is also evidence that UXO may be present within the western boundary of Yanchep National Park and on the seabed near the coast between Yanchep and to the north of Two Rocks, particularly in the vicinity of Wreck Point.

#### **Assessment**

The area considered for assessment of this factor is the Amendment area.

The EPA's environmental objective for this factor is ensure that risk is managed to meet the EPA's criteria for individual fatality risk off-site and the DME's requirements in respect of public safety.

The EPA recognises that the Amendment area may be subject to Unexploded Ordnance (UXO) pollution which may present a risk to future residents within the area.

To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve:

- prior to development occurring in areas where there is a potential for the presence of Unexploded Ordnance, the subdivider shall obtain written clearance from the UXO Unit of the Fire and Emergency Services Authority (FESA) that the area has been investigated and cleared of UXO in a manner consistent with the proposed land use.

The UXO unit of FESA has expressed particular concern about the potential risk that UXO poses to future residents within the area. Of particular concern is the area around the Two Rocks Artillery Range.

The DEP has negotiated with the Responsible Authority and the landowner to make some small modifications to the Environmental Management Recommendations described above to adequately address the management of this factor. The modifications involve the following:

- the subdivider shall prepare an Unexploded Ordnance Remediation Plan at the Local Structure Planning stage to render the Amendment area safe for the intended land uses to the requirements of Council with the concurrence of the UXO unit of the Fire and Emergency Services Authority (FESA) on advice from the DEP and the Department of Minerals and Energy. The plan shall include:
  - the results of investigations of the Amendment area to determine the presence of any unexploded ordnance an/or explosive wastes;
  - a remediation plan to address the findings of the investigations; and
  - timing for remediation to be prior to the subdivider lodging plans/diagrams of survey for final endorsement and prior to any other ground disturbing works.

## **Summary**

Having particular regard to the:

- potential for the Amendment area to be subject to UXO pollution;
- risk UXO pollution poses to future residents;
- the Responsible Authority's Environmental Management Recommendations which require the subdivider/s to obtain written clearance from the UXO Unit of FESA that the area has been investigated and cleared of UXO in a manner consistent with the proposed land use;
- advice from the UXO Unit of the Fire and Emergency Services Authority of WA that the area around the Two Rocks Artillery Range is of particular concern; and
- Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;

it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective for risk.

### **3.10 Aboriginal Culture and Heritage**

#### **Description**

Surveys for Aboriginal archaeological ethnographic sites within the Amendment area were undertaken by Quartermaine (1991) and MacIntyre and Dobson (1991). No ethnographic sites were identified within the Amendment area however, one Aboriginal archaeological site was recorded within the Amendment area.

This site is located approximately 1km north of the current Yanchep townsite on the eroding crest of an older Quindalup Dune sequence and consists of up to 40 artefacts dominated by quartz. It also includes one fossiliferous chert flake and one quartzite blacked blade. This site is considered to be important as it represents one of few sites recorded on the Quindalup Dune System.

A check of the Aboriginal Sites register in May 1999 confirmed that no other sites have been subsequently identified.

#### **Assessment**

The area considered for assessment of this factor is the Amendment area.

The EPA's environmental objective for this factor is:

- i) Ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act 1972*; and
- ii) Ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.

The EPA recognises that the proposed development of the Amendment area could directly impact upon the Aboriginal archaeological site identified 1km north of the current Yanchep townsite.

To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve:

- the developer and subdivider shall ensure that District and Local Structure Planning has regard to the presence of the archaeological site within the Amendment area and shall take all reasonable measures to limit or prevent disturbance of this site during or following development;
- if it becomes necessary to disturb the archaeological site, the subdivider shall obtain the necessary clearances under the Aboriginal Heritage Act 1972; and
- the subdivider shall ensure that employees and workers involved in construction activities in the vicinity of the archaeological site receive training regarding protection of its values.

The Aboriginal Affairs Department (AAD) raised concerns about further sites of Aboriginal significance, particularly subsurface cultural material and burials, being identified during the development of the Amendment area. To protect these potential sites the AAD has requested that construction activities be carefully monitored to ensure that no potential sites are damaged.

The AAD also stipulated the requirements under Section 18 of the Aboriginal Heritage Act 1972 for developers to apply for a permit from the Minister if development is to impact upon an identified Aboriginal site.

To address these concerns the DEP negotiated with the Responsible Authority and the landowner following the public comment period to modify the Environmental Management Recommendations. This involves the inclusion of the following:

- prior to commencement of site works, staff shall undergo a briefing on Aboriginal Heritage issues to enable staff to recognise materials that may constitute an Aboriginal site. During earthworks all contractors will be supervised by a Site Manager, who, if a suspected site is discovered, will seek specialist advice to confirm the identification of the site.

### **Summary**

Having particular regard to the:

- a) Aboriginal site 1km north of the current Yanchep townsite, and within the Amendment area;
- b) Aboriginal Affairs Department's advice; and
- c) Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;

it is the EPA's opinion that the Amendment is capable of being managed to meet the EPA's objective for Aboriginal Culture and Heritage

## **4. Conditions**

Section 48D of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the Amendment and on the conditions to which the Amendment should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

In developing recommended conditions, the EPA's preferred course of action is to have the Responsible Authority provide an array of management measures and/or environmental conditions to ameliorate the impacts of the amendment on the environment. The management measures are considered by the EPA as part of its assessment of the amendment and, following discussion with the Responsible Authority the EPA may seek additional management measures or environmental conditions.



#### **4.1 Recommended conditions**

Having considered the Responsible Authority's proposed environmental conditions and the information provided in this report, the EPA has developed a set of conditions which are consistent with but replace those environmental conditions as originally proposed in the Amendment documentation and as modified during the assessment process, if the proposed amendment is approved for implementation. These conditions are presented in Appendix 3. Matters addressed in the conditions include:

- (a) assessment of vegetation at the District Structure Planning (DSP) stage;
- (b) preparation and implementation of a Vegetation and Fauna Management Plan at the Local Structure Planning (LSP) stage;
- (c) preparation and implementation of a Drainage, Nutrient and Water Management Plan at the LSP stage;
- (d) preparation of a Karst Management Strategy at the LSP stage to identify development constraints;
- (e) seeking further advice and undertaking investigations where appropriate to develop a Stygofauna and/or Troglotic Fauna Management Plan at the LSP stage;
- (f) management of emissions (odour, noise, dust);
- (g) preparation and implementation of a Solid and Liquid Waste Management Plan;
- (h) preparation and implementation of a UXO Remediation Plan;
- (i) preparation and implementation of an Aboriginal Culture and Heritage Management Plan; and
- (j) a general environmental review to be undertaken every five years.

#### **5. Other Advice**

The EPA notes that with respect to the scheme amendment, provision can be made to annotate the relevant City of Wanneroo TPS No. 1 map/s so that the environmental conditions inserted in the TPS No. 1 text are identified. In the case of this assessment, an environmental condition to that effect has been recommended.

As discussed in the Introduction, the EPA recognises that the proposed amendment will facilitate the development over 30 years of a \$12 billion satellite city incorporating 55,000 new homes for up to 150,000 people over a landholding of approximately 4000ha. Therefore, the EPA considers that the proposed development of the Amendment area needs to be environmentally sustainable in the long-term which requires an integrated approach to planning and environmental management in the Amendment area.

This report has detailed the relevant environmental factors which require management throughout the planning process to ensure that the development is environmentally sustainable, resulting in a series of environmental conditions to be included in the Scheme. One of these conditions refers specifically to a general environmental review every five years to ensure that the environmental assessment of scheme amendments is achieving sustainable development and, as scientific research continues and environmental management techniques evolve, the development continues to be environmentally sustainable.

The EPA also notes that this amendment does not allow for the development of a marina nor does it give environmental approval for groundwater extraction. Any proposal/s for groundwater abstraction or the development of a marina should be referred to the EPA under Section 38 of the *Environmental Protection Act 1986* prior to approval being granted.

## 6. Conclusions

The EPA has concluded that Amendment 787 to the City of Wanneroo's Town Planning Scheme No. 1 to rezone the Yanchep/Two Rocks area to "Urban Development Zone", "Centre Zone" and "Industrial Development Zone" from the current TPS No. 1 zonings of "Central City Area", "Rural", "Service Station", "Special Zone (Additional Use) Video Hire" and "Residential Development" can be implemented to meet the EPA's objectives provided the conditions recommended in Section 4 and set out in Appendix 3 are imposed and enforced.

## 7. Recommendations

Section 48D of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposed amendment and on the conditions and procedures to which the amendment should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the project being assessed is to rezone the Yanchep/Two Rocks area to "Urban Development Zone", "Centre Zone" and "Industrial Development Zone" from the current Town Planning Scheme (TPS) No. 1 zonings of primarily "Central City Area", "Rural", "Service Station", "Special Zone (Additional Use) Video Hire" and "Residential Development" (Figure 1).
2. That the Minister considers the report on the relevant environmental factors of vegetation, stygofauna and troglobitic fauna, groundwater quantity, karst, air quality, groundwater quality, solid and liquid waste, Unexploded Ordnance, Aboriginal Culture and Heritage as set out in Section 3.
3. That the Minister notes that the EPA has concluded that the EPA's objectives can be met, provided the recommended conditions set out in Section 4 are incorporated by the Responsible Authority into the scheme and implemented at the appropriate level of planning.
4. That the Minister in consultation with the Minister for Planning imposes the conditions recommended in Appendix 3 of this report.
5. That the Minister notes that where any future development proposal complies with the Plans and raises no additional environmental factors, the development proposal will not normally be subject to further assessment under Part IV of the *Environmental Protection Act 1986*. However, future development proposals will still be subject to the normal development approvals process, including licensing and pollution control environmental conditions of the *Environmental Protection Act 1986* where applicable.
6. That the Minister notes that this amendment does not allow for the development of a marina nor does it give environmental approval for groundwater extraction. Any proposal/s for groundwater abstraction or the development of a marina should be referred to the EPA under Section 38 of the *Environmental Protection Act 1986* prior to approval being granted.

## **Appendix 1**

### **List of submitters**

**Organisations:**

Urban Bushland Council of WA  
Two Rocks Yanchep Residents Association Inc.  
Water Corporation (2)  
Fire and Emergency Services Authority of WA  
Aboriginal Affairs Department  
Australian Speleological Federation  
Western Australian Speleological Group  
Masterplan Consultants  
Western Power

**Individual:**

Mr R. Spence  
Mr W. Bowman  
Mrs C.M. Edwards  
Mr R. Foulds  
Mr Iain MacLean, MLA

## **Appendix 2**

### **References**

Alan Tingay & Associates (1998). *Karstic Terrain Appraisal for Lots 201 and 202 Breakwater Drive, Two Rocks*.

Alan Tingay & Associates (1992). *Yanchep Structure Plan Flora and Vegetation Report*. Prepared on behalf of Tokyu Corporation.

Alan Tingay & Associates and Peck (1991). *Yanchep Structure Plan Hydrogeology and Water Resource Development*. Prepared on behalf of Tokyu Corporation.

Bastian, L. (1996). Speleogenetic Controls at Yanchep. *The Western Caver*, Volume 36, pp. 13-19.

Beard, J.S. (1979). *The Vegetation of the Perth Area, Western Australia*. Vegmap Publications.

Department of Conservation and Environment (1983). *Conservation Reserves for Western Australia as recommended by the Environmental Protection Authority - 1983. The Darling System - System 6. Part II: Recommendations for Specific Localities*. Report 13. Department of Conservation and Environment, October 1983.

Department of Conservation and Land Management (1999). *Yanchep National Park Management Plan 1989 - 1999*. Department of Conservation and Land Management.

Department of Conservation and Land Management (1999). *Gnangara Park, Concept Plan*. Department of Conservation and Land Management, May 1999.

Department of Environmental Protection and Western Power Corporation (1996). *The Perth Photochemical Smog Study*. Department of Environmental Protection and Western Power Corporation.

Department of Planning and Urban Development (1993). *Yanchep Structure Plan*.

English, V. & Blyth, J. (1997). *Identifying and conserving threatened ecological communities (TEC's) in the South West Botanical Province*. ANCA National Reserves System Cooperative Program: Project Number N702. Final Report: May 1997.

Environmental Protection Authority (1993). *Draft WA Guidelines for Fresh and Marine Waters*.

Environmental Protection Authority (1994). *Central Coast Regional Strategy*. (Bulletin 765) Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority (1996) Advice to the Western Australian Planning Commission under Section 16 of the Environmental Protection Act in relation to Metropolitan Region Scheme Amendment 975/33 and Superlot subdivision of Yanchep / Two Rocks area, St Andrews. Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority (1996a) *Special Residential Development, Lyndon locations 222 and 223, Exmouth* (Bulletin 829) Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority (1997a) *Limestone mine, quicklime plant and use of existing port facility (Point Murat), Shire of Exmouth* (Bulletin 846), Environmental Protection Authority, Perth, Western Australia.

Environmental Protection Authority (1997b) *Extensions to the Exmouth water supply borefield* (Bulletin 843) Environmental Protection Authority, Perth, Western Australia.

