PRECINCT 3 – ENVIRONMENTAL REVIEW

SOUTHERN RIVER

On behalf of :

CITY OF GOSNELLS

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STATEMENT OF LIMITATIONS

Scope of Services

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

Reliance on Data

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

Environmental Conclusions

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

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

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

Report for Benefit of Client

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

Other Limitations

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

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

EXECUTIVE SUMMARY

ENV Australia undertook an environmental assessment on behalf of the City of Gosnells of the area in Southern River identified as Precinct 3. The environmental assessment comprised vegetative and floristic surveys of remnant vegetation and wetland associated vegetation, and fauna surveys.

Ultimately the results of the assessment will inform the City of Gosnells' planning activities and development requirements within Precinct 3, including the development of an Outline Development Plan. The report will also inform future management objectives and mechanisms.

Precinct 3 is predominately a low lying landscape, subject to seasonal inundation. Of the many wetlands mapped as Geomorphic Wetlands of Swan Coastal Plain, twelve were considered to require an investigation into their classification. Based on vegetation condition and general disturbance it is recommended that the classification of 7 of these could be reconsidered. Buffer requirements for these wetlands were recommended commensurate with their anticipated classification.

Floristically a total of 50 families, 146 genera and 227 taxa were recorded in the survey area, of which 41 were introduced species. Two Priority Four species where located during the survey. One species that is considered to be significant was located within Precinct 3. Two vegetation communities were identified that have been inferred as Threatened Ecological Communities. One is the community Shrublands and Woodlands on Muchea Limestone which is listed as Endangered (Part B, section 2) by the WA Threatened Species and Communities Unit and endorsed by the Minister for the Environment. The community is also listed as Endangered under the Environmental Protection and Biodiversity Conservation Act, 1999 (EPBC Act). The other community is FCT 3a – *Corymbia calophylla – Kingia australis* Woodlands on heavy soils. This community is listed as Critically Endangered, Part B section 2 by the WA Threatened Species and Communities Unit and endorsed by the Minister for the Environment and Endangered under the EPBC Act.

The condition of the vegetation within Precinct 3 varied between excellent to completely degraded. All the remnant vegetation with Precinct 3 is considered to be locally significant as per the Perth Biodiversity Project Assessment Guidelines.

Precinct 3 is potentially inhabited or frequented on occasions by 221 species of vertebrate fauna. Survey work identified the presence of 92 fauna species, including 10 introduced species. The survey confirmed the presence in the study area of 3 species listed under State or Federal legislation (two threatened species and one migratory species). The survey also confirmed the presence of 14 avifauna species which are listed as Decreaser Species by Bush Forever.

The greatest diversity of fauna species was found within Area E. Vegetatively, Bush Forever Areas E and G are confirmed as regionally significant and should be priorities for protection.

The vegetation linkage designed by ENV for Precinct 3 illustrates the best possible linkages within the study site that would facilitate fauna movement between the areas of remnant bush. The recommended linkage connects all major vegetation remnants within the Precinct, utilising drainage lines and small remnants to provide ecological stepping stones.

1 INTRODUCTION

ENV. Australia Pty Ltd (ENV) was commissioned in August 2005 by the City of Gosnells to undertake an environmental review of Precinct 3, Southern River. (see Figure 1 for site location). This assessment was undertaken with the aim of determining the issues associated with Precinct 3 in reference to wetlands, flora, vegetation and fauna.

The City of Gosnells is currently planning for a new urban and industrial development within Precinct 3. The area is known to contain features of conservation value, some of which are protected by state mechanisms, however, the environmental characteristics and value of the majority of Precinct 3 are not well documented.

It is understood that the environmental assessment will provide critical input into the future Outline Development Plan (ODP) and associated planning processes. The review will provide advice on the existing environmental assets and potential opportunities and constraints for future urban development and biodiversity conservation. The review will also provide support for the Metropolitan Region Scheme (MRS) and the Town Planning Scheme (TPS) Amendments and ultimately guide future subdivision and development.

1.1 LOCATION

The Precinct is approximately 18 kilometres south east of Perth. Precinct 3 is bound by Southern river to the north, Southern River Road to the east, Ranford Road to the south and Passmore Street to the west (see Figure 1). The survey area includes the whole of Precinct 3 excluding Bush Forever sites 413 and 465.

The Precinct is located in the south west province of Western Australia in the Darling Botanical District. This region typically consists of forest country with related woodlands and is divided into four subregions or botanic subdistricts.

Precinct 3 is located within the Swan Coastal Plain Subregion in the Drummond Botanical Subdistrict, which consists mainly of the following vegetation communities:

- Banksia Low Woodland on leached sands and Melaleuca Swamps in poorly drained areas.
- Woodland of Tuart (*Eucalyptus gomphocephala*); and
- Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) on the less leached soils (Beard, 1990).

The climate of this region is Warm Mediterranean, with winter precipitation of 600-1000 mm and 5-6 dry months per year.

1.2 DECLARED RARE AND PRIORITY FLORA

Flora species acquire Declared Rare or Priority conservation status where populations are geographically restricted or threatened by local processes. The Department of Conservation and Land Management (CALM) enforces regulations under the *Wildlife Conservation Act (1950)* to conserve Declared Rare Flora and protect significant populations.

Rare Flora species are gazetted under Subsection 2 of Section 23F of the *Wildlife Conservation Act* (1950) and therefore it is an offence to "take" or damage rare flora without Ministerial approval. Section 23F of the Wildlife Conservation Act (1950-1980) defines "to take" as …. to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means.

Priority Flora are under consideration for declaration as 'rare flora', but are in urgent need of further survey (Priority One to Three) or require monitoring every 5-10 years (Priority Four) (see Appendix A for definitions).

Flora is also classified according to their conservation status at a federal level, under the *Environmental Protection and Biodiversity Conservation Act*, 1999 (EPBC Act). These categories of classification are summarised in Appendix A

1.3 LISTING OF THREATENED FLORA AND VEGETATION

The Wildlife Conservation Act provides for taxa of plants and animals to be listed as 'threatened'. CALM Policy Statements Nos 9 *Conservation of threatened flora in the wild* and 33 *Conservation of endangered and specially protected fauna in the wild* cover this area.

Threatened flora and vegetation lists are reviewed and changes recommended by CALM's Threatened Species Scientific Committee. Ministerial approval is necessary before changes are given legal status in a notice in the Government Gazette.

There is currently no equivalent legislation or formal policy for the protection of threatened ecological communities, however, an informal, non-statutory process, including advice from a scientific advisory committee, the establishment of the threatened ecological communities database, and steps for assigning ecological communities to categories of threat, is now in place.

The Department has been identifying and informally listing threatened ecological communities (TECs) for ten years. At May 2003, 106 ecological communities had been entered into the Department's TEC Database. Of these, 21 have been endorsed by the Minister for the Environment as Critically Endangered, 17 as Endangered, 28 as Vulnerable and three as presumed totally destroyed. The

remainder are either awaiting endorsement as threatened or are allocated to one of five priority lists. Sixteen TECs are now listed under the Commonwealth's EPBC Act.

Any person may nominate an ecological community for listing under the EPBC Act, 1999. Nominations are forwarded to the Threatened Species Scientific Committee. Once the Committee has conducted an assessment of the conservation status of the ecological community, its advice and subsequent recommendations are forwarded to the Minister for the Environment and Heritage who makes the final decision. The recommendations endorsed by the Minister in making a listing decision are provided via the EPBC Act lists.

1.4 THREATENED ECOLOGICAL COMMUNITIES

A vegetation community is considered a Threatened Ecological Community (TEC) if it is found to fit into one of the following categories:

- Presumed Totally Destroyed;
- Critically Endangered;
- Endangered; or
- Vulnerable

The definitions of these categories are described in Appendix B.

Coordination of threatened species and ecological community conservation is carried out by CALM's Nature Conservation Division, primarily through the Western Australian Threatened Species and Communities Unit (WATSCU).

1.5 FAUNA OF CONSERVATION SIGNIFICANCE

The conservation status of fauna species in Western Australia is assessed under the federal *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the state administered *Western Australian Wildlife Conservation Act 1950*.

Under the EPBC Act threatened fauna may be listed in any one of the following categories as defined in Section 179 of the Act:

- Extinct;
- *Extinct in the wild;
- *Critically endangered;
- *Endangered;

- *Vulnerable; and
- Conservation dependent.

*Only species in those categories marked with an asterix are matters of national environmental significance under the EPBC Act.

The Wildlife Conservation Act uses a set of schedules (see Appendix C) in addition to utilising the categories defined by the EPBC Act.

In Western Australia, the Department of Conservation and Land Management (CALM) also produce a supplementary list of priority fauna. The species listed are not considered threatened under the Wildlife Conservation Act, but due to a lack of knowledge or where species are poorly represented in secure conservation reserves, some concern for there long term survival exists. The five priority fauna classifications levels used by CALM are listed in Appendix C.

The EPBC Act also requires the compilation of a list of migratory species that are recognised under international treaties including the Japan Australia Migratory Bird Agreement (JAMBA), the China Australia Migratory Bird Agreement (CAMBA) and the Bonn Convention (The Convention on the conservation of Migratory Species of Wild Animals). Species listed under JAMBA are also protected under Schedule 3 of the Wildlife Conservation Act.

1.6 OTHER FAUNA SPECIES OF SIGNIFICANCE

A number of other species not listed in official lists can also be considered of regional conservation significance. These include species that have a restricted range, those that occur in breeding colonies and those at the limit of their range.

While not classified as rare, threatened or vulnerable under any State or Commonwealth legislation, a number of bird species have been listed as of significance on the Swan Coastal portion of the Perth Metropolitan Region (Bush Forever - Government of Western Australia 1998 and 2000). The bird species are often referred to as Bush Forever Decreaser Species. The two categories used for birds within the Bush Forever documents are:

- Habitat specialists with reduced distribution on the Swan Coastal Plain (code Bh)
- Wide ranging Species with reduced population’s on the Swan Coastal Plain. (code Bp)

Other fauna species of regional significance due to declining populations on the Swan Coastal Plain include the Honey Possum and Pygmy Possum (Dell 2000).

2 SCOPE OF WORK

The scope of services for the project consisted of the following:

2.1 WETLANDS

- Review current wetland classifications and condition;
- Make recommendations regarding reclassification of wetlands; and
- Map wetlands and appropriate buffers.

2.2 FLORA AND VEGETATION

- Undertake a data base search for Rare and Endangered species and Threatened Ecological Communities (TECs) that may occur in the area, by reference to Department of Conservation and Land Management (CALM) and Environment Australia (EA) databases;
- Undertake a comprehensive flora and vegetation field survey;
- Search for Rare and Endangered Flora contained within the precinct;
- Identify any Threatened Ecological Communities (TECs);
- Produce maps illustrating the location of environmental features/issues within the survey site;
- Comment on significant features of flora, such as known range extensions or new species;
- Identify any potential environmental impacts and develop management recommendations for protection of flora; and
- Develop recommendations on how environmental impacts can be minimised and appropriately managed.

2.3 FAUNA

- Compile an inventory of relevant species in the designated works area;
- Undertake a habitat assessment;
- Undertake field surveys to include ground fauna, birds and fish;
- Identify any potential environmental impacts and develop management recommendations for protection of fauna and habitat; and

- Consider and develop management recommendations on potential effects to other ecological factors.

3 METHODS

The methodology for works involved the following key steps:

3.1 WETLANDS

Maps for the survey site of the Geomorphic Wetlands of the Swan Coastal Plain and Environmental Protection Policy wetlands were obtained from the Perth Groundwater Atlas, and the Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy, 2004, respectively. The map of the Geomorphic Wetlands (Figure 7) was then sent to the Department of Environment to confirm the currency and accuracy of the mapped wetlands to aid in the analysis of the wetland classifications and boundaries.

ENV then ground truthed the map by walking the boundaries and assessing the condition of the vegetation and determining whether the wetlands were mapped accurately. Based on this ground assessment indicative recommendations on appropriate classifications and buffers were made.

In line with the Scope of Work, ENV's wetland assessment considered flora, vegetation and condition only and therefore does not meet the current protocol for assessing wetland classifications and buffers, or Bulletin 686. The DoE has released a Draft Guideline outlining an evaluation method to assign management categories, which will supersede Bulletin 686. This is in recognition that Bulletin 686 is not well equipped to recognise wetland condition, floristic complexities, less conspicuous fauna, and functions and values present in systems such as damplands and palusplains. Wetland classification assessments now require the collecting of hydrological, soil and vegetation information.

3.2 FLORA AND VEGETATION

On the 31 August 2005 a database search request was submitted to the Department of Conservation and Land Management to obtain a list of Rare and Priority flora species and Threatened Ecological Communities (TECs) that occur within the precinct and surrounding area up to a 2km radius. The search co-ordinates used were 398951.4E, 6449915.7N and 405234.2E, 6444901.7N (GDA94) (CALM, 2005 Department's *Threatened (Declared Rare) Flora* database).

Between 19 September and 14 October a field survey of the site was undertaken. For each location surveyed the information was collected systematically in accordance with the Local Government Biodiversity Planning Guidelines (LGBPG) along with using the field survey templates provided in Part C of the LGBPG. In addition to the locations where the LGBPG field sheets were used, ENV collected information along transects such as suspected significant flora species and additional species present in each community.

