Industrial Subdivision of Lots 300—303 and 14 & 15 Beringarra Avenue, Malaga

Public Environmental Review

Prepared by:
Cardno BSD Pty Ltd

For:
Sandbourne Holdings Pty Ltd

March 2005

Invitation to make a submission

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal. In accordance with the Environmental Protection Act, a Public Environmental Review (PER) has been prepared which describes this proposal and its likely effects on the environment. The PER is available for a public review period of 8 weeks from Monday 14 March 2005 closing on Monday 9 May 2005. Submissions will help the EPA to prepare an assessment report in which it will make recommendations to Government.

Why write a submission?
A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in the EPA's report.

Why not join a group?
If you prefer not to write your own comments, it may be worthwhile joining with a group interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission
You may agree or disagree with, or comment on, the general issues discussed in the PER or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific elements of the PER:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable;
- suggest recommendations, safeguards or alternatives.

Points to keep in mind
By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- refer each point to the appropriate section, chapter or recommendation in the PER;
- if you discuss different sections of the PER, keep them distinct and separate, so there is no confusion as to which section you are considering;
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include: your name; address, date; and whether you want your submission to be confidential. The closing date for submissions is Monday 9 May 2005.

Submissions should preferably be emailed to: glen.mcleod-thorpe@environment.wa.gov.au

Submissions may also be posted to:
Chairman
Environmental Protection Authority
Westralia Square 141 St George's Terrace
PERTH WA 6000
Attention: GLEN McLEOD-THORPE

If you have any questions on how to make a submission, please ring the EPA project officer, **Glen McLeod-Thorpe**, on (08) 9222 7182.

If you have any technical questions on the PER or aspects of the proposal please call **Jason Hick** at Cardno BSD, on 9273 3888.

EXECUTIVE SUMMARY

INTRODUCTION

The Public Environmental Review (PER) describes the proposal, the existing environment and the potential environmental impacts. The basis for the formal environmental impact assessment is the presence of a 'Conservation' category wetland (CCW) and associated flora and fauna within the proposal area. Therefore, this document describes the proposal, presents the environmental values of the CCW, associated flora and fauna, the potential impacts and proposes a mitigation strategy to the extent that development will achieve a "no net loss" outcome.

THE PROPOSAL

Sandbourne Holdings Pty Ltd is the proponent for the industrial subdivision of Lots 300 – 303 and 14 & 15 Beringarra Avenue, Malaga. The proposal area is 11.68 hectares in size and is bound by Victoria Road to the north and Reid Highway to the south. The proposed Hepburn Avenue extension from Marshall Road to Reid Highway is directly east and the proposal area itself would be the final section of an already established industrial estate.

The proposal involves the industrial subdivision of Lots 300 - 303 and 14 &15 Beringarra Avenue, Malaga. A subdivision application has been lodged with the Western Australian Planning Commission (WAPC Reference 115108). The proposal is consistent with the objectives of the City of Swan's Town Planning Scheme 14 (TPS 14): East Malaga Industrial Development Scheme and will result in the creation of industrial lots but not their individual development or use.

PROPOSAL JUSTIFICATION AND ALTERNATIVES

The proposal is the last stage of the Freeway Industrial Estate development, planned by TPS No. 14, completing the eastern portion of the estate. The industrial land use that will result from the proposal is consistent and compatible with other surrounding land uses and completes the last section of an area that has been intended by the planning authorities to be used for industrial purposes.

The proponent's view is the proposal is viable, given that:

- The proposal area has been planned for industrial purposes for over 20 years and has been part of two submissions to the EPA, which have not been formally assessed (see **Section 2.4**);
- Informal assessment of TPS 14 by the EPA in 1990 allowed for the development of scheme roads which would significantly impact the wetland, which have been approved by the City of Swan for construction in 2004 (see **Section 2.4** and **Appendix H**);
- The wetland in question is small and degraded due to adjacent industrial development, rubbish dumping, historic uncontrolled access, and ultimately the construction of the road through it (see **Section 4.3.6**);
- The proposal area no longer has any significant linkage to other natural areas due to surrounding industrial development and road construction (see **Section 4.3.6**);

- The vegetation within the proposal area does not support any Declared Rare Flora (see **Section 4.3.3.2**) or Specially Protected (Threatened) Fauna (see **Section 4.4.3.3**); and
- The proposal area is not recognised as regionally significant in either System 6 (Department of Conservation and Environment 1983) or Bush Forever (Government of Western Australia 2000) (see **Section 4.5.5.2**).

The only alternative to the proposal is to 'not develop' the wetland area and retain it as a natural area within the industrial estate. The surrounding area is zoned 'industrial' or reserved for road construction and it is therefore expected that all surrounding vegetation, not held within the proposal area, will eventually be cleared for these uses. Reid Highway restricts the corridor potential and natural hydrological exchange between the proposal area, Bush Forever site 307 (Lightning Swamp) and Bush Forever Site 480 (Victoria Road Bushland). Additionally, development to the north and west and the proposed Hepburn Avenue extension to the immediate east and residential development further east will completely surround the wetland. The surrounding area is highly modified and it is considered that an industrial estate bordering the wetland will increase traffic flow and uncontrolled access to the proposal area as well as the incidence of fire, introduction of weeds and pathogens by rubbish dumping.

EXISTING ENVIRONMENT

The pertinent biophysical factor in the assessment of this project is the presence of a "sumpland" CCW. The flora and fauna of the wetland has been assessed during field studies to indicate the "health" of the remnant vegetation and to gain an understanding of the biodiversity supported by the wetland.

The proposal area falls within the Jandakot consanguineous suite of wetlands, which are located in the Bassendean Dune System. The Jandakot suite is a reflection of the natural groundwater level expressed as sumplands and damplands (Hill *et al.* 1996). The proposal area was originally described within the Bennett Brook suite however consanguineous suite boundaries were revised and the wetland is mapped as Jandakot suite in Hill *et al.* (1996).

As part of the PER preparation process, the boundary of the CCW has been remapped according to the current extent of wetland dependent vegetation, and based on this mapping is approximately 6.34 ha. This compares to a wetland of approximately 4.43 ha as depicted by the original DoE wetland mapping (see **Figure 5**). The remapped CCW is partially situated within the boundaries of the proposal area (4.95 ha), and partially situated within the Reid Highway road reserve (1.39 ha). The wetlands remaining in the area are part of what was a larger wetland, described on Map 2034 II NE in *The Wetlands of the Swan Coastal Plain Vol 2B* (Hill *et al.* 1996) as 43Sc, Victoria Road Sumpland. The proposal area has one of the two remaining wetland areas of the Victoria Road Sumpland.

The wetland, since originally being identified as a CCW in 1996, has been the subject of numerous studies and has had its CCW status reconfirmed in 1997, 1999 and twice in 2000. Although the wetland suffers from minor weed invasion, it is intact and overall vegetation is generally in good condition as defined by Bush Forever condition rating scale (Government of Western Australia 2000).

ENVIRONMENTAL IMPACT AND MANAGEMENT

Implementation of the proposal will result in complete loss of the wetland and its surrounding buffer. On this basis it is not possible to avoid or minimise this impact. Even so, if the proposal does not proceed the road will be constructed through the wetland and any remaining environmental values will degrade over time. Further, it is the proponent's view that the Shire of Swan and the Department of Conservation and Land Management (CALM) will be unlikely to accept vesting and management of the wetland for conservation purposes if the road is constructed.

The proponent commits to mitigate the loss of wetland through the preparation and implementation of a Wetland Mitigation Strategy in consultation with CALM, Department of Environment (DoE) and EPA. In accordance with (Preliminary) *Position Statement No. 9: Environmental Offsets* (EPA, 2004), the Wetland Mitigation Strategy will seek to incorporate the following principles:

- The use of both primary and secondary offsets;
- To achieve a "no net loss" situation through primary offsets and the use of secondary offsets to achieve a "net benefit" outcome overall;
- The environmental impact and offsets package should be 'like for like or better'; and
- Ensure a long lasting benefit.

Further detail regarding the Wetland Mitigation Strategy is provided in **Section 4.6** of this document, including a review of the environmental offsets principles provided in EPA Preliminary Position Statement No. 9. CALM, DoE and EPA will approve the Wetland Mitigation Strategy prior to its implementation.

Table ES.1 Summary of Proponent Commitments

	Topic	Action	Objective	Timing	Advice
1.	Wetland Mitigation Strategy	Prepare a Wetland Mitigation Strategy as detailed in **Section 4.6** of this document and in accordance with the principles outlined in (Preliminary) *Position Statement No. 9: Environmental Offsets* (EPA, 2004).	• Ensure "no net loss" of Conservation Category Wetlands on the Swan Coastal Plain. • Provide for a "net benefit" outcome in relation to the proposed wetland impacts and the wetland mitigation/offsets.	During construction phase.	DoE/CALM
2.	Wetland Mitigation Strategy	Implement the Wetland Mitigation Strategy in Commitment 1.	Achieve the objectives of Commitment 1.	Within 3 years of project commencement.	

TABLE OF CONTENTS

Page

APPENDICES

FIGURES

TABLES

GLOSSARY/ACRONYMS

CALM	Department of Conservation and Land Management
CCW	Conservation Category Wetland
DEP	Department of Environmental Protection
DoE	Department of Environment
DRF	Declared Rare Flora
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
ESR	Environmental Scoping Report
MfP	Ministry for Planning
MRS	Metropolitan Region Scheme
PF	Priority Flora
PER	Public Environmental Review
PMR	Perth Metropolitan Region
TEC/s	Threatened Ecological Community/ies
TPS	Town Planning Scheme
WAPC	Western Australian Planning Commission
WRC	Water and Rivers Commission

ACKNOWLEDGMENTS

BSD Consultants Project Team

Project Leader	Adrian Vlok/Jason Hick
Environmental Scientist/Botanist	Vanessa Clarke/Kelly Freeman
Environmental Scientist	Ben McCarthy
Draftsperson	Natalie Pleiter/Mark Clews

Subconsultants:

Hart, Simpson and Associates	Dr.Ray Hart
M. J. & A. R. Bamford Consulting Ecologists	Dr.Mike Bamford

1 INTRODUCTION

The proposal being assessed in this Public Environmental Review (PER) is subdivision application 115108 referred to the Environmental Protection Authority (EPA) by the Western Australian Planning Commission (WAPC) in August 2000. Following referral, the EPA resolved to formally assess the project and the level of assessment was set at PER with an eight week public review period (EPA letter dated 17 June 2002). An Environmental Scoping Report (ESR) was prepared by Cardno BSD (formerly BSD Consultants) in consultation with the EPA, which provided specific and general information on the form, content and scope of the PER document to be prepared. This document (the PER) has been prepared to satisfy the ESR (**Appendix A**) and the EPA has authorised it to be released for public comment.

The PER describes the proposal, the existing environment and the potential environmental impacts. The basis for the formal environmental impact assessment is the presence of a Conservation Category Wetland (CCW) and associated flora and fauna within the proposal area. Therefore, this document describes the proposal, presents the environmental values of the CCW, its associated flora and fauna, the potential impacts arising from the implementation of the proposal, and proposes a wetland mitigation strategy (in accordance with *Preliminary Position Statement No. 9: Environmental Offsets* (EPA, 2004)) to offset the proposed impacts on the CCW.

This PER has been released for an eight (8) week public submission period. The EPA will assess the proposal following the eight (8) week public submission period taking into account the submissions and advice from the Department of Environment (DoE) and the Department of Conservation and Land Management (CALM). The Report and Recommendations of the EPA will then be presented to the Minister for the Environment.

2 THE PROPOSAL

2.1 THE PROPONENT

Sandbourne Holdings Pty Ltd. is the proponent for the industrial subdivision of Lots 300 – 303 and 14 & 15 Beringarra Avenue, Malaga.

2.2 PROPOSAL LOCATION

The industrial subdivision of Lots 300 - 303 and 14 & 15 Beringarra Avenue, Malaga ('the proposal'), is situated within the Freeway Industrial Park boundary in the suburb of Malaga, as illustrated in **Figure 1**.

The proposal is 11.68 hectares in size and is bounded by Victoria Road to the north and Reid Highway to the south. The proposed Hepburn Avenue extension from Marshall Road to Reid Highway is directly east and the proposal area itself is intended to be the final section of the Freeway Industrial Park.

2.3 PROPOSAL DESCRIPTION

The proposal involves the industrial subdivision of Lots 300 - 303 and 14 & 15 Beringarra Avenue, Malaga. A subdivision application has been lodged with the WAPC (WAPC Reference 115108). **Figure 2** shows the proposed subdivision plan. The proposal is consistent with the objectives of the City of Swan's Town Planning Scheme 14: East Malaga Industrial Development Scheme (TPS 14) and will result in the creation of industrial lots but not their individual development or use.