- Environmental Protection Authority (1997b) *Draft Policy for Industrial - Residential Buffer Areas (Separation Distances)*. Environmental Protection Authority, Perth, Western Australia.
- Gillieson, D. (1996). *Caves: Processes, Development and Management*.
- Government of Western Australia (1998). *Perth's Bushplan (Draft)*. Volumes 1 and 2A, B and C. Government of Western Australia, November, 1998.
- Hamilton-Smith, E., Kiernan, K. & Spate, A. (1998). *Karst Management Considerations for the Cape Range Karst Province Western Australia*, Prepared for Department of Environmental Protection (WA).
- Humphreys, W.F. (1993). 'The significance of the subterranean fauna in biogeographical reconstruction: examples from Cape Range Peninsula, Western Australia'. *The Biogeography of Cape Range, Western Australia*, Western Australian Museum, Perth, Western Australia. pp 165-192.
- Jasinka, E.D., Knott, B., and McComb, A.J. (1996). Root mats in Groundwater: A Fauna-Rich Cave Habitat. *Journal of North America Benthological Society* 15 (4): 508 - 519.
- Jasinka, E.J. (1990). *Root mat Ecosystem in an Epiphreatic stream; Cabaret Cave, Yanchep National Park*. Honours thesis, Murdoch University, Perth, WA.
- Jasinka, E.J. (1997). *Faunae of aquatic root mats in caves of southwestern Australia: origins and ecology*. PhD thesis, Department of Zoology, The University of Western Australia.
- Jasinka, E.J. and Knott, B. (1991). *Stability of Root Mat Ecosystems in a Groundwater Stream: Cabaret Cave, Yanchep National Park, Western Australia*. Report to ANPWS, ESP Project No. 46.
- Jones Lang Wootton (1992). *Yanchep Structure Plan Overview Report: Response to Draft North West Corridor Structure Plan*, Department of Planning and Urban Development (February, 1991). Prepared for Tokyu Corporation.
- MacIntyre, K. and Dobson, B. (1991). *Yanchep Structure Plan Report on a survey for Aboriginal Sites*. Prepared on behalf of Tokyu Corporation.
- National Health and Medical Research Council & Agriculture and Resource Management Council of Australia and New Zealand (1996). *Australian Drinking Water Guidelines*. Commonwealth of Australia.
- Quartermaine, G. (1991). *Yanchep Structure Plan - Report on an Archaeological Survey for Aboriginal Sites*. Prepared on behalf of Tokyu Corporation.
- Shire of Wanneroo (1999). *Shire of Wanneroo, Town Planning Scheme No. 1, Amendment No. 787 - Yanchep/Two Rocks. Environmental Review*. Prepared by Alan Tingay & Associates on behalf of the Shire of Wanneroo, June 1999.
- State Planning Commission (1994). *Central Coast Regional Strategy*.
- Trudgen, M. (1990). *A Report on the Flora and Vegetation of Areas at Wilbinga and Breton Bay Proposed as Alternatives for a Future Industrial Site*. Prepared for Halpern Glick Maunsell.
- Water Authority of Western Australia (1990). *Groundwater Scheme Review Yanchep - Two Rocks*. Water Authority of Western Australia, Report No. WG 101.
- Water and Rivers Commission (1998). *Land Use Compatibility in Public Drinking Water Source Areas*. Water Quality Protection Note, July, 1998.

Weston, A.S and Gibson, N. (1997) *Report on the limestone vegetation of the Wabling Hill area, Reserves 3911 and 39412, and the Ridges extension to Yanchep National Park.* Unpublished report for the Department of Conservation and Land Management, Como, Western Australia.



## **Appendix 3**

### **Recommended Environmental Conditions**

## **Recommended Environmental Conditions**

### **STATEMENT THAT A SCHEME MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF DIVISION 3 OF PART IV OF THE ENVIRONMENTAL PROTECTION ACT 1986)**

CITY OF WANNEROO TOWN PLANNING SCHEME NO. 1, AMENDMENT NO. 787

#### **Scheme Purpose:**

- a) to rezone the portion of the Yanchep-Two Rocks area zoned "Central City Area" on the Metropolitan Region Scheme, being portions of Pt Lot 8 and Pt Lot M1689 from "Rural" and "Residential Development" to "Centre Zone";
- b) rezone the portion of the Yanchep-Two Rocks area zoned "Industrial" on the Metropolitan Region Scheme being portion of Pt Lot M1689 from "Rural" to "Industrial Development Zone"; and
- c) rezone Lots 1, 101, 102, 103, Pt Lot 8, Lot 12, Pt Lot 9, Pt Lot M1689, Lot 200, lot 201, Reserve 41479, Lot 16, lot 8, Portion Lot 35, lot 1011 and Pt Lot M1688, being those portions of the Yanchep-Two Rocks area which are zoned "Urban" or "Urban Deferred" under the Metropolitan Region Scheme and zoned "Rural", "Service Station", "Special Zone (Additional Use) Video Hire" and "Residential Development" under City of Wanneroo Town Planning Scheme No. 1 to "Urban Development Zone".

**Responsible Authority:** City of Wanneroo

**Responsible Authority Address:** 11 Moolanda Boulevard  
KINGSLEY WA 6026

**Assessment Number:** 1136

#### **Report of the Environmental Protection Authority: Bulletin 959**

Subject to the following Environmental Conditions, there is no known environmental reason why the planning Scheme Amendment to which the above report of the Environmental Protection Authority relates should not be implemented:

1. The following clauses shall be inserted into the City of Wanneroo Town Planning Scheme No.1 Scheme Text:

#### **"5.13 Environmental Conditions**

- 5.13.1** In accordance with Section 7A4 of the Town Planning and Development Act, environmental conditions imposed by the Minister for the Environment on the Scheme or amendments to the Scheme and contained in Statements under Section 48F Environmental Protection Act, are incorporated into the Scheme by Schedule 13 of the Scheme.
- 5.13.2** Where appropriate, the Environmental Conditions are indicated on the Scheme Map by the Symbol EC to indicate that Environmental Conditions apply to the land.

**5.13.3** The Responsible Authority shall maintain a register of all the Statements published under Section 48F referred to in sub-clause 5.13.1 which shall be made available for public inspection at the offices of the local government.”

2. The following schedule shall be inserted into the City of Wanneroo Town Planning Scheme No. 1 Scheme Text:

**Schedule 13 Environmental Conditions**

<b>Amendment No. (Gazettal Date)</b>	<b>Location of Land</b>	<b>Environmental Conditions associated with the Area Identified in “Location of Land”</b>
787 X/X/19X	The suburbs of Yanchep and Two Rocks	<p><b>1. Assessment of Local Vegetation</b></p> <p>At the <b>District Structure Planning Stage</b>, the landowner shall undertake a assessment of the local vegetation within the Amendment area. This assessment shall build on the strategies outlined in the Yanchep Structure Plan (1993) and the existing vegetation surveys (Alan Tingay and Associates 1992a,1992c) and (Trudgen 1990, 1996). Where necessary further vegetation surveys shall be undertaken to update the existing surveys. The assessment shall identify significant areas of vegetation and this information shall be used when developing the structure plan, in order to optimise the area and value of vegetation retained in public open space. Consultation shall also occur with agencies responsible for managing adjacent reserves to allow their input at this strategic stage, this includes the Department of Conservation and Land Management, National Parks and Nature Conservation Authority, Department of Environmental Protection, and in addition with relevant community groups. The preservation of vegetation shall also assist in maintaining the diversity of the fauna using the remnant vegetation as habitat. The fauna values of the vegetation shall therefore be considered in any assessment.</p>
		<p><b>2. Vegetation and Fauna Management Plan</b></p> <p>At the <b>Local Structure Planning Stage</b>, the landowner shall prepare a detailed Vegetation and Fauna Management Plan which builds on the assessment undertaken at the District Structure Planning stage. The Vegetation and Fauna Management Plan shall endeavour to ensure the long-term viability of remnant vegetation that may be affected directly or indirectly by development of the subject lots to the requirements of the Responsible Authority, with the concurrence of the Department of Environmental Protection and Department of Conservation and Land Management and in consultation with relevant community groups.</p> <p>This plan shall include:</p> <p>2.1 Description of vegetation and vegetation values, and the identification of the environmental outcome (including sustainability indicators) to be achieved through the implementation of this plan.</p> <p>2.2 The definition and retention of “locally significant” areas of vegetation within the Amendment area with consideration to the creation of vegetation corridors to facilitate the movement of fauna and floristic genepools;</p> <p>2.3 Management of indirect impacts on the adjacent Parks and Recreation (P&amp;R) areas to the satisfaction of relevant State Agencies through appropriate subdivision design (eg. roads abutting P&amp;R areas).</p> <p>2.4 Clear delineation of significant areas of vegetation to be preserved through use of dual use paths, roads and the like.</p>

		<p>2.5 Details on vegetation maintenance arrangements - including weed control and consideration of the use of provenance seed for rehabilitation.</p> <p>2.6 Fire Management.</p> <p>2.7 Control of off-road vehicle use and dumping of rubbish.</p> <p>2.8 Enhancement of community awareness of bushland protection.</p> <p>2.9 Allocation of responsibilities and identification of timing and duration for implementation.</p> <p>2.10 Provision for routine monitoring of remnant vegetation within the Amendment area. Factors to be monitored include species diversity, cover and density.</p> <p>2.11 Provision of details of contingency plans in the event that the monitoring surveys indicate that the development has had an adverse impact upon remnant vegetation which is surveyed as part of Condition 2.10.</p>
		<p><b>3. Stygofauna and Troglobitic Fauna Management</b></p> <p>If studies in relation to Karst and hydrology indicate the likelihood of significant stygofauna and/or troglobitic fauna assemblages being present in or immediately adjacent to the Amendment area the landowner (with assistance from relevant scientific experts) shall undertake a survey (at the <b>Local Structure Planning stage</b>) to assess the nature and extent of any population/s.</p> <p>This survey shall be completed prior to finalisation of the Local Structure Plan. A Stygofauna and/or Troglobitic Fauna Management Plan shall then be developed by the landowner to the requirements of the Responsible Authority on advice from the Department of Environmental Protection, Department of Conservation and Land Management and relevant scientific experts. This plan shall include:</p> <p>3.1 The identification of the environmental outcome (including sustainability indicators) to be achieved through the implementation of this plan.</p> <p>3.2 Management strategies for the protection of stygofauna and/or troglobitic fauna within and immediately adjacent to the Amendment area.</p> <p>3.3 Recommendations for ongoing sampling as required of karstic areas to determine number and species diversity of stygofauna and/or troglobitic fauna.</p> <p>3.4 Provision of details of contingency plans in the event that the investigations and monitoring surveys indicate that the development has had an adverse impact upon populations of stygofauna and/or troglobitic fauna.</p> <p>3.5 Allocation of responsibilities and identification of timing and duration for implementation.</p>
		<p><b>4. Assessment of Hydrology</b></p> <p>At the <b>District Structure Planning stage</b>, developers must liaise with Water Corporation during the preparation of District Structure Plans to ensure any development of the area shall not jeopardise future groundwater extraction.</p> <p><b>5. Drainage, Nutrient and Water Management Plan</b></p> <p>At the <b>Local Structure Planning stage</b>, the landowner shall prepare a Drainage, Nutrient and Water Management Plan, to the requirements of the Responsible Authority on the advice of Department of Environmental Protection, Water and Rivers Commission, Water Corporation and relevant scientific experts to:</p> <p>5.1 Identify the environmental outcome (including sustainability indicators) to be</p>

		<p>achieved through the implementation of this plan.</p> <p>5.2 Ensure surface and groundwater are managed to the minimum requirements of a Priority 3 Groundwater Source Protection Area.</p> <p>5.3 Include provisions for the connection of all areas of development to the deep sewerage system.</p> <p>5.4 Demonstrate that best practice Water Sensitive Urban Design principles are incorporated to maximise on-site water infiltration generally.</p> <p>5.5 Provide details of reporting mechanisms to demonstrate compliance with performance criteria specified in the Plan.</p> <p>5.6 Provide details of contingency plans in the event that the performance criteria specified in the plan are not achieved.</p>
		<p><b>6. Assessment of Karst Landform</b></p> <p>At the <b>District Structure Planning Stage</b>, the landowner shall review existing geotechnical information and undertake further site investigations to confirm the nature and extent of Karst landform. District Structure Planning shall have regard to the presence of Karst.</p> <p><b>7. Karst Management Strategy</b></p> <p>At the <b>Local Structure Planning Stage</b>, the landowner shall prepare a Karst Management Strategy to the requirements of Responsible Authority on the advice of Department of Environmental Protection, Water and Rivers Commission, and relevant scientific experts. The Strategy shall include:</p> <p>7.1 The identification of the environmental outcome (including sustainability indicators) to be achieved through the implementation of this plan.</p> <p>7.2 Detailed geotechnical investigations in areas of karst or potential karst in accordance with the protocols described in Alan Tingay &amp; Associates (1999) and summarised in Table 1 (attached).</p> <p>7.3 Provision to ensure that no development shall be permitted on areas immediately over large karstic structures unless approved by a qualified geotechnical consultant and environmental scientist and agreed to by the Responsible Authority.</p> <p>7.4 Provision for routine monitoring of high risk karstic features within the Amendment area to note enlargements in karstic features, new openings and recent collapse or subsidence.</p> <p>7.5 Provision of details of contingency plans in the event that the investigations and monitoring surveys indicate that the development has had an adverse impact upon karstic landforms.</p> <p>7.6 Allocation of responsibilities and identification of timing and duration for implementation.</p>
		<p><b>8. Assessment of Emissions</b></p> <p>At the <b>District Structure Planning stage</b>, the landowner shall take account of:</p> <p>8.1 The EPA's draft policy for Industrial - Residential Buffer areas (Separation distances).</p> <p>8.2 Statement of Planning Policy No. 4 (State Industrial Buffer Policy).</p>