Due to Precinct 3 being too large (410 ha) to adequately survey as a whole (which is the method recommended by the LGBPG) the precinct was divided into 7 separate study areas, A-G (areas were selected purely based on easily defined boundaries such as lot boundaries and roads). TPS17 formed an eighth study area, Area H. The study areas are identified in Figures 2 and 3 as areas A – H. These were dealt with as individual study areas with Part C of the LGBPG being completed for each (Appendix D). Figures 4 and 5 show where survey sites were undertaken to complete the LGBPG templates. Corresponding photos are in Appendix E.

The LGBPG instructs that a 10m x 10m quadrat be established within vegetation communities that have been identified as Threatened Ecological Communities (TECs), however, due to the two TECs found within the study area being very small in size and on private property, ENV considered it to be inappropriate to establish the quadrats. This was especially the case for the TEC found within area F as the community is inside a deer farm and therefore the establishment of a quadrat could cause injury (vegetation used for cover by the deer). Instead of establishing quadrats a field sheet was completed as per the LGBPG templates.

Searches were conducted for significant flora known to occur in the area. Searches focused predominantly on their known habitats to provide the best possible chance of detecting their presence within the site.

Where field identification of plant taxa was not possible, specimens were collected in a systematic manner. Collections were later identified at the West Australian Herbarium by comparison with the reference collection and use of identification keys. GPS coordinates were taken of every plant that was suspected to be Rare or Priority species.

The vegetation communities of the site were then mapped onto an aerial photograph (Figure 11 and 12). The condition of the vegetation was mapped also by using the scale commonly used in the Perth metropolitan area and Bush Forever, Keighery B. J. 1994 (Figure 9 and 10).

3.3 FAUNA

A list of all vertebrate fauna potentially occurring within the study area was compiled after a review of information gained from searches done on the WA Museum Database, the Department of Conservation and Land Management's Threatened Fauna Database, Department of the Environment and Heritage's Commonwealth Environment Protection and Biodiversity Conservation Database, Birds Australia's 'Birdata", published and unpublished reports and specialist books detailing fauna of the general area.

In particular reference was made to reports on previous fauna surveys done in the general area, these being How *et al* (1996), Harvey *et al* (1997), Gole (2004),

Bamford (2003), Alan Tingay and Associates (1994) and Alan Tingay and Associates (1997).

Taxonomy and nomenclature for fauna species used in this report generally follow Allen *et al.* (2003) for fishes, Aplin and Smith (2001) for amphibians and reptiles, How *et al*. (2001) for mammals and Johnstone (2001) for birds. Some names, including common names recommended for national and international use by Christidis and Boles (1994) for birds, are also used. Common names for reptiles and amphibians come from a variety of sources and are not necessarily generally accepted. Sources include Tyler *et al.* (2000) and Glauret (1961).

The project area was assessed and broad fauna habitat types identified and mapped (Figure 13). Habitat types are largely based on the vegetation types present and mirror the vegetation mapping carried out as part of the botanical survey work. In addition, the presence of potential wildlife corridors (Figure 15) and their relationship with areas of remnant vegetation outside the study area was investigated by examination of air photos and from information gained during field observations.

The habitat assessment was carried out specifically targeting the likely habitats of listed (under the relevant Federal and State Acts) threatened vertebrate species potentially occurring in the general area. The aim of the habitat assessment was to determine if it was likely that any of the threatened species would utilise the area.

During the field survey the habitat at the site was assessed to determine its potential to be hosting any of the listed threatened species as well as aiding in the compilation of a potential fauna list based on available habitats and opportunistic observations.

To provide information on the abundance and distribution of ground fauna present within the study area six trap grids, utilising a combination of cage, Elliott funnel and pit fall traps, were put in place at selected locations over a period of eight nights between the 13th and 21st October 2005 and were checked daily. Figure 6 shows the location of each trap grid.

Each trapping grid consisted of nine pitfall traps on a three by three grid with approximate 30m spacing between traps. Each pit trap had its own 25cm high, 5m long flywire drift fence. Within each grid an Elliot trap was also placed at each of the trap sites. A Sheffield type cage trap was placed on each corner of the grid and a funnel trap was placed at each of the three central trap points. The basic grid layout was based on the survey design used by How *et al* (1996) during their assessment of the ground fauna of urban bushland remnants in Perth. It should be noted that trapping undertaken during How's study only utilised pit traps (i.e. no cage, Elliott or funnel traps).

In addition to trapping, systematic and non-systematic opportunistic observations of fauna species were made and recorded (principally bird species) on the 20th September and between the 13th and 21st October 2005. Systematic observations of bird species were conducted for 20 minute intervals in specific habitat types and aimed to survey selected areas at different times of the day to provide comparative data on distributions and abundance.

During the course of all the survey work non-systematic opportunistic observations of fauna species were made and recorded (principally bird species). In addition to the direct observation of fauna species, secondary evidence of fauna such as tracks, diggings and scats were also noted. Some active searching was undertaken in specific areas with the aim of locating the more elusive frog and reptile species that may inhabit the site.

Sampling (using a small hand net at random locations) of the drains and some wetlands was also undertaken to determine if any native fish were present. This was done on an opportunistic basis at five locations within study areas D and E.

During the course of opportunistic surveys across the study area the presence of trees containing hollows suitable for use by the black cockatoo and large owl species for nesting and any existing birds of prey nests (potential Peregrine Falcon nests) were noted.

All assessments of hollows were conducted from ground level. Because it is impossible to determine all the characteristics of hollows that are favoured by cockatoos and owls, the assessment of suitability was based entirely on the size of each hollow's entrance. Hollows that were large enough to allow the entry of a cockatoo or owl were recorded as a potential nest site.

All hollows found were studied with binoculars for signs of use (eg wear and chewing) and trunks and branches checked for scarring which may indicate use by other fauna species (e.g. territory marking by parrot species such as the Galah).

The presence of hollows considered unsuitable for cockatoos and owls were also noted as they provided an idea of the area's suitability for other obligate hollow nesters.

Other prerequisites that determine the suitability of a hollow, not fully assessed as part of this study, include the project site location as obviously hollow trees must be within suitable breeding areas. While black cockatoo species are known to pass through the area it has not been determined if they actually breed on site or in the vicinity. In addition to entrance size, the depth and floor space of the hollow are important factors. The existence of suitable hollows, even in breeding areas does not necessarily make them available for breeding as hollows must be spatially, structurally and temporally correct (Johnstone R. E & C 2004).

The scale of the combined fauna survey was designed to comply with the requirements of the EPA Guidance Statement 56 (Level 2 Survey).

4 RESULTS

The following results are accurate at the time of report preparation. Flora composition changes over time with flora species having specific growing periods, especially annuals and ephemerals (plants lasting for a markedly brief time, some only a day or two). For this reason the outcome of future botanical surveys undertaken within the precinct has the potential to change.

4.1 WETLANDS

The wetlands of the Swan Coastal Plain were originally mapped by the Water and Rivers Commission and Department of Environmental Protection over the period 1987 - 1996. This mapping was published in Volume 2B of the Wetlands of the Swan Coastal Plain (Hill et. al., 1996). Numerous amendments and verifications to the mapping by the Water and Rivers Commission have resulted since then.

The Geomorphic Wetlands of the Swan Coastal Plain map for Precinct 3 was obtained from the Perth Groundwater Atlas (Figures 7a and 7b). This indicates that approximately 65% of the study area (excluding Bush Forever sites 413 and 465) is identified as wetland. This includes:

- Conservation Category Wetlands: 10%
- Resource Enhancement Wetlands: 20%
- Multiple Use Wetlands: 35%

To better protect and conserve the remaining wetlands of high ecological value on the Swan Coastal Plain, the Environmental Protection Authority (EPA) has developed a Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004 (EPP) under Section 26 of the Environmental Protection Act 1986 (the Act). This decision follows the statutory review of the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 in 1999 and the government's endorsement of the 1997 State Wetlands Conservation Policy for Western Australia. According to the draft policy there are 2 EPP wetlands within Precinct 3 (excluding the Bush Forever site and the site proposed as Parks and Recreation). These can be seen in Figure 8.

4.2 WETLAND CLASSIFICATION ASSESSMENT

A comparison of the mapping in Volume 2B and the updated maps available via the Perth Groundwater Atlas shows that the drawn boundaries of the wetlands within Precinct 3 have not been altered since the wetlands were originally mapped in 1996. It was noted, however, that management categories for a number of the wetlands have changed between the1996 mapping and the current Geomorphic wetland mapping.

The field survey undertaken by ENV identified that many of the boundaries and management categories are inaccurate. Below is a description of selected wetlands. Recommendations are highlighted only for those wetlands that are considered suitable to having their boundaries and/or management categories altered, the letters correspond to the wetlands in Figure 7c.

A: Is mapped as a Resource Enhancement Wetland (dampland) on the Geomorphic Wetland of the Swan Coastal Plain map (GWSCP). ENV's field survey found that the vegetation of the wetland had been cleared except for a few *Melaleuca preissiana* trees. There was no understorey species and the site had recently been tilled (Photo 62). Due to the wetlands lack of vegetation, degraded state and small size (0.3ha), consideration should be given to re-evaluating the management category.

Recommendation 1: It is considered likely, based on its assessed vegetation values that a re-evaluation of Wetland A will result in a downgrade of its current management category.

B: Is mapped as a Multiple Use wetland (dampland) on the GWSCP map. The wetland is small (60m x 70m) and isolated from other remnants of vegetation, the vegetation and wetland ecosystem is in very good condition. The management category could be considered as not providing sufficient protection for this wetland and therefore re-evaluation could be considered.

Recommendation 2: It is considered likely, based on its assessed vegetation values that a re-evaluation of Wetland B will result in an upgrade of its current management category.

C: Is mapped as a Resource Enhancement wetland (dampland) on the GWSCP map. The wetland extends over several properties and therefore is segregated by fences, tracks and firebreaks. Notwithstanding this the vegetation varies from good to excellent and is one of the few wetlands that has surface water, which is not associated with a drain. It also contains two priority species, which is discussed in section 4.2.2. The results of the field survey undertaken by ENV support the current management category placed on the wetland.

D: Is mapped as a Resource Enhancement wetland (dampland) on the GWSCP map. The wetland is in excellent condition however is surrounded by paddocks on three sides, which is a medium for weed invasion. The wetland also has an artificial drain running through the centre. The results of the field survey undertaken by ENV support the current management category placed on the wetland.

E: Is mapped as a Resource Enhancement wetland (area borders artificial channel) on the GWSCP map. The site has been totally cleared of vegetation and consists of a paddock of weeds. The site is used as a deer farm and there is no evidence of a wetland ecosystem except for a few scattered *Melaleuca viminea* var. *viminea*. The Forrestdale main drain runs along the rear boundary fence of the property (wetland), however there is no evidence of surface or subsurface water within the mapped Resource Enhancement wetland. Due to the wetlands lack of vegetation and degraded state, consideration of re-evaluating the management category could be undertaken.

Recommendation 3: It is considered likely, based on its assessed vegetation values that a re-evaluation of Wetland E will result in a downgrade of its current management category.

F: Is mapped as a Resource Enhancement wetland (dampland) on the GWSCP map. The species present at the site are not characteristic of a wetland vegetation community, being more representative of upland species. The area mapped as a wetland is assessed as being the transition community between the wetter communities and the dryer. The vegetation has also been disturbed from weed invasion, brush-cutting and by the current land use of horse paddocks. Due to these factors the wetlands management category could be re-evaluated or the boundary altered.

Recommendation 4: Consideration should be given to amending the boundary of Wetland F to reflect the presence of upland vegetation.

G: The wetland includes an area of Resource Enhancement wetland (area borders artificial channel) to the north west and a Multiple Use wetland (palusplain) to the south east (same wetland, different management categories). The portion mapped as Multiple Use wetland is in excellent condition. The portion of wetland mapped as Resource Enhancement (marked as G1 in Figure 7) has had most of the vegetation cleared between the Multiple Use wetland and Matison Road. See Figure 7c for boundary. The management categories of these two wetland areas is considered inappropriate and re-evaluations could be considered.

Recommendation 5: It is considered likely, based on its assessed vegetation values that a re-evaluation of the Multiple-Use portion of Wetland G will result in an upgrade of its current management category.

H: Is mapped as a Resource Enhancement wetland (area borders artificial channel) and is highly disturbed. The majority of the vegetation has been cleared

and is currently used to graze cows. The only remnant vegetation within the site consists of scattered *Eucalyptus rudis* and therefore consideration of re-evaluating the management category could be undertaken.

Recommendation 6: It is considered likely, based on its assessed vegetation values that a re-evaluation of Wetland H will result in a downgrade of its current management category.

I: Is mapped as a Conservation Category wetland (dampland) on the GWSCP map. It is the only large (26.8ha) Conservation Category wetland within Precinct 3, excluding Bush Forever sites 413 and 465. The wetland varies between good and excellent condition except for the area associated with the main drain that runs through the centre, which is degraded. There is an area that is fragmented and disturbed in the north and is currently being used as a horse paddock (marked as I1 in Figure 7). This area is considered to be of lesser conservation value then the majority of the wetland. The wetland also has the presence of a priority species as discussed in section 4.2.2. It is therefore recommended that this area be a priority for protection.

Given the wetlands EPP status, the private property owner/future development will require authorisation under the EP Act via referral to the EPA under section 38 if a prescribed action is proposed that impacts upon the Lake (filling, amendment to drainage etc),. The City of Gosnells can similarly pursue an amendment to the wetland's EPP status by referral to the EPA under section 48 during scheme assessment.

Recommendation 7: The protection of Wetland I should be considered a priority for areas protected within Precinct 3.