The proposal subject to this assessment involves:

- Vegetation clearing;
- Earthworks (cut to fill);
- Construction of roads and installation of signs, mounted kerbing and lighting;
- Construction of drainage basins and drainage infrastructure;
- Installation of all services (i.e. gas, water, electricity, telecommunications and sewer); and
- Landscaping.

Table 2.1: Key Characteristics of Proposal

Element	Description
Proposal Description	The subdivision of Lots 300 - 303 and 14 & 15 Beringarra Avenue, Malaga and associated earthworks for the creation of individual industrial use lots and access roads.
Area of proposal	11.68 hectares
WAPC Subdivision Reference Number	115108

2.4 BACKGROUND

Notice of the intention to prepare an Industrial Development Scheme was initially sent to the EPA by letter from the City of Swan (formerly the Shire of Swan) in 1989. TPS 14 is a Guided Development Scheme (statutory scheme) and provides the basis for the development of the area and provisions for distribution of costs and proposals for pre-agreed future drainage works and scheme roads. Comments made by the EPA in response to the letter were taken into consideration in preparation of the document, which was subsequently submitted to the EPA in 1990. The EPA decided that the proposal required no formal environmental assessment (see **Appendix G**). The principle objective of TPS 14 is "*to plan, facilitate and encourage the progressive subdivision and development of the land within the Scheme Area for industrial and other purposes.*"

In 1996, the WAPC referred Amendment No. 262 of TPS 9 to the EPA for consideration. TPS 9 is the City of Swan's district zoning scheme, and Amendment No. 262 imposed a more specific zoning regime under TPS 9 in respect of the land in the TPS 14 Scheme Area. TPS 9 was referred to the EPA and no formal environmental assessment was required.

The subdivision application for the proposal area was lodged in August 2000 and was referred to the EPA by the WAPC. On receipt of an initial letter from the EPA indicating that the proposal has been referred pursuant to s 38 of the *Environmental Protection Act 1986* for a level of assessment, the proponent's representatives instigated legal proceedings to prevent the EPA from assigning a level of assessment for the proposal. The ability of the EPA to formally assess the subdivision application was contested by the proponent, who considered the proposal to be in accordance with TPS 14, previously considered by the EPA and therefore s 38(5) of the *Environmental Protection Act 1986* applied. Section 38 (5) states *"Subject to section 46(6), a proposal shall be referred once only to the Authority under this section."*

The decision handed down by the Supreme Court of Western Australia ([2002] WASCA 75) ruled in favour of the EPA, concluding that the subdivision application did not constitute the same proposal initially assessed by the EPA. The Supreme Court ruled that the framework outlined in TPS 14, which included scheme roads, was assessed by the EPA in 1990 and therefore could not be assessed again. In 2004, the proponent received approval to commence development on scheme roads from the City of Swan (**Appendix H**). These roads pass through the wetland subject to this EPA assessment (**Figure 2**).

The EPA chose to formally assess the subdivision at the level of PER (public review period of eight (8) weeks) due to the potential impacts upon a CCW. Following this decision, the proponent submitted an application dividing the initial subdivision application into Stage 1 and Stage 2. Stage 2 encompasses the eastern sector of the proposal including the wetland and buffer vegetation subject to this formal PER assessment. Stage 1 (WAPC Reference 116258) is the balance of the initial proposal and consists of land to the west of Stage 2, not directly associated with the CCW (**Figure 2**). Advice was received from the EPA Service Unit in September 2002 that the Stage 1 proposal required no formal assessment with conditions. Therefore, this PER deals only with Stage 2 of the proposal.

2.5 COMMUNITY CONSULTATION

The preparation of this PER, and all supporting reports prepared by Cardno BSD (and other sub-consultants) have involved consultation with State Government Agencies, the Local Government, and various Conservation groups. The stakeholder groups that were consulted with are outlined below.

Table 2.2: Stakeholder Groups Consulted

Sector	**Organisation**
Local Government	City of Swan
State Government Agencies	Department of Conservation and Land Management (CALM) Department of Environment (DoE) Environmental Protection Authority (EPA) Main Roads Western Australia (MRWA) Water and Rivers Commission (WRC)
Conservation groups	Bennett Brook Catchment Group (BBCG) Birds Australia (RAOU) Conservation Council of WA Waterbird Conservation Society Wetlands Conservation Society

Most consultation was undertaken via telephone conversations and written communication. Meetings to discuss aspects of the project were undertaken with CALM, DoE and EPA. MRWA was consulted in regards to the section of the Victoria Road sumpland, which is reserved for road construction. DoE (formerly the WRC) were consulted with by telephone and in writing during the course of the PER preparation. An updated wetland boundary (based on the field assessment and as shown in **Figure 5**) has been provided to DoE for their review and comments.

The conservation groups were consulted prior to field surveys being undertaken to ensure sufficient background information was obtained and reviewed prior to commencing surveys at the site. The independent field surveys undertaken by the Bennett Brook Catchment Group were provided after contact with the group to increase the project teams' depth of local knowledge regarding the flora in the area.

To date the consultation with stakeholders has focussed on generating background and technical information regarding the existing local and regional environment, and not about the nature of the proposal itself. The PER will be released for public review at which point it is expected that submissions will be received regarding the proposal and any concerns that key stakeholders or members of the public may have.

3 PROPOSAL JUSTIFICATION

3.1 INDUSTRIAL SUBDIVISION OF THE PROPOSAL AREA

The proposal is situated on land zoned 'Industrial' in the Metropolitan Regional Scheme (MRS) and the City of Swan's TPS 9 and 14. **Figure 3** shows the location of the proposal within the MRS. Zoning of the area confirms that an industrial land use is intended from a strategic and statutory planning perspective. The proponent is the owner of the land in full and purchased it in good faith with the intention of developing industrial lots.

The proposal is the last stage of the Freeway Industrial Park development, planned by TPS No. 14, completing the eastern portion of the estate. **Figure 4** shows the extent of development in the area and the location of the proposal. The industrial land use that will result from the proposal is consistent and compatible with other surrounding land uses and completes the last section of an area that has been intended by the planning authorities to be used for industrial purposes for over 20 years.

The proponent's view is that the proposal is viable, given that:

- The proposal area has been planned for industrial purposes for over 20 years and has been part of two submissions to the EPA, which have not been formally assessed (see **Section 2.4**);
- Informal assessment of TPS 14 by the EPA in 1990 allowed for the development of scheme roads which would significantly impact the wetland, which were approved by the City of Swan for construction in 2004 (see **Section 2.4** and **Appendix H**);
- The wetland in question is small and degraded due to adjacent industrial development, rubbish dumping, historic uncontrolled access, and ultimately the construction of the road through it (see **Section 3.2**);
- The proposal area no longer has any significant linkage to other natural areas due to surrounding industrial development and road construction (see **Section 4.3.6**);
- The vegetation within the proposal area does not support any Declared Rare Flora (see **Section 4.3.3.2**) or Specially Protected (Threatened) Fauna (see **Section 4.4.5**); and
- The proposal area is not recognised as regionally significant in either System 6 (Department of Conservation and Environment 1983) or Bush Forever (Government of Western Australia 2000) **Section 4.5.5.2**).

3.2 CONSIDERATION OF ALTERNATIVES

The only alternative to the proposal is to 'not develop' the area and retain it as a natural area within the industrial estate. The surrounding area is zoned 'Industrial' or reserved for road construction and it is therefore reasonable to expect that all surrounding vegetation, not held within the proposal area, will eventually be cleared for these uses.

When considering the alternative of 'not to develop' the area, it is the proponent's view that there are a number of factors associated with the surrounding land uses that are likely to negatively effect the condition of this wetland, and therefore jeopardise its' long term conservation value. At this stage, the area is in generally good condition due mainly to its isolation from the industrial estate to the west as well as being part of a larger complex of vegetation. The Hepburn Avenue Extension, if approved, will divide this vegetation complex and effectively fragment the two wetlands, significantly impacting the wetland to the east.

Figure 8 illustrates the degrading effects of development on the wetland. Over a three-year period, the amount of remnant vegetation surrounding the proposal area has dramatically reduced and the edge effects of industrial development are evident in the thinning of the buffer *Banksia* community. Two site visits over a one year period (February 2003 and February 2004) have confirmed increased access to the proposal area and dumping of rubbish as development encroaches. It is a general ecological understanding that larger areas of remnant vegetation are more sustainable than smaller remnants and are less likely to degrade noticeably or demonstrate as significant edge effects. This principle is exemplified in this case.

If the wetland was retained, it would require intensive ongoing management resources and funding commitments to retain its status as being in the top 10% of its wetland suite and as a CCW (refer to **Section 4.5.5.1** for an explanation of wetland suites). Neither the City of Swan, CALM nor DoE have expressed an interest to acquire or have the wetland vested in them. This apparent reluctance may be a function of the wetland's limited values and the significant cost of future management.

Development and subsequent fragmentation of the Victoria Road Sumpland and associated bushland has effectively dissected the proposal area from surrounding natural areas (see **Figure 4** and **8**). Reid Highway and the proposed Hepburn Avenue restrict the corridor potential and natural hydrological and biological exchange between the proposal area, Bush Forever site 307 (Lightning Swamp), and Bush Forever site 480 (Victoria Road Bushland). Additionally, development to the north and west and the proposed Hepburn Avenue extension to the immediate east, and residential development further east will severely limit any natural linkages in these directions. The area surrounding the wetland will be highly modified from its current state and it is assumed that an industrial estate bordering the wetland will increase traffic flow, potential access to the proposal area, the incidence of fire, and introduction of weeds and pathogens.

In 2004, the proponent received approval from the City of Swan and the WAPC to construct scheme roads within the proposal. The scheme road design was set out in TPS 14, referred to the EPA in 1989 and informally assessed. TPS 14 was given statutory force in September 1990 when it received approval from the Minister for Planning and published in the *Government Gazette*. Should the scheme roads be constructed, as permitted by law and the current approvals, the proposal area would be severely fragmented and unviable in the long-term. At this stage, the proponent has chosen not to construct the scheme roads.

4 ENVIRONMENTAL ASSESSMENT – BIOPHYSICAL FACTORS

The pertinent biophysical factor in the assessment of this project is the presence of a CCW. The flora and fauna of the wetland has been assessed during field studies to indicate the "health" of the remnant vegetation and to measure biodiversity.

The EPA objective in assessing this proposal is:
"To avoid adverse impacts on biological diversity, comprising the different plants and animals and the ecosystems they form, at the levels of genetic diversity, species diversity and ecosystem diversity."

4.1 CLIMATE

The climate for this district is described as warm Mediterranean with warm dry summers of approximately 5-6 months per year and an annual rainfall between 600-1000mm (Beard 1990).

4.2 LANDFORMS AND SOILS

The Swan Coastal Plain is generally flat, approximately 20 to 30kms wide, and consists of a series of geomorphic entities running parallel to the coastline. The northern part of the Plain is formed from either fluviatile or aeolian depositional material. The Swan Coastal Plain consists of the Pinjarra Plain and three dune systems of differing ages of deposition whose soils are at different stages of leaching and formation. The coastal plain itself is low lying, often swampy with sandhills and therefore the soils predominately consist of recent sands or swampy deposits (Beard, 1990).

The Coastal Belt consists of the Quindalup and Spearwood quaternary Dune Systems. The Quindalup Dune System is young and formed of both fixed and mobile sand dunes that lie in a generally north-south orientation. The Spearwood Dune System consists of dunes without any recognisable patterns, which have lithified to limestone (Beard 1990).

The Bassendean Dune System is further inland and has older leached grey sands as well as wetlands and alluvial deposits (Bassendean Sand) associated with the Moore River System. Churchward and McArthur (1980) further classified the Bassendean Dune System into three categories associated with the nature of swamps in the area; the Bassendean unit, the Southern River unit and the Caladenia unit.

The proposal area is located on or close to the interface between the Bassendean unit (as described by Churchward and McArthur 1980) and recent marine deposits from the Vasse unit

4.3 VEGETATION AND FLORA

4.3.1 EPA SCOPE OF WORK

- Suitably qualified personnel will conduct baseline studies within the appropriate season, to identify the diversity, distribution and condition of existing vegetation, which will be directly and indirectly impacted by the proposal;
- The vegetation will be mapped and described, relating to soil/landform units;
- The assessment will be at a level, consistent with the methodology outlined in Bush Forever Volume 2 (Government of Western Australia 2000). The assessment will also be consistent with the EPA's Position Statement No. 3 (2002) "Terrestrial Biological Survey as an Element of Biodiversity Protection" and will include a desktop study, a reconnaissance survey and a comprehensive flora survey;
- The proposal area will be specifically surveyed for Declared Rare and Priority Flora. The presence/absence of Threatened Ecological Communities should also be determined and CALM and Environment Australia consulted in accordance with the *Wildlife Protection Act 1950* and the *Environmental Protection and Biodiversity Conservation Act 1999*, as required; and
- The PER will describe the area of each vegetation complex and floristic community type to be cleared and provide details of offsets for the loss of significant vegetation.