		<p><b>9. Emissions Management</b>  At the <b>Local Structure Planning stage</b>, the landowner shall ensure land use compatibility between the industrial zone and surrounding land uses. The landowner shall take account of:</p> <p>9.1 EPA's Interim guidance on Air Quality Impacts from Development Sites;</p> <p>9.2 Environmental Protection (Noise) Regulations 1997; and</p> <p>9.3 Codes of Practice.</p> <p>Development Applications within the industrial zone shall be assessed by the Responsible Authority with regard to compliance with government policies in relation to buffer zones.</p>
		<p><b>10. Solid and Liquid Waste Management Plan</b></p> <p>The landowner shall ensure that lots within the industrial zone are connected to the deep sewerage system for the disposal of appropriate liquid wastes as approved by the relevant Government Agency/ies. A Solid and Liquid Waste Management Plan shall be prepared at the <b>Local Structure Planning stage</b> to the requirements of the Responsible Authority on the advice of the DEP. The report shall detail:</p> <p>10.1 The identification of the environmental outcome to be achieved through the implementation of this plan.</p> <p>10.2 Options for recycling, and appropriate storage and disposal options for liquid and solid wastes from industry.</p>
		<p><b>11. Unexploded Ordnance Remediation Plan</b></p> <p>The landowner shall prepare an Unexploded Ordnance Remediation Plan at the <b>Local Structure Planning stage</b> to render the Amendment area safe for the intended land uses to the requirements of Responsible Authority with the concurrence of the UXO unit of the Fire and Emergency Services Authority (FESA) on advice from the Department of Environmental Protection and the Department of Environmental Protection and Department of Minerals and Energy. The plan shall include:</p> <p>11.1 The identification of the environmental outcome to be achieved through the implementation of this plan.</p> <p>11.2 The results of investigations of the Amendment area to determine the presence of any unexploded ordnance an/or explosive wastes.</p> <p>11.3 A remediation plan to address the findings of the investigations.</p> <p>11.4 Timing for remediation to be prior to the subdivider lodging plans/diagrams of survey for final endorsement and prior to any other ground disturbing works.</p>
		<p><b>12. Aboriginal Culture and Heritage Management</b></p> <p>The landowner shall ensure that District and Local Structure Planning has regard to the presence of the archaeological site within the Amendment area and shall take all reasonable measures to limit or prevent disturbance of this site during or following development.</p> <p>The landowner shall prepare an Aboriginal Culture and Heritage Management Plan at the <b>Local Structure Planning stage</b> to the requirements of Responsible Authority with the concurrence of the Aboriginal Affairs Department and the Department of Environmental Protection. The plan shall include:</p>

		<p>12.1 The identification of the environmental outcome to be achieved through the implementation of this plan.</p> <p>12.2 Management strategies for the archaeological site, (if it becomes necessary to disturb the archaeological site, the subdivider shall obtain the necessary clearances under the <u>Aboriginal Heritage Act, 1972</u>).</p> <p>12.3 Management strategies to ensure that employees and workers involved in construction activities in the vicinity of the archaeological site receive training regarding protection of its values.</p> <p>12.4 Management strategies to ensure that prior to commencement of site works, staff shall undergo a briefing on Aboriginal Heritage issues, to enable staff to recognise materials that may constitute an Aboriginal Site. During earthworks all contractors shall be supervised by a Site Manager, who, if a suspected site is discovered, shall seek specialist advice to confirm the identification of the site.</p>
		<p><b>13. General Environmental Review</b>  An environmental review of land within the Amendment area shall be undertaken by the Responsible Authority on the advice of the Department of Environmental Protection, to the satisfaction of the EPA every five years and up until all land within the Amendment area is subdivided and developed. This review shall involve:</p> <p>13.1 Reporting on progress in regards to the achievement of environmental outcomes. This can be achieved through consolidation and analysis of the monitoring results and management responses to these results (contingency plans) which are required as per the provisions of the Management Plans detailed in Conditions 2, 3, 5 and 8.</p> <p>13.2 Documentation of progress in respect to the achievement of the environmental outcomes specified under the other conditions ie. Conditions 11, 12 and 13.</p> <p>13.3 Proposals for any modifications to management strategies (outlined in the conditions) which are necessary to achieve the environmental outcomes.</p> <p>13.4 Notwithstanding the above:</p> <ul style="list-style-type: none"> <li>• any potentially new significant environmental issues or information which are raised during the development; and</li> <li>• any need for immediate contingency measures;</li> </ul> <p>shall be referred immediately to the EPA.</p> <p>13.5 An appraisal of progress in regard to the environmental sustainability of the development area, as per the intentions of the developers.</p>

3. Condition 1 and 2 requires modification to Town Planning Scheme No. 1 by the insertion of text. This modification shall not have effect until Amendment No. 787 is approved and gazetted. Notwithstanding this, the intent of the text modification shall have effect from the date of this Statement.

**TABLE 1**

**WORK SCHEDULE REQUIRED FOR SUBDIVISION OF LOTS 201 AND 202 BREAKWATER DRIVE WITH RESPECT TO KARST TERRAIN APPRAISAL**

	Placement of Building Envelopes/Drainage Design for Proposed Subdivision				Building Envelope Assessment		Prior to Foundation		
	Structure Assessment Prior to Subdivision	Detailed interpretation of existing GPR data	Detailed geotechnical inspection target location, drilling, and possible remediation	Geotechnical inspection and recommendations for additional site geotechnical assessment prior to building <sup>1</sup>	Geotechnical Assessment	Investigations for			
	A further geotechnical appraisal of the high and medium risk karst areas with respect to the draft LSP design **				Further GPR as recommended from the geotechnical evaluation	Drilling >1 borehole to total depth of 15m	Drilling at least 1 borehole to a total depth of more than 15m	Testing Pitting to 3m depth <sup>2</sup>	Perth Sand Penetro meter Testing to 750mm <sup>3</sup>
High	✓	✓	✓						Further work on high risk only if specifically required/remediation work
Medium	✓			✓	✓*	✓		✓	✓
Low		✓		✓	✓*		✓	✓	✓
Very Low		✓		✓	✓*			✓	✓



\* On the basis of advice from the geotechnical assessment.

\*\* Geotechnical works likely to involve mapping and GPR. Program to be developed in consultation with Shire of Wanneroo and a geotechnical engineer.

1. Following the geotechnical assessment a reappraisal of the work program for building envelope assessment with respect to the risk rating may be required.

2. Test Pitting is generally carried out by a backhoe and refilled after logging and sampling.

3. The Perth Sand Penetrometer is a hand held portable device used for measuring the compaction of soils.

## **Appendix 4**

### **Summary of Submissions and Responsible Authority's Response to Submissions**

**City of Wanneroo Town Planning Scheme No. 1, Amendment No. 787 - Primarily to Rezone the Yanchep/Two Rocks area from "Rural" and "Residential Development" to "Urban Development Zone", "Centre Zone" and "Industrial Development Zone"**

**Environmental Review**

**Assessment Number 1136**

**BIOPHYSICAL**

**1 Vegetation**

**1.1 The terminologies employed in the "Vegetation Condition Ratings" set out in Appendix 3 of the Environmental Review (ER) are inappropriately negative. For example, the Vegetation Condition Scales used in "Perth's Bushplan Directory" (Volume 2 Part A, Table 12) are such that the category "Very Good" equates in actual site attributes to the ER's category of "Obvious Disturbance" (Appendix 3). Therefore, why were these Vegetation Condition Scales used in "Perth's Bushplan Directory" not used to assess the condition of the vegetation within the Amendment area? Given that Bushplan was prepared by the Western Australian Planning Commission, the Environmental Protection Authority, the National Parks and Nature Conservation Authority and the Water and Rivers Commission, it is preferable that these condition rating terminologies be employed in planning documents of this nature.**

R1.1 Vegetation mapping of the Amendment area, including determination of the vegetation condition, was undertaken in 1992 and incorporated into the amendment documentation in 1998, prior to the publication of the Draft Perth's Bushplan report.

The condition classification system historically used by Alan Tingay & Associates is an objective, descriptive system, and has six categories, like the Bushplan scale. The only difference between the scales is the terminology adopted to describe the vegetation condition (refer to the following comparison table).

Condition Rating Used by Keighery (1994) and adopted by Bushplan (1999)	Condition Rating Used by (Trudgen (1993)	Condition Rating Used by Alan Tingay & Associates
<p><b>Pristine</b> Pristine or nearly so, no obvious signs of disturbance</p>	<p><b>Excellent</b> Pristine or nearly so, no obvious signs of damage caused by the activities of European man.</p>	<p><b>Undisturbed</b> No obvious sign of impact caused by human activities</p>
<p><b>Excellent</b> Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive</p>	<p><b>Very Good</b> Some relatively slight signs of damage caused by the activities of European man. For example, some signs of damage to tree trunks caused by repeated fires and the presence of relatively non aggressive weeds or occasional vehicle tracks.</p>	<p><b>Slightly Disturbed</b> Some slight signs of impact caused by human activities such as the presence of non-aggressive weeds and vehicle tracks.</p>
<p><b>Very Good</b> 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.</p>	<p><b>Good</b> More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones.</p>	<p><b>Disturbed</b> Signs of impact caused by human activities including some impact on the vegetation structure such as caused by grazing, fire and logging. Mainly non-aggressive weeds with some more aggressive ones also possibly present.</p>
<p><b>Good</b> Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.</p>	<p><b>Poor</b> Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man such as grazing or partial clearing (chaining) or very frequent fires. Weeds as above, probably plus some more aggressive ones such as <i>Ehrharta</i> spp.</p>	<p><b>Obviously Disturbed</b> Obvious human impacts such as grazing, partial clearing, and frequent fires. Vegetation structure slightly altered but still able to regenerate. More aggressive weeds such as Veldt Grass probably present.</p>
<p><b>Degraded</b> 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.</p>	<p><b>Very Poor</b> Severely impacted by grazing, fire, clearing, or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species including aggressive species.</p>	<p><b>Severely Disturbed</b> Severely impacted by grazing, fire or clearing with little scope of regeneration to normal structure. Usually with a number of weed species including aggressive species.</p>

<p><b>Completely Degraded</b> The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.</p>	<p><b>Completely Degraded</b> Areas that are completely or almost completely without native species in the structure of their vegetation, i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.</p>	<p><b>Degraded</b> Areas that are completely or almost completely without native species in the structure of the vegetation. Includes areas that are parkland cleared with their flora comprising weed or crop species with isolated native trees or shrubs.</p>
--	--	--

**1.2 Why was an aerial photograph of the Amendment area, superimposed with appropriate borders and boundaries, not included in the ER? The non-inclusion of such data is very disappointing.**

R1.2 There are eleven figures in the ER document presenting information on the Amendment area. All issues of environmental importance are detailed and the document was approved as suitable for public release.

**1.3 Remnant vegetation within the Amendment area which is not in poor to very poor condition ("Severely disturbed" to "Degraded" in the ER) should be conserved.**

R1.3 The majority of the Amendment area comprises vegetation that has been extensively modified by human activities such as clearing for stock grazing.

The vegetation survey conducted in 1992 did not identify any vegetation listed as Threatened or of regional significance. Some areas of limestone heath within the Amendment area are of sufficient size and quality to be regarded as locally significant. The reservation of specific areas will be considered during a strategic vegetation assessment (at District Structure Planning Stage) and then presented in detail in the Vegetation and Fauna Management Plan. Refer to Conditions 1 and 2 (attached).

**1.4 Ecological communities 26a, 29a and 29b (ER p14) are present within the Amendment area, as such they should be made a priority for conservation.**

R1.4 The community types 26a, 29a and 29b occur as small populations within the Amendment area and are expected to be present also within the surrounding areas of proposed or existing Regional Open Space. The potential for reservation of these areas for conservation purposes will be addressed at the District and Local Structure Planning Stage through the Conditions 1 and 2 (attached).

**1.5 Why have only some pockets of remnant vegetation within the Amendment area been identified as locally significant? Most of the remnant bushland within the Amendment area should be recognised at least as locally significant. How will areas of locally significant vegetation be conserved if they are to be identified at later stages of planning when proponents and their consultants may simply deny that specific areas have any local significance?**

R1.5 The recognition of vegetation as locally significant, as distinct from regionally significant, is dependent on a number of factors as identified in the following table.

**CRITERIA FOR LOCALLY AND REGIONALLY  
SIGNIFICANT BUSHLAND  
(Urban Bushland Strategy, 1995)**

<b>REGIONALLY SIGNIFICANT</b>	<b>LOCALLY SIGNIFICANT</b>
Example of a regional vegetation type which is threatened or poorly reserved or a site with special value for flora or fauna conservation.	One of the better examples of a local vegetation type.
Having considerable biodiversity or supports a population of Declared Rare Flora, priority listed flora, or threatened fauna.	Having biodiversity value but unlikely to include Declared Rare Flora. May include geographically significant species at the limit of their range.
Vegetation is in good condition or better. Threatened vegetation types may be regionally significant even if in poor condition.	Vegetation may be in poor condition but if poor, capable of regeneration.
Usually greater than 20 hectares but may be smaller in the case of threatened or poorly reserved vegetation types, or in areas with special significance for other purposes.	Ideally greater than 4 hectares but smaller areas may be of significance depending on how much remains in the locality.
Suitable for passive recreation by people from both within and beyond the locality.	Suitable for passive recreation by the local community.
Region wide use or potential for scientific or educational study.	Use or potential for use by local schools.
Having cultural heritage values of a regional or greater significance.	Having local heritage value.
Regular shape is desirable unless the area functions as a significant corridor linking other remnants.	Shape not critical but remnant should be capable of ongoing management.

Based on the criteria presented above, the remnant vegetation within the Amendment area is predominantly locally significant with elements of regional significance. The amendment documentation proposes that the Scheme include provisions which require subdivision proponents to specifically identify locally significant areas of vegetation within the Amendment area and to demonstrate that subdivision plans comply with government policies for vegetation management which prevail at that time.

The landowners earlier structure planning proposals for the Yanchep region provide significant guidance as to the layout of future developments and the need to preserve locally significant areas of vegetation. Refer to Conditions 1 and 2 (attached).

**1.6 The ER does not clearly identify environmentally important areas and how they must be treated. Why not give some indication of the minimum proportion of the Amendment area which is envisaged to be set aside for conservation?**

R1.6 This Amendment area is a very large tract of land and at the current stage of the planning process, it is not realistic to identify particular areas of locally significant vegetation to be conserved. Regionally significant vegetation has already been identified and preserved in conservation areas that are excluded from this Amendment. The strategic vegetation assessment and preparation of a Vegetation and Fauna Management Plan and will take place at the DSP and LSP stages respectively. Refer to Conditions 1 and 2 (attached).

**1.7 Why does the ER not address conservation commitments directly? Why are these commitments pushed along to subsequent stages of the planning process?**

R1.7 It is necessary to recognise that much of the Amendment area has already been rezoned for urban purposes pursuant to the Metropolitan Region Scheme and that the amendment to the City of Wanneroo's Town Planning Scheme is required to bring the City's Scheme into conformity with the Region Scheme (as required under State legislation).

As indicated previously, the size of the Amendment area makes it extremely difficult to accurately map areas of locally significant vegetation. This work needs to be undertaken when more detailed planning is undertaken. The City's scheme will, in effect, establish the framework for detailed structure planning processes through which environmental commitments will be addressed. Consistent with this proposition, the amendment includes provisions relating to completion of a Strategic Vegetation Assessment at the District Structure Planning Stage, preparation of a Vegetation Management Plan at the Local Structure Planning Stage (refer to Conditions 1 and 2, attached).