Recommendation 8: That the City of Gosnells' planning documentation recognises the EPP status of Wetland I through appropriate zoning. Current landholders should be made aware of the wetland's legislative protection.

J: Is mapped as a Conservation Category wetland (dampland) on the GWSCP map. The wetland runs along a drainage line and is in very good condition. It is important to note that it is the only location within the precinct that is dominated by *Pteridium esculentum* as so is considered unique compared to other wetlands in the area, therefore the wetlands current management category is considered appropriate.

K: Is mapped as Conservation Category on the GWSCP map. The flora species present do not indicate that it is a wetland community. The species consist of upland species except for *Banksia ilicifolia,* which may indicate a higher moisture

content in the soil. The management category of this wetland area is considered inappropriate and a re-evaluation could be considered.

Recommendation 9: Consideration should be given to amending the boundary of Wetland K to reflect the presence of upland vegetation.

L: Wetland L is mapped as Multiple Use by the Geomorphic wetland maps, however, is identified as a Environmental Protection Policy Wetland and Lake. Vegetatively, the wetland is in completely degraded condition, however, this wetland provides the only open water body in Precinct 3, and is utilised by water birds. It is unusual, to have a Multiple Use wetland identified as an EPP wetland. This has occurred due to the wetland originally being mapped as an EPP Lake, the criteria for which required a particular area of open water at a particular time of year.

Given the wetlands EPP status, the private property owner/future development will require authorisation under the EP Act via referral to the EPA under section 38 if a prescribed action is proposed that impacts upon the Lake (filling, amendment to drainage etc),. The City of Gosnells can similarly pursue an amendment to the wetland's EPP status by referral to the EPA under section 48 during scheme assessment.

Recommendation 10: That the City of Gosnells' planning documentation recognises the EPP status of Wetland L and either provides for its conservation (and rehabilitation) or seeks amendment to its EPP listing by referral to the EPA.

As previously indicated, those wetlands identified in Figure 7c not specifically identified by the letter A-L are considered to be adequately mapped and have appropriate management categories.

4.3 FLORA AND VEGETATION

A total of 50 families, 146 genera and 227 taxa were recorded in the survey area, of which 41 were introduced species (see Appendix F).

To successfully record all species from an area surveys should be undertaken several times throughout the year. The majority of species occur through spring, however there are some species that occur at different times of year, for example, RESTIONACEAE and CYPERACEAE families flower in autumn.

The dominant plant families recorded from the survey were as follows:

- MYRTACEAE 31 species

- PAPILIONACEAE 22 species
- PROTEACEAE 15 species
- POACEAE 14 species

4.3.1 Priority flora

The database search resulted in 27 Rare and Priority species being identified as potentially occurring in the area. The 27 species are:

Taxa	Conservation Code: STATE	Conservation Code: FEDERAL	Taxa	Conservation Code: STATE	Conservation Code: FEDERAL
Acacia benthamii	P2	NL	*Drakaea elastica*	R	Endangered
Acacia lasiocarpa var. *bracteolata*	P1	NL	*Drakaea micrantha* (ms)	R	Vulnerable
Acacia oncinophylla subsp. *patulifolia*	P2	NL	*Dryandra mimica*	R	Endangered
Anthotium junciforme	P4	NL	*Eremaea asterocarpa* subsp. *brachyclada*	P1	NL
Aponogeton hexatepalus	P4	NL	*Halgania corymbosa*	P3	NL
Asteridea gracilis	P3	NL	*Rhodanthe pyrethrum*	P3	NL
Boronia tenuis	P4	NL	*Schoenus benthamii*	P3	NL
Byblis gigantea	P2	NL	*Stenanthemum sublineare*	P2	NL
Caladenia huegelii	R	Endangered	*Stylidium longitubum*	P3	NL
Caladenia longicauda subsp. *clivicola*	P4	NL	*Tetrateca sp. granite*	P3	NL
Calothamnus rupestris	P4	NL	*Thysanotus glaucus*	P4	NL
Calytrix breviseta subsp. *breviseta*	R	Endangered	*Tripterococcus paniculatus*	P1	NL
Conospermum undulatum	R	Vulnerable	*Verticordia lindleyi* subsp. *lindleyi*	P4	NL
Diuris purdieri	R	Endangered			

4.3.2 Rare and Priority Flora

No plant taxa gazetted as Declared Rare pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* were located within the survey area.

No Endangered or Vulnerable species, pursuant to s178 of the Environmental Protection and Biodiversity Conservation Act, 1999 were located during the survey.

Two Priority Four species where located during the survey. These were: *Aponogeton hexatepalus* and *Verticordia lindleyi* subsp. *lindleyi*. The locations of these were as follows:

Taxa	Easting (GDA94)	Northing
Verticordia lindleyi subsp. *lindleyi* (P4)	402375	6447 627
	403 056	6447 578
	403 413	6447 458
Aponogeton hexatepalus (P4)	402 378	6447 459

(see Figure 9 for locations)

4.3.3 Significant flora

During the survey one species that is considered to be significant was located within Precinct 3. Significant flora species are of particular interest as they are rare, poorly known, restricted in distribution or have some other distinctive feature (Bush Forever, 2000).

Evandra pauciflora was the only significant flora species found during the survey. It is considered significant on the Bassendean Dunes due to there being significant populations and they are at their boundary limit of its known geographic range. The species was found at the following locations:

Site Number (Figure 9)	Easting (GDA94)	Northing
A2	401 589	6446 596
B4	401 842	6447 147
B6	402 107	6446 940
E2	403 203	6447 243
E6	403 413	6447 458
E10	402 990	6447 285
E15	403 054	6447 583
G3	402 367	6446 830

4.3.4 Introduced species

Of the 227 species recorded at the site 41 were introduced. The dominant weed families were POACEAE (11), ASTERACEAE (4), IRIDACEAE (4) and PAPILIONACEAE (4).

The Environmental Weed Strategy for Western Australia contains criteria for the assessment and ranking of weeds in terms of their environmental impact on biodiversity.

These criteria, described below, were used to assess the introduced species within Precinct 3.

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

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

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

Taxon	**Common Name**	**Criteria**			
		Rating	**Invasiveness**	**Distribution**	**Impacts**
**Acacia longifolia* subsp. *longifolia*	Sydney golden wattle	NL	NL	NL	NL
**Arctotheca calendula*	Capeweed	Moderate	√	√	X
**Arundo donax*	Giant reed	Low	X	X	X
**Asparagus asparagoides*	Bridal creeper	High	√	√	√
**Avena barbata*	Bearded oat	Moderate	√	√	X
**Briza maxima*	Blowfly grass	Moderate	√	√	X
**Briza minor*	Shivery grass	Moderate	√	√	X

Taxon	Common Name	Criteria			
		Rating	Invasiveness	Distribution	Impacts
**Bromus diandrus*	Great brome	High	√	√	√
**Carpobrotus edulis*	Pigface	Moderate	√	√	X
**Cortaderia selloana*	Pampas grass	High	√	√	√
**Cynodon dactylon*	Couch	Moderate	√	√	X
**Dischisma capitatum*	-	Information not available	-	-	-
**Echium plantagineum*	Paterson's curse	Information not available	-	-	-
**Ehrharta calycina*	Perennial veldt grass	High	√	√	√
**Eragrostis curvula*	African lovegrass	High	√	√	√
**Erodium botrys*	Corkscrews, long storksbill	Low	X	X	X
**Erythrina* x *sykesii*	Coral tree	Low	X	X	X
**Freesia* 'hybrid'	Freesia	Information not available	-	-	-
**Fumaria capreolata*	White fumitory	Mild	X	X	X
**Gladiolus caryophyllaceus*	Pink gladiolus	Moderate	√	√	X
**Hypochaeris glabra*	Smooth catsear	Moderate	√	√	X
**Ipomoea indica*	Blue morning glory	Mild	√	X	X
**Leptospermum laevigatum*	Victorian tea-tree	High	√	√	√
**Lolium rigidum*	Annual ryegrass	Moderate	√	√	X
**Lupinus cosentinii*	WA Blue lupin	High	√	√	√
**Moraea flaccida*	One leaf cape tulip	High	√	√	√
**Orobanche minor*	Lesser broomerape	Moderate	√	√	X
**Oxalis pes-caprae*	Soursob, Sour grass	Mild	X	√	X
**Pelargonium capitatum*	Rose pelargonium	High	√	√	√
**Pennisetum clandestinum*	Kikuyu	Moderate	√	√	X
**Pinus pinaster*	Maritime pine	Moderate	√	√	X
**Raphanus raphanistrum*	Wild radish	Mild	X	√	X
**Ricinus communis*	Castor oil plant	Low	X	X	X
**Romulea rosea* var. *australis*	Guildford grass	Information not available	-	-	-
**Rumex crispus*	Curled dock	Mild	X	√	X
**Schinus terebinthifolia*	Brazilian pepper, Japanese pepper	Information not available	-	-	-
**Sonchus oleraceus*		Moderate	√	√	X
**Trifolium campestre*	Hop clover	Moderate	√	√	X
**Trifolium dubium*	Suckling clover	Moderate	√	√	X
**Ursinia anthemoides*	Ursinia	Moderate	√	√	X

Taxon	Common Name	Criteria			
		Rating	Invasiveness	Distribution	Impacts
**Zantedeschia aethiopica*	Arum lily	High	√	√	√

(NL: denotes species that are not listed in the Weed Strategy)

Plants may be "declared" by the Agriculture Protection Board under the Agriculture and Related Resources Protection Act, 1979. Declared Plants are gazetted under 5 categories (P1 – P5), which define the action required. Details on the standard meaning of these are in Appendix G. The category may apply to the whole state, districts, individual properties or even paddocks. If a plant is declared, all landholders are obliged to control that plant on their properties. (Department of Agriculture, 2004).

The four declared species found within Precinct 3 are:

- Asparagus asparagoides is listed as P1 for the whole state;
- Echium plantagineum is listed as P1 for the whole state;
- *Moraea flaccida* is listed as P1 for the whole state; and
- *Zantedeschia aethiopica* is listed as P1 and P4 for various areas however is not listed for Gosnells.

4.3.5 Vegetation Communities

An extensive survey of the bushland within Precinct 3 resulted in 32 vegetation mapping units being identified. Many of the vegetation communities are very similar, however, possess different tree species combinations and dominant understorey species. The communities were therefore named by the tree species and the dominate understorey species.

Below are the community descriptions. See Figure 11 and 12 for the distribution of the communities. Appendix H describes the species composition of each vegetation community.

JpLl – 1 Sedgeland of *Juncus pallidus* and *Lepidosperma longitudinale* with *Xanthorrhoea preissii*, *Schoenus efoliatus* and various introduced species (Photo 4).

BmBaBi – 2 Woodland of *Banksia menziesii*, *Banksia attenuata*, *Banksia ilicifolia*, *Eucalyptus todtiana* and *Allocasuarina fraseriana* over *Leucopogon conostephioides*, *Acacia pulchella*, *Phlebocarya ciliata*, *Gompholobium tomentosum*, *Melaleuca thymoides*, *Patersonia occidentalis* and *Lyginia imberbis* (Photo 1).

MpRc – 3 Low Open Woodland of *Melaleuca preissiana*, *Eucalyptus todtiana* and *Corymbia calophylla* over *Regelia ciliata*, *Astartea affinis*, *Xanthorrhoea preissii*, *Schoenus efoliatus*, *Patersonia occidentalis*, *Phlebocarya ciliata* and *Euchilopsis linearis* (Photo 8)

EtAc – 4 Low Open Woodland of *Eucalyptus todtiana*, *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana* and *Nuytsia floribunda* over *Adenanthos cygnorum*, *Allocasuarina humilis*, *Scholtzia involucrata*, *Leucopogon conostephioides*, *Eremaea pauciflora* var. *paucilflora*, *Phlebocarya ciliata* and *Lyginia imberbis* (Photo 5)

Af – 5 Open Forest of *Allocasuarina fraseriana*, *Banksia menziesii* and *Banksia attenuata* over *Jacksonia sternbergiana*, *Melaleuca thymoides*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius* and *Phlebocarya ciliata* (Photo 9)

Ll – 6 Very Open Sedgeland of *Lepidosperma longitudinale* with **Moraea flaccida*, **Cynodon dactylon* and **Ehrharta calycina* (Photo 11).