4.3.2 EXISTING ENVIRONMENT

The proposal area lies on the Swan Coastal Plain within the Drummond Botanical Subdistrict of the Southwestern Botanical Province, as described by Beard (1990). Flora composition of the Swan Coastal Plain Subregion has been described by Beard (1990) as consisting of *Banksia* Low Woodlands on leached sands with *Melaleuca* swamps where ill drained and Woodlands of *Eucalyptus* spp. on less leached soils.

During the assessment of the natural resources of the Darling System in the late 1970s, the vegetation was described and mapped by Heddle *et al.* (1980) to reflect the influence of landform, soils and climate on the distribution of the plant communities. Based on this mapping, the vegetation complex that occurs on the proposal area is the Southern River Vegetation Complex. Typical vegetation on the Southern River vegetation complex is Open Woodlands of *Corymbia calophylla – Eucalyptus marginata – Banksia* sp. on elevated areas with Woodlands of *Eucalyptus rudis* (flooded gum) – *Melaleuca rhaphiophylla* on the low lying areas and drainage lines that dissect the flatter unit.

4.3.3 FLORA AND VEGETATION SURVEY METHODOLOGY

4.3.3.1 Flora

Prior to fieldwork, a desktop analysis of the existing Declared Rare and Priority Flora database records on species known to occur in the region (CALM 2002) was undertaken. Relevant species were examined at the Western Australian Herbarium prior to the field survey being undertaken. A literature review was also undertaken to review the flora and vegetation previously described for the area.

A botanist from Cardno BSD undertook the field-based assessment in October 2002. The proposal area was surveyed by traversing the area on foot, using a compass and GPS unit. Plot-based recording of the flora was undertaken in each major vegetation community type, located within areas of good quality vegetation, using a 10 x 10 metre monitoring plot (the locations of which correspond with the vegetation communities shown in **Figure 6**). Recording plots were not permanently constructed. For each survey site, the flora was systematically recorded and collections of plant specimens were made where further identification was required. Non-quantitative opportunistic recordings/collections were then made outside of the plot (within the same vegetation community type) of species that were not recorded within the monitoring plot. The recordings from each plot, photographic representation and opportunistic collections within the same community types are set out in **Appendix D**.

4.3.3.2 Vegetation

The vegetation communities occurring within the proposal area were described in detail during a field survey in October 2002. The use of a standard data collection form ensured that the data was collected in a systematic and consistent manner. At each site the following records were made: condition rating; disturbance; topography; percentage litter cover; soil ratio; percentage bare ground; outcropping rocks and their type; and age since fire. For each species recorded, the average height and percent foliage cover was noted.

Aerial photography was used to extrapolate and map vegetation communities at a scale of 1:5000, in combination with the running notes made during the course of the survey. Vegetation condition was also mapped based on recorded observations at each plot-based assessment site, running notes made while traversing the proposal area, and aerial photography.

To determine the conservation and reservation status of the vegetation types defined for the proposal area, a comparison was made with previous floristic community types (FCTs) identified on the Swan Coastal Plain (Gibson *et al.*, 1994). FCTs were inferred by comparing the results of the plot-based assessments with the full list of species for each Gibson *et al*. FCT.

4.3.4 SITE FLORA

A total of 199 taxa comprising 49 families and 131 genera were found within the proposal area during a survey in October 2002 (see **Appendix B** for full species list). Species representation was greatest amongst the Myrtaceae, Papilionaceae, and Cyperaceae families, a composition typical of the Swan Coastal Plain Botanical Subdistrict and wetlands of the Bassendean Dune System. Twenty-seven introduced (weed) species were collected, which indicates some degradation to the vegetation, although core areas of the wetland were fairly dense and had few weed occurrences.

A comprehensive species list was produced using the BSD Consultants' October 2002 flora and vegetation survey and data from the Bennett Brook Catchment Group's (BBCG) surveys of the area undertaken during 2001 and 2002 (**Appendix B**). A total of 258 taxa comprising 51 families and 146 genera were included in this list. Thirty weed species were described from the combination of the two species lists.

4.3.4.1 Declared Rare and Priority Flora

No DRF species, pursuant to Subsection 2 of Section 23F of the *Wildlife Conservation Act 1950* and listed by CALM were located during the survey (see **Appendix K**). No endangered or vulnerable species, pursuant to s178 of the EPBC Act were located. CALM records indicate that DRF species *Caladenia huegelii* and *Epiblema grandiflora* var. *cyaneum* (ms) may potentially occur in the Malaga area (see **Appendix C**), however these were not identified during the surveys.

Calectasia cyanea (R) was located during the spring survey in October 2002 and has previously been listed in other surveys of the area (Bennett Brook Catchment Group 2002). The genus *Calectasia* was revised in 2001 (Nuytsia 13:431-433, 2001) and one of the outcomes of that revision was the reduction of the range of *Calectasia cyanea* (P2) to the Geraldton Sandplains region, specifically Eneabba. Two species of *Calectasia* are recorded as occurring on the Swan Coastal Plain, *Calectasia naragarra* and *Calectasia grandiflora* (with subspecies). It is most likely that the species collected is *Calectasia naragarra* as this is most structurally similar to *Calectasia cyanea* (P2). This species is not listed as threatened.

4.3.4.2 Significant Flora

Bush Forever (Government of Western Australia 2000) presents a list of vascular plant taxa on the Swan Coastal Plain, which are considered to be significant, of scientific interest or extending their geographical range. Two species recorded at the proposal area are listed in Table 13 in Bush Forever (pp 51, Government of Western Australia 2000); which are *Conostephium minus* and *Verticordia nitens*.

Conostephium minus has recently been removed from the Priority flora list where it was listed as Priority 4, however it is still considered significant and endemic to the Swan Coastal Plain. *Verticordia nitens* is also considered to be a significant species, endemic to the Swan Coastal Plain.

4.3.5 SITE VEGETATION COMMUNITIES

Four vegetation communities were recorded within the proposal area and are described below in **Table 4.1**. The distribution of these vegetation communities is illustrated in **Figure 6,** and the information recorded from the field survey for each vegetation community is included in **Appendix D.**

Table 4.1: Vegetation Communities Described at Lots 300-303 and 14 & 15 Beringarra Avenue, Malaga

	Community Description
Wetland communities:	
1	Melaleuca Forest Low Closed Forrest of *Melaleuca preissiana* over an Open Shrubland of *Astartea fascicularis, Regelia ciliata* and *Acacia pulchella* var. *pulchella* over a Sedgeland dominated by ?*Schoenus efoliatus* in low-lying grey sands.
2	Wetland Heath *Astartea fascicularis-Pericalymma ellipticum* Closed Heath with occasional *Melaleuca preissiana* over a Low Open Shrubland of *Hypocalymma angustifolium*, *Calothamnus lateralis* and *Melaleuca lateritia* over an Open Sedgeland of *Lepidosperma longitudinale*, *Baumea articulata* and *Schoenus subfascicularis* in inundated humus rich sandy soils.
Transition communities:	
3	Herbland *Patersonia occidentalis*, *Dasypogon bromeliifolius* and *Phlebocarya ciliata* Herbland with occasional *Jacksonia furcellata*, *Calytrix fraseri* and *Hypocalymma angustifolium* over an Open Sedgeland of *Lyginia barbata*, *Lepidosperma pubisquameum* and *Alexgeorgea nitens* in grey sands on gentle sandy rises from wetland areas.
Dryland communities:	
4	Banksia Woodland *Banksia menziesii*, *Banksia attenuata* and *Banksia ilicifolia* with occasional *Eucalyptus todtiana* Low Woodland over a Shrubland of *Allocasuarina humilis*, *Daviesia divaricata* subsp. *divaricata* and *Conostephium pendulum* over an Open Herb/Sedgeland of *Mesomelaena pseudostygia*, *Alexgeorgea nitens* and *Conostylis aurea* on deep pale grey sands.

The wetland heath dominates the proposal area and varies in species composition, which may be due to the degree of inundation of the soils. The *Melaleuca* Forest is an unusual unit found only at the far northern edge of the proposal area adjacent to Victoria Road. It is a small area of almost closed canopy *Melaleuca preissiana* over a virtual monoculture of the sedge ?*Schoenus efoliatus*, the identity of which could not be positively determined due to the lack of flowering material.

On the western side of the wetland there exists a transitional area, which is a Herbland (Vegetation Community 3) and the surrounding *Banksia* Woodlands occurs on the sandy dunal upland from the transitional zone.

4.3.5.1 Vegetation Significance

To determine the conservation and reservation status of the vegetation types defined, a comparison was made with previous floristic community types identified on the Swan Coastal Plain (Gibson *et al.* 1994) and the vegetation communities defined for the proposal area, resulting in inferred FCTs, which are presented below in **Table 4.2**.

Table 4.2: Inferred Floristic Community Types at Lots 300-303 and 14 & 15 Beringarra Avenue, Malaga

Community Description		Inferred Gibson *et al*. Floristic Community Type
Wetland communities:		
1	Melaleuca Forest Low Closed Forrest of *Melaleuca preissiana* over an Open Shrubland of *Astartea fascicularis, Regelia ciliata* and *Acacia pulchella* var. *pulchella* over a Sedgeland dominated by ?*Schoenus efoliatus* in low-lying grey sands.	4
2	Wetland Heath An *Astartea fascicularis-Pericalymma ellipticum* Closed Heath with occasional *Melaleuca preissiana* over a Low Open Shrubland of *Hypocalymma angustifolium, Calothamnus lateralis* and *Melaleuca lateritia* over an Open Sedgeland of *Lepidosperma longitudinale, Baumea articulata* and *Schoenus subfascicularis* in inundated humus rich sandy soils.	4
Transition communities:		
3	Herbland A *Patersonia occidentalis, Dasypogon bromeliifolius* and *Phlebocarya ciliata* Herbland with occasional *Jacksonia furcellata, Calytrix fraseri* and *Hypocalymma angustifolium* over an Open Sedgeland of *Lyginia barbata, Lepidosperma pubisquameum* and *Alexgeorgea nitens* in grey sands on gentle sandy rises from wetland areas.	Not an FCT
Woodland communities:		
4	Banksia Woodland *Banksia menziesii, B. attenuata* and *B. ilicifolia* with occasional *Eucalyptus todtiana* Low Woodland over a Shrubland of *Allocasuarina humilis, Daviesia divaricata* subsp. *divaricata* and *Conostephium pendulum* over an Open Herb/Sedgeland of *Mesomelaena pseudostygia, Alexgeorgea nitens* and *Conostylis aurea* on deep pale grey sands.	23a (strongly similar to 21a & 23b)

The reservation status of all inferred FCTs are "well reserved" and the conservation status is classed as "low risk" (Gibson *et al*. 1994). Currently none of the inferred floristic community types (FCT) are triggers under the EPBC Act (1999) and are not recognised as Threatened Ecological Communities at the State level (English and Blyth 1997).

Previous soil-based vegetation mapping for the region by (Heddle *et al*. 1980) describes the vegetation occurring across proposal area as the Southern River Complex. EPA Guidance Statement No. 10 (EPA 2003) provides some direction for vegetation complexes where less than 10% is protected or proposed for protection. It advises that the regional conservation value of an area should be assessed in the context of changes to the representation of ecological communities being protected. It is inferred that 19.8% of the pre-1750 extent of the Southern River Vegetation Complex remains within the area covered by the EPA Guidance Statement No. 10. Overall approximately 7% is currently held in secure tenure that will facilitate its long-term retention such that it is not subject to any impending threats or pressures.

4.3.5.2 Bush Forever and Linkages

Bush Forever replaces the System 6 recommendations as a blueprint for conservation of bushland of regional significance in the Perth Metropolitan Region(PMR).

Vegetation within the proposal area has been mapped as 'other vegetation' within Bush Forever and was generally contiguous with two adjoining areas of remnant vegetation prior to road construction and industrial development. The proposal area was surveyed twice during the preparation of the final Bush Forever report, but was not included as a Bush Forever site.

The adjoining vegetation to the east is Bush Forever Site No. 480 'Victoria Road Bushland' and the site to the south (separated by Reid Highway) is Bush Forever site No. 307 'Lightning Swamp'. Bush Forever site No. 480 has been zoned in the MRS as "Major Road/Railway Reserve" for the purposes of the Hepburn Avenue extension, which will result in a bisection of the wetland and clearing of significant areas of remnant vegetation.

In an analysis of existing and potential bushland/wetland linkages in the Perth Metropolitan Region, Bush Forever (Government of Western Australia 2000) suggested that the proposal area formed part of a regionally significant but not continuous linkage of bushland/wetland area.