The Vegetation Management Plan will be developed in consultation with CALM and NPNCA under the framework set out in the Environmental Review, so that protection of bushland will be accomplished. It should also be noted that Conditions 1 and 2 have been modified to include consultation with UBC to ensure conservation commitments are appropriately addressed at the DSP and LSP stages.

**1.8 It is accepted that the best quality vegetation within the region is located in areas adjacent to the Amendment area. However, this should not be used as an excuse to dismiss the conservation values of the Amendment area. It is highly likely that the conservation values of the surrounding reserves and proposed reserves are enhanced by the large habitat remnants located within the Amendment Area.**

R1.8 The amendment does not seek to dismiss the conservation values of the Amendment Area. Specific Scheme provisions have, in fact, been included to require structure planning to address locally significant vegetation and to manage the preservation of remnant vegetation to optimise environmental outcomes. This process will be implemented through the Strategic Vegetation Assessment to occur at the DSP Stage and preparation of the Vegetation and Fauna Management Plan at the LSP Stage. Refer to Conditions 1 and 2 (attached).

**1.9 The ER states that the number of native plant species within the Amendment Area is comparable with the number in surrounding reserves and that the vertebrate fauna is similar to that also found in surrounding reserves. This information is highlighted in many ER's in an effort to show that what will be lost exists elsewhere. However, there is no excess of remnant bushland on the Swan Coastal Plain, therefore, there is no consolation drawn from the fact that the species of flora and fauna found in the Amendment Area are also found in nearby reserves.**

- R1.9 It is agreed that it would be ideal environmentally for there to be no further clearing of native vegetation throughout the Swan Coastal Plain. However, this is probably impractical while urbanisation continues and Perth's population grows, and it is also important to recognise that the Amendment Area has already been rezoned for urban related uses pursuant to the Metropolitan Region Scheme. The need to protect representatives of Swan Coastal Plain native vegetation has, nevertheless, also been recognised, and has prompted preparation of the Draft Perth's Bushplan documentation. The principal objective of Bushplan is to conserve representative portions of vegetation complexes at the regional level. The Amendment Area is surrounded by vegetation recognised for its regional conservation values under Bushplan. On this basis, it can be assumed that the proposed reservation of representative portions of significant vegetation at the regional level has been addressed in the vicinity of the Amendment Area.

Exclusion of the Amendment Area from Bushplan does not however, reduce the potential of local significance of the vegetation it contains. As indicated in previous responses, the retention of locally significant vegetation within the Amendment Area is acknowledged as important and will be addressed at District and Local Structure Planning levels and will consider issues such as the conservation values of individual species of flora and fauna. Refer to Conditions 1 and 2 (attached).

- 2.0 How will the likely effects of urban development on the remnant vegetation within the Amendment Area and on surrounding reserves be managed to reduce the potential environmental impacts? There needs to be an assurance that all practical measures available will be employed to reduce the impacts.**

- R2.0 The preparation of a Vegetation and Fauna Management Plan will address the management of remnant vegetation within the Amendment Area and the impact of development on adjoining conservation reserves. The issues relevant to the management of urban bushland, including the control of off road vehicle use, domestic pets, fire, introduction of disease, dumping of rubbish, weed invasion and stormwater management, will also be addressed in the Plan. Refer to Condition 2 (attached).

- 2.1 How much bushland within the Amendment Area will be preserved? Where are the figures?**

- R2.1 The landowner has already transferred very substantial areas of regionally significant native vegetation to Crown ownership in the form of Regional Parks and Recreation Reserve. The protection of locally significant vegetation within the Amendment Area will be addressed at the District and Local Structure Planning stages and will determine the exact area of bushland to be retained, and this will be generally in accordance with local authority requirements. Refer to Conditions 1 and 2 (attached).

- 2.2 The concept of a "detailed Vegetation Management and Fauna Plan" which is described in the ER is supported but the requirement or suggestion is loose and open to interpretation. How will the preparation of a "plan" guarantee reasonable conservation outcomes? The conservation outcomes here are unknown. What are they?**



R2.2 The Vegetation and Fauna Management Plan will achieve the following conservation outcomes:

- Retention of locally significant vegetation as part of local structure plans,
- Protection and long-term viability of remnant vegetation within local reserves,
- Management strategies to reduce the impact of the interface of development, and
- Allocation of responsibilities for the management of remnant vegetation.

This plan will be prepared to the satisfaction of relevant Government agencies prior to any development commencing. The Condition relating to the Vegetation and Fauna Management Plan has been substantially reworded to ensure the aims of the plan are specific and achievable. Refer to Condition 2 (attached).

**2.3 The conservation of linkages and corridors between reserves areas, both within and adjoining the Amendment Area, is essential. The planting of indigenous plant species grown from provenance seed, rather than merely native species, should be a priority.**

R2.3 Previous planning documents prepared by the land owner have consistently identified the need for development to incorporate green corridors containing remnant vegetation to provide the necessary linkages.

Conditions 1 and 2 have been modified to include consultation with UBC to ensure conservation commitments (including linkages and corridors) are appropriately addressed (refer to attachment). Revegetation strategies which, wherever possible, include the use of local native species grown from origin will also be considered in the Vegetation and Fauna Management Plan. Refer to Condition 2.5.

**2.4 Management measures designed to prevent damage to surrounding areas of high conservation value should include measures to prevent increased firewood stealing from the conservation reserves adjoining the Amendment Area.**

R2.4 Agreed. It is anticipated that the treatment of the interface between conservation reserves and urban development will include the installation of fences where appropriate, to restrict degradation of these areas. In addition, signage will be installed to encourage community cooperation in protecting the regional bushlands and to identify the penalties associated with its degradation. These issues will be addressed primarily at the LSP stage through the Vegetation Management Plan. Other measures to ensure community awareness of the importance of bushland conservation will also be addressed through the Vegetation and Fauna Management Plan, to be proposed at the Local Structure Plan Stage (refer to Condition 2, attached).

### **3 TERRESTRIAL FAUNA**

**3.1 The intensity of urban development seems to have an inversely proportional effect on our indigenous fauna assemblages. The proposed urban development could have severe impacts on fauna populations in the Amendment Area and surrounding areas. How will this be managed? Where are the firm assurances for the retention of significant areas of habitat for fauna? Where are the figures indicating how much of the habitat areas are to be retained?**

R3.1 Major areas of high quality regionally significant vegetation have already been allocated as Regional Parks and Recreation Reserve. The protection of fauna habitats within the Amendment Area will be addressed through the Vegetation and Fauna Management Plan. Localised vegetation assessments to determine areas for protection will consider the significance of the vegetation as fauna habitat and appropriate strategies for conserving these habitats. The area of vegetation to be retained will be determined at the local structure planning stage and will be in accordance with local authority requirements for the retention of urban bushland and the Vegetation and Fauna Management Plans will be developed to the satisfaction of relevant government agencies. Refer to Condition 2 (attached).

**3.2 When some removal of remnant vegetation is proposed the rationale for removal is that no significant loss of biodiversity occurs because of surrounding reserves or possible reserves. To continue to reduce vegetation must at some stage also reduce the size of wildlife habitat. On page 16 of the ER the point about green links as useful fauna habitats and acting as corridors linking regionally significant vegetation is made. How will this management measure be effective when the Mitchell Freeway is constructed in the future and cuts along the eastern side of the Amendment Area?**

R3.2 The Environmental Review documentation recognises the importance of corridors for the movement of fauna and floristic gene pools. The proposed extension to the Mitchell Freeway immediately adjacent to the Amendment Area will form a barrier to the movement of fauna. Strategies to mitigate the impacts of this barrier on fauna will be addressed as a separate issue during the construction of the Mitchell Freeway and is likely to include, but not be limited to, fauna underpasses and overpasses where applicable. Liaison with CALM, NPNCA, DEP and relevant community groups will ensure the issue of green links is appropriately addressed at the DSP and LSP stage. Refer to Condition 2 (attached).

#### **4 SPECIALLY PROTECTED (THREATENED) FAUNA**

**4.1 The description in the ER of Black Cockatoos as “occasional visitors” seems unwarranted as from personal observations they very regularly frequent the Amendment Area. How will they be protected?**

R4.1 The conservation of vegetation types within adjoining reserves ensures that the development of the Amendment Area will not affect the survival of Carnaby's Cockatoo (*Calyptorhynchus latirostris*). The retention of vegetated linkages between the coastal area and the eastern conservation reserves as part of the local structure planning process will also provide habitat for transient fauna.

## 5 SUBTERRANEAN FAUNA

**5.1 There should be further surveys of the Amendment Area by a person experienced in the identification of terrestrial invertebrates as it appears from the ER that terrestrial occupants of caves in the area have not been surveyed for.**

R5.1 As identified in the ER, investigations of stygofauna habitats by specialist consultants in the region surrounding Yanchep determined that subterranean fauna preferentially occur in areas where the root mats of Tuart co-exist with karstic terrain. No areas of potential karst formation occurring in conjunction with Tuart Woodlands were identified in the Amendment Area. On this basis, it was determined that the presence of stygofauna in the Amendment Area is very unlikely.

The proposed Scheme provisions encompass further investigations to determine the possible occurrence of karstic terrain at the local level. If karstic formations are identified during these investigations, the potential occurrence of stygofauna and troglobitic fauna will be investigated. Refer to Condition 3 (attached).

**5.2 How will the non-stygofaunal invertebrate occupants of caves and 'karst at depth' be preserved?**

R5.2 Further investigations to determine the presence of karst formations within the Amendment Area will address the preservation of non-stygofaunal invertebrate populations if this is deemed appropriate by the Department of Environmental Protection. Refer to Condition 3 (attached).

**5.3 The ER assumes that much the same cave fauna will be located in the Amendment Area as that found in nearby Yanchep National Park and on Lots 201 and 202 Breakwater Drive. However, it is possible that many existing and unknown species could exist within short distances of one another. Stygofauna and troglobites may also exist in many caves that are not presently open to the surface. Therefore, further studies of the stygofauna within the Amendment Area should be conducted by experienced biospeleologists prior to any decision by the City of Wanneroo to allow development of the Amendment Area.**

R5.3 See Response 5.1. Furthermore, it is incorrect to assume the same fauna as found in Yanchep National Park will occur within the Amendment Area. As indicated in the ER, the importance of surface waters at the Yanchep National Park, for example Loch McNess and Yonderup Lake, serving as conduits for possible colonisation of caves in the area is readily apparent. The absence of surface water in the Amendment Area is therefore likely to be a causal factor for limited stygofauna/fauna.

The ER documentation recommended further investigations to determine the presence of karst within the Amendment Area. If karst features are found, the possibility of stygofauna and troglobites will also be investigated. These investigations will be conducted prior to the Local Structure Planning stage. Refer to Condition 3 (attached).

**5.4 It is acknowledged that stygofauna are a subset of troglobitic fauna but the issues and management of each may be different. Therefore, it is not correct to assume that management for stygofauna will also pertain to the protection of troglobitic fauna.**

R5.4 Dr Brenton Knott from the University of WA, a recognised authority on stygofauna, advises that, as stygofauna are likely to be the most sensitive to environmental disturbance (Brenton Knott, pers. comm.), it is appropriate to consider management objectives relating particularly to stygofauna as such will also ensure effective management of troglobitic fauna.

**5.5 Why were there no specific searches done of the Amendment Area for stygofauna and troglobitic fauna? What relevance do the surveys undertaken on Lots 201 and 202 Breakwater Drive (for Amendment No.837) have to this area? To not carry out appropriate investigations in the Amendment Area and to infer that because a nearby area is “unlikely to support a diverse stygofauna population”, that the Amendment Area has no species of stygofauna is a flawed method.**

R5.5 The studies in adjacent Lots 201 and 202 Breakwater Drive are relevant as they provide supporting evidence as to the restricted habitats of subterranean fauna. It is recognised that further work involving delineation of any karstic areas is required. If the studies in relation to karst indicate the likelihood of significant stygofauna assemblages being present in or immediately adjacent to the Amendment Area, then there is a requirement for the subdivider to implement a monitoring program to assess the nature and extent of any population and develop management strategies. These monitoring studies will be completed prior to finalisation of the Local Structure Plan.

Refer to Section 3.2.5 of the ER report and Conditions 3, 4 and 5 (attached).

**5.6 It appears that the consultants have the mindset that no subterranean fauna exists within the Amendment Area and so further investigations to confirm this will be predisposed to ensuring that this is the case. Does the reference to further geotechnical investigations imply that a walk through a cave will satisfy the viewpoint that no fauna exist? Or will the City of Wanneroo employ a suitably qualified and experienced biospeleologist to carry out a proper investigation of the subterranean fauna that may exist within the Amendment Area?**

R5.6 The conclusion that subterranean fauna are unlikely to be in the Amendment Area, is drawn from the investigation of the biophysical and geological environment that indicates a low probability of subterranean fauna occurring in the area rather than any mindset.

As there are no documented caves in the Amendment Area there is no opportunity to investigate caves. The Amendment Area has already been mapped by geological consultants during the preparation of an assessment of the physical environment (ATA, 1992). A geologist familiar with karstic terrain appraisal in the Yanchep region will be used to further define any prospective areas of karst. If a likelihood of subterranean fauna is determined, then a subterranean fauna expert will be involved in the monitoring studies and appropriate management strategies will be developed to the satisfaction of relevant government agencies. Refer to Conditions 3 and 5.