PeRc – 7 Low Open Woodland of *Eucalyptus todtiana*, *Nuytsia floribunda* and *Melaleuca preissiana* over *Pericalymma ellipticum* var. *ellipticum*, *Regelia ciliata*, *Pericalymma ellipticam* var. *floridum*, *Patersonia occidentalis*, *Phlebocarya ciliata* and *Dasypogon bromeliifolius* (Photo 54)

EtAf – 8 Low Open Woodland of *Eucalyptus todtiana* and *Allocasuarina fraseriana* over *Phlebocarya ciliata*, *Patersonia occidentalis*, *Adenanthos cygnorum*, *Acacia pulchella*, *Dasypogon bromeliifolius* and *Lyginia imberbis* (Photo 51)

MrMp – 9 Low Woodland of *Melaleuca rhaphiophylla* and *Melaleuca preissiana* over *Melaleuca incana* subsp. *incana*, *Regelia ciliata*, *Meeboldina cana* and various introduced species (Photo 12)

BmMpKg – 10 Low Open Woodland of *Banksia attenuata*, *Melaleuca preissiana*, *Corymbia calophylla* and *Eucalyptus todtiana* over *Kunzea glabrescens*, *Regelia ciliata*, *Xanthorrhoea preissii*, *Phlebocarya ciliata* and *Dasypogon bromeliifolius* (Photo 20)

BaBmEt – 11 Woodland of *Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia*, *Eucalyptus todtiana* and *Nuytsia floribunda* over *Adenanthos cygnorum*, *Kunzea glabrescens*, *Melaleuca scabra*, *Acacia pulchella*, *Phlebocarya ciliata*, *Patersonia occidentalis* and *Lyginia imberbis* (Photo 19)

BiBaBm – 12 Open Woodland of *Banksia ilicifolia*, *Banksia attenuata* and *Banksia menziesii* over *Acacia pulchella*, *Xanthorrhoea preissii*, *Macrozamia riedlei*, *Conostylis aculeata*, *Lyginia imberbis*, *Phlebocarya ciliata* and *Hibbertia subvaginata* (Photo 17)

EtBaAc – 13 Low Open Woodland of *Eucalyptus todtiana*, *Banksia ilicifolia*, *Banksia attenuata*, *Banksia menziesii* and *Nuytsia floribunda* over *Adenanthos cygnorum*, *Eremaea pauciflora* var. *pauciflora*, *Hibbertia hypericoides*, *Allocasuarina humilis*, *Xanthorrhoea preissii* and *Lyginia imberbis* (Photo 23).

MrKg – 14 Low Open Woodland of *Melaleuca rhaphiophylla* over *Kunzea glabrescens*, *Astartea affinis*, *Regelia ciliata*, *Schoenus efoliatus*, *Lepidosperma longitudinale*, *Juncus pallidus* and *Hypolaena exsulca* (Photo 22).

CcMp – 15 Open Woodland of *Corymbia calophylla*, *Melaleuca preissiana* and *Allocasuarina fraseriana* over *Kunzea glabrescens*, *Xanthorrhoea preissii*, *Astartea affinis*, *Dasypogon bromeliifolius*, *Lepidosperma longitudinale* and *Schoenus efoliatus* (Photo 26)

EtCc – 16 Open Woodland of *Eucalyptus todtiana*, *Corymbia calophylla*, *Melaleuca preissiana* over *Jacksonia sternbergiana*, *Regelia ciliata, Xanthorrhoea preissii*, *Phlebocarya ciliata*, *Hibbertia hypericoides*, *Hybanthus calycinus* and *Dasypogon bromeliifolius* (Photo 27).

MpAa – 17 Low Woodland of *Melaleuca preissiana* and *Nuytsia floribunda* over *Astartea affinis*, *Regelia ciliata*, *Kunzea glabrescens*, *Hypolaena exsulca*, *Phlebocarya ciliata* and *Schoenus efoliatus* (Photo 28).

CcKa – 18 Open Forest of *Corymbia calophylla*, *Melaleuca preissiana* and *Nuytsia floribunda* over *Kingia australis*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*, *Acacia pulchella*, *Phlebocarya ciliata* and *Baeckea camphorosmae* (Photo 43).

EtCcXp – 19 Woodland of *Eucalyptus todtiana*, *Corymbia calophylla* and *Nuytsia floribunda* over *Melaleuca thymoides*, *Xanthorrhoea preissii*, *Phlebocarya ciliata*, *Leucopogon conostephioides*, *Eremaea pauciflora* var. *pauciflora*, *Dasypogon bromeliifolius* and *Lyginia imberbis* (Photo 42).

EtBmMt – 20 Woodland of *Eucalyptus todtiana*, *Banksia ilicifolia*, *Allocasuarina freseriana*, *Banksia attenuata* and *Banksia menziesii* over *Melaleuca thymoides*, *Leucopogon conostephioides*, *Acacia pulchella*, *Eremaea pauciflora* var. *pauciflora*, *Patersonia occidentalis* and *Lyginia imberbis* (Photo 30).

MpCcMi – 21 Woodland of *Melaleuca preissiana* and *Corymbia calophylla* over *Regelia ciliata*, *Melaleuca incana* subsp. *incana*, *Viminaria juncea*, *Lepidosperma longitudinale*, *Schoenus efoliatus*, *Astartea scoparia*, *Pericalymma ellipticum* var. *ellipticum*, *Hypolaena exsulca* and *Juncus pallidus* (Photo 32).

MpMrJsAs – 22 Open Woodland of *Melaleuca preissiana*, *Melaleuca rhaphiophylla* and *Nuytsia floribunda* over *Jacksonia sternbergiana, Acacia saligna*, *Melaleuca seriata*, *Xanthorrhoea preissii* with various introduced species (Photo 34).

PeXp – 23 Shrubland of *Pericalymma ellipticum* var. *ellipticum*, *Xanthorrhoea preissii*, *Pericalymma ellipticum* var. *floridum*, *Phlebocarya ciliata*, *Dasypogon bromeliifolus*, *Hypolaena exsulca*, *Melaleuca seriata*, *Sholtzia involucrata*, *Patersonia occidentalis* and *Hypocalymma angustifolium* (Photo 44).

MpRcLs – 24 Low Open Woodland of *Melaleuca preissiana*, *Eucalyptus todtiana* and *Nuytsia floribunda* over *Regelia ciliata*, *Chaetanthus aristatus*, *Leucopogon sprengelioides*, *Schoenus efoliatus*, *Xanthorrhoea preissii* and *Verticordia densiflora* var. *densiflora* (Photo 35).

CcBgMp – 25 Woodland of *Corymbia calophylla*, *Banksia grandis* and *Melaleuca preissiana* over *Jacksonia sternbergiana*, *Tetraria octandra*, *Xanthorrhoea preissii*, *Conostylis setigera* subsp.

setigera, *Hibbertia hypericoides*, *Gompholobium aristatum*, *Tricoryne elatior* and *Daviesia incrassata* subsp. *Incrassate* (Photo 47).

CcMpVj – 26 Woodland of *Corymbia calophylla* and *Melaleuca preissiana* over *Viminaria juncea*, *Hakea trifurcata*, *Xanthorrhoea preissii*, *Hakea varia*, *Jacksonia sternbergiana*, *Hakea candolleana*, *Petrophile juncifolia, Mesomelaena tetragona* and *Neurachne alopecuroidea* (Photo 49).

VjPeVd – 27 Tall Open Shrubland of *Viminaria juncea*, *Pericalymma ellipticum* var. *ellipticum*, *Verticordia densiflora* var. *densiflora*, *Lepidosperma longitudinale*, *Lepidosperma leptostachyum*, *Gahnia trifida* and *Hakea sulcate* (Photo 50).

EdXp – 28 Low Woodland of *Eucalyptus decipiens* subsp. *decipiens* and *Eucalyptus gomphocephala* over *Xanthorrhoea preissii* and *Baumea vaginalis* with numerous introduced species (Photo 51).

BmBaPcXp – 29 Low Open Woodland of *Banksia menziesii* and *Banksia attenuata* over *Phlebocarya ciliata*, *Xanthorrhoea preissii*, *Scholtzia involucrata*, *Patersonia occidentalis*, *Adenanthos cygnorum* and *Lyginia imberbis* (Photo 56).

CcMpPte – 30 Woodland of *Corymbia calophylla*, *Eucalyptus* sp. and *Melaleuca preissiana* over *Pteridium esculentum*, *Astartea affinis*, *Kunzea glabrescens*, *Patersonia occidentalis*, *Lepidosperma longitudinale*, *Regelia ciliata*, *Juncus pallidus* and *Euchilopsis linearis* (Photo 60).

NT – 31 Stand of native trees over weeds

Xp – 32 Shrubland of *Xanthorrhoea preissii*.

4.4 VEGETATION CONDITION

The condition of the vegetation within Precinct 3 varied between Excellent to Completely Degraded. The condition scale commonly used in the Perth metropolitan area and Bush Forever, Keighery B. J. 1994, was used for this assessment. The definition of the condition scales are in Appendix I.

The vegetation considered to be in excellent condition occur within the larger remnants. As indicated by Figures 2 and 3, these remnants occur in study areas A, B, D, E, G and H.

The locations of the main disturbances are the residential areas (private property) and the edges of tracks, roads and the edges of the vegetation remnants.

4.5 FLORISTIC COMMUNITY TYPES

Floristic Community Types (FCT) are a result of a classification system to describe vegetation on the Swan Coastal Plain. FCTs were defined by a study undertaken of plant communities of remnant bushland on the Swan Coastal Plain. Five hundred and nine (509) quadrats were established and the data from these were used to define the major regional community types. 30 community

types, which possibly could be further subdivided, were also recognised. In the Bush Forever document a number of Floristic Community types additional to Gibson *et al.* were included, which are described as supplementary groups. The FCT system is the most commonly used classification both by State and National agencies.

The following table portrays the inferred FCT's in reference to the descriptions in Gibson *et al.* (1994) and Bush Forever (Government of Western Australia, 2000), against the 31 vegetation communities listed above in section 4.2.5.

Vegetation Community	Floristic Community Type (inferred)
JpLi - 1	5
BmBaBi - 2	23a
MpRc - 3	4
EtAc - 4	23a
Af - 5	?23a
Li - 6	5
PeRc - 7	5
EtAf - 8	23a
MrMp - 9	4
BmMpKg - 10	21c
BaBmEt – 11	23a
BiBaBm - 12	23a
EtBaAc - 13	23a
MrKg - 14	4
CcMp - 15	4
EtCc - 16	?4
MpAa - 17	4
CcKa - 18	3a
EtCcXp - 19	23a
EtBmMt - 20	23a
MpCcMi - 21	4
MpMrJsAs - 22	4
PeXp - 23	5
MpRcLs - 24	4
CcBgMp - 25	4
CcMpVj - 26	4

Vegetation Community	Floristic Community Type (inferred)
VjPeVd - 27	4
EdXp - 28	Muchea Limestone
BmBaPcXp - 29	23a
CcMpPte - 30	4
Xp - 32	23a

FCT 3a – *Corymbia calophylla – Kingia australis* Woodlands on heavy soils

FCT 4 – *Melaleuca preissiana* damplands

FCT 5 – Mixed Shrub damplands

FCT 21c – Low lying *Banksia attenuata* Woodlands or Shrublands

FCT 23a – Central *Banksia attenuata – Banksia menziesii* Woodlands

(Gibson et al. (1994), Bush Forever (2000))

4.6 THREATENED ECOLOGICAL COMMUNITIES (TEC'S)

The database search identified four Threatened Ecological Communities that could possibly occur within the study area. These are:

MUCHEA LIMESTONE: Shrublands and Woodlands on Muchea Limestone (listed as Endangered (Part B, section 2) by the State and listed as Endangered by the Commonwealth)

SCP20b: Banksia attenuata and/or Eucalyptus marginata Woodlands of the eastern side of the Swan Coastal Plain (Listed as Endangered by the state and not listed by the Commonwealth).

SCP8: Herb rich Shrublands in clay pans (Listed as Vulnerable by the State and not listed by the Commonwealth)

SCP10a: Shrublands on dry clay flats (Listed as Endangered by the State and not listed by the Commonwealth)

The field survey identified two vegetation communities that have been inferred as Threatened Ecological Communities, these are:

EdXp – 28 Low Woodland of *Eucalyptus decipiens* subsp. *decipiens* and *Eucalyptus gomphocephala* over *Xanthorrhoea preissii* and *Baumea vaginalis* with numerous introduced species (inferred as MUCHEA LIMESTONE)

CcKa – 18 Open Forest of *Corymbia calophylla*, *Melaleuca preissiana* and *Nuytsia floribunda* over *Kingia australis*, *Xanthorrhoea preissii*, *Dasypogon bromeliifolius*, *Acacia pulchella*, *Phlebocarya ciliata* and *Baeckea camphorosmae.*

Community CcKA has been inferred as **FCT 3a –** *Corymbia calophylla – Kingia australis* Woodlands on heavy soils, this TEC wasn't identified by the database search.

(See Appendix B for the definitions of Threatened Ecological Community conservation categories. Locations of the TEC's are provided in Figure 9)

4.7 VEGETATION COMPLEX

The patterning of plant and animal distributions on the Swan Coastal Plain is closely related to the geology, geomorphology and soils of the plain. Precinct 3 is located on the Bassendean Dunes (Bush Forever, 2000). This major landform element is identified as the following:

The Bassendean Dunes lie in the centre of the Swan Coastal Plain and is the oldest of the three Aeolian dune systems. The dune system is generally of low relief and often consists of broad swales or relatively flat sand sheets between low dunes.

The Bassendean Dunes at a regional level have six vegetation complexes, of which Precinct 3 falls within the Southern River Complex (Bush Forever, 2000). The Southern River Vegetation Complex is considered to be made up of a combination of Bassendean Dunes, Pinjarra Plain and Spearwood Dunes.

In assessing a proposal that includes the clearing of vegetation, the EPA's consideration of biological diversity includes the expectation that a proposal would demonstrate that the vegetation removal would not compromise any vegetation type by taking it below the "threshold level" of 30% of the pre-clearing extent of the vegetation type. This target of 30% representation is also articulated in the Native Vegetation Clearing Regulations, 2004 and thus informs the Department of Environment (DoE) Protection's administration of clearing permits. However, on a case by case basis the EPA and DoE can lower the bottom threshold as low as 10% of the pre-clearing extent of the ecological community where >10% of the ecological community remains. The 10% threshold is generally applied in the Perth Metropolitan Region.