4.3.5.3 Vegetation Condition

Vegetation condition was mapped according to the vegetation condition commonly used in Bush Forever Vol. 2 (Government of Western Australia 2000). The vegetation condition ranged from "Excellent" to "Completely Degraded" and is illustrated in **Figure 7**.

Essentially, the core areas of the wetland and a marginal wetland buffer area are in "Excellent" condition with the upland areas ranging from "Very Good" to "Completely Degraded". The effects of the encroaching industrial development are exemplified in **Figure 7** and **Figure 8**. The remnant vegetation edges are "Degraded" to "Completely Degraded" and only the inner core area is in "Very Good" to "Excellent" condition. Generally the area is in "Good" condition and hence would require intensive ongoing management to improve the overall prevailing vegetation condition ratings. The area's involved are referred to in **Table 4.3**.

Table 4.3: Summary of Vegetation Condition in the Proposal Area

Legend	Vegetation Condition	Condition Description (Based on the Bush Forever vegetation condition scale)	Area (ha)
1	Pristine	Pristine or nearly so, no obvious signs of disturbance	0.0
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive	3.4
3	Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing	1.2
4	Good	Vegetation structure significantly altered by very obvious sign of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing	2.3
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback or grazing	1.1
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as "parkland cleared" with the flora comprising weed or crop species with isolated native trees or shrubs.	3.6

The historic decline of vegetation condition is likely to be a direct result of numerous tracks traversing the proposal area. These firebreaks and tracks have allowed vehicle access and have resulted in rubbish dumping and other associated disturbances. Site visits revealed deep tracks in some area, which appear to be well used by 4WD vehicles. Weed invasion is generally low considering there has never been any access control or active weed management within the vegetation. Multiple dumpings of garden waste in the areas close to Victoria Road has significantly degraded the edges of Vegetation Community 1 (Melaleuca Forest).

4.3.5.4 Introduced Species

Introduced species were recorded in all vegetation communities. 30 introduced species were recorded across the proposal area and make up 11% of the total recorded flora. Introduced species were dominant from the Poaceae (grasses), Asteraceae (daisies) and Iridaceae (irises) families. The survey revealed that the entire proposal area has a number of common bushland weeds, including **Ehrharta calycina*, **Cynodon dactylon* and **Hypochaeris glabra*. These weeds are common both in local bushland and across most of the Swan Coastal Plain. Other weeds identified were common in localised pockets and a

number of 'garden escapees' were proliferating, and likely to have been spread by rubbish dumping in the area.

Vegetation Community 1 recorded 16 introduced species in the area (the most of any Vegetation Community), most of which are highly invasive and indicative of the degrading processes occurring in the area (**Appendix D**). Vegetation Community 4 recorded a lower diversity of introduced species but did exhibit more intensive infestations. Vegetation Communities 2 and 3 recorded lower species diversity and less intensity of invasions, which is likely to be due to the buffering effect provided by Vegetation Communities 1 and 4.

4.3.6 DIRECT IMPACTS

During the earthworks to construct Stage 1, the proponent's civil contractor failed to comply with EPA conditions and did not construct a fence to separate Stage 1 and Stage 2, which resulted in the clearing of an area of the upland vegetation along the boundary of the proposal area (in the order of approximately 0.5 hectares). The contractor was required to rehabilitate the area, based on rehabilitation conditions agreed by the EPA, and the rehabilitation works were completed in June 2003.

The direct impacts associated with the future implementation of the proposal in terms of vegetation and flora would be associated with the clearing of all vegetation within the proposal area to allow for the creation of industrial lots and the provision of associated infrastructure.

Table 4.4 gives a breakdown of the impacted vegetation communities occurring across the proposal area. The remaining areas of the site (4.69 hectares) are completely degraded and are not identified as any FCT.

Table 4.4: Expected Area of Each FCT Impacted by Proposal

Community Description		Inferred Gibson *et al.* (1994) FCT	Area Impacted (ha)
Wetland Communities			
1	Melaleuca Forest	4	0.46
2	Wetland Heath	4	4.14
Transition Communities			
3	Herbland	Not a FCT	0.46
Woodland Communities			
4	Banksia Woodland	23a	1.93
		TOTAL	**6.99**

4.3.7 INDIRECT IMPACTS

Indirect impacts to surrounding natural areas in relation to flora and vegetation may include disruptions to groundwater flow and quality (potentially affecting downstream phreatophytic vegetation) and increased edge effects arising from construction disturbances and ongoing activities within an active Industrial area. The most significant areas of remnant vegetation for which these effects should be considered are Bush

Forever Site No. 480 and Bush Forever Site No. 307, which are to the east and south of the proposal area respectively.

Bush Forever Site No. 480 is located within the Hepburn Avenue Road Reserve to the east of the proposal. Based on information contained in *Extension of Hepburn Avenue (Stage 2) from Marshall Road to Reid Highway, Malaga - Public Environmental Review* (Parsons Brinckerhoff, 2004), the condition of the existing remnant vegetation within Bush Forever Site No. 480 that is adjacent to the Malaga Industrial Subdivision proposal area was rated as "Degraded" and "Good" condition, which indicates that there has been significant historical degradation of this vegetation (see **Table 4.3** for condition descriptions). On this basis, any additional indirect impacts associated with the proposal to develop the Malaga Industrial Subdivision (the subject of this PER) are not likely to be significant given the current condition of the vegetation. The areas within Bush Forever Site No. 480 that were determined to be in "Pristine" and "Excellent" condition are located more than 100 from the nearest area of industrial development associated with this proposal.

Bush Forever Site No. 307 is located on the southern side of Reid Highway, and to the south of the Industrial Subdivision proposal area. The road reserve in which Reid Highway is situated is approximately 100 metres wide. The Reid Highway is a four lane divided road, which would serve as a significant and relatively absolute delineation between the proposal area and Bush Forever Site No. 307. Based on the significant distance between the proposal area and Bush Forever Site No. 307, and the presence of the Reid Highway, it is expected that the indirect impacts associated with the implementation of the proposal (being the development of an Industrial area) would be minor and are not likely to be considered significant.

The Perth Groundwater Atlas (WRC 1990) indicates that groundwater movement is from east to west, and based on this any alterations to the local groundwater regime are unlikely to have a significant impact on wetland dependant vegetation associated with Bush Forever Site No. 480 and Bush Forever Site No. 307. Notwithstanding this, while the implementation of the proposal is likely to bring about changes to the surface hydrological regimes through the creation of impermeable surfaces and the construction of engineered drainage systems, it is unlikely that these will have a significant impact on local groundwater levels (particularly outside the proposal area) and groundwater quality to the extent that impacts on downstream receiving environments would result. The proposal has been designed such that all stormwater is to be retained on site in accordance with City of Swan requirements and drainage best practice. Drainage management is addressed in more detail in **Section 4.5.6**.

4.3.8 ENVIRONMENTAL MANAGEMENT

The proponent commits to the preparation and implementation of a Wetland Mitigation Strategy in consultation with the CALM, DoE and EPA. The Wetland Mitigation Strategy will consider the flora and vegetation within the proposal area, will be developed in accordance with *Preliminary Position Statement No. 9: Environmental Offsets* (EPA, 2004). The Wetland Mitigation Strategy will be developed in consultation with and approved by CALM, DoE and EPA.

4.3.9 SUMMARY

Having regard to:

- the area supporting no Declared Rare Flora which has been confirmed from the October 2002 survey and other known surveys;
- the FCTs inferred in the area are considered to be well reserved;
- the rapid degradation of the edges of vegetation exposed to development that is likely to occur;
- the proposal area not being included in either Bush Forever or the System 6 areas;
- the future development proposed for the surrounding area;
- increased traffic flow and uncontrolled access to the proposal area as well as the likely incidence of fire and introduction of weeds and pathogens by rubbish dumping;
- the currently approved road construction through the wetland;
- the low probability of significant indirect impacts occurring to adjacent Bush Forever sites arising from the implementation of the proposal; and
- a Wetland Mitigation commitment (**Section 4.6**),

it is concluded that the EPA's objective for this environmental factor can be met.

4.4 FAUNA AND HABITAT

4.4.1 EPA SCOPE OF WORK

- The PER will involve baseline studies to identify the existing fauna and habitats in the proposal area;
- Surveys will be conducted in accordance with the EPA Position Statement No. 3 (2002) Terrestrial Biological Surveys as an Element of Biodiversity Protection, and include a desktop, a reconnaissance survey and a comprehensive fauna survey;
- The proposal area will be specifically surveyed for Specially Protected (Threatened) Fauna and CALM and Environment Australia will be consulted in accordance with the Wildlife Protection Act 1950 and the Environmental Protection and Biodiversity Conservation Act 1999, as required; and
- The PER will discuss the direct and indirect impacts of the proposal on the existing fauna and their habitats.

4.4.2 EXISTING ENVIRONMENT

The Swan Coastal Plain lies in the southwest portion of the southern Bassian zoogeographic region (Serventy & Whittell, 1976) and in the Darling Botanical District of the mesic South-West Botanical Province (Beard, 1981). It is a biogeographic region of considerable environmental significance, described in the Biogeographic Regionalisation of Australia (ANCA, 1997) as:

> *"Low lying coastal plain, mainly covered with woodlands. Banksia or Tuart dominates it on sandy soils, Allocasuarina obesa on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. The area has a Warm Mediterranean climate. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by A. obesa-marri woodlands and Melaleuca shrublands, are extensive only in the south."*

Botanically the region includes species from the relatively more xeric districts of Irwin to the north and Avon to the east, in combination with species from the wetter southwest. In addition, the Swan Coastal Plain is the centre of distribution for many flora species and contains numerous endemics, resulting in comparatively high species richness. The biogeographic patterns of the fauna parallel those of the flora; the area containing predominantly mesic south western species with some northern elements, resulting in relatively high species richness, but with few endemic fauna species.

With colonisation and development of much of the Swan Coastal Plain for agricultural and then residential purposes, regional and local extinction of numerous vertebrate (particularly mammalian) species has occurred. Changes in distribution and abundance of the vertebrate fauna as a consequence of urban development have been described in some detail by How and Dell (1993). Habitat modification and fragmentation and exotic predators are thought to be the primary factors that have caused a dramatic reduction in the species richness of the region (Kitchener et al., 1978; Storr, Harold and Baron, 1978, How & Dell, 2000). Fire, particularly increased fire frequency in urban bushland remnants, is also

thought to have had a negative influence on the fauna (How, 1978), with some vertebrate taxa more strongly impacted than others (Dell & How, 1995).

4.4.3 SURVEY METHODOLOGY

The fauna survey methodology was undertaken in two stages. Firstly reconnaissance work, habitat survey and assessment, and compilation of indicative species lists by Dr. Ray Hart from Hart Simpson and Associates. Following this, Dr. Mike Bamford from Bamford Consulting Ecologists undertook a more comprehensive review of previous survey work from the local area and a second site survey.

Guidance Statement 56: *Terrestrial Fauna Surveys for Environmental Impact Assessment* (EPA, 2004) suggests a Level 2 survey for sites where a high degree of habitat loss has occurred and where the proposal will have a high impact on the site. Level 2 surveys involve a comprehensive field program including trapping at peak times of the year and some seasonal surveys. The fauna methodology undertaken for this PER is consistent with a through Level 1 assessment, based on the proposal area being situated in a region where a considerable body of information on fauna and fauna habitats is available. Since it was concluded (based on consultation with the DoE) that trapping would simply confirm the species that could confidently be expected to occur at the site, trapping was not undertaken as part of the survey methodology.

4.4.3.1 Desktop and Existing Information Review

The fauna of the Perth region is quite well-known, particularly for vertebrates, with general information on distribution and habitats available for frogs (Tyler *et al.* 2000); reptiles (Storr *et al.* 1983, 1990, 1999 and 2002); birds (Barrett *et al*. 2003; Johnstone and Storr 1998; the Handbook of Australian and New Zealand Birds 1989 - 2003); and mammals (Menkhorst and Knight 2001; Strahan 1995). In addition, there are some publications specific to the Perth area, including the Bush Forever documentation (Government of Western Australia, 2000) that provides a summary of available information on fauna in the Perth region; Bush *et al.* (1995) for frogs and reptiles; van Delft (1997) for birds; and Wykes (1991) for a range of species.

To supplement information obtained from these publications, specimen records of frogs, reptiles and mammals held by the Western Australian Museum (Faunabase) were obtained for the region, with further information on threatened and specially protected species from the threatened fauna database maintained by CALM and the EPBC database. The two latter databases provide information only on a broad scale. The Atlas Database of Birds Australia was searched for Perth Metropolitan Region.