## **6 KARST WETLANDS**

- 6.1 Some of the International Union for the Conservation of Nature (IUCN) guidelines which have been developed to assist karst managers with specialised knowledge relating to karst systems clearly indicate that the hydrology of karst regions is vital to their integrity. With regards to these guidelines, the hydrology of the Amendment Area has not been sufficiently documented particularly considering that there is a line of dolines indicating the presence of an underground stream.**

**The path of this stream and associated feeder streams should be adequately mapped by an experienced karst geomorphologist before any development proceeds. The total catchment area of the karst should also be identified. Development over the active streamways would be dangerous both to the cave environment and to the structures built on the surface above.**

- R6.1 The management framework set out in the Drainage, Nutrient and Water Management Plan will ensure that "Groundwater extraction bores are located in areas where drawdowns will not impact on areas of karst or potentially significant stygofauna habitats." Implicit in this commitment is that more detail of the borefield layout and impacts will be assessed at the stage of borefield design. This work will be undertaken by a hydrogeologist. The karst mapping was undertaken by a geologist with environmental qualifications. Mapping of "karst feeder streams" by a "karst geomorphologist" is not considered necessary on the site due to the limited occurrence of karst. Refer to Conditions 3, 4 and 5 (attached).**

## **7 GROUNDWATER QUANTITY**

- 7.1 The information provided in the ER on the hydrology of the site is inadequate to predict impacts on the groundwater table and the resultant impacts on the karst environment. The figures that are referred to in the ER are 'proposed', 'predicted', 'estimates' and 'assumptions'. Further modelling should be undertaken using more site specific data. This would enable more reliable predictions of water table drawdowns and the resultant potential impact on the karst environment.**
- R7.1 Impacts on karst will be minimised by careful borefield placement which will be determined by detailed site investigation and numerical groundwater modelling at the LSP stage. The Proposed Management conditions for groundwater quantity specify adequate protection of karst or potentially significant stygofauna habitat. Refer to Conditions 4 and 7 (attached).**
- 7.2 Why was a 'water balance' not developed for the site? This should be done and the 'urban development model' would provide the information necessary to make a valid assessment. Any local data which may be available should be used and may need to be supplemented through the generation of site-specific data.**

- R7.2 Refer to Response 7.1. It is not feasible to prepare a water balance at this stage of the development as planning is not sufficiently advanced to allow this to be meaningful. This work will be undertaken in consultation with government agencies at later stages of planning.
- 7.3 The Western Australian Speleological Group (WASG) supports the proposed management plan that utilises the ‘water balance’ in regard to variations in the water table. If the amendment is approved, a condition of approval should be that water extraction is managed to maintain the water table within natural fluctuations.**
- R7.3 The Water Management Plan will ensure that drawdowns do not adversely effect the surrounding environment or the development impact adversely on the water resource. Refer to Condition 4 (attached).
- 7.4 The WASG also supports the proposed management plan that proposes that ‘variations in water level will not significantly exceed current maximum seasonal variations’.**
- R7.4 See Response 7.1
- 7.5 A water monitoring program should also be developed to determine changes to the water table.**
- R7.5 It is anticipated that any monitoring requirements will be established through Water and Rivers Commission groundwater extraction licensing process. The issue of monitoring will be further addressed in the Water Management Plan.
- 7.6 The WASG has some concerns regarding the proposed location of the future “reservoir and water treatment site”. This site should be located away from areas of karst. Development may involve compaction of the ground and may also affect the recharge rates and hydrology in the area. It would be important to ensure that additional surface water drainage is not concentrated into any dolines or other karst features.**
- R7.6 The reservoir and water treatment sites shown on Figure 11 in the ER document reflect the existing Public Purpose Reserves for these purposes pursuant to the Metropolitan Region Scheme. Any karst related constraints upon these sites will, therefore, need to be addressed through other processes. Development related hydrological issues (including drainage) will be addressed through preparation of the DNWMP, the scope of which is stipulated in the proposed Scheme provisions. Refer to Condition 4 (attached).
- 7.7 The Water Corporation currently holds the operating licence for this area from the Office of Water Regulation and, as such, developers should liaise with the Corporation regarding the provision of water to the Amendment Area.**
- R7.7 Noted.
- 7.8 The Water Corporation operates water production bores within the Amendment Area and each has individual wellhead protection zones to protect them. Future landuses within these zones must be developed in accordance with the relevant guidelines.**
- R7.8 Agreed.

## **8 DUNES**

**8.1 Urban development is highly inappropriate in near-coastal landscapes. These areas should be in public ownership and conserved for the enjoyment of all.**

R8.1 The determination of appropriate setbacks to development and delineation of a foreshore reserve formed part of the coastal planning strategy prepared by Alan Tingay & Associates in 1993. The delineation of the reserve boundary was based on the physical and biological attributes and potential recreational demand. Subsequently, the WAPC adopted boundaries for the foreshore reservation areas, and these have been incorporated into the MRS which is a statutory document.

**8.2 How will the impacts on the Quindalup Dunes system be managed if No. 8, part 1000, Lisford Avenue and Lot 35, No. 50 Two Rocks Road is rezoned to Urban development zone?**

R8.2 Most of the area surrounding Two Rocks is already developed. Vegetation typical of the Quindalup Dune System, ie the coastal dune heath and to a lesser extent limestone heath, will be protected within the foreshore reserve. Impacts associated with the development of area adjoining the reserve will be managed through the preparation of a Foreshore Management Plan.

**8.3 How will access to the Yanchep Beach for surf club vehicles and equipment be managed to have minimal impact on the surrounding vegetation and dune system? There should be no further removal of vegetation in the area.**

R8.3 Access requirements and infrastructure along the coast will be addressed during the preparation of a Coastal Foreshore Management Plan. The management of recreational activities will be a priority to ensure damage to the dunes and associated vegetation does not occur.

## **9 FORESHORE (BEACH)**

**9.1 The foreshore area between the Lagoon Beach and the beach at Club Capricorn has eroded considerably since the construction 25 years ago of the Club Capricorn Groyne. The implications of these changes to the beach environment need to be carefully understood before any other marinas or groynes are constructed in the future.**

R9.1 Noted. The Club Capricorn Groyne was constructed by a previous owner. Detailed studies of coastal processes would be required prior to constructing any significant marine structure, and any new marina proposal would require a separate EPA assessment under Section 38 of the Environmental Protection Act, 1986, thereby enabling relevant environmental issues to be fully considered.

## **10 SEABED**

**10.1 Personal witness over time, photographic evidence from the Marine and Harbours department and numerous environmental reports all show that the Yanchep Beach and the Yanchep Lagoon areas are accreting due to sand deposition caused in the main by the placement of the “Club Capricorn” Groyne immediately north of Yanchep Beach. The Lagoon and Reef need to be protected from sand accretion, how will this be achieved?**

R10.1 The installation of a barrier to impede the net northerly movement of sediment along the WA coast will naturally result in the nourishment of a beach and nearshore area located to the south of the barrier. This is not an issue appropriately addressed through the Environmental Review process.

## **11 KARST LANDFORMS**

**11.1 It is vital that caves not yet visited by the public should be carefully entered by experienced persons before the entrances are enlarged, promoting greater evaporation, and before the food sources such as aerial roots and detritus on the floors is trodden on or swept away by visiting recreational cavers. People with experience in this relatively unstable type of karst landform at Yanchep should be spoken to before the amendment is finalised.**

R11.1 There are no documented caves in the Amendment Area.

**11.2 The ER describes a cave located in the north-east of the Amendment Area as “a cave of significant size”, “at least 30m deep” and “the cave is extensive”. If this is the case then a cave of 30m depth would be the deepest known cave in the Yanchep karst making it a very important feature, with the possibility of extensive underground drainage to allow dolines to form in 30m thickness of limestone. If a cave of this size exists then why was there not a more detailed survey done of its true boundaries, as well as for tight solution pipes which can lead to extensive caves? Further survey work of the caves and karst features within the Amendment Area by experienced speleologists is recommended prior to any decision by the City of Wanneroo to allow development of this area.**

R11.2 This response incorrectly quotes the ER document. The cave is located ‘to the north-east of the Amendment Area’ not in the Amendment Area. The management of the cave in question is documented in a concurrent ER document for Amendment 837 of TPS No. 1, Shire of Wanneroo.

**11.3 Why did the consultants who prepared the ER not reference any of the works by Bastian (1991, 1964, 1996) and Williamson, K & Lance, K (1979)? Lex Bastian has been conducting speleological studies at Yanchep for over forty years. Why was he not consulted over the eight year period of this research? Clearly the use of his expertise would have provided a more thorough understanding of the karstic terrain within the Amendment Area.**

R11.3 The mapping of the Amendment Area indicates only minor areas of ‘possible karstic formation at depth’ and no documented caves. On this basis, there was no need to involve speleologists.



**11.4 How will the impact of fire on karst landforms be managed? It is suggested that a detailed Fire Management Plan should be drafted to ensure that bush areas containing karst features are adequately protected. Fire can impact on karst features through:**

- the leaching of carbon deposits in caves;
- the impacts of smoke and ash on secondary cave deposits and cave fauna;
- the degradation of cave entrances through denudation followed by rainfall;
- the spalling of limestone throughout the karst; and
- fracture and collapse due to heating.

R11.4 See Response 11.3.

**11.5 Karst systems can be highly intrusive and housing nearby to active karst systems, whilst appearing to be in a safe location initially can become the victim of subsidence at short notice. Therefore, it is recommended that the high risk karst area within the Amendment Area be included in the proposed reserve, Site No. 284 of Perth's Bushplan. This will involve moving the southwestern boundary of Site 284 further west to encompass the area of high risk karst identified in the ER.**

R11.5 If any areas of "high risk" of karst scenery are found, they are likely to become POS or Parks and Recreation Reserve at the discretion of the City. Refer to Condition 5 (as attached).

**11.6 The ER refers to "large karst structures". What is the definition of a large karst structure? In comparison with most other karst areas in Australia, the Yanchep area contains caves which are small in size. It is suggested that the specific term of reference should be determined in conjunction with speleological experts. It is important that karst landforms are referred to appropriately and can be compared to other karst features within the area.**

R11.6 The term large karst structures is used in the context of the ER to refer to interdunal dolines, which are sand filled collapse features. Generally, large karst structure as used in the ER refers to structures having a linear dimension greater than 5m.

## **POLLUTION MANAGEMENT**

### **12 NOISE**

**12.1 How will the impacts of noise (associated with cray fishing boats going in and out of the Two Rocks marina during the cray fishing season) on future residents within No. 8, part 1000 Lisford Avenue be managed, if this area is rezoned to the urban development zone?**

R12.1 Any proposal for this area will need to take account of the prevailing policies and Regulation relating to management of noise.

### **13 GROUNDWATER QUALITY**

**13.1 The proposed amendment is within the Perth Coastal Pollution Control Area (Priority 3) administered by the Water and Rivers Commission and will need to conform to any requirements that they may have.**

R13.1 The Water and Rivers Commission has specific guidelines relating to land use within the Perth Coastal Underground Water Pollution Control Area which will be addressed at the local structure planning stage. Refer to Condition 8 (attached).

**13.2 The provision of sewer services to the area is considered to be essential.**

R13.2 It is proposed that all urban areas will be serviced by reticulated sewerage.

## **SOCIAL SURROUNDINGS**

### **14 Aboriginal Culture and Heritage**

**14.1 The one archaeological site found is important as it is one of only a few sites found on the Quindalup Dunes. However, only 33% of the Amendment Area was surveyed for Aboriginal archaeological sites. Therefore, the Aboriginal Affairs Department (AAD) endorses Mr Quartermaine's recommendation that the Amendment Area be monitored for subsurface cultural materials and also burials when the surface is excavated for development.**

R14.1 As the ER document specifies, it is proposed that the identified archaeological site be retained if feasible. Due consideration will be given to protection of the site at the detailed design phase. Refer Condition 10 (as attached).

The response is inaccurate in specifying that only 33% of the Amendment Area was surveyed. The Amendment Area was covered by the Archaeological study by Quartermaine, (1991). The archaeological survey covered approximately 7000 hectares of land situated on the coast and Two Rocks, and comprised:

- Assembly of data from previous work in the region, including information from WA Museum Aboriginal site files, previous survey reports, maps and environmental data.
- A sample survey of the project area.
- The location and recording of archaeological sites within the designated survey area.

Prior to the commencement of site works, staff shall undergo a briefing on Aboriginal Heritage, to enable staff to recognise materials that may constitute an Aboriginal Site. During earthworks all contractors will be supervised by a Site Manager, who if a suspected site is discovered, will seek specialist advice to confirm the identification of the site. Condition 10 has been modified accordingly to clarify this issue.

**14.2 The AAD has only one of the two Aboriginal heritage reports that are mentioned in the ER, the "Report on an Archaeological Survey for Aboriginal Sites" by Gary Quartermaine. Would you please ensure that Alan Tingay and Associates provides the AAD with a copy of the ethnographic report, in order for staff to assess it. This report is almost eight years old and depending on who was consulted in the anthropological report, you may need to consult**

**others with interests in the area in regard to the proposed amendment.**

R14.2 A copy of the report will be forwarded to the Aboriginal Affairs Department.

**14.3 If the archaeological site is to be impacted by the development, it will be necessary for the proponent to obtain a section 18 permit from the Minister on advice from the Aboriginal Cultural Material Committee.**

R14.3 Noted.

## **15 PUBLIC SAFETY - UNEXPLODED ORDNANCE**

**15.1 The UXO Unit of the Fire and Emergency Services Authority of Western Australia is concerned with UXO pollution throughout all of the Amendment Area. Of particular concern is the Tokyu Corporation's interests in and around the Two Rocks Artillery Range. If appropriate please include UXO units concerns in the amendment.**

R15.1 These concerns are noted and the necessary clearances will be obtained for all areas of land potentially affected by UXO. Refer to Condition 9 (attached).

## **16 RECREATION**

**16.1 It is requested that all land west of Sovereign Drive, Lisford Avenue and Two Rocks Road extending to Club Capricorn, but not including Club Capricorn or the current shopping centre area, be rezoned as Public Open Space. This area could then be developed into lawn areas with the only buildings being Toilets, sun shelters and barbeque areas.**

R16.1 As indicated in Response 1.7, much of the Amendment Area has already been rezoned for urban purposes pursuant to the Metropolitan Region Scheme. The coastal reserve has already been established through the Metropolitan Region Scheme rezoning amendment process. Detailed planning of the existing coastal reserves will occur through subsequent stages of the planning process.