The Southern River Complex has 17% of the pre-clearing extent remaining (based on 1997 native vegetation extent, Bush Forever, 2000) with 10% proposed for protection. This complex consists of Open Woodland of *Corymbia calophylla – Eucalyptus marginata* – Banksia species with fringing Woodland of *Eucalyptus rudis – Melaleuca rhaphiophylla* along creek beds.

4.8 FAUNA

4.8.1 Potential Fauna

The following table summarises the numbers of potential species inhabiting the study area based on vertebrate class. A complete list of vertebrate fauna possibly inhabiting or frequenting the study area is provided in Appendix J.

Summary of Potential Fauna Species (As listed in Appendix J)

Group	Total number of potential species	Number of specially protected species	Number of priority /migratory species	Number of species observed
Fish	3[A]	0	0	1
Amphibians	10	0	0	6
Reptiles	48	1	3	15
Birds	137[D]	4	6	64[C]
Mammals	23[C]	1	3	6[B]

Note: some species fall into more than one category of protection, A= includes one introduced species
B= includes four introduced species, C= includes six introduced species, D= includes seven introduced species

4.8.2 Habitats within the Study Area

The extent of the broadly defined fauna habitats (based on vegetation structure) within the study area are shown in Figure 13 with a description of each given below. More detail on the composition of each vegetation remnant can be found in Section 4.2.5.

4.8.3 Ground Fauna Survey

Ground Fauna trapping was carried out under CALM Licence SF005124. The trap grids were set up over three days starting on the 13th October and closed on the 21st October 2005. Location of traps sites are shown in Figure 6.

The results of the trapping program (including feral bees, amphibian and reptile opportunistic observations/captures) are summarised in the table below with discussion of results in the following sections. Full trapping results are held in Appendix K. In total twenty eight species of ground fauna were observed or captured. Of particular note were nineteen captures of the CALM priority 5 species, the Southern Brown Bandicoot.

Group	Species	Common Name	Systematic & Non Systematic Observations						
			Opportunistic	Trapping Grids					
				1	2	3	4	5	6
Insects									
Apidae (Honey Bees)	*Apis mellifera**	Feral Honey Bee	Area B, C & E						
Amphibians									
Myobatrachidae (Ground or Burrowing Frogs)	*Crinia glauerti*	Glauert's Froglet	Area B & G				1		1
	Crinia insignifera	Squelching Froglet	Area D & G						
	Heleioporus eyrei	Moaning Frog		6	3	7	8	12	19
	Limnodynastes dorsalis	Banjo Frog	Area D						
Hylidae (Tree Frogs)	*Litoria adelaidensis*	Slender Tree Frog	Area D						
	Litoria moorei	Motorbike Frog	Area D & E						
Reptiles									
Chelidae (Side-necked Tortoises)	*Chelodina oblonga*	Long-necked Tortoise	Area E						
Pygopodidae (Legless Lizards)	*Delma fraseri*	Fraser's Scale-footed Lizard	Area B		1				
	Lialis burtonis	Common Snake Lizard		2	4			1	2
	Pletholax gracilis gracilis	Slender Snake Lizard					1	3	1
Agamidae (Dragon Lizards)	*Pogona minor*	Bearded Dragon	Area A, B & G	2	2	1	1		3
Varanidae	*Varanus gouldii*	Gould's Sand	Area H						

Group	Species	Common Name	Systematic & Non Systematic Observations						
			Opportunistic	Trapping Grids					
				1	2	3	4	5	6
(Monitor's or Goanna's)		Monitor							
Scincidae (Skinks)	*Acritoscincus trilineatum*	South-west Cool Skink		3	2	1	2	3	5
	Cryptoblepharus plagiocephalus	Fence Skink	Area D & G		1	1			
	Ctenotus australis	Ctenotus						1	2
	Lerista distinguenda	South-western Four-toed Lerista				1	3	1	1
	Menetia greyii	Dwarf Skink			1		4	1	
	Tiliqua rugosa	Bobtail	Area A	1	4	10	1	3	2
Elapidae (Elapid Snakes)	*Elapognathus coronatus*	Crowned Snake					1		
	Notechis scutatus	Tiger Snake	Area F						
	Pseudonaja affinis	Dugite	Area D	1					1
Mammals									
Peramelidae (Bandicoots)	*Isoodon obesulus fusciventer*	Southern Brown Bandicoot		15		1			3
Macropodidae (Kangaroos, Wallabies)	*Macropus fuliginosus*	Western Grey Kangaroo	Area B & G						
Muridae (Rats, Mice)	*Mus musculus**	House Mouse		3	7	3		11	
	Rattus sp.	Unidentified Species				1			
Canidae (Dogs, Foxes)	*Vulpes vulpes**	Red Fox	Area A & G						
Felidae (Cats)	*Felis catus**	Cat	Area B						

Group	Species	Common Name	Systematic & Non Systematic Observations						
			Opportunistic	Trapping Grids					
				1	2	3	4	5	6
Leporidae (Rabbits, Hares)	*Oryctolagus cuniculus**	Rabbit	Area B						

4.8.4 Opportunistic Fauna Surveys

The results of the opportunistic fauna surveys are included as sightings within the species listing held in Appendix J with discussion of results in the following sections.

Random sampling of the wetland within the study area with a net (and observations) failed to find any native fish species present. The only species captured was the introduce Mosquito Fish (*Gambusia holbrooki*)

4.8.5 Black Cockatoo, Owl and Peregrine Falcon – Potential Nest Site Survey

During the course of all the survey work (i.e. on the 20th September and from the 13th to the 21st October) observations were made of trees containing hollows suitable for use by black cockatoo and the larger owl species for nesting. Broken spouts were also looked for as they are potential nest sites for the Peregrine Falcon (along with existing bird of prey/raven nests). The survey aimed to assess all trees within the study site though access to some areas was not possible.

While a number of trees within the site contain hollows, only one was considered to be potentially suitable for use by cockatoo's or large owls (see Figure 13). No evidence that the tree was in use was found.

A number of other trees examined had small and medium size hollows suitable for other obligate hollow nesting fauna (e.g. Galah, Regent Parrot, Twenty Eight Parrot, Red-capped Parrot, Western Rosella, Elegant Parrot, Boobook Owl, Australian Owlet-nightjar, Kookaburra, Sacred Kingfisher, Rufous Treecreeper, Striated Pardalote and Tree Martin). Feral honey bees were observed utilising hollows in several trees.

As the survey did not take into account all factors relating to the suitability of a nest hollows the potential nest site recorded may in fact be unsuitable for use. No evidence was found to suggest the hollow identified as a potential nest site

had been or was in use by cockatoo's/owls or that the general area is in fact used for nesting by these species.

Foraging black cockatoo species are principally attracted to seeding and flowering *Eucalyptus*, C*orymbia*, *Banksia, Dryandra, Hakea, Grevillea, Pinus* and *Allocasuarina* (Johnstone and Storr, 1998). During the course of the survey Forest Red-tailed Black Cockatoo's were commonly observed and appeared to be resident in the northern part of the study area where Marri trees (*Corymbia calophylla*) were predominant and on which they were seen feeding.

4.8.6 Fauna of Conservation Significance

A review of information gained from searches done on the WA Museum Database, the Department of Conservation and Land Managements Threatened Fauna Database, Commonwealth Department of the Environment and Heritage's Environment Protection and Biodiversity Conservation Database, Birds Australia's 'Birdata", published and unpublished reports and specialist books detailing fauna of the general area and the results of the survey work reported on here have identified 18 specially protected, priority or migratory fauna species as actually or potentially occurring in the study area. An account of these species with details on their distribution, habitat preference and likely presence within the study area based on the results of research and survey work are given below.

Jewelled Skink *Ctenotus gemmula*

Status and Distribution: Listed as Priority 3 by CALM. In the west at Cataby and from Wanneroo south to Medina. Also present in the southern interior and along the south coast from Rocky Gully, inland to Lake Magenta and east to Toolinna Cove (Storr *et al* 1999). Scarce on the Swan Coastal Plain (Bush *et al* 2002).

Habitat: White sand plains, mainly in semiarid and subhumid zones (Storr *et al* 1999) supporting heathlands, usually in association with Banksia, sheltering in leaf litter, abandoned stick-ant nests and burrows at the base of Banksia trees and shrubs (Bush et al 2002).

Likely presence in study area: Potentially present as suitable habitat exists but given lack of records in vicinity (e.g. Jandakot Airport surveys ~8.0km west - How *et al* 1996) and its general scarcity on the Swan Coastal Plain, probability appears low. This species has, however, been recorded in similar bushland surrounding Perth Airport which is located about 14km north (Tingay 1997).

Perth Lined Lerista *Lerisita lineata*

Status and Distribution: Listed as Priority 3 by CALM. Found in the lower west coast from Perth to Mandurah. It has also been found at Busselton, Rottnest Island and Garden Island (Storr *et al*, 1999) and at the Jandakot Airport, ~8.0km

west of the study site (How *et al* 1996). Found in the southern suburbs (Bush et al 2002).

Habitat: This small species of skink inhabits white sands (Storr et al, 1999) under areas of shrubs and heath where it inhabits loose soil and leaf litter (Nevill 2005) particularly in association with banksias (Bush *et al* 2002).

Likely presence in study area: The presence of suitable habitat and records of this species at Jandakot Airport suggest it may be present within the study area.

Southern Carpet Python *Morelia spilota impricata*

Status and Distribution: The south western subspecies of the Carpet Python is classified as Priority 4 by CALM and is also listed in Schedule 4 under the *WAWC Act (1950)*. This sub species has wide distribution within the south west but is uncommon. Occurs north to Geraldton and Yalgoo and east to Pinjin, Kalgoorlie, Fraser Range and Eyre (Storr *et al*, 2002).

Habitat: This species has been recorded from semi-arid coastal and inland habitats, Banksia woodland, Eucalypt woodlands, and grasslands. It commonly utilises hollow logs for shelter.

Likely presence in study area: No CALM database records for this area. May be present but probability is low. Near Perth this species is more often found in areas of substantial undisturbed bushland such as catchment areas and rocky outcrops of the Darling Range (Bush *et al* 2000).

Black-striped Snake *Neelaps calonotos*

Status and Distribution: Listed as Priority 3 by CALM. Found in the lower west coast from Lancelin to Mandurah. It is locally abundant but is under threat due to land clearing. Closest WAM record from general area is Riverton, about 10km north west of study area (Storr *et al* 2002).

Habitat: This species of snake favours sandy soils of coastal and near coastal dunes and sandplains supporting heath and banksia/eucalypt woodland (Nevill 2005, Bush *et al* 2005).

Likely presence in study area: Given the presence of suitable habitat this species may inhabit the study area.

Great Egret *Ardea alba*

Status and Distribution: This species of egret is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. The Great Egret is common and very widespread in any suitable permanent or temporary habitat (Morcombe, 2003).

Habitat: Wetlands, flooded pasture, dams, estuarine mudflats, mangroves and reefs (Morcombe, 2003).

Likely presence in study area: Likely to infrequently visit the area in low numbers, particularly in winter when the seasonal wetlands contain water. Not sighted during surveys.

Cattle Egret *Ardea ibis*

Status and Distribution: This species of egret is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. The Cattle Egret is common in the north sections of its range but is an irregular visitor to the better watered parts of the state (Johnstone and Storr 1998). The population is expanding (Morcombe, 2003).

Habitat: Moist pastures with tall grasses, shallow open wetlands and margins, mudflats (Morcombe, 2003).

Likely presence in study area: Potentially an infrequent visitor to the general area especially in during the winter months.

Peregrine Falcon *Falco perigrinus*

Status and Distribution: This species is listed as Schedule 3 under the *Wildlife Conservation Act 1950*. Individuals of this species are uncommon/rare but wide ranging across Australia. Moderately common at higher levels of the Stirling Range, uncommon in hilly, north west Kimberley, Hamersley and Darling Ranges; rare or scarce elsewhere (Johnstone and Storr 1998).

Habitat: Diverse from rainforest to arid shrublands, from coastal heath to alpine (Morcombe, 2003). Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes (Johnstone and Storr 1998). The species utilises the ledges, cliff faces and large hollows/broken spouts of trees for nesting. It will also occasionally use the abandoned nests of other birds of prey.

Likely presence in study area: The species possibly utilises the study area on occasions as part of a much larger home range. No evidence of this species nesting within the study area was found during the survey.

Common Sandpiper *Tringa hypoleucos*

Status and Distribution: The Common Sandpiper is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. The species is a widespread summer migrant to Australia. Despite its name it is generally uncommon (Morcombe, 2003).

Habitat: Permanent and temporary wetlands varying from billabongs, swamps, lakes, floodplains, sewerage farms, saltwork ponds, estuaries, lagoons, mudflats and sandbars (Morcombe, 2003).

Likely presence in study area: Potential short term visitor to the seasonal wetland present in private property at the east end of Holmes Street (Wetland L). Suitable habitat would be absent during the summer months.

Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*

Status and Distribution: This sub-species is listed as Scheduled 1 under the *Wildlife Conservation Act (1950)* and as Vulnerable under the *EPBC Act (1999)*. Humid and subhumid south west, mainly hilly interior, north to Gingin and east to Mt Helena, Christmas Tree Well, North Bannister, Mt Saddleback, Rock Gully and the upper King River (Johnstone and Storr 1998).

Habitat: Eucalypt forests, feeds on Marri, Jarrah, Blackbutt, Karri, Sheoak and Snottygobble. Breeding occurs in winter/spring (Johnstone and Storr 1998).