General publications and databases provide only a broad indication of species likely to be present in an area as small as the proposal area; therefore records from specific studies carried out at nearby locations were considered important for developing an understanding of the fauna likely to be present. Information from comprehensive fauna surveys was available for Whiteman Park (Arnold *et al.* 1991, Bamford and Bamford 2000 & 2002, Brooker 2004 and a fauna database maintained by Dr M. Bamford on behalf of the Whiteman Park Authority), Bennett Brook (Cooper *et al.* 1999), and Lightning Swamp (Murdoch University, 1996). Maryan *et al.* (2002) and Bamford and Davis (2004) present the results of detailed

fauna sampling just to the north of Whiteman Park, where the influence of urbanisation can be expected to be low. Bamford Consulting Ecologists also has a private database of fauna records from, sites in the region of the Malaga site, including bushland near Alexander Drive and Koondoola Open space.

In addition, there are publications that provide an indication of what fauna are expected to persist in small remnants of native vegetation in urban areas. These include Dell and How (1993, 1995), How and Dell (1993, 2000), How (1998), How *et al.* (1996), Cooper (1995) and Turpin (1990, 1991a, 1991b). The Bush Forever Report (Government of Western Australia, 2000) provides a summary and review of many of these publications.

These sources of information were used to create lists of species known from the region and species expected to occur at the site. In this case, the region is defined as an area of approximately 10km radius of the proposal area, but excluding broad habitats that are not represented within the proposal area (e.g. such as heavy soils associated with the base of the escarpment). Expected species are those that are likely to utilise the project area, and exclude species that have been recorded in the general region as vagrants or for which suitable habitat is absent. Particularly among the birds, for example, vagrants can be recorded almost anywhere. The lists also excludes species that are considered to be regionally extinct based on information provided by CALM and in the Bush Forever Report (Government of Western Australia, 2000).

A list of rare species known from the general area was obtained from the CALM Rare Fauna database. All other species that might be present were considered so that all rare species could be identified.

4.4.3.2 Field Survey

Two separate field surveys were carried out as part of the process of compiling the fauna information used in the preparation of the PER.

Dr. Ray Hart of Hart Simpson & Associates Pty Ltd. carried the initial field survey in July 2002, in order to identify the likely fauna present, habitat values of the proposal area, and to identify potential impacts of the proposal on these fauna and habitats.

Specifically this initial survey was carried out to:

- Describe the habitats present and their condition.
- Record the species present in an opportunistic survey.
- Identify any rare species present or which might be present.
- Identify the values of the habitats and the fauna.

The proposal area was examined on foot traverses. The habitats present were recorded from the vegetation, plant species present, soils, hydrology, and vegetation condition. The surrounding area was also examined briefly to provide a wider local context.

An opportunistic search for fauna was carried out during the fieldwork. This consisted of observing birds and larger mammals, searching for frogs and reptiles under vegetation and rubbish, and recording any other signs including feathers, bones, burrows, diggings and droppings which could be used to identify species which might be present.

The second field survey was undertaken in November 2004 by Dr Mike Bamford of Bamford Consulting Ecologists Pty Ltd. The purpose of this survey was to re-assess the fauna habitats present within the proposal area (based on the initial habitat assessment work) and also to record some of the most conspicuous fauna species on the site. As part of the site inspection, nearby locations were visited and briefly examined, including Lightning Swamp Conservation Area (Bush Forever Site No. 307), which lies adjacent to the proposal area, south of the Reid Highway.

4.4.3.3 Assessment of Conservation Significance

The conservation status of fauna species is assessed under Commonwealth and State Acts such as the *Commonwealth Environment Protection and Biodiversity Conservation Act* (EPBC Act) 1999 and the *Western Australian Wildlife Conservation Act* 1950. The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN) and reviewed by Mace and Stuart (1994). The *WA Wildlife Conservation Act* 1950 uses a set of Schedules but also classifies species using some of the IUCN categories. These categories and Schedules are described in **Appendix I**.

The EPBC Act also has lists of migratory species that are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA) and the Bonn Convention (The Convention on the Conservation of Migratory Species of Wild Animals). The list of migratory species under the EPBC Act has been revised to include listed species only, thus excluding family listings. Those species listed in JAMBA are also protected under Schedule 3 of the *WA Wildlife Conservation Act*. The EPBC also lists marine species, but this applies only to lands and waters managed by the Commonwealth. In addition, the Department of the Environment and Heritage (DEH, formerly Environment Australia) has supported the publication of reports on the conservation status of most vertebrate fauna species including reptiles (Cogger *et al.* 1993), birds (Garnett and Crowley 2000), monotremes and marsupials (Maxwell *et al.* 1996), rodents (Lee 1995), and bats (Duncan *et al.* 1999). These publications also use the IUCN categories, although those used by Cogger *et al.* (1993) differ in some respects as this report pre-dates Mace and Stuart's review (1994).

In Western Australia, CALM has produced a supplementary list of Priority Fauna, being species that are not considered Threatened under the WA Act but for which the Department feels there is cause for concern. Levels of Priority are described in **Appendix I**.

Fauna species including those under conservation acts and/or agreements are formally recognised as of conservation significance under State or Federal legislation. Species listed only as Priority by CALM, or that are included in publications such as Garnett and Crowley (2000) and Cogger *et al.* (1993) but not in State or Commonwealth Acts, are also of recognised conservation significance. In addition, species that

are at the limit of their distribution, those that have a very restricted range, and those that occur in breeding colonies, such as some waterbirds, can be considered of conservation significance, although this level of significance has no legislative or published recognition and is based on interpretation of distribution information. This sort of interpretation was used to identify significant bird species in the Perth Metropolitan Area as part of Perth Bushplan (Government of Western Australia, 2000).

On the basis of the above comments, three levels of conservation significance are recognised in the PER:

- *Conservation Significance (CS) 1*: Species listed under State or Commonwealth Acts.
- *Conservation Significance (CS) 2*: Species not listed under State or Commonwealth Acts, but listed in publications on threatened fauna or as Priority species by CALM.
- *Conservation Significance (CS) 3*: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

4.4.4 HABITATS

The habitats present are Jarrah-Banksia woodland on grey sand and scattered paperbarks over shrubs and dense sedges on humic sand in a dampland.

Originally there would have been a tall tree stratum of Jarrah over smaller Banksias and Sheoaks, and possibly with Pricklybark (*Eucalyptus todtiana*) in places as these are present immediately to the south west on taller dunes. Most of the Jarrah and possibly the Sheoaks have been removed for timber, leaving only small trees. There is an understorey of diverse shrubs and perennial herbs mostly less than 1m tall. This vegetation is in variable condition. An area on the south-west side is in excellent condition, while areas on the north-west side are in poorer condition with extensive disturbance and weed invasion or completely cleared. An area on the eastern side is in poor condition with only scattered trees and understorey species in amongst numerous weeds and some bare ground. This degradation has probably been caused over many years by a combination of partial clearing, grazing by stock and rabbits, localised disturbances and excessive burning. There has also been extensive and continuing rubbish dumping.

There is an overstorey of patchy *Melaleuca preissiana* ranging from tall shrubs and small trees forming thickets, particularly in the north, to some large isolated trees in the centre. The trees are over variable shrubs that are dominated by myrtaceous species, and over a dense stratum of sedges and rushes with some herbs and other low species. The soil is humic sand that is muddy in places. The proposal area is relatively wet and in November there was standing water in deep wheel ruts, which had cut into the soil where vehicles had been bogged. Much of this dampland vegetation is in excellent condition with little or no damage to the vegetation density or structure, apart from localised disturbances due mainly to track clearing and some rubbish dumping. Grazing by rabbits is severe in places.

The proposal area is well divided into these two habitats, with only a limited fringe of more dense shrubs under Banksias along the boundary. Despite the extent of disturbance by tracks a large part of the proposal area has native vegetation in excellent condition with some degraded areas around the edge.

The key habitat features are:

- dense dampland vegetation in excellent condition;
- tall paperbark trees; and
- good quality Banksia woodland in the south-west corner.

The proposal area considered here is large enough to support populations of many of the smaller fauna species, and to accommodate many mobile bird species, but there appear to be no kangaroos remaining. The dampland area is larger and in better condition than the Banksia woodland area.

The vegetation of the proposal area is relatively isolated within an area that is becoming more developed as an urban and industrial area. There is no adjacent native vegetation to the northwest or north. The adjoining vegetated areas are:

- Vegetation of both units along the Reid Highway to the south, although this is not continuous and is in variable condition. This is in turn connected to other areas to the south as well as east-west along the Reid Highway.
- An adjacent area on the south west side of good quality Banksia woodland continuous with that considered here, although this is likely to be cleared in time as the industrial estate develops further.
- Poor quality and patchy Banksia woodland on a site to the east (Bush forever Site No. 307) similar to that described on the proposal area considered here, and areas without vegetation in the north-east and south-east corners.

The main values of the fauna habitat are as follows:

- An urban remnant of habitat for common species in an area otherwise heavily cleared; and
- As part of a potential corridor of fragmented vegetation through the urban area which allows the possibility for the movement of migratory and nomadic species, and for mobile species at least to colonise small areas.

Many species of birds in particular move through the suburban area as part of local and regional movements as well as long distance movements, and even small remnants or single trees may be of value to some species. The most important features are the dense dampland vegetation, tall paperbark trees, and the good quality Banksia woodland in the southwest. The paperbarks provide tall roosting proposal areas as well as limited nesting hollows for a few species. The areas of good quality vegetation provide the opportunity for smaller species to move through the remnant, as well as providing direct habitat.

4.4.5 FAUNA SPECIES

Vertebrate fauna known from the general region of the Malaga site are listed in **Tables J1**, **J2**, **J3** and **J4** included in **Appendix J**, with species expected to occur at the site indicated. As noted above, these general lists exclude fauna associated with environments that are not present within the proposal area, such as vegetation of heavy soils at the base of the escarpment to the east, and vegetation of calcareous soils with limestone close to the surface that lie to the west. The intention of these lists is to show the species that could have occurred at proposal site if it was not a small, degraded and partly isolated

remnant of native vegetation, and the species that are likely to persist and rely upon a remnant of this nature and condition.

4.4.5.1 Amphibians

Two frog species were recorded at the site and up to nine species can be confidently expected to be present (see **Appendix J**). One species listed for the area by the WA Museum, the Marbled Frog, is probably not present, as it is not known from Whiteman Park or any other sites in the region. The Sandplain Froglet was breeding during the November 2004 survey.

The frog fauna list for the site is likely to be complete or very nearly so. All species except the Turtle Frog, which breeds terrestrially, would rely on the wetland for breeding, but the majority are also likely make extensive use of upland habitat.

Most of the frog species present or expected to be present are widespread in the Perth area where suitable habitat remains, and several persist in very badly degraded wetlands. Two species are considered to be of Conservation Significance Level 3; as they have no formal conservation significance but are locally significant.

The Quacking Frog is patchily distributed around Perth, being absent from many apparently suitable wetlands. The Turtle Frog is confined to upland areas and has therefore probably declined around Perth to a greater extent than wetland-dependent species, since wetlands are often retained during clearing for development.

4.4.5.2 Reptiles

Six reptile species were recorded within the proposal area and up to 26 species can be confidently expected to occur (see **Appendix J**). This is contrasted against a total of 42 species still extant in the wider Malaga region. Species known from the Malaga region but not expected within the proposal area are mostly uncommon species that have not been recorded in other small bushland remnants in the area.

Most of the reptile species would be expected in the upland environment, although could make some use of dampland areas, while the Long-necked Tortoise, Cool Skink and Tiger Snake are closely associated with dampland and wetland areas. The Long-necked Tortoise is probably only an occasional visitor to the site, since the wetland is not permanent.

None of the reptile species recorded as present or expected to be present, from either the site or the wider Malaga region, are of conservation significance. The South-western race of the Carpet Python *Morelia spilota imbricata* is listed under Schedule 4 of the *WA Wildlife Conservation Act*, but it is almost certainly regionally extinct. In the Perth Metropolitan Area it is known to persist only in large tracts of undisturbed vegetation in outer areas (Bush *et al.* 1995). The Black-striped Snake (Conservation Significance Level 2 due to its inclusion in Cogger *et al.* 1993) is present in the region but is considered unlikely to persist within the proposal area. It is one of a suite of fossorial (burrowing) snakes that persist around Perth only in large tracts of remnant woodland.

Cooper (2002) lists only six reptile species as occurring in local gardens, while a number of other species also occur in gardens regularly (based on person observations by Dr. M. Bamford). On this basis, all other reptile species that persist in woodland remnants are probably locally dependent upon such remnants. This could be considered to make such species Conservation Significance Level 3, as has been done for birds dependent upon remnant native vegetation in the urban area (Government of Western Australia, 2000). On this basis, 14 of the 26 reptile species either observed or expected are Conservation Significance Level 3 because they are dependent upon the remnant native vegetation (see **Appendix J**).