## **17 PUBLIC HEALTH AND SAFETY - RISK**

**17.1 The proposed industrial area is adjacent to a future Water Corporation water treatment plant facility that may incorporate chlorine buffers. The compatibility of possible uses adjacent to this facility will need to be assessed in accordance with the Water Corporation buffer guidelines.**

R17.1 This issue will be investigated at the LSP stage during preparation of the Drainage, Nutrient and Water Management Plan. Refer to Condition 4 (attached).

## **Appendix 5**

### **Identification of Relevant Environmental Factors and Summary of Assessment of Relevant Environmental Factors**

Table 2: Identification of Relevant Environmental Factors

FACTOR	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
<b>BIOPHYSICAL</b>			
Vegetation	<p>The amendment area includes three System Six Areas, M1, M2 and M3. It is also surrounded by regionally significant vegetation identified in draft "Perth's Bushplan" (Western Australian Government, 1998) as site No.'s 288, 284, 406, 397 and 289.</p> <p>Clearing for development will impact upon M1, M2 and M3 whereas the indirect impacts on adjacent Bushplan sites could include intrusion by domestic pets, impacts on water quality and water table levels, weed invasion, the use of fertilisers and pesticides, and increase in fires and litter.</p>	<ul style="list-style-type: none"> <li>• Remnant vegetation within the amendment area which is not "Severely disturbed" or "Degraded" should be conserved and should be recognised at least as locally significant.</li> <li>• Ecological communities 26a, 29a and 29b are present within the amendment area and, as such, should be made a priority for conservation.</li> <li>• There needs to be an assurance that all practical measures available will be employed to reduce the potential indirect impacts associated with urban development on the surrounding reserves. These measures should include the prevention of firewood removal from the surrounding areas of regionally significant vegetation.</li> <li>• The conservation of linkages and corridors between reserve areas is essential. The planting of indigenous plant species grown from provenance seed, rather than merely native species, should be a priority.</li> </ul>	Requires further evaluation. Considered to be a relevant factor.
Declared Rare and Priority Flora	<p>Populations of the Declared Rare Flora (DRF) species <i>Eucalyptus argutifolia</i> occur in the adjacent Bushplan sites no.'s 284 and 406. All of the adjacent Bushplan sites except for 284 also include species of Priority flora.</p> <p>Development within the amendment area may indirectly impact on this species of DRF, and on species of Priority flora, through intrusion by domestic pets, changes to hydrology, weed invasion, the use of fertilisers and pesticides, and increase in fires and litter.</p>	No submissions in relation to this factor.	Considered to be a relevant factor, but addressed under the factor of Vegetation.
Terrestrial Fauna	A total of 3 amphibians, 24 reptiles, 63	<ul style="list-style-type: none"> <li>• The proposed urban development could have severe impacts on fauna</li> </ul>	Considered to be a relevant factor but

FACTOR	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
	<p>native and 3 introduced birds, and 6 native and 5 introduced mammals have been recorded within the amendment area. This assemblage is relatively diverse but typical for the region. The adjacent Bushplan sites also support a wide range of the locally important fauna habitats. Clearing of the amendment area for development will result in direct habitat loss for some fauna species. The potential indirect impacts on habitats in adjacent areas as a result of development include weed invasion, changes to water quality and water table levels, increase in litter and fire, and an increase in predation from domestic pets.</p>	<p>populations within the amendment area and in surrounding areas through the loss of habitat through clearing. These impacts should be managed and management measures should consider the effect that the development of the Mitchell Freeway (immediately to the east of a section of the amendment area) could have on maintaining green links as useful wildlife corridors between the amendment area and areas of regionally significant vegetation.</p>	<p>habitat loss addressed under the factor of Vegetation.</p>
<p>Specially Protected (Threatened) Fauna</p>	<p>Remnant vegetation within the amendment area does provide an occasional habitat for two species of threatened fauna. These being the Short-billed Black Cockatoo (<i>Calyptorhynchus latirostris</i>) (Schedule 1) and the Peregrine Falcon (<i>Falco peregrinus</i>) (Schedule 4). These two species are listed "in need of special protection" under the provisions of the <i>Wildlife Conservation Act 1950</i>. The adjacent Bushplan sites also support threatened fauna.</p> <p>The clearing of vegetation within the amendment area for development could potentially remove some habitats for these species. The potential indirect impacts on habitats in adjacent areas as a result of development include weed invasion, changes to water quality and water table levels, increase in litter and fire, and an increase in predation from domestic pets.</p>	<ul style="list-style-type: none"> <li>The Short-billed Black Cockatoo regularly frequents the amendment area and as such, its habitat should be protected.</li> </ul>	<p>Considered to be a relevant factor, but habitat loss addressed under the factor of Vegetation.</p>

FACTOR	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Stygofauna and troglobitic fauna	<p>Karstic terrain is often host to stygofauna and troglobitic fauna. Approximately 245ha or 6% of the amendment area is within the zone of karst (20ha) or potential karst at depth (225ha).</p> <p>The potential impacts associated with development on stygofauna and troglobitic fauna species which may occur in the area include a lowering of the water table, pollution of groundwater through fertiliser application, leakage of fuel and other stored chemicals and stormwater runoff.</p>	<ul style="list-style-type: none"> <li>The amendment area has not been specifically surveyed with regards to the identification of stygofauna and troglobitic fauna. The assumption has been made that because nearby areas (ie. Lots 201 and 202 Breakwater Drive) have been surveyed and found not to support a diverse stygofauna population then this area will not either. Therefore, further survey work for stygofauna and troglobitic fauna should be undertaken specifically on this site.</li> <li>It is not correct to assume that management for stygofauna will also pertain to the protection of troglobitic fauna.</li> </ul>	Requires further evaluation. Considered to be a relevant factor.
Groundwater quantity	<p>The Tamala Limestone, Leederville Formation and the Yarragadee Formation aquifers all underlie the site. The Tamala Limestone is the shallowest and most productive aquifer in the amendment area, as such the Water Corporation plans to draw water from the aquifer in this area to meet future supply needs.</p> <p>Groundwater extraction from this aquifer to support development could potentially result in an excessive drawdown of the water table which may adversely impact upon vegetation, karstic landforms and subterranean fauna.</p>	<ul style="list-style-type: none"> <li>Further modelling of the hydrological environment within the amendment area should be undertaken using more site-specific data. This study should also focus on the identification of underground streams associated with karstic landforms. A water balance for the amendment area should also be developed using the 'urban development model'. A water monitoring program needs to be implemented following development.</li> <li>A condition of approval for the amendment should be that water extraction is managed to maintain the water table within natural fluctuations.</li> <li>The location of the future "reservoir and water treatment site" should be away from areas of karst.</li> <li>The Water Corporation currently holds the operating licence for this area from the Office of Water Regulation and, as such, developers should liaise with the Corporation regarding the provision of water to the amendment area.</li> <li>The Water Corporation operates water production bores within the amendment area and each has individual wellhead protection zones to protect them. Future landuses within these zones must be developed in accordance with the relevant guidelines.</li> </ul>	Requires further evaluation. Considered to be a relevant factor.

FACTOR	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Karstic landform	<p>Localised areas of karstic landforms have been identified along the eastern boundary of the amendment area. This constitutes approximately 225ha of potential karst at depth (about 5.5% of the amendment area) and 20ha of karst (about 0.5% of the amendment area).</p> <p>There is a potential for collapse or subsidence of karstic structures if development occurs over (or near to) these features. Stormwater runoff could also potentially impact on karstic structures, if infiltration is concentrated over subsurface collapse structures and washing sand down into cavities.</p>	<ul style="list-style-type: none"> <li>• A detailed Fire Management Plan should be prepared for the amendment area to ensure that bushland areas featuring karstic landforms are adequately protected from the effects of fire.</li> <li>• Housing adjacent to the active karst systems can become the victim of subsidence at short notice. Therefore, the high risk karst area within the amendment area should be included in the Parks and Recreation reserved land immediately to the east of the northern section of the amendment area. This will involve extending the southwestern boundary of this P&amp;R area further west to encompass the high risk karst area.</li> <li>• The cave in the northeastern part of the amendment area is of high significance if it is 30m deep. This cave should be further surveyed with a view to determining exact boundaries and identifying tight solution pipes which can lead to extensive caves.</li> <li>• Caves within the amendment area which have not yet been visited by the public should be carefully entered by experienced persons before the entrances are enlarged, promoting greater evaporation, and before the food sources such as aerial roots and detritus on the cave floors is swept away.</li> </ul>	Requires further evaluation. Considered to be a relevant factor.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
<b>POLLUTION</b> Groundwater quality	<p>The amendment area is within the Perth Coastal (Priority 3) Underground Water Pollution Control Area (UWPCA).</p> <p>Groundwater within the area could potentially be contaminated as a result of urban development. Potential sources of pollution include fertiliser application, stormwater runoff, pesticide use, leakage</p>	<ul style="list-style-type: none"> <li>• The proposed amendment is within the Perth Coastal Pollution Control Area (Priority 3) administered by the Water and Rivers Commission and will need to conform to any requirements that they may have.</li> <li>• The provision of sewer services to the area is considered to be essential.</li> </ul>	Requires further evaluation. Considered to be a relevant factor.



FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
	from sewers, and leakage of fuel and other stored chemicals.		
Solid Waste	Development within the industrial zone will result in the production of waste materials. If disposal is inappropriately managed these waste materials could potentially have detrimental impacts on the environment including pollution of groundwater.	No submissions received in relation to this factor.	Requires further evaluation. Considered to be a relevant factor.
Air Quality	Development within the Industrial Zone could potentially result in particulate and gaseous emissions, odour and noise that may adversely affect nearby future residents in the proposed adjacent Urban Development Zone.	No submissions received in relation to this factor.	Requires further evaluation. Considered to be a relevant factor.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
<b>SOCIAL SURROUNDINGS</b>			
Unexploded Ordnance (UXO)	Investigations in and around Two Rocks, including parts of the amendment area, have identified that UXO may be present, therefore, posing a serious risk to public safety.	<ul style="list-style-type: none"> <li>The UXO Unit of the Fire and Emergency Services Authority of Western Australia is concerned with UXO pollution throughout all of the amendment area. Of particular concern is the Tokyu Corporation's interests in and around the Two Rocks Artillery Range.</li> </ul>	Requires further evaluation. Considered to be a relevant factor.
Aboriginal Culture and Heritage	One archaeological site has been found within the amendment area, whilst an	<ul style="list-style-type: none"> <li>The Aboriginal Affairs department recommends that the amendment area be monitored for subsurface cultural materials and also burials</li> </ul>	Requires further evaluation. Considered to be a relevant factor.

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
	<p>ethnographic site has been found adjacent to the northeastern sector of the area. These sites could potentially be damaged or destroyed as a result of construction activities (archaeological site only), acts of vandalism or the introduction of pets into the area.</p>	<p>when the surface is excavated for development.</p> <ul style="list-style-type: none"> <li>If the archaeological site identified within the amendment area is to be impacted by the development, it will be necessary for the proponent to obtain a section 18 permit from the Minister on advice from the Aboriginal Cultural Material Committee.</li> </ul>	
Public safety	<p>The development of an Industrial zone adjacent to an urban development zone could potentially present a risk to residents as a result of gaseous emissions, noise, dust, leaking of stored chemicals and other discharges associated with the industries.</p>	<ul style="list-style-type: none"> <li>The proposed industrial area is adjacent to a future Water Corporation water treatment plant facility that may incorporate chlorine buffers. The compatibility of possible uses adjacent to this facility will need to be assessed in accordance with the Water Corporation buffer guidelines.</li> </ul>	<p>The proposed industrial area will only include service and light industries generally involving processes, machinery or goods which are not expected to cause or present an unacceptable risk of off-site fatalities. <b>Therefore, factor does not require further evaluation.</b></p>

**Table 3: Summary of Assessment of Relevant Environmental Factors**

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Vegetation	Swan Coastal Plain	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation.	<p>The EPA considers that the Responsible Authority (RA) has provided sufficient information to confirm that the potential direct and indirect impacts upon vegetation can be managed under the Environmental Management Recommendations (as revised and to be applied as environmental conditions) to meet the EPA's objective.</p> <p>The EPA notes that:</p> <ul style="list-style-type: none"> <li>• Wilbinga (Bushplan Site No. 406) which has greater environmental and landscape attributes than the System Six M1 Area has been set aside for conservation as a replacement for M1.</li> <li>• The M2 boundary has been modified based on the physical attributes, conservation values and potential recreational demand of the foreshore areas as determined in the Yanchep Coastal Planning Strategy (1993) The modified area of M2 is now reflected as Bushplan Site No. 397 (EPA, 1996).</li> <li>• Based on vegetation studies of M3 (Alan Tingay &amp; Associates, 1992) which identified that a portion of M3 had been disturbed the EPA gave general endorsement (at its meeting of 8 October, 1992) to the (then) Yanchep Structure Plan which recommended a revised boundary for M3 (EPA, 1996). Now reflected as Bushplan Site No. 288.</li> <li>• The amendment area supports vegetation of "local significance" which provides wildlife habitat (including for two threatened species, the Short-billed Black Cockatoo and the Peregrine Falcon) but is not considered to be regionally significant.</li> <li>• The vegetation alliances within the amendment area are also within adjacent Bushplan sites No.'s 284, 406, 288, 397 and 289. Both sites 284 and 406 support populations of the DRF species, <i>Eucalyptus argutifolia</i>. All of these sites are reserved for Parks &amp; Recreation in the MRS except for 406 which is proposed for inclusion in "Gnangara Park" which will be established and managed by CALM.</li> <li>• The Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve the assessment of local vegetation at the DSP stage and the development of a Vegetation and Fauna Management Plan at the LSP stage.</li> <li>• Submissions raised concerns about:</li> </ul>	<p>Having particular regard to the:</p> <ol style="list-style-type: none"> <li>Values inferred in System Six Areas M1 being replaced at Wilbinga which has higher conservation value;</li> <li>EPA's previous endorsement of modifications to the System Six Areas M2 and M3 based on detailed vegetation analyses undertaken in 1993 and 1992 respectively;</li> <li>adjacent areas supporting regionally significant vegetation either reserved as P&amp;R in the MRS or proposed for inclusion in "Gnangara Park" which will be established and managed by CALM;</li> <li>identification of "locally significant" vegetation providing wildlife habitat, and three ecological communities recommended for listing as "Threatened" within the Amendment area;</li> <li>identification of a species of DRF adjacent to the Amendment area; and</li> <li>Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;</li> </ol> <p>it is the EPA's opinion that the</p>