Likely presence in study area: Sighted numerous times during the course of the survey and also recorded by CALM in the area (CALM database search Oct 2005). During the survey period this species appeared to be resident in the north of the study area where it was seen feeding and roosting in mostly in Marri trees on private property. Unlikely to breed in the area but possibility can not be totally discounted. A potential nest site exists though no evidence was found that it was, or has been used, by cockatoo's.

Baudin's Black- Cockatoo *Calyptorhynchus baudinii*

Status and Distribution: Listed as Scheduled 1 under the *Wildlife Conservation Act (1950)* and as Endangered under the *EPBC Act (1999)*. Confined to the south-west of Western Australia, north to Gidgegannup, east to Mt Helena, Wandering, Quindanning, Kojonup, Frankland and King River and west to the eastern strip of the Swan Coastal Plain including West Midland, Byford, Nth Dandalup, Yarloop, Wokalup and Bunbury. (Johnstone and Storr 1998).

Habitat: Mainly eucalypt forests where it feeds primarily on the Marri seeds, (Morcombe, 2003), banksia, hakeas and *Erodium* sp. Also strips bark from trees in search of beetle larvae (Johnstone and Storr 1998).

Likely presence in study area: This species is likely to visit the area on occasions as suitable foraging habitat exists. Unlikely to breed in the area but possibility can not be totally discounted. A potential nest site exists though no evidence was found that it was or has been used by cockatoo's.

Carnaby's Black- Cockatoo *Calyptorhynchus latirostris*

Status and Distribution: Carnaby's Black Cockatoo is listed as Scheduled 1 under the *Wildlife Conservation Act (1950)* and as Endangered under the *EPBC Act (1999)*. Confined to the south-west of Western Australia, north to the lower Murchison River and east to Nabawa, Wilroy, Waddi Forest, Nugadong, Manmanning, Durokoppin, Noongar (Moorine Rock), Lake Cronin, Ravensthorpe Range, head of Oldfield River, 20 km ESE of Condingup and Cape Arid; also casual on Rottnest Island (Johnstone and Storr 1998).

Habitat: Forests, woodlands, heathlands, farms; feeds on banksia, hakeas, dryandras and Marri. Breeding occurs in winter/spring mainly in eastern forest and wheatbelt where they can find mature hollow bearing trees to nest in (Morcombe, 2003).

Likely presence in study area: An individual of this species was observed on the 20th September 2005 flying over the study area and it is likely to visit the area during non breeding season as suitable foraging and roosting habitat exists. Unlikely to breed in the area but possibility can not be totally discounted. A potential nest site exists though no evidence was found that it was or has been used by cockatoo's.

Barking Owl *Ninox connivens connivens*

Status and Distribution: Listed as Priority 2 by CALM. Found north to Perth (formerly) and east to Northam, Katanning and nearly to Bremer Bay. Declining in south west (Johnstone and Storr 1998).

Habitat: Dense vegetation, especially forest and thickets of waterside vegetation such as melaleucas (Johnstone and Storr 1998).

Likely presence in study area: The only suitable habitat present within the study site, based on published descriptions (Johnstone and Storr 1998) appears marginal, though some vegetation along Southern River may be suitable (Bamford 2003). More likely to be an occasional visitor to the site than a resident.

Fork-tailed Swift *Apus pacificus*

Status and Distribution: The Fork-tailed Swift is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. It is a summer migrant (Oct-Apr) to Australia (Morcombe, 2003).

Habitat: Low to very high airspace over varied habitat from rainforest to semi desert (Morcombe, 2003).

Likely presence in study area: It is potentially an occasional summer visitor to the study area.

Rainbow Bee-eater *Merops ornatus*

Status and Distribution: This species is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. The Rainbow Bee-eater is a common summer migrant to southern Australia but in the north they are resident (Morcombe, 2003).

Habitat: Open Country, of woodlands, open forest, semi arid scrub, grasslands, clearings in heavier forest, farmlands (Morcombe, 2003). Breeds underground in areas of suitable soft soil firm enough to support tunnel building.

Likely presence in study area: Sighted during surveys. The site also contains areas of ground suitable for breeding.

Chuditch *Dasyurus geoffroii*

Status and Distribution: Listed as Scheduled 1 under the *WAWC Act (1950)* and as Vulnerable under the *EPBC Act (1999).* Formerly occurred over nearly 70 per cent of Australia. The Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of southwest Western Australia. Also occurs in very low numbers in the Midwest, Wheatbelt and South Coast Regions with records from Moora to the north, Yellowdine to the east and south to Hopetoun.

Habitat: Chuditch are known to have occupied a wide range of habitats from woodlands, dry sclerophyll (leafy) forests, riparian vegetation, beaches and deserts. Riparian vegetation appears to support higher densities of Chuditch, possibly because food supply is better or more reliable and better cover is offered by dense vegetation. Chuditch appear to utilise native vegetation along road sides in the wheatbelt (CALM 1994). The estimated home range of a male Chuditch is over 15 km^2 whilst that for females is 3-4 km^2 (Sorena and Soderquist 1995).

Likely presence in study area: There appears to be no recent documented records of the Chuditch from the general area and it appears unlikely to be present. The species is more likely to be found in forested areas of the Darling Range.

Southern Brush-tailed Phascogale *Phascogale tapoatafa tapoatafa*

Status and Distribution: Listed as Priority 4 by CALM. Present range is believed to have been reduced to approximately 50 per cent of its former range. Now known from Perth and south to Albany, west of Albany Highway. Occurs at low

densities in the northern Jarrah forest. Highest densities occur in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton (CALM information pamphlet). Records are less common from wetter forests.

Habitat: This subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. A nocturnal carnivore relying on tree hollows as nest sites. The home range for a female Brush-tailed Phascogale is estimated at between 20 and 70 ha, whilst that for males is given as twice that of females. In addition, they tend to utilise a large number (approximately 20) of different nest sites throughout their range (Soderquist, 1995).

Likely presence in study area: There appears to be no recent documented records of this species from the general area and it appears unlikely to be present. If present most likely to be in the northern areas where larger trees (eg Marri and River Gum) with hollows are most prevalent. Suitable nest hollows appear scarce in Banksia woodland areas.

Southern Brown Bandicoot *Isoodon obesulus fusciventer*

Status and Distribution: Listed as Priority 5 by CALM. Widely distributed in the south west from near Cervantes north of Perth to east of Esperance, patchy distribution through the Jarrah and Karri forest and on the Swan Coastal Plain, and inland as far as Hyden (CALM information pamphlet 2005).

Habitat: Dense scrubby, often swampy, vegetation with dense cover up to one metre high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting Jarrah and Wandoo forests are usually associated with watercourses. Quendas will thrive in more open habitat subject to exotic predator control (CALM information pamphlet 2005).

Likely presence in study area: Individuals of this species were captured on 19 occasions during trapping program (some individuals twice). Capture rates and observations suggest some areas, particularly those with dense low vegetation contain significant populations of this species.

Western False Pipstrelle *Falsistrellus mackenziei*

Status and Distribution: Listed as Priority 4 by CALM. Confined to south west W.A. south of Perth and east to the wheat belt. Most records from Karri forests but also recorded in wetter stands of jarrah and tuart and woodlands on the Swan Coastal Plain (Mennkhorst and Knight 2001).

Habitat: This species of bat occurs in high jarrah forest and coastal woodlands. It roosts in small colonies in tree hollows and forages in the cathedral-like spaces between trees.

Likely presence in study area: This species may be present in the study area as suitable habitat appears to be present. It was recorded at Jandakot in surveys carried out in 2002 (Bamford 2003)

4.8.7 Other Fauna Species of Significance

Forty five (45) species of birds potentially frequent or occur in the study area that are noted as Bush Forever Decreaser Species in the Perth Metropolitan Region (fourteen were sighted during surveys conducted on site). Decreaser species are a significant issue in biodiversity conservation in the Perth section of the Coastal Plain as there have been marked reductions in range and population levels of many sedentary bird species as a consequence of disturbance and land clearing (Dell & Hyder-Griffiths, 2002). It can be expected that with increasing pressures on land use, populations and the ranges of some species will further decline unless preventative measures are implemented.

Other species that can be considered of significance are several duck and waterbird species that were seen breeding in Study Area F (Wetland L). Grey Teal, Mountain Ducks, Australasian Grebes and Black-winged Stilts were observed breeding in the seasonal wetland in this area. All the duck species listed and some of the other water bird species must therefore be regarded as potentially using the study area for breeding.

4.9 GENERAL ENVIRONMENTAL ISSUES

An environmental issue that will need to be addressed concerning the precinct is the area that is currently being used as a rubbish dump. This is at the northern end of Area B (E402 244, N6447 667). The public are using the limestone tracks to gain access into the area to dump rubbish (Photo 63 -65). As evident from the photos there are many issues concerning the site such as land contamination, fire potential and weeds.

5 DISCUSSION

5.1 WETLANDS

Precinct 3 contains all three management category wetlands, these being Conservation Category (C category), Resource Enhancement (R category) and Multiple Use (M category) wetlands. The buffer recommendations for the Precinct 3 wetlands were determined by their current management category. Only general buffer distances are provided for each wetland as accurate buffers will have to be determined during the planning phase of the precinct as they are determined by several factors, such as surrounding land uses, soils and hydrological information.

Figures 7a and 7b show the current Geomorphic Wetland Management Categories along with their designated buffers as determined by the *Guideline for the Determination of Wetland Buffer Requirements* (Western Australian Planning Commission, 2005). ENV has, however, suggested possible wetland management category changes to certain wetlands within the precinct (section 4.2, Figure 7c).

Re-evaluation of the wetlands and determination of buffer distances will need to be undertaken in line with the following protocols:

Wetland Management Category Assessment

- Collection of Hydrological Information
    - Aerial photographs overlaid with topographical and ground water contours and the current wetland mapping;
    - Any available groundwater data;
    - Profile of maximum groundwater level across the wetland (from hand auger holes, incorporating measurements from the centre and margins of a wetland); and
    - Visual observations or indicators of inundation or waterlogging.
- Soil Information
    - Available information from existing maps and databases;
    - Evidence of hydric soils;
    - Evidence of anthropogenic fill;

- Soil profile analyses from the centre and margins of a wetland (description of the soil components from auger sample at 10cm intervals along core);
- Evidence of biogenesis associated with waterlogging or inundation; and
- Evidence of biochemical processes associated with waterlogging or inundation.

- Vegetation information including
  - A vegetation survey in accordance with the Guidance statement 51;
  - The survey should include:
  - at least one sample plot (10x10m) per mapped vegetation unit with additional plots to demonstrate variation of floristics and condition;
  - a description of the vegetation units including the variation between plots within a unit;
  - a comprehensive flora list; and
  - vegetation unit mapping.
  - Analyses of the variation between wetland and dryland vegetation units discussing:
  - the existing mapped vegetation (as per the dataset);
  - The area proposed for modification; and
  - The area outside of the existing mapped wetland (ie dryland).

Wetland Buffer Assessment

- Identify wetland attributes, wetland management category and establish management objective;
- Define the wetland's function area;
- Identify threatening processes (e.g. surrounding land uses);
- Establish separation requirement - the separation requirement effectively is the furthest extent of separation distances required to deal with issues (habitat protection, fire management, water quality management) specific to each proposed or existing adjacent land use.

M category wetlands are defined as wetlands with few important ecological attributes and functions remaining. Use, development and management should be considered in the context of ecologically sustainable development. They should be considered in strategic planning (e.g. drainage, town/ land use planning).

The Department of Environment (DoE) assess development plans that will affect an M category wetland on a case by case basis. The outcome of the assessment could be permission to delete the wetland altogether or if the DoE believes the wetland is worthy of conservation, it will place restrictions on the development plan including buffer zone requirement.

Wetland B and the M Category portion of Wetland G are two such wetland areas, whereby if a re-evaluation is undesirable, protection may be able to be provided through development conditions requiring the conservation of the wetland and the enforcement of a wetland buffer. For both of these wetland areas a buffer of 50m is considered appropriate.

Recommendation 11: That an indicative buffer of 50m is provided for Wetland B to reflect the condition of the wetland.

Recommendation 12: That an indicative buffer of 50m is provided for the Multiple-Use Category portion of Wetland G to reflect the condition of the wetland.

R category wetlands are defined as being partially modified but still support substantial ecological attributes and functions. The ultimate objective for R category wetlands is management, restoration and protection towards improving their conservation category. The DoE regards R – category wetlands to have the same value as C- category and are unlikely to support any plan that will affect the wetland or any proposal that suggests changes to the buffer zone. A DoE goal is to restore R category wetlands back to C category wetland condition.

As the results and mapping demonstrate, the R category wetlands within Precinct 3 vary considerably in condition. The two that are in the best condition are C and D (Figure 7c). Both of these are anticipated to require a buffer zone of 50m to protect the attributes present. For wetlands F and the R category section of G, a reduced buffer distance (less than 50m) would be appropriate considering their condition. A buffer has not been factored for R category wetlands A, E and H due to their degraded nature and potential for their management category to be downgraded through a re-evaluation.

Recommendation 13: An indicative buffer of 50m is recommended for Wetland C to reflect its management category.

Recommendation 14: An indicative buffer of 50m is recommended for Wetland D to reflect its management category.

Recommendation 15: An indicative buffer of < 50m is recommended for Wetland F given its degraded condition.

Recommendation 16: An indicative buffer of < 50m is recommended for the Resource Enhancement portion of Wetland G given its degraded condition.

Recommendation 17: No wetland buffer is provided for Wetlands A given its degraded nature.

Recommendation 18: No wetland buffer is provided for Wetland E given its degraded nature.