4.4.5.3 Birds

Twenty-five (25) bird species were recorded within the proposal area, and up to 67 species can be confidently expected to occur (see **Appendix J**). This is contrasted against a likely total of 91 species still extant in the Malaga region. This total excludes vagrants and species associated with large wetlands. Species known from the Malaga region but not expected within the proposal area are those for which the site provides little or no suitable habitat. Species observed or expected at the site include some closely associated with wetlands, such as ducks and herons, species associated with woodland, and a few associated with cleared land.

Bird species of conservation significance are indicated in **Appendix J** and are also discussed below in **Table 4.5**.

Table 4.5: Bird Species of Conservation Significance

Conservation Significance Level 1
Carnaby's Black-Cockatoo - Listed as endangered under the EPBC Act, the WA Wildlife Conservation Act and by Garnett and Crowley (2000). The proposal area provides some foraging habitat for this species. **Peregrine Falcon** - Listed as 'other specially protected fauna' under the *WA Wildlife Conservation Act*. Likely to be an occasional visitor to the site but there is unlikely to be suitable nesting habitat. Small areas of remnant vegetation in the Perth area are of low importance for the Peregrine Falcon unless they provide nesting sites. **Rainbow Bee-eater -** Classified as migratory under the JAMBA, CAMBA and Bonn Convention, and as such is protected under the EPBC Act. The Rainbow Bee-eater may occasionally nest at the site, but this is an opportunistic species that will nest on the banks of roads and around construction sites, so small areas of remnant vegetation in the Perth area are of low importance for it. **Fork-tailed Swift -** Classified as migratory under the JAMBA, CAMBA and Bonn Convention, and as such is protected under the EPBC Act. The swift is an aerial forager that is unlikely to utilize the site. **Great Egret -** This egret is classified as migratory under the JAMBA, CAMBA and Bonn Convention, and as such is protected under the EPBC Act. Individuals may occasionally visit the wetland on the site.
Conservation Significance Level 3
Twenty-two of the bid species either observed or expected are of Conservation Significance Level 3, mostly because they are listed in Bush Forever (Government of western Australia, 2000) as having declined in the Perth area and as dependent upon native vegetation. Six of these species have been recorded on the site, and it is notable that the Splendid Fairy-wren and Western Thornbill were observed during the preliminary survey by Hart, Simpson and Associates (2002) and subsequently during the follow-up survey by Bamford Consulting Ecologists (2004). Both these species tend to disappear from small bushland remnants in the Perth Metropolitan Area over time.

4.4.5.4 Mammals

The mammal fauna representation is very poor, with only one native species, the Quenda or Southern Brown Bandicoot, observed (see **Appendix J**). This observation was during the preliminary survey by Hart, Simpson and Associates (2002), and there was no evidence of the species during the follow-up survey by Bamford Consulting Ecologists (2004), so it may no longer be present. However, it is abundant in nearby areas such as Whiteman Park and Lightning Swamp, so there is potential for it to recolonise the site if it is currently absent. The Quenda is Conservation Significance Level 2 (listed as Priority 5 by CALM), and as lower risk (near threatened) by Maxwell *et al.* (1996).

Nine (9) mammal species may potentially present on the site contrasted with a total of 19 expected for the Malaga regional area. The absence of so many species known from the proposal area is largely attributable to the site being small and larger mammals in particular require large areas of relatively intact habitat.

4.4.5.5 Invertebrates

Little information on invertebrates is currently available, but there may be threatened invertebrate species present. Bush Forever (Government of Western Australia, 2000) lists 5 species of native bee, a cricket, and a moth as being threatened and present in the Perth Metropolitan Area. Two of the native bees, *Leioproctus douglasiellus* and *Neopasiphae simplicior* are listed under Schedule 1 of the *WA Wildlife Conservation Act* 1950 and are therefore are Conservation Significance Level 1. Both are known to forage on flowers of Goodeniaceae, and since there are 6 species this family known to occur on the site, there is a possibility that it these species may occur on the site, although this was not confirmed during either of the surveys.

4.4.6 ENVIRONMENTAL IMPACT

4.4.6.1 Direct Impacts

The direct impacts of the proposal on vertebrate and invertebrate fauna species will be the loss of habitat through the clearing and subsequent implementation of the proposal. This involves 3.6ha of potential habitat ranging from "Excellent" to "Completely Degraded".

Although the proposal area is small and part of the upland vegetation is degraded, the site does support a moderately rich assemblage of native fauna. The persistence of some bird species that usually disappear from small bushland remnants is of particular interest, although this likely to be attributed to the surrounding bushland being cleared in recent years.

Few threatened species are known or expected on the site. Carnaby's Black-Cockatoo and the Quenda or Southern Brown Bandicoot are known to use the site, and two threatened invertebrates could potentially be present, most likely in areas where the understorey is in good condition.

The Black-Cockatoo is likely to utilise *Banksia spp*. within the proposal area for occasional foraging, and based on studies of the food value of *Banksia spp.* seeds (Cooper *et al.* 2002) and the density of *Banksia* trees in woodland around the Perth Metropolitan Area, it has been estimated that *Banksia* woodland can support Carnaby's Black-Cockatoo at a rate of 3 birds per hectare per year (based on unpublished data from Bamford Consulting Ecologists). There is approximately. 3.5 ha of *Banksia* woodland within the proposal area so this represents a relatively low foraging value for this species.

Quendas were present during the survey by Hart Simpson and Associates (2002) but appeared to be absent during the Bamford Consulting Ecologists (2004) survey. The site lies between areas such as Whiteman Park and Lightning Swamp conservation areas where the species is known to be abundant, so the site may be important for supporting dispersal and genetic exchange between populations. There may be a regional role of the site for a number of species in the Malaga area, as native vegetation is highly fragmented (although with a broken corridor) along Reid and Tonkin Highways.

If the proposal does not proceed the road will be constructed through the wetland and any remaining environmental values will continue to rapidly degrade over time. Further it is the proponents view that

the Shire of Swan or CALM are unlikely to accept vesting and management of the wetland for conservation purposes if the road is constructed.

4.4.6.2 Indirect Impacts

Implementation of the proposal will result in complete loss of the wetland and its surrounding buffer, which would result in the loss of a linkage function. It is not possible to avoid or minimise this impact through the development process, and this could potentially affect populations of some fauna species in nearby areas, although the extent of this impact is very difficult to predict.

4.4.7 ENVIRONMENTAL MANAGEMENT

The proponent commits to the preparation and implementation of a Wetland Mitigation Strategy in consultation with the CALM, DoE and EPA. The Wetland Mitigation Strategy will be prepared in accordance with *Preliminary Position Statement No. 9: Environmental Offsets* (EPA, 2004). The Wetland Mitigation Strategy will be developed in consultation with and approved by CALM, DoE and EPA.

4.4.8 SUMMARY

Having regard to:

- the development of the site not imparting unacceptable impacts on any threatened fauna species;
- the site not providing critical habitat for any fauna species that does not already occur at other local and/or regional sites that provide more suitable or intact habitat;
- the linkage value of the site being likely to significantly decline over time due to continued development in surrounding areas and the construction of significant regional roads;
- the rapid degradation of the edges of vegetation exposed to development;
- the future development proposed for the surrounding area;
- increased traffic flow and uncontrolled access to the proposal area as well as the incidence of fire and introduction of weeds and pathogens by rubbish dumping;
- approved road construction; and
- a Wetland Mitigation commitment (**Section 4.6**),

it is concluded that the EPA's objective for this environmental factor can be met.

4.5 WETLANDS

For the purposes of this document and as outlined in EPA (1991), wetlands are defined as:

> *"Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including area of marine water the depth of which at low tide does not exceed six metres." (UNESCO 1971)*

Wetlands of the Swan Coastal Plain exist mostly as expressions of the water table due to the sandy nature of the underlying soils. Pressure from development and water extraction from the two major aquifers (Gnangara and Jandakot Mounds) in the region have had degrading effects on wetland processes and it is widely accepted that 80% of wetlands on the Swan Coastal Plain have been destroyed and the remaining areas degraded to varying extents (EPA 1991).

4.5.1 EPA SCOPE OF WORK

- The wetland boundary has already been accurately mapped using a differential GPS;
- The revised boundary of the wetland will be referred to the WRC in preparing the PER, for endorsement and record of the new boundary in the regional wetlands database;
- The PER will describe the values, functions and attributes of the wetland;
- The PER will describe how the CCW will be directly impacted by the proposal;
- The PER will describe how the removal of this wetland may indirectly impact other wetlands and ecosystems nearby;
- The PER will assess the wetland's future if the proposal is not approved, considering recent development to the north, the other planned developments for the land directly south of the proposal and current environmental management plans; and
- The PER will describe how drainage infrastructure will be constructed and managed to ensure the existing hydrological system are not adversely affected.

4.5.2 EXISTING ENVIRONMENT

In studies carried out in 1987 and 1988, Semenuik described 42 interrelated or consanguineous wetland systems in the Darling System based on the criteria of wetland type, wetland geometry, stratigraphy, inferred origin and water characteristics which were used as an interpretation tool in *The Wetlands of the Swan Coastal Plain* (Hill *et al.* 1996).

In 2001, WRC provided advice to the (then) Ministry for Planning and outlined a number of studies undertaken for the wetland located on the industrial subdivision of Lots 300 - 303 and 14 &15 Beringarra Avenue, some of which are available for viewing from WRC. References are not complete for the entire list as reference is taken directly from WRC correspondence and are not all publicly available.

Nonetheless, the reports listed below demonstrates that various agencies and conservation groups have studied the area over many years and the status of CCW has been confirmed over this time without

progress to protect the proposal area within the conservation estate or as a Bush Forever site. A number of the reports state that the area was not at risk however the industrial zoning that has been in place since 1990 suggests that the proposal area would be developed for this purpose and therefore the wetland would be at risk.

Ecological studies carried out in the area, as well as those outlined by WRC are:

1. **Wetland Vegetation Assessment Project from Moore River to Mandurah (1993)**
   This project is referred to in WRC correspondence but is not expanded on, except to say that the wetland was recognised in this study.

2. **Hill *et al*. (1996). *Wetlands of the Swan Coastal Plain***
   The wetland in question was part of a larger system described on Map 2034 II NE as 43Sc – Victoria Road Sumpland. It was ranked within the top 10% of the Bennett Brook suite as being an "outstanding wetland recognised in other regional studies", namely the above assessment.

3. **V&C Semenuik Research Group (1997). Wetland Verification Project**
   Wetland verification work undertaken for the draft of Perth's Bushplan (Government of Western Australia 1998). The boundaries of 43Sc were redrawn to reflect cleared areas and it was again confirmed as a CCW.

4. **Alan Tingay & Associates (1999). Assessment of CCWs**
   This report was commissioned by WRC to assess the risk of CCWs no longer being conservation category. This report studied the proposal area and recommended it still be given "Conservation" management category.

5. **WRC (2000). Wetland Verification Project**
   As part of the finalisation of Bush Forever (Government of Western Australia, 2000), the wetland was again studied by WRC and found again to be a CCW but not included as a Bush Forever site.

4.5.3 WETLAND SURVEY METHODOLOGY

The latest Water and Rivers Commission wetland mapping (WRC 2002) was used to identify any areas of wetland that may occur within, or immediately adjacent to, the proposal area. The field survey also involved the potential for recording any low-lying or dampland areas.

WRC mapping of wetlands has been produced from the interpretation of aerial photography. Using a differential GPS, BSD Consultants accurately mapped the wetland on 13 March 2001. The boundary of the wetland was defined as being the extent of wetland dependant vegetation, and in this case this was clear from the extent of *Astartea fascularis* and *Pericalymma ellipticum.* The position of the wetland mapped with the differential GPS in relation to WRC data and the boundaries of the proposal is shown in **Figure 5**. The GPS recoded boundary was referred to WRC (at that time being DoE) in July 2004 for review and endorsement and as a record of the new wetland boundary.

The other environmental values of the wetland were surveyed in line with the flora and vegetation methodology.

4.5.4 WETLAND MANAGEMENT CATEGORIES

Much of the Swan Coastal Plain is categorised by wetland environments. Conservation and management of these resources have required that classification systems be developed in order to group and describe the variations in wetland types. One recognised system is that of Semeniuk (1988) based on geomorphic setting and hydrological processes. The resultant classification allocates individual wetlands with shared characteristics to wetland suites.

Large discrepancies in the condition of wetlands has added further classification systems, such as that detailed in Hill *et al.* (1996), which is based on a range of characteristics of individual wetlands including size, condition, physical, hydrological and biological functions, and human use attributes. The mapping and discussion of the wetlands impacted by the proposal are based on the results of this mapping system. The data has been updated over the intervening years by the WRC, and it is data from October 2000, which has formed the basis for the following assessments.

The wetland management categories as set out in Hill *et al* (1996) are defined in **Table 4.7**.