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Subterranean fauna	Chain of caves on the Swan Coastal Plain	1) Ensure that subterranean fauna are adequately protected, in accordance with the <i>Wildlife</i>	<p>⇒ the retention of vegetation identified as not being "severely disturbed" or "degraded" (including ecological communities 26a, 29a and 29b) for conservation and wildlife habitat value (including the provision of wildlife corridors);</p> <p>⇒ the adequacy of the vegetation conditions ratings used in the ER;</p> <p>⇒ the definition of what is "locally significant";</p> <p>⇒ the use of provenance seed for rehabilitation; and</p> <p>⇒ indirect impacts associated with the amendment should be managed with regards to protecting the adjacent conservation areas.</p> <ul style="list-style-type: none"> <li>• To address these concerns the DEP negotiated with the RA and the landowner to include consultation with CALM, DEP and relevant community groups during the preparation of the Vegetation and Fauna Management Plan. Also the plan is to be revised to include the following: <ul style="list-style-type: none"> <li>⇒ description of vegetation and vegetation values;</li> <li>⇒ the definition and retention of "locally significant" areas of vegetation within the amendment area with consideration to the creation of vegetation corridors to facilitate the movement of fauna and floristic gene-pools;</li> <li>⇒ management of indirect impacts on the adjacent Parks and Recreation (P&amp;R) areas to the satisfaction of relevant State Agencies through appropriate subdivision design (eg. roads abutting P&amp;R areas);</li> <li>⇒ clear delineation of significant areas of vegetation to be preserved through use of dual use paths, roads and the like;</li> <li>⇒ details on vegetation maintenance arrangements - including weed control and consideration of the use of provenance seed for rehabilitation;</li> <li>⇒ fire management;</li> <li>⇒ control of off-road vehicle use and dumping of rubbish;</li> <li>⇒ enhance community awareness of bushland protection; and</li> <li>⇒ allocation of responsibilities and identification of timing for the implementation of the Vegetation Management Plan.</li> </ul> </li> </ul> <p>The EPA recommends that these modified Environmental Management Recommendations (to be applied as environmental conditions) be included in the Scheme so that the potential direct and indirect impacts on vegetation are minimised.</p>	Amendment is capable of being managed to meet the EPA's objective for vegetation subject to an assessment of vegetation at the District Structure Planning stage, and the preparation and implementation of a Vegetation and Fauna Management Plan at the Local Structure Planning stage.
Subterranean fauna	Chain of caves on the Swan Coastal Plain	1) Ensure that subterranean fauna are adequately protected, in accordance with the <i>Wildlife</i>	<p>The EPA considers that the Responsible Authority (RA) has provided sufficient information to confirm that the potential direct impacts upon stygofauna and troglobitic fauna can be managed under the Environmental Management Recommendations (as revised and to be applied as environmental conditions) to meet the EPA's objective.</p>	<p>Having particular regard to the:</p> <ul style="list-style-type: none"> <li>• fact that only 0.5% of the Amendment area has been identified as a karstic zone and 5.5 % has been identified as potentially karstic;</li> </ul>

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES <i>Conservation Act 1950</i> ; and ii) Maintain the abundance, diversity and geographical distribution of subterranean fauna	EPA ASSESSMENT	EPA ADVICE
			<p>The EPA notes that:</p> <ul style="list-style-type: none"> <li>• Stygofauna and troglobitic fauna are restricted to living within karstic environments and that only 20ha, or about 0.5% of the amendment area has been identified as a karstic zone, and 22.5ha or 5.5% could potentially be karstic.</li> <li>• No specific surveys of these areas for stygofauna or troglobitic fauna were undertaken but the EPA considers that it is unlikely that the amendment area supports a significant assemblage of stygofauna and/or troglobitic fauna for the following reasons: <ul style="list-style-type: none"> <li>⇒ lack of suitable karstic terrain within the amendment area;</li> <li>⇒ an absence of Tuart woodlands in karstic areas (Tuartas are linked to the development of root mat habitats in karstic areas);</li> <li>⇒ a survey of an adjacent area (Lots 201 and 202 Breakwater Drive, to the east of the amendment area) which includes more pronounced karstic areas (including caves and dolines) only found two species of stygofauna and no species of troglobitic fauna; and</li> <li>⇒ depth to water table of 10m to 50m beneath the amendment area (depth to cave waters needs to be less than 30m for root mat habitat formation).</li> </ul> </li> <li>• A lowering of the water table and pollution of the groundwater could impact upon a small population of stygofauna and/or troglobitic fauna which may exist within the Amendment area.</li> <li>• The proposed borefield is over 2km west of the areas of possible karst at depth and maximum drawdowns of 0.1m at 1km from the borefield have been predicted.</li> <li>• The effect of drawdowns on the area that may support stygofauna and troglobitic fauna is negligible as seasonal variations will exceed the impacts from the drawdowns.</li> <li>• There is some uncertainty with regards to the sensitivity of stygofauna and troglobitic fauna to increases in the levels of nutrients or other contaminants in the groundwater.</li> <li>• Given that the depth to groundwater within the amendment area is between 10m and 50m, and that the amendment area will be deep sewerer the impact can be managed.</li> <li>• The Responsible Authority has developed Environmental Management Recommendations to go into the scheme to manage the potential impacts which involve:</li> </ul>	<ul style="list-style-type: none"> <li>• troglobitic fauna and the critically endangered "Aquatic Root Mat Communities of caves of the Swan Coastal Plain" (includes species of stygofauna) are restricted to these environments;</li> <li>• absence of Tuart woodlands associated with karst in the Amendment area and the relatively deep water table; both essential criteria for critically endangered root mat communities;</li> <li>• lack of surface water within the Amendment area (surface waters are important in Yancheep National Park for serving as conduits for possible colonisation of the subterranean world); and</li> <li>• Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;</li> </ul> <p>it is the EPA's opinion that the Amendment is capable of being managed to meet the EPA's objective for stygofauna and troglobitic fauna, subject to seeking further advice and undertaking investigations where appropriate to develop a Stygofauna and/or Troglobitic fauna Management Plan and preparation of a Karst Management Strategy to identify</p>

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			<p>⇒ the preparation of a Drainage, Nutrient and Water Management Plan by the subdivider at the LSP stage to the requirements of the Responsible Authority and on the advice of the DEP, Water and Rivers Commission and the Water Corporation;</p> <p>⇒ if studies in relation to karst and water indicate the likelihood of significant stygofauna assemblages being present in or immediately adjacent to the amendment area the subdivider shall undertake investigations and implement a monitoring program to assess the nature and extent of any population. These monitoring studies will be completed prior to finalisation of the Local Structure Plan;</p> <p>⇒ at the DSP level, the developer shall review existing geotechnical information and undertake further site investigations to confirm the nature and extent of karst landform; and</p> <p>⇒ at the LSP level the subdivider shall undertake detailed geotechnical investigations in areas of karst and potential karst, and no development will be permitted on areas immediately over large karstic structures unless approved by a qualified geotechnical consultant and environmental scientist.</p> <ul style="list-style-type: none"> <li>• Submissions raised concerns about the lack of a survey of the amendment area for stygofauna and troglobitic fauna and that management for stygofauna cannot also manage for troglobitic fauna.</li> <li>• The amendment area has not been surveyed for stygofauna and troglobitic fauna. However, based on the conditions described above the presence of stygofauna and/or troglobitic fauna within the amendment area is expected to be low. The EPA also considers that on the advice of Dr Brenton Knott, stygofauna are the most sensitive of the two to environmental disturbance, therefore the management of stygofauna can also be applied to the management of troglobitic fauna.</li> <li>• However, the DEP has negotiated with the Responsible Authority and the landowner following the public comment period to modify the Environmental Management Recommendations to include: <ul style="list-style-type: none"> <li>⇒ the subdivider is to seek advice from relevant scientific experts during the preparation of the Drainage, Nutrient and Water Management Plan and the undertaking (if necessary) of monitoring programs of stygofauna and/or troglobitic fauna populations within the amendment area;</li> <li>⇒ a Stygofauna and/or Troglobitic Fauna Management Plan will be developed at the LSP stage;</li> <li>⇒ a Karst Management Strategy shall be prepared at the LSP stage.</li> </ul> </li> </ul>	<p>development constraints.</p>

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Groundwater quantity	Perth Coastal UWPCA	Maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.	<p>The EPA recommends that these modified Environmental Management Recommendations (to be applied as environmental conditions) be included in the Scheme so that the potential direct impacts on stygofauna and troglotic fauna are minimised.</p> <p>The EPA considers that the Responsible Authority (RA) has not provided sufficient information to confirm that the potential direct impacts upon water table levels can be managed.</p> <p>The EPA notes that:</p> <ul style="list-style-type: none"> <li>• The Water Corporation (WC) plans to supply the amendment area with water from three clusters and three production bores. The borefield will be located within areas of Public Open Space to minimise the possibility of contamination. A 1ha reserve will be created to encompass the bores.</li> <li>• Groundwater extraction within the Amendment area is not being assessed as part of this Environmental Review and future proposals to extract groundwater should be referred to the EPA under Section 38 of the Environmental Protection Act 1986.</li> <li>• Submissions received in relation to the management of this factor raised concerns about the following: <ul style="list-style-type: none"> <li>⇒ inadequacy of the hydrological study and that further modelling should be undertaken using more site-specific data;</li> <li>⇒ the need for a water balance to be undertaken for the amendment area using the 'urban development model';</li> <li>⇒ that a water monitoring program should be implemented following development; and</li> <li>⇒ water extraction should be managed to maintain water table levels within natural fluctuations.</li> </ul> </li> <li>• The WC has also advised the EPA that they: <ul style="list-style-type: none"> <li>⇒ currently hold the operating licence for this area from the Office of Water Regulation and, as such, developers should liaise with the Corporation regarding the provision of water to the amendment area; and</li> <li>⇒ operate water production bores within the amendment area and each has individual wellhead protection zones, as such future landuses within these zones must be in accordance with the relevant guidelines.</li> </ul> </li> </ul>	<p>Having particular regard to:</p> <p>a) a lack of information provided to the EPA at this stage to determine if groundwater quantities at the proposed extraction rate can be adequately managed;</p> <p>it is the EPA's opinion that groundwater extraction (groundwater quantity) should be a deferred factor and assessed after further investigations have been undertaken.</p>

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Karst	Chain of caves on the Swan Coastal Plain	Maintain the environmental, scientific, cultural and recreational values of karst landforms.	<ul style="list-style-type: none"> <li>• The EPA concludes that groundwater extraction (groundwater quantity) should be a deferred factor and assessed after further investigations have been undertaken.</li> </ul> <p>The EPA considers that the Responsible Authority (RA) has provided sufficient information to confirm that the potential direct impacts upon karstic areas can be managed under the Environmental Management Recommendations (as revised and to be applied as environmental conditions) to meet the EPA's objective.</p> <p>The EPA notes that:</p> <ul style="list-style-type: none"> <li>• Only 20ha, or about 0.5% of the amendment area has been identified as a karstic zone and that 225ha or 5.5% could potentially be karstic.</li> <li>• Surveys of the amendment area have identified that the karst and potential karst areas fall into the low and very low risk category.</li> <li>• These karstic areas are a complex interplay of various factors (eg. pedologic, geological, climatic) and as such impacts on vegetation, water quality and water table levels will impact upon karstic terrain.</li> <li>• To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve: <ul style="list-style-type: none"> <li>⇒ at the DSP level, the developer shall review existing geotechnical information and undertake further site investigations to confirm the nature and extent of karst landform; and</li> <li>⇒ at the LSP level the subdivider shall undertake detailed geotechnical investigations in areas of karst and potential karst, and no development will be permitted on areas immediately over large karstic structures unless approved by a qualified geotechnical consultant and environmental scientist.</li> </ul> </li> <li>• Submissions raised concerns about the following: <ul style="list-style-type: none"> <li>⇒ the impact of fire on karstic areas;</li> <li>⇒ development of the proposed water treatment plant should not be in karstic areas;</li> <li>⇒ the need for further surveys of the karstic areas (particularly given that the cave adjacent to the amendment area is 30m deep, which makes it highly significant);</li> <li>⇒ the inclusion of the karst areas into the P&amp;R land to the east of the amendment area; and</li> <li>⇒ that caves within the amendment area which have not yet been visited by the public should be carefully entered by experienced persons before the entrances are enlarged creating degradation of the cave environment.</li> </ul> </li> </ul>	<p>Having particular regard to:</p> <ul style="list-style-type: none"> <li>• Amendment area has been identified as a karstic zone and 5.5 % has been identified as potentially karstic;</li> <li>• troglobitic fauna and the critically endangered "Aquatic Root Mat Communities of caves of the Swan Coastal Plain" (includes species of stygofauna) are restricted to these environments;</li> <li>• absence of Tuart woodlands associated with karst in the Amendment area and the relatively deep water table; both essential criteria for critically endangered root mat communities;</li> <li>• lack of surface water within the Amendment area (surface waters are important in Yanchep National Park for serving as conduits for possible colonisation of the subterranean world); and</li> <li>• Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;</li> </ul> <p>it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective for</p>



RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			<ul style="list-style-type: none"> <li>To address these concerns the DEP negotiated with the Responsible Authority and the landowner following the public comment period to revise the Responsible Authority's Environmental Management Recommendations to go into the scheme. This includes: <ul style="list-style-type: none"> <li>⇒ fire management will be addressed in the Vegetation and Fauna Management Plan; and</li> <li>⇒ a Karst Management Strategy will be prepared by the subdivider at the LSP stage</li> </ul> </li> <li>Further surveys of the karstic and potentially karstic areas will be undertaken at the DSP stage and the LSP stage as per the Responsible Authority's Environmental Management Recommendations. Further to this the development of the Karst Management Strategy and other management plans proposed for the protection of vegetation, stygofauna and troglobitic fauna will provide protection for the karstic areas, reservation in the MRS is not necessarily required.</li> </ul> <p>The EPA recommends that these modified Environmental Management Recommendations (to be applied as environmental conditions) be included in the Scheme so that the potential direct impacts on karst areas are minimised.</p>	<p>stygofauna and troglobitic fauna.</p>
Air quality	Amendment area	Ensure that gaseous emissions do not adversely affect the environment or health, welfare and amenity of nearby landusers by meeting the statutory requirements (including Section 51 of the <i>Environmental Protection Act 1986</i> ) and acceptable standards.	<p>The EPA considers that the Responsible Authority (RA) has provided sufficient information to confirm that the potential indirect impacts of emissions from industrial landuses can be managed under the Environmental Management Recommendations (to be applied as environmental conditions) to meet the EPA's objective.</p> <p>The EPA notes that:</p> <ul style="list-style-type: none"> <li>There are no existing significant sources of air pollution within the existing amendment area because the area is undeveloped.</li> <li>The Amendment Area is and will be affected by regional air quality issues such as photochemical smog and haze.</li> <li>The proposed Industrial Development zone, which will be adjacent to the proposed Urban Development Zone, will only support mainly light and service industries which are considered to be generally compatible with urban development.</li> <li>The planning and development of these potential industrial landuses will be managed through a number of statutory and non-statutory mechanisms to ensure the potential impacts on future residents are minimised.</li> </ul>	<p>Having particular regard to the:</p> <ul style="list-style-type: none"> <li>proposed development of industry adjacent to urban areas;</li> <li>industrial development zone mainly supporting light and service industries which are generally compatible with urban development;</li> <li>statutory and non-statutory mechanisms which exist to manage pollution from industrial landuses such as: <ul style="list-style-type: none"> <li>⇒ EPA's draft policy for Industrial - Residential Buffer areas (Separation distances);</li> <li>⇒ EPA's Interim guidance on Air Quality Impacts from Development Sites;</li> </ul> </li> </ul>

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Groundwater quality	Perth Coastal UWPCA	Minimise the risk of pollution to the water source	<ul style="list-style-type: none"> <li>• There were no submissions received in relation to the management of this factor.</li> <li>• The EPA is satisfied that a number of statutory and non-statutory mechanisms exist to manage pollution from the Industrial Development Zone. However, it is necessary for an Environmental Condition to go into the Scheme which addresses the following: <ul style="list-style-type: none"> <li>At the <b>District Structure Planning stage</b>, the landowner shall take account of: <ul style="list-style-type: none"> <li>• The EPA's draft policy for Industrial - Residential Buffer areas (Separation distances).</li> <li>• Statement of Planning Policy No. 4 (State Industrial Buffer Policy).</li> </ul> </li> <li>At the <b>Local Structure Planning stage</b>, the landowner shall ensure land use compatibility between the industrial zone and surrounding land uses. The landowner shall take account of: <ul style="list-style-type: none"> <li>• EPA's Interim guidance on Air Quality Impacts from Development Sites.</li> <li>• Environmental Protection (Noise) Regulations 1997.</li> <li>• Codes of Practice.</li> </ul> </li> </ul> </li> </ul> <p>Development Applications within the industrial zone shall be assessed by the Responsible Authority with regard to compliance with government policies in relation to buffer zones.</p> <p>The EPA recommends that these Environmental Conditions be included in the Scheme so that the potential indirect impacts associated with emissions from industrial landuses are minimised.</p>	<ul style="list-style-type: none"> <li>⇒ Works Approval and licensing through Part V of the Environmental Protection Act 1986;</li> <li>⇒ Environmental Protection (Noise) Regulations 1997;</li> <li>⇒ Statement of Planning Policy No. 4 State Industrial Buffer Policy 1997;</li> <li>⇒ Codes of Practice;</li> <li>⇒ the Structure Planning process;</li> <li>⇒ subdivision design; and</li> <li>⇒ conditions on development applications;</li> </ul> <p>it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective for air quality.</p>
			<p>The EPA considers that the Responsible Authority (RA) has provided sufficient information to confirm that the potential direct impacts upon groundwater quality can be managed under the Environmental Management Recommendations (to be applied as environmental conditions) to meet the EPA's objective.</p> <p>The EPA notes that:</p> <ul style="list-style-type: none"> <li>• The Amendment area is within the Perth Coastal (Priority 3) UWPCA.</li> <li>• The proposed development of urban, commercial and industrial areas may potentially pollute groundwater within the Amendment area.</li> </ul>	<p>Having particular regard to the:</p> <ul style="list-style-type: none"> <li>• Amendment area being within a P3 UWPCA; and</li> <li>• Environmental Management Recommendations proposed by the Responsible Authority;</li> </ul> <p>it is the EPA's opinion that the Amendment can be managed to</p>

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			<ul style="list-style-type: none"> <li>• The types of industrial landuses proposed for the Industrial Development Zone are mainly light and service industries which are not an incompatible use within a P3 UWPCA but are a restricted use. These uses may be compatible with the management objectives of the priority classification, with appropriate site management practices.</li> <li>• These practices will be managed through a number of statutory and non-statutory mechanisms to ensure that potential impacts on groundwater quality are minimised.</li> <li>• To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve: <ul style="list-style-type: none"> <li>⇒ the preparation of a Drainage, Nutrient and Water Management Plan by the subdivider at the LSP stage to the requirements of the Responsible Authority and on the advice of the DEP, Water and Rivers Commission and the Water Corporation; and</li> <li>⇒ at the DSP stage the developer shall ensure that there is provision for deep sewerage to all areas of development.</li> </ul> </li> <li>• The Water and Rivers Commission has advised that development will need to conform with the minimum requirements for development in a P3 UWPCA.</li> <li>• The Drainage, Nutrient and Water Management Plan will be prepared to meet these requirements to the satisfaction of the Responsible Authority and on the advice of the DEP, Water and Rivers Commission and the Water Corporation.</li> <li>• The Responsible Authority's Environmental Management Recommendations (to be applied as environmental conditions) will adequately manage the potential impact of development on groundwater quality beneath the Amendment area.</li> </ul> <p>The EPA recommends that these Environmental Management Recommendations (to be applied as environmental conditions) be included in the Scheme so that the potential direct impacts on groundwater quality are minimised.</p>	<p>meet the EPA's objective for groundwater quality.</p>
Solid and liquid waste	Amendment area	Wastes should be contained and isolated from groundwater and surface surrounds.	<p>The EPA considers that the Responsible Authority (RA) has provided sufficient information to confirm that the potential direct impacts on the environment from the inappropriate disposal of solid and liquid waste can be managed under the Environmental Management Recommendations (to be applied as environmental conditions) to meet the EPA's objective.</p>	<p>Having particular regard to the:</p> <ul style="list-style-type: none"> <li>• light and service industries proposed for the industrial area having minimal potential for the production of hazardous wastes; and</li> </ul>

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Unexploded ordnance (UXO)	Amendment area	Ensure that risk is managed to meet the	<p>The EPA notes that:</p> <ul style="list-style-type: none"> <li>• There are no significant sources of solid and/or liquid waste within, or immediately surrounding, the Amendment area.</li> <li>• The Industrial Development Zone will consist of light and service industries which have a minimal potential for the production of hazardous wastes.</li> <li>• To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve the subdivider at the LSP stage ensuring that the lots within the industrial zone are serviced to the deep sewerage system for the disposal of liquid wastes.</li> <li>• There were no submissions received in relation to this factor.</li> <li>• The EPA considers that it is possible that some of the industrial wastes may not be suitable for disposal in the sewerage system. Therefore, the EPA has negotiated with the Responsible Authority to revise the Environmental Management Recommendations (to be applied as environmental conditions) described above to the following:</li> </ul> <p>The landowner is to ensure that lots within the industrial zone are connected to the deep sewerage system for the disposal of appropriate liquid wastes as approved by the relevant Government Agency/ies. A Solid and Liquid Waste Management Plan will be produced at the <b>Local Structure Planning stage</b> to the requirements of the Responsible Authority on the advice of the Department of Environmental Protection. The report will detail:</p> <ul style="list-style-type: none"> <li>• the identification of the environmental outcome to be achieved through the implementation of this plan; and</li> <li>• options for recycling, and appropriate storage and disposal options for industrial, liquid and solid wastes.</li> </ul> <p>The EPA recommends that these Environmental Management Recommendations (to be applied as environmental conditions) be included in the Scheme so that the potential direct impacts on the environment from inappropriate solid and liquid waste disposal are minimised.</p>	<ul style="list-style-type: none"> <li>• Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;</li> </ul> <p>it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective for this factor.</p>
			The EPA considers that the Responsible Authority (RA) has provided sufficient information to confirm that the potential risk associated with industrial development	<ul style="list-style-type: none"> <li>• Having particular regard to the: potential for the Amendment</li> </ul>

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
		<p>EPA's criteria for individual fatality risk off-site and the DME's requirements in respect of public safety.</p>	<p>adjacent to urban areas can be managed under the Environmental Management Recommendations (as revised and to be applied as environmental conditions) to meet the EPA's objective.</p> <p>The EPA notes that:</p> <ul style="list-style-type: none"> <li>• The North West Corridor has been previously used by sections of the Australian and Allied defence forces for military exercises, therefore, unexploded ordnance (UXO) may be within the Amendment area.</li> <li>• UXO may present a risk to future residents within the Amendment area.</li> <li>• To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve: <ul style="list-style-type: none"> <li>⇒ prior to development occurring in areas where there is a potential for the presence of Unexploded Ordnance, the subdivider shall obtain written clearance from the UXO Unit of the Fire and Emergency Services Authority (FESA) that the area has been investigated and cleared of UXO in a manner consistent with the proposed land use.</li> </ul> </li> <li>• The UXO unit of FESA has expressed particular concern about the potential risk that UXO poses to future residents within the area. Of particular concern is the area around the Two Rocks Artillery Range.</li> <li>• The DEP has negotiated with the Responsible Authority and the landowner to make some small modifications to the Environmental Management Recommendations described above to adequately address the management of this factor. The modifications involve the following: <ul style="list-style-type: none"> <li>⇒ the subdivider shall prepare an Unexploded Ordnance Remediation Plan at the Local Structure Planning stage to render the Amendment area safe for the intended land uses to the requirements of Council with the concurrence of the UXO unit of the Fire and Emergency Services Authority (FESA) on advice from the DEP and the Department of Minerals and Energy.</li> </ul> </li> </ul> <p>The EPA recommends that these modified Environmental Management Recommendations (to be applied as environmental conditions) be included in the Scheme so that the potential risk to future residents from UXO is minimised.</p>	<p>area to be subject to UXO pollution;</p> <ul style="list-style-type: none"> <li>• risk UXO pollution poses to future residents;</li> <li>• the Responsible Authority's Environmental Management Recommendations which require the subdivider/s to obtain written clearance from the UXO Unit of FESA that the area has been investigated and cleared of UXO in a manner consistent with the proposed land use;</li> <li>• advice from the UXO Unit of the Fire and Emergency Services Authority of WA that the area around the Two Rocks Artillery Range is of particular concern; and</li> <li>• Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;</li> </ul> <p>it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective for risk.</p>
Aboriginal	Amendment	Ensure that the	The EPA considers that the Responsible Authority (RA) has provided sufficient	Having particular regard to the:

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Culture and Heritage	area	<p>proposal complies with the requirements of the <i>Aboriginal Heritage Act 1972</i>; and</p> <p>ii) Ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.</p>	<p>information to confirm that the potential risk associated with industrial development adjacent to urban areas can be managed under the Environmental Management Recommendations (as revised and to be applied as environmental conditions) to meet the EPA's objective.</p> <p>The EPA notes that:</p> <ul style="list-style-type: none"> <li>• One Aboriginal archaeological site has been identified within the Amendment area.</li> <li>• The proposed development of the Amendment area could impact upon this site.</li> <li>• To manage these potential impacts the Responsible Authority has developed Environmental Management Recommendations to go into the scheme which involve: <ul style="list-style-type: none"> <li>⇒ the developer and subdivider shall ensure that District and Local Structure Planning has regard to the presence of the archaeological site within the Amendment area and shall take all reasonable measures to limit or prevent disturbance of this site during or following development;</li> <li>⇒ if it becomes necessary to disturb the archaeological site, the subdivider shall obtain the necessary clearances under the Aboriginal Heritage Act 1972; and</li> <li>⇒ the subdivider shall ensure that employees and workers involved in construction activities in the vicinity of the archaeological site receive training regarding protection of its values.</li> </ul> </li> <li>• The Aboriginal Affairs Department (AAD) raised concerns about further sites of Aboriginal significance, particularly subsurface cultural material and burials, being identified during the development of the Amendment area. To protect these potential sites the AAD has requested that construction activities be carefully monitored to ensure that no potential sites are damaged.</li> <li>• The AAD also stipulated the requirements under Section 18 of the Aboriginal Heritage Act 1972 for developers to apply for a permit from the Minister if development is to impact upon an identified Aboriginal site.</li> <li>• To address these concerns the DEP negotiated with the Responsible Authority and the landowner following the public comment period to modify the Environmental Management Recommendations. This involves the inclusion of the following: <ul style="list-style-type: none"> <li>⇒ prior to commencement of site works, staff shall undergo a briefing on</li> </ul> </li> </ul>	<p>a) Aboriginal site 1km north of the current Yanchep townsite, and within the Amendment area;</p> <p>b) Aboriginal Affairs Department's advice; and</p> <p>c) Environmental Management Recommendations proposed by the Responsible Authority and revised by the DEP, the Responsible Authority and the landowner following the public comment period;</p> <p>it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective for Aboriginal Culture and Heritage.</p>

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			<p>Aboriginal Heritage issues to enable staff to recognise materials that may constitute an Aboriginal site. During earthworks all contractors will be supervised by a Site Manager, who, if a suspected site is discovered, will seek specialist advice to confirm the identification of the site.</p> <p>The EPA recommends that these modified Environmental Management Recommendations (to be applied as environmental conditions) be included in the Scheme so that the potential impact on Aboriginal culture and heritage is minimised.</p>	