Recommendation 19: No wetland buffer is provided for Wetlands H given its degraded nature.

C category wetlands are defined as wetlands that support a high level of ecological attributes and functions. They are the highest priority wetlands and the DoE will oppose any activity that may lead to further loss or degradation.

The majority of the Wetland I is in excellent condition and should be a priority for protection and therefore the maximum buffer distance of 100m should be put in place. The only exception to the buffer could be where management actions could be applied to reduce the influence of surrounding land uses on the wetland.

Recommendation 20: That an indicative buffer of 100m is provided for Wetland I.

5.2 FLORA AND VEGETATION

Based on the results of the survey, the overall condition of the vegetation within Precinct 3 has great variability due to the majority of the precinct being privately owned and the variable land uses. Land uses include residential, dog kennels and horse, cow and deer paddocks. The majority of the properties have been cleared.

The large areas of vegetation within Study Areas A, B, D, E and G are relatively intact and range from good to excellent condition. They contain localised disturbance along the main drains that dissect the precinct and along tracks. The three areas that have very little disturbance are E, G and the southern edge of Area B. Wetland C in the north of Area B ranges from good to excellent condition and although fragmented by localised disturbance still provides a relatively large area (9.5 ha) of vegetation.

The vegetation survey found two areas of vegetation that are considered to be Threatened Ecological Communities (see Figure 11). Vegetation community 28 has been inferred to Muchea Limestone, which is listed as Endangered (Part B, section 2) by the WA Threatened Species and Communities Unit and endorsed by the Minister for the Environment. The community is also listed as Endangered under the Environmental Protection and Biodiversity Conservation Act (1999). The site of the TEC is small (0.5ha), it may extend onto the neighbouring property, however access was not granted for the property. The vegetation community is in good condition, is weed infested with low native species diversity and is currently being used by deer for protection. The community does have the potential to be rehabilitated to improve its condition.

Vegetation community 18 has been inferred to SCP 3a – *Corymbia calophylla* – *Kingia australis* Woodlands on heavy soils, Swan Coastal Plain. This community is listed as Critically Endangered, Part B section 2 by CALM and Endangered under the EPBC Act.

Due to both vegetation communities being listed under the EPBC Act a person must not take an action that will have, or is likely to have significant impact on a listed community without the approval of the Commonwealth Minister for the Environment and Heritage. Significant penalties can apply if correct procedures are not followed and/or listed communities are damaged. Actions which may have significant impact on these species should be referred to the Commonwealth Department of Environment and Heritage for assessment.

Recommendation 21: That areas supporting vegetation community Muchea Limestone and FCT 3a, which are mapping sites 28-EdXp and 18-CcKa are:

- **reflected by the City of Gosnells as priorities for protection (as provided by State and Commonwealth legislation);**
- **incorporated into ecological linkages/vegetation corridors; and**
- **highlighted to affected property owners, including advice on legislative obligations.**

During the survey two priority species, *Aponogeton hexatepalus* (P4) and *Verticordia lindleyi* subsp. *lindleyi* (P4) were found. The locations of these are listed in section 4.2.2 and shown in Figure 9. Priority flora are those species which appear to be rare or threatened, but insufficient information exists to make a proper evaluation of their conservation status. Priority flora require further investigation before they can be considered for inclusion on the schedule of Declared Rare Flora (DRF). Priority flora do not have the same legal status as

DRF, however, they are considered for conservation in approvals processes under the Environmental Protection Act.

In regards to vegetation linkages through the precinct, two have been identified by Perth's Greenways project. One runs from Southern River through Precinct 3 along the western boundaries of Areas E, G and the area proposed for Parks and Recreation. There is also a corridor identified by Greenways that runs along the southern boundary of Area E heading west. Both these corridors identified by the Greenways project run along the main drains that dissect the site. The drains are not well vegetated by native species and are dominated by weeds. The drains were artificially created and therefore offer minimal ecological value as they have very large, steep banks that would not be easily accessible by fauna and are unlikely to become vegetated with native species without intensive rehabilitation methods.

As mentioned in Bush Forever, the Greenways corridors link bushland remnants and are usually associated with bushland and wildlife corridors, actual or potential. Greenways can also encompass drainage corridors, creek lines and road verges. The guiding principles for establishing Greenways in the Perth Metropolitan Region are that corridors should support a wide variety of uses, functions and ownerships and include compatible multiple uses.

Considering that the Forrestdale main drain joins three of the largest vegetated areas within the study area, it would seem reasonable that this corridor could be utilised to create a continuous vegetated strip through the area. To address the limitations previously noted, a management plan involving weed control, landscaping and planting of natives will need to be adopted if this is the route chosen to create a wildlife corridor. Management arrangements would also have to be agreed with the Water Corporation.

The drain heading west from Area E also offers linkage value by joining the Resource Enhancement wetland in Area B to the wildlife corridor mentioned above. This could be achieved by rehabilitating the drain for the portion within Precinct 3 that runs along the northern boundary of Area B up until it joins the main drain.

As mentioned in the Local Government Biodiversity Planning Guidelines Existing greening plans and corridor strategies focus solely on Local Government land or revegetation of cleared land to create corridors. This is the case for the corridor suggested by Greenways in Precinct 3 that utilises the Forrestdale main drain. The Local Government Biodiversity Planning Guidelines have identified a different route for a regional linkage through the area (Figure 14). The link joins Southern River to Areas E, F, G and the area proposed for Parks and Recreation, which maintains connectivity between regionally significant natural areas and reflects a "stepping stone" appearance. This option includes a lot more

remnant vegetation as the linkage is wider than the Greenways corridor but both include the three largest vegetated areas within the study area.

ENV has evaluated the linkages that have been suggested for the area and used information that was gathered during the field survey to develop an ecological linkage that includes the significant natural areas and those areas ENV considers worthy of retention (Figure 15). Selection of the ecological linkages was informed by the LGBPG 'Guidelines for identifying local ecological linkages' but the environmental conditions within Precinct 3 have not allowed all criteria to be met.

The selected ecological linkages include the wetland in the northern section of Area B (which also contains priority species) and the block of bushland in excellent condition on the southern edge of Area B. Small corridors were used in a number of places to utilise existing tracts of vegetation and a section of the drain is also used to join Bush Forever sites 464 and 340. Bush Forever site 413 was not considered to be a priority for inclusion into the linkage as it connects to large remnants of bushland outside of precinct 3 to the northwest.

The vegetation corridors chosen for the Precinct 3 area illustrate the best possible linkages still present within the study site that would facilitate fauna movement between the areas of remnant bush. Existing vegetation remnants were taken advantage of instead of trying to create corridors by extensive rehabilitation and planting regimes. Not withstanding this, a few of the connecting corridors would benefit from such works.

Recommendation 22: That the ecological linkages provided by Figure 15 are adopted by the City of Gosnells as the ecological linkages for Southern River Precinct 3.

5.3 FAUNA

The study area is potentially inhabited or frequented on occasions by about 221 species of vertebrate fauna. During the course of the fauna survey work the presence of 92 fauna species was confirmed (~42% of potential species). It can be expected that if additional surveys were conducted over different seasons that the presence of more fauna species would be confirmed.

Greatest species diversity was found within Area E. This area has the largest expanse of intact native vegetation in addition to having a variety of habitats present. Species diversity is considerably less in developed areas where the extent of remnant bushland is limited and patchy (i.e. Areas C & H).

Potentially 10 species of amphibians (frogs) inhabit the study area of which 6 were identified during the survey. A large percentage of Precinct 3 is low lying and subject to inundation during the wetter part of the year. Suitable breeding

habitat for those species requiring water is extensive. No frog species present or potentially present on the site are listed threatened or priority species.

Previous studies on reptile fauna in the Perth area have illustrated that even degraded vegetation can sustain relatively intact reptile fauna assemblages though perturbation from fire is known to have a dramatic impact on species diversity, at least in the short term (How & Dell 1994). During the survey at Precinct 3, 15 species of reptiles out of a potential 48 species were identified. A number of the listed potential species are known to occur in relatively low densities and are therefore difficult of trap or locate. These species are also most likely to suffer local extinction as a result of fragmentation of habitat as a consequence of development. For example, while listed as potentially present, the Carpet Python (*Morelia spilota* subsp *imbricata*) is probably locally extinct.

Over half of the potential fauna species are birds, in part as consequence of their mobility and in some cases wide ranging habit. Because of there mobility it can be expected that some of those species listed may only occur infrequently, as vagrants. 64 species of avifauna were sited during the survey period which is a good result given the limited survey period. Of significance was the sighting of fourteen Bush Forever decreaser species. Theses species typically do not persist in developed areas or in small bushland remnants. The preservation of substantial tracts of intact bushland is required to ensure their continued survival in the Perth, Swan Coastal Plain region.

Off particular note was the presence of a resident flock of about 15 or 20 Forest Red-tailed Cockatoos in the north of Precinct 3 (a State and Federally listed threatened species). The birds seem to be attracted to groves of Marri trees present in a number of the smaller rural lots in this area. On occasions small groups of birds from the main flock were also seen feeding on Marri trees in other sections of the study area to the south (where Marri is less common). Banksia seeds also form part of the Forest Red-tailed Cockatoos diet though feeding on these plants was not observed. A single Carnaby's Cockatoo was also sited during initial survey of the study area. This species and Baudin's Back Cockatoo undoubtedly also visit the area on occasions for foraging.

The number of native mammal species inhabiting, or potentially inhabiting sections of the study area is small and the presence of only two species was confirmed. The listed threatened species, the Chuditch is very likely locally extinct as is the Southern Brush-tailed Phascogale though they may be present on occasion as vagrants. The site does, however, contain populations of the Southern Brown Bandicoot, a CALM priority species. The maintenance of relatively dense low vegetation is import for this species if it is to persist in the area. The other native mammal species observed was the Western Grey Kangaroo, which is not a listed species.

During the course of the opportunistic surveys across the study site foxes were observed on several occasions. The presence of foxes in the study area is of major concern due to the detrimental effect they would undoubtedly be having on native fauna.

Feral bees were also observed occupying hollows in trees. Hollows are an import habitat resource for a wide range of native animals and any reduction in their availability, from any cause, will have a detrimental effect of fauna populations.

6 LOCAL SIGNIFICANCE

To establish whether any of the natural areas within Precinct 3 are regarded as locally significant, Table 7 provided in the Local Government Biodiversity Planning Guidelines (LGBPG) was adapted to summarise the finding of this project. Floristic Community Types have not been mapped across the Perth Metropolitan Region therefore Vegetation Complexes are used to determine Local significance based on the representation ecological criteria set down in the LGBPG. Natural areas within Precinct 3 are in the Southern River Complex.

The LGBPG's provide that any local natural area confirmed as meeting one or more of the local significance criteria is considered as locally significant. A map produced by the Perth Biodiversity Project (Figure 14) identifies local natural areas that potentially meet local significance criteria, however, these could change depending on ground truthing. ENV used the results of the field survey as well as Bush Forever and the LGBPGs to evaluate Precinct 3 against the criteria.

Criteria	Study Area that Meets the Criteria
1. Representation a) Regional	
i) recognised International, National, State or Regional conservation value (outside Bush Forever Sites and CALM managed Estate) not already protected, for example, System 6 Areas in the Jarrah Forest outside CALM Managed Estate.	Northern half of Area D, E, open water lake in eastern corner of Area F
ii) of an ecological community with only 1500 ha or 30% or less (whichever is the greater) remaining in the IBRA subregion.	All areas with Native vegetation
iii) large (greater then 20 ha), viable natural areas in good or better condition of an ecological community with more than 30% remaining within the IBRA subregion.	Criteria not met
iv) of an ecological community with only 1500 ha or 15% or less (whichever is the greater) protected for conservation in the Jarrah Forest IBRA subregion.	Not relevant
v) of an ecological community with only 400 ha or 10% or less (whichever is the greater) protected for conservation in Bush Forever Study Area.	All areas with Native vegetation
1. Representation b) Local	
i) of an ecological community with 10% or less remaining within the Local Government area. The aim of this criterion is to conserve local biodiversity and local sense of place at a bare minimum level. However, 10% is	City of Gosnells is regarded as meeting this criteria by the Local Biodiversity Project even though its above the 10%.