Table 4.7: Wetland Management Categories and Management Objectives

Management Category	Description of Wetland	Management Objectives
Conservation (C)	Wetlands which support high levels of attributes and functions.	To preserve wetland attributes and functions through reservation in national parks, crown reserves, state owned land and protection under environmental protection policies.
Resource Enhancement (R)	Wetlands which have been partly modified but still support substantial functions and attributes.	To restore wetlands through maintenance and enhancement of wetland functions and attributes by protection in crown reserves, state or local government owned land and by environmental protection policies, or in private property by sustainable management.
Multiple Use (M)	Wetlands with few attributes which still provide important wetland functions.	Use, development and management should be considered in the context of water, town and environmental planning through land care.

In general, the wetland areas classified as being in the 'Multiple Use' management category are totally or mostly cleared, and are used for agricultural purposes. These wetlands still serve hydrological functions, such as groundwater recharge and flood mitigation. The wetlands that are designated 'Resource Enhancement' have some native vegetation remaining, but are also often used for grazing or agistment of horses or other stock. They can be considered to have hydrological functions but limited biological significance. Only the wetlands in the 'Conservation' management category support relatively intact vegetation and have a range of natural attributes that render them significant.

4.5.5 WETLAND SIGNIFICANCE

A CCW is partially (but largely) situated within the boundaries of the proposal. The wetland in the proposal area is part of what was a larger wetland, described on Map 2034 II NE in *The Wetlands of the Swan Coastal Plain Vol 2B* (Hill *et al.* 1996) as 43Sc, Victoria Road Sumpland. Wetlands of the area generally consist of low-lying sumplands in which the groundwater is located very close to the surface and usually expressed in depressions.

The wetland, since originally being identified as a CCW by the DEP in 1996, has been the subject of numerous studies and has had its CCW status reconfirmed in 1997, 1999 and twice in 2000. The wetland within the proposal area has been recognised in the top 10% of the Bennett Brook Suite based on its natural values.

According to Hill *et al.* (1996), the Victoria Road Sumpland extended approximately two kilometres to the east in an undulating manner, past Beachboro Road North. The proposal area is the most southern extent of the original Victoria Road Sumpland.

In 2004, WRC mapping displayed three conservation category wetlands of the Victoria Road Sumpland in the Malaga area. Since that time, the wetland to the direct north of the proposal area has been destroyed and is now a drainage sump.

The proposal area is one of three conservation category wetland areas of the Victoria Road Sumpland and the only CCW of this group held as private property. The other two wetlands of this type to the east of the proposal site, one is reserved for the construction of Hepburn Avenue extension and the other is reserved for "Parks and Recreation".

The wetland reserved for road construction is the largest area of remnant wetland, with the proposal area being the second largest and the wetland to the northeast the smallest. One resource enhancement wetland lies to the southeast of the proposal area and is within road reserve and land zoned "Urban" by the MRS. The remaining areas of the Victoria Road Sumpland are "Multiple Use" management category.

4.5.5.1 Consanguineous Suite Values

The term "consanguineous suite' was defined by Sememuik in a paper published in the Journal of the Royal Society of Western Australia in 1988 is used to described the relationship between wetlands in terms of proximity, size/shape, wetland type (e.g. dampland or lake) salinity, hydrology and geological origin. The consanguineous suite theory was further developed in Hill *et al*. (1996).

The proposal area falls within the Jandakot consanguineous suite of wetlands, which are located in the Bassendean Dune System. The Jandakot suite is a reflection of the natural groundwater level expressed as sumplands and damplands (Hill *et al.* 1996). The proposal area was originally described within the Bennett Brook suite however consanguineous suite boundaries were revised and the wetland is mapped as Jandakot suite in Hill *et al.* (1996).

The area covered by the Jandakot suite is significant and follows the band of the Bassendean Dune system running parallel to the coastline varying from 5 to 25 kilometres inland. An area of Jandakot suite mapped outside the Perth Metropolitan Region stretches from south of Waroona to Australind (approximately 45 kilometres) and runs parallel to the coast in an approximately 5 kilometre wide band. Other areas of Jandakot suite are likely to exist outside the Perth Metropolitan Area. The condition of the rural wetlands are not known however this area is heavily used for primary production and many of the wetland may be degraded. A long band of Jandakot wetlands also run north from Wanneroo to Wedge Island.

Within the Perth Metropolitan Area, the Jandakot suite runs inland from the coast from inland of Rockingham to the Swan River in South Perth, then occurs again after the river from Mt Lawley to Malaga and begins again after Wanneroo extending out of the Perth Metropolitan Area to past Gingin.

The Malaga area was once a significant wetland system but the vast majority of the wetland has been cleared for development, with the three wetlands of Victoria Road being the only vegetated remnants remaining. Original wetlands still exist in the general location as drainage sumps.

4.5.5.2 Regional Conservation Values

Regionally significant bushland has been identified for the Perth Metropolitan Region by environmental studies over a number of years. The recommendations of System 6 “Red Book” produced in 1983 by the Department of Conservation and Environment (DCE) was based on a contribution of government agencies to recommend areas for conservation reserves on the Swan Coastal Plain. In recent years, the System 6 recommendations for the Perth Metropolitan area of the Swan Coastal Plain have been updated to become Perth’s Bushplan (Government of Western Australia 1998), then ultimately becoming Bush Forever recommendations (Government of Western Australia 2000).

The criteria for the selection of regionally significant bushland is based on (adapted from Government of Western Australia 2000):

- Representation – of the range of vegetation community types;
- Diversity – areas with a high range of flora and/fauna;
- Rarity – areas containing rare or threatened species or communities;
- Maintaining ecological systems or processes;
- Scientific or evolutionary importance – such as fossilised material or unusual relics;
- Wetland, streamlines and estuarine systems; and
- Other criteria – may have landscape or historical values.

The second wetland of the Jandakot suite in the area exists to the east and is defined in Bush Forever (Government of Western Australia 2000) as Bush Forever site 480, Victoria Road Bushland. This area is partially reserved for the construction of the Hepburn Avenue extension and has been listed in Bush Forever as ‘Major Road and Rail Reserve Mechanism’.

The regional significance of this area is described as:

- Representation of ecological communities;
- Diversity; and
- General criteria for the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation.

The proposal area has similar regional values as it is part of the same system and in similar condition. The proposal area was surveyed twice during the implementation of Bush Forever, as discussed in WRC communication to the EPA supporting a formal assessment of the proposal, however even with the survey confirming a CCW and the wetland occurring within the top 10% of the Bennett Brook suite based on natural values, it was not included as part of Bush Forever site 480. This wetland has been considered part of the Bennett Brook suite for many years and it is not known if this wetland is in a similar percentile of the Jandakot suite.

4.5.5.3 Local Conservation Values

The Malaga area was once a significant wetland system but the vast majority of the wetland has been cleared for development, with the three wetlands of Victoria Road being the only vegetated areas remaining. Original wetlands still exist in the industrial estate as drainage sumps and within parkland reserves in the adjoining urban areas.

There are a number of areas of Jandakot Suite wetlands protected within Bush Forever sites reserved for "Parks and Recreation". Lightning Swamp (Bush Forever Site No. 380) and Reid Highway Bushland (Bush Forever Site No. 385) are both "Parks and Recreation" reserves and support Jandakot Suite wetlands and dryland buffers. Dianella Open Space (Bush Forever Site No. 80) supports a Jandakot suite CCW of 0.9 hectares. Gnangara Road Bushland (Bush Forever Site No. 196) and Koondoola Regional Bushland (Bush Forever Site No. 201) supports both Bennett Brook and Jandakot Suite wetlands.

The local area supports five conservation category wetlands. Three as discussed above are within the Victoria Road sumpland, one within Dianella Open Space (Bush Forever Site No. 280), and one within Koondoola Regional Bushland (Bush Forever Site No. 201). None of these CCWs are held in private ownership.

4.5.5.4 Disturbance and Development

Development and subsequent fragmentation of the Victoria Road Sumpland and associated bushland has effectively dissected the proposal area from surrounding natural areas (see **Figure 8**). The entire Malaga area once supported many wetlands which have been developed over a number of years.

Reid Highway restricts the potential corridor value of the proposal area between Bush Forever Site No. 307 - Lightning Swamp and Bush Forever Site No. 480 - Victoria Road Bushland. Additionally, development to the north and west and the proposed Hepburn Avenue extension to the immediate east, and residential development further east have formed a definitive and absolute boundary. The surrounding area is highly modified and it is considered that the development of the remaining portion of Victoria Road Sumpland would have no detrimental effect on wetlands in the surrounding area.

Should it be decided that this wetland be retained within industrial development, its future viability would not be guaranteed. Degrading processes from surrounding development have already reduced the viability of the vegetation in the medium term.

The proposed Hepburn Avenue extension is likely to dissect the connecting wetland to the east leaving the area severely fragmented.

4.5.6 DRAINAGE MANAGEMENT

The southeast portion of the Malaga Industrial Estate has been designed to discharge stormwater into a 1:100 year basin (**Figure 2**). This basin is located at the low point in the topography of the area and all pipes flowing into the basin have been designed for a 1:5 year event.

A temporary sump is located to east of the site. The intention is to grade out the existing temporary sump when the future drainage basin located within the proposal area is constructed.

The future compensating basin will be owned and operated by the Water Corporation and will be constructed to their standard requirements. This includes sediment traps in manholes immediately upstream from the discharge into the basin. The sump will be fenced and a locked gate provided for access by Water Corporation personnel.

The catchment and location of the basin was determined by McDowall Affleck as part of Malaga TPS 14 and Basin No. 5 will ultimately be taken over by the Water Corporation as an asset.

As part of this proposal, individual lots and infrastructure will be created but use of individual lots is not part of the proposal. Drainage within the lots will be managed in line with the Stormwater Management Manual for Western Australia (Department of Environment, 2004), incorporating the following strategy:

- Specific developments on each lot will infiltrate stormwater on-site through soakwells or detention structures to the City of Swan requirements.
- The City will approve detailed drainage design on each lot as part of subsequent development applications and building licences.
- Subject to detailed design of development on each lot, storm events in excess of 1:5 ARI will be directed to the drainage basin as discussed above.
- Stormwater will not be directed from any of the lots toward Bush Forever Site No. 480 wetland.
- Roads will be constructed to an industrial standard (kerbed and drained).

4.5.7 ENVIRONMENTAL IMPACT

4.5.7.1 Direct Impacts

The proposal involves clearing of the wetland and removal of all associated flora and fauna habitats. Once cleared, the land will be cut and filled and be re-contoured to create industrial lots. It is assumed that no native vegetation currently on proposal area will remain after subdivision in accordance with standard industrial development.

The direct impacts of the proposal on wetlands are the destruction of the CCW and reduction of the amount of the Jandakot Consanguineous Wetland Suite held outside the conservation estate in the Perth Metropolitan Area.

4.5.7.2 Indirect Impacts

Potential indirect impacts could include:

- Changes to the hydrological function in the area;
- Changes to existing remnant vegetation due to changes in hydrological function;
- Changes to fauna habitat due to changes in hydrological function;
- Increasing edge effects to remnant vegetation;
- Changes to existing remnant vegetation due to weed/pathogen introduction;

There will be no discharge of stormwater to any adjacent areas of wetlands associated with the proposal. As discussed previously in **Section 4.3.6**, groundwater flow is generally in an east to west direction and therefore the proposal area is downstream of the wetland areas to the east (Victoria Sumpland) and above the wetland areas to the south (Lightning Swamp). Notwithstanding this, the proposal is not expected to impart any significant alterations to the local groundwater regime (either in terms of quality or quantity) that would extend significantly beyond the boundary of the proposal area.

The management of indirect impacts on wetlands is traditionally dealt with through the use of wetland buffers or setback distances, and the default distance adopted through various policy documents is 50 metres from the edge of wetland dependant vegetation. *Position Statement on Wetlands of the Swan Coastal Plain* (WRC, 2001) provides a range of buffer distances to protect wetlands from various actions and activities. From this, 50 metres was considered sufficient to contain the movement of weeds, while up to 200 metres is required to contain the influence of general industrial activities. Based on the location of the nearest wetlands from the proposal area, it is assumed that there is sufficient separation distance to contain any indirect impacts arising from the construction activities and also any future industrial or commercial uses. The nearest edge of the CCW to the east of the proposal area is approximately 100 metres from the proposal area, however as stated previously this wetland is upstream of the proposal area. The CCW to the south is more than 200 metres away from the closest edge of the proposal area.

4.5.8 ENVIRONMENTAL MANAGEMENT

Implementation of the proposal will result in complete loss of the wetland and its surrounding buffer. On this basis it is not possible to avoid or minimise this impact. A wetland mitigation strategy will be developed to identify a mitigation offset to replace the values of the impacted wetland.

If the proposal does not proceed the road will be constructed through the wetland and any remaining environmental values will degrade over time. The Shire of Swan and CALM may not accept vesting and management of the wetland for conservation purposes if the road is constructed.