Criteria	Study Area that Meets the Criteria
not recognised as adequate for biodiversity conservation. No LNAs will meet this criterion where 10% of an ecological community is already protected in CALM Managed Estate, Regional Parks or Bush Forever Sites.	City of Gosnells has 13% remaining of the Southern River Complex.
ii) of an ecological community with 30% or less remaining within the Local Government area. The aim of this criterion is to conserve local biodiversity and local sense of place at an adequate level for biodiversity conservation. No LNAs will meet this criterion where 30% of an ecological community is already protected in CALM Managed Estate, Regional Parks or Bush Forever Sites.	City of Gosnells has 13% remaining of the Southern River Complex. Criteria met
iii) large (greater than 10ha), viable natural areas in good or better condition of an ecological community with more than 30% remaining within Local Government area.	Criteria not met
2. Diversity	
i) natural area in good or better condition that contains upland and wetland structural plant communities.	A, B, E, F, G, H
3. Rarity	
i) of an ecological community with only 1500 ha or 10% less (whichever is the greater) remaining in the IBRA subregion.	Criteria not met (for city of Gosnells, 17% remains for SCP)
ii) of an ecological community with only 400 ha or 10% or less (whichever is the greater) remaining in Bush Forever Study Area.	Criteria not met
iii) contains a threatened ecological community (TEC).	E, F
iv) contains Declared rare Flora (DRF), Specially Protected Fauna (SPF) or significant habitat for these fauna.	A, B, D, E, F, G
v) contains Priority or other significant flora or fauna or significant habitat for these fauna.	A, B, D, E, F, G
4. Maintaining ecological processes or natural systems – connectivity	
i) natural areas acting as stepping stones in a Regionally Significant Ecological Linkage.	E, F, G
ii) natural areas acting as stepping stones in a locally	Information not known/

Criteria	Study Area that Meets the Criteria
significant ecological linkage.	
5. Protection of wetland, streamline and estuarine fringing vegetation and costal vegetation	
i) Conservation or Resource Enhancement category wetland plus buffer.	B, D, E, F, H (they however don't have applied buffers)
ii) EPP Lake plus buffer.	Lake in eastern corner of Area F but has no designated buffer
iii) riparian vegetation plus buffer.	B, D, E (they however don't have applied buffers)
iv) floodplain area plus buffer.	-
v) estuarine fringing vegetation plus buffer.	-
vi) coastal vegetation on foredunes and secondary dunes.	-

(table temple sourced from Local Government Biodiversity Planning Guidelines, 2004)

As evident in the table above all the native vegetation remnants within Precinct 3 are considered to be locally significant due to fulfilling several of the criteria.

7 REGIONAL SIGNIFICANCE

Bush Forever has used various sources to assess each vegetation area to determine whether it was of particular regional significance within the Perth Metropolitan Region. Compliance with at least one of the following criteria was considered essential for bushland to be regarded as regionally significant:

- An example of regional vegetation type which is threatened or poorly reserved or a site with special value for flora and fauna conservation;
- Having considerable biological diversity or supports a population of Declared Rare Flora, Priority Flora, or Threatened Ecological communities;
- Vegetation is in good condition or better, but threatened vegetation may be regionally significant even if in poor condition; and
- Usually greater than 20ha but may be smaller in the case of threatened or poorly reserved vegetation types, or areas with special significance for other purposes.

Other matters that were taken into consideration, including usefulness for passive recreation, value for educational or scientific study, cultural heritage value and linkage value.

The final decision on vegetated areas considered to be regionally significant was based on the following parameters:

- Rarity (vegetation complexes and communities);
- Planning Constraints (existing and future land use proposals);
- Opportunities outside the Perth Metropolitan Region (identification of substitute areas outside of the Perth Metropolitan Region to secure minimum 10% representation of complexes was investigated);
- Size and Shape;
- Condition;
- Relationships to Other Areas (establishment of an integrated system and linkage corridors);
- Conservation Category Wetlands;
- Ownership or Reservation Status;

- Regional Infrastructure Requirements (roads, railways and main public utility services); and
- Basic Raw materials and Titanium Minerals (Bush Forever recognises the importance of the extractive and mining industries in the context of broader community considerations)

Using these criteria areas E and G (Bush Forever sites 464 and 340 respectively) are considered to be regionally significant. Bush Forever site 413 within the precinct (which wasn't surveyed) is also considered regionally significant as well as the area proposed for Parks and Recreation (Bush Forever site 465). Bush Forever Sites were selected if they were considered regionally significant based on fulfilling the following criteria:

- Representation of ecological communities;
- Diversity;
- Rarity;
- Maintaining ecological processes or natural systems;
- Scientific or evolutionary importance;
- General criteria for the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation; and
- Criteria not relevant to determination of regional significance, but which may be applied when evaluating areas having simular values.

When assessing the remaining areas against the criteria, the Resource Enhancement wetland (wetland C) in the northern area of Area B should be regarded as regionally significant also as it contains two priority species, is in good to excellent condition and could easily be linked to the other regionally significant areas within the precinct. Even though the site is below the 20ha recommendation for protection it is still worthy of protection due to its biological attributes.

The two areas mapped as Threatened Ecological Communities Muchea Limestone (Area E) and FCT 3a (Area F, south of Phoebe Street), also meet the regional significance criteria. Area E is already recognised as regionally significant.

Recommendation 23: Wetland C, Wetland L, the two Threatened Ecological Communities and mapped Bush Forever Sites should be priorities for protection given their regional significance.

8 RECOMMENDATIONS AND CONCLUSIONS

Precinct 3 contains all three management category wetlands, these being Conservation Category, Resource Enhancement and Multiple Use wetlands. There are two EPP wetlands identified within the precinct (excluding the Bush Forever site and the site proposed as Parks and Recreation). Recommendations for particular wetlands are as follows:

Wetland A

Recommendation 1: It is considered likely, based on its assessed vegetation values that a re-evaluation of Wetland A will result in a downgrade of its current management category.

Recommendation 17: No wetland buffer is provided for Wetland A given its degraded nature.

Wetland B

Recommendation 2: It is considered likely, based on its assessed vegetation values that a re-evaluation of Wetland B will result in an upgrade of its current management category.

Recommendation 11: That an indicative buffer of 50m is provided for Wetland B to reflect the condition of the wetland.

Wetland C

Recommendation 13: An indicative buffer of 50m is recommended for Wetland C to reflect its management category.

Wetland D

Recommendation 14: An indicative buffer of 50m is recommended for Wetland D to reflect its management category.

Wetland E

Recommendation 3: It is considered likely, based on its assessed vegetation values that a re-evaluation of Wetland E will result in a downgrade of its current management category.

Recommendation 18: No wetland buffer is provided for Wetland E given its degraded nature.

Wetland F

Recommendation 4: Consideration should be given to amending the boundary of Wetland F to reflect the presence of upland vegetation.

Recommendation 15: An indicative buffer of < 50m is recommended for Wetland F given its degraded condition.

Wetland G

Recommendation 5: It is considered likely, based on its assessed vegetation values that a re-evaluation of the Multiple-Use portion of Wetland G will result in an upgrade of its current management category.

Recommendation 12: That an indicative buffer of 50m is provided for the Multiple-Use Category portion of Wetland G to reflect the condition of the wetland.

Recommendation 16: An indicative buffer of < 50m is recommended for the Resource Enhancement portion of Wetland G given its degraded condition.

Wetland H

Recommendation 6: It is considered likely, based on its assessed vegetation values that a re-evaluation of Wetland H will result in a downgrade of its current management category.

Recommendation 19: No wetland buffer is provided for Wetlands H given tits degraded nature.

Wetland I

Recommendation 7: The protection of Wetland I should be considered a priority for areas protected within Precinct 3.

Recommendation 8: That the City of Gosnells' planning documentation recognises the EPP status of Wetland I through appropriate zoning. Current landholders should be made aware of the wetland's legislative protection.

Recommendation 20: That an indicative buffer of 100m is provided for Wetland I.

Wetland K

Recommendation 9: Consideration should be given to amending the boundary of Wetland K to reflect the presence of upland vegetation.

Wetland L

Recommendation 10: That the City of Gosnells' planning documentation recognises the EPP status of Wetland L and either provides for its conservation (and rehabilitation) or seeks amendment to its EPP listing by referral to the EPA.

Flora

The findings of the vegetation and flora survey indicate that there were 227 taxa identified within Precinct 3, Southern River, of these there were 41 introduced species.

During the survey two priority species, *Aponogeton hexatepalus* and *Verticordia lindleyi* subsp. *lindleyi* were found within Areas B and E. Priority flora do not have the same legal status as DRF, however, they are considered for protection/management in approvals processes under the Environmental Protection Act.

No plant taxa gazetted as Declared Rare pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950)* (Department of Conservation and Land Management 2000) were located within the survey area. No Endangered or Vulnerable species, pursuant to s178 of the Environmental Protection and Biodiversity Conservation Act, 1999 were located during the survey.

There were two Threatened Ecological Communities (Muchea Limestone and FCT 3a) identified within the Precinct. Both communities are listed by the State and the Commonwealth. It would be expected that any development would seek to avoid impact on a TEC if possible, and if this were not possible, would seek to minimise and mitigate the impact. If a proposal is likely to cause a direct loss or have a significant impact on a TEC it is likely to require a referral to the Commonwealth Department of Environment and Heritage and may attract a formal level of assessment. A proposal impacting on a TEC may also be formally assessed by the Environmental Protection Authority and classified as Unlikely to be Environmentally Acceptable (PUEA) (EPA Guidance Statement 10).

Recommendation 21: That areas supporting vegetation community Muchea Limestone and FCT 3a, which are mapping sites 28-EdXp and 18-CcKa are:

- **reflected by the City of Gosnells as priorities for protection (as provided by State and Commonwealth legislation);**
- **incorporated into ecological linkages/vegetation corridors; and**
- **highlighted to affected property owners, including advice on legislative obligations.**

Areas E, G, the northern end of Area B (Wetland C) and the two TEC's are identified as being regionally significant therefore should be priorities for protection.

Recommendation 23: The regionally significant natural areas of Wetland C, the two Threatened Ecological Communities and the mapped Bush Forever Sites should be priorities for protection.

Areas E and G also form part of a regional linkage creating more importance in their protection and management.

All remnants of native vegetation within the Precinct 3 and Area H are considered to be locally significant according to the criteria set by the Local Government Biodiversity Planning Guidelines. This implies that consideration should be given to protecting all the vegetation remnants that have a condition rating of good or higher.

Recommendation 24: All remnant vegetation within Precinct 3 and Area H that has a condition rating of good or higher is Locally significant and should be considered for protection.

The Regional and Locally significant areas contained within the study site provide an opportunity to create ecological linkages. Ecological linkages have been identified for Precinct 3 and reflect the best possible linkages still present within the study site that would facilitate fauna movement between the areas of remnant bush. Existing vegetation remnants were taken advantage of instead of trying to create corridors by extensive rehabilitation and planting regimes. Not withstanding this, a few of the connecting corridors would benefit from such works.

Recommendation 22: That the ecological linkages provided by Figure 15 are adopted by the City of Gosnells as the ecological linkages for Southern River Precinct 3.

Precinct 3 potentially hosts 221 fauna species of which six are listed threatened species under the EPBC Act (1999). Due to a range of historical processes such as widespread clearing, habitat fragmentation and the introduction of predators, it appears highly probable that two of the species, the Chuditch and Carpet Python, are locally extinct. The remaining four species are birds, the three Black Cockatoo species and the Peregrine Falcon.

The study area was found to contain suitable foraging habitat for all the Black Cockatoo species and they would all at various times utilise the area. Forest Red-tailed Cockatoos and a single Carnaby's Cockatoo were sited during surveys. The area appears to contain few breeding opportunities for cockatoos. A single potential nest hollow was identified but no evidence that it was in use or had previously been used was found. The Peregrine Falcon possibly utilises the study area on occasions as part of a much larger home range. This uncommon wide ranging species was not sighted during the survey and no evidence of it nesting within the study area was found.

The study site is also utilised at times by a number of migratory bird species protected under international agreement to which Australia is a signatory and consequently also listed under the EPBC Act (1999).

When development of sections of Precinct 3 take place it will be necessary to assess the specific impact on the listed threatened and migratory bird species present in the area utilising the "Principal Significant Impact Guidelines" – Matters of National Environmental Significance (issue by The Department of Environment and Heritage, 2005) and if required a referral will need to be submitted. Project specific management issues will need to be addressed to ensure compliance with relevant legislative requirements but should aim to reduce impact on fauna, to ensure their continued existence in the general area.

Remnant bushland within the study site was also found to contain or potentially contain a number of CALM priority and Bush Forever decreaser species (birds) While not having any formal protection, theses species are of local significance. It is anticipated that with the retention of the identified Bush Forever sites along with the implementation of appropriate management plans that most of these species should persist.

Without adequate management, areas of remnant bushland have the potential to become degraded over time and lose some of their value as conservation areas for both fauna and flora. While it is acknowledged that some of the area is currently under private ownership, which makes management of the entire area

difficult, the following recommendations should be implemented when and if possible for all areas of vegetation to be protected:

Recommendation 25: Protected vegetation and wetland areas should be fenced or barricaded to prevent vehicle access.

Recommendation 26: That a fire management plan is prepared and adopted for all protected areas. The Fire Management Plan should define areas where clearing for the purposes of complying with fire regulations is to take place and also set out defined low energy burn cycles. The low energy burn cycles should aim to maintain a patch work of areas of dense vegetation around the site, suitable for fauna species such as the Southern Brown Bandicoot, while not comprising the safety of nearby residences.

Recommendation 27: A revegetation plan should be formulated to rehabilitate degraded areas, including areas within identified ecological linkages. Rehabilitated areas should be revegetated with local seed stock that includes cockatoo food plants (e.g. *Corymbia, Banksia, Dryandra, Hakea*, and *Allocasuarina*). Local residents should be encouraged to plant these species and other natives on their properties.

Recommendation 28: A management plan for the eradication and control of feral animals such as the Fox should be formulated and implemented with collaboration with CALM.

Implementation of the above management actions for areas of remnant vegetation should be supported by a comprehensive hydrological management strategy. The vegetation and faunal communities identified by this report are reflective of the historic hydrological regime. The maintenance and management of this regime is pivotal to the long term protection of the environmental values contained within Southern River Precinct 3 and area TPS17.

Recommendation 29: A hydrology management strategy incorporating adaptive management principles should be developed that understands and protects the surface and groundwater relationship with dependant vegetation and fauna. The strategy should provide for ongoing monitoring of water levels and water quality in the wetlands to help

identify any issues that may affect the conservation value of the site such as the lowering of water tables or changes in water quality. Information gained should inform adaptive management actions.

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