4.5.8.1 Wetland Mitigation

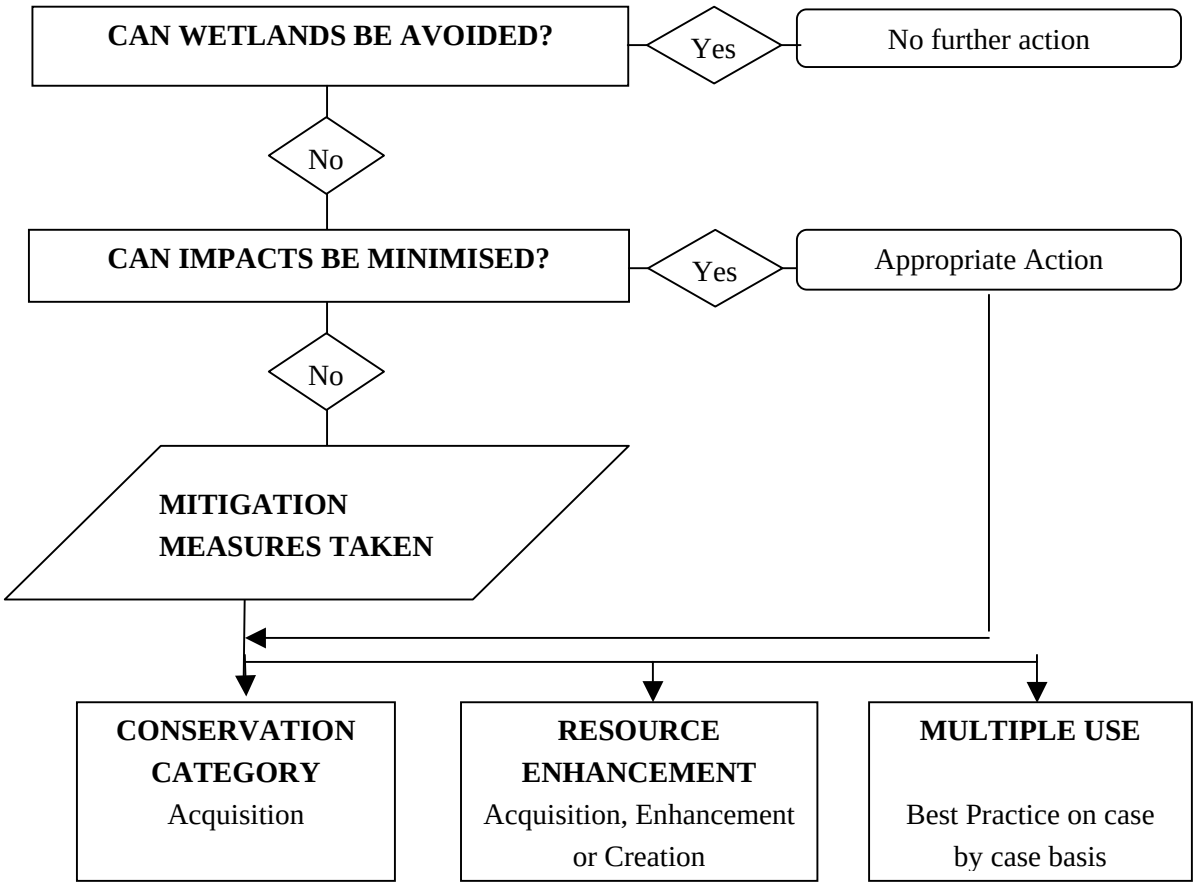
The environmental issue is the impact to, and the subsequent loss of a CCW wetland. Intrinsically, this also relates to flora, fauna and biodiversity. In order to address impacts on wetlands, the standard process is to prepare a Wetland Mitigation Strategy, with the purpose of ensuring that the proposal avoids impacting wetlands. Where this is not possible, establishing a framework in which the functions and values of the impacted wetlands are replaced through appropriate mitigation measures is appropriate.

Based on discussions with the DoE, the following guiding principles should be applied with regards to CCWs:

1. Avoid impacting wetlands through careful and appropriate design;
2. Ensure 'no net loss' of wetland value and function;
3. Where CCWs will be impacted, mitigation will be through acquisition and appropriate vesting and management of wetland in a similar management category;
4. Where wetlands are proposed for acquisition the following approach should apply:
    - the wetland(s) should be in as good a condition as the impacted wetland(s);
    - area of wetland acquired should match the area of wetland impacted;
    - the wetland(s) should be selected from the same type and preferably the same consanguineous suite;
    - the wetland(s) should contain similar vegetation type(s);
    - larger consolidated wetlands should be acquired where possible rather than fragmented small wetlands;
    - the wetland(s) should occur on private property;
    - the wetland(s) should be subject to some short to medium term threat including clearing, development, weeds, fire or grazing;
    - vesting and management arrangements for the wetland(s) in an appropriate body should be prepared and agreed before acquisition which should occur as quickly as possible after construction;
    - the wetland(s) should be acquired in accordance with Ministerial conditions/commitments or via WAPC using Special Control Areas under the *Metropolitan Region Scheme Act 1959;*
    - the wetland(s) should be identified in consultation with landowners, conservation and community groups;

- the wetland(s) should provide for linkages, corridors, buffers and be adjacent to existing reserves where 'Resource Enhancement' category wetlands are to be mitigated; and
- there should be an audit trail for wetland(s) acquired.

WETLAND MITIGATION HIERARCHY



4.5.8.2 Wetland Mitigation Process

The intention is to prepare the Wetland Mitigation Strategy to the satisfaction of the DoE and CALM prior to the EPA releasing its report and recommendations. In other words, the intention is for the PER process to proceed concurrently with efforts to find an appropriate and agreeable wetland mitigation offset.

It is possible that a wetland mitigation offset may not be finalised prior to the EPA releasing its report and recommendations. If this were to occur, the proponent is agreeable to legally binding conditions being applied to ensure this outcome was achieved to the satisfaction of DoE and CALM.

The wetland mitigation hierarchy and principles discussed in **Section 4.5.9.1** has been followed to identify an appropriate offset area, ensuring that the values of the wetland to be lost are represented.

The purpose of this approach is to locate a wetland with the same or similar values to the proposal area or if none exist, a wetland which will provide a net environmental gain to the conservation estate.

Wetlands will first be identified by the same suite in the same area (i.e. Jandakot Suite in the City of Swan). Other environmental values of the proposal area such as Priority Flora and Fauna will be surveyed following initial identification and reconnaissance. Currently no suitable threatened wetlands appear to exist in the general Malaga area. Potential offsets have therefore been viewed in north of Ellenbrook of the City of Swan.

4.6 WETLAND MITIGATION COMMITMENT

The proposal area supports a Conservation Category Wetland within the Jandakot Consanguineous Suite. The remnant vegetation in the area ranges from “Excellent” to “Completely Degraded” condition. The vegetation communities on site supports two Priority 3 Flora species.

The proponent will prepare a Wetland Mitigation Strategy and identify a suitable area as an offset. It is proposed that the proponent will purchase the land identified, with conditions on purchase to ensure that the land meets the offset requirements of CALM, DoE and EPA. It is likely that the area will ultimately be vested with CALM for inclusion in the conservation estate and that they will have control over the ongoing management of the area. It should be recognized that this will be finalised during the Wetland Mitigation Strategy preparation process.

If no suitable wetland can be located following the Wetland Mitigation Strategy, monetary compensation will be considered as an alternate offset which could then be directed towards the management of areas already held in secure tenure. This approach could also involve the proponent developing and implementing a management plan for a wetland in secure tenure. The offset package will be researched, presented to necessary agencies and finalised within 3 years of project commencement.

Preliminary Position Statement No. 9: Environmental Offsets (EPA, 2004), provides the EPA's view on environmental offsets, and establishes principles for environmental offsets that the EPA will consider in future advice and recommendations. While this is in a "Preliminary" form, it reflects the EPA's current thinking in regards to the acceptable use environmental offsets in proposals.

Preliminary Position Statement No. 9 establishes eight (8) key principles, and in the context of the Malaga Industrial Subdivision proposal and associated Wetland Mitigation Strategy, are discussed in detail below:

- *Environmental offsets should only be considered after all other attempts to mitigate adverse impacts have been exhausted:* Given the approved road through the wetland and the likely threats posed to the wetland as a result of development (being situated as a small natural island within a developed industrial area), retaining the wetland is not likely to preserve its values in the medium to long term. Given this, the proposal to develop the site and prepare and implement a Wetland Mitigation Strategy is likely to deliver a more sustainable environmental outcome than not progressing the proposal at all.

- *An environmental offset package should address both primary and secondary offsets:* As outlined previously in this PER, the Wetland Mitigation Strategy will include both primary and secondary offsets. The ultimate offset package will depend on the nature of the wetland identified in the Wetland Mitigation Strategy. Primary offsets are likely to involve include revegetation and restoration activities. Secondary offsets are likely to include land acquisition and transfer to conservation estate.

- *Environmental offset should ideally be "like for like or better":* This principle will be addressed through the preparation of the Wetland Mitigation Strategy, and will be a central criterion when selecting an appropriate wetland. This will be based on the consideration of environmental values, vegetation, habitat, species, ecosystem, landscape, hydrology, and physical area associated with the impacted wetland and the wetland identified within the offset package.

- *Positive environmental offset ratios should apply where risk of failure is apparent:* The process will involve the Wetland Mitigation Strategy being reviewed and accepted by EPA, DoE and CALM. Offsets will be based on current best practice and outcomes that are considered to be realistically achievable. Risk of failure is therefore not likely to be a significant consideration.

- *Environmental offsets must entail a robust and consistent assessment approach:* The assessment approach for the offset package is via the formal environmental impact assessment process. This will ensure an assessment that is both robust and consistent since the preparation and implementation of the Wetland Mitigation Strategy is assumed to be a statutory requirement associated with this process and based on information contained within this PER.

- *Environmental offsets must meet all statutory requirements:* The Wetland Mitigation Strategy will be developed to ensure compliance with all planning, statutory and regulatory

requirements. Apart from the requirements of the *Environmental Protection Act 1986* there are no other significant statutory limitations imposed on the proposal.

- *Environmental offsets must be clearly defined, transparent and enforceable:* Considering the assessment is being undertaken through a formal environmental impact assessment process, it is likely that this process will result in legally enforceable proponent commitments and/or Ministerial conditions. This will ensure that the Wetland Mitigation Strategy will be auditable and enforceable.

- *Environmental offset must ensure a long lasting benefit:* While the exact nature of the offset package is to be determined as part of the preparation of the Wetland Mitigation Strategy, it is envisaged that the acquisition of a comparable wetland area and associated primary offset activities will result in a long lasting environmental benefit.

The proponent commits to the development, preparation and implementation of a Wetland Mitigation Strategy in consultation with the CALM, DoE and EPA. The Wetland Mitigation Strategy will be prepared in accordance with *Preliminary Position Statement No. 9: Environmental Offsets* (EPA, 2004).

4.6.1 SUMMARY

Having regard to:

- the wetland being part of the Jandakot Consanguineous Suite which from the available information would appear to be reasonably well represented across the Swan Coastal Plain;
- the potential for indirect impacts to nearby CCW or REW areas being unlikely due to the separation distances from the proposal area;
- the area supports no Declared Rare Flora;
- the FCTs inferred in the area are considered to be well reserved;
- the rapid degradation of the edges of vegetation exposed to development;
- the proposal area not being identified within Bush Forever or as a System 6 area;
- the future development proposed for the surrounding area;
- increased traffic flow and uncontrolled access to the proposal area as well as the incidence of fire and introduction of weeds and pathogens by rubbish dumping;
- approved road construction; and
- a Wetland Mitigation commitment,

it is concluded that the EPA's objective for this environmental factor can be met.

5 REFERENCES

Arnold, G.W., Smith, G.T. and Brooker, M.G. (1991). Whiteman Park Fauna Survey. Final Report May 1991. Unpub. report by CSIRO Division of Wildlife and Ecology, Perth, for the State Planning Commission, Western Australia.

Bamford, M.J. and Bamford, A.R. (2000). Whiteman Park. Survey of the Quenda *Isoodon obesulus* in the existing Consrvation Zone and in IP8, August 2000. Unpublished report by Bamford Consulting Ecologists to the Whiteman Park Authority.

Bamford, M.J. and Bamford, A.R. (2002). A Study of the Brush or Black-gloved Wallaby *Macropus irma* (Jourdan 1837) in Whiteman Park. Whiteman Park Technical Report Series No. 1. Western Australian Planning Commission, Perth.

Bamford, M. and Davis, R. (2004). Report on East Lexia Frog Monitoring: 2003 and 2004. Unpubl. report to Water and Rivers Commission, Perth.

Beard, J.S. (1981). *Vegetation Survey of Western Australia: Swan*. 1:1,000,000 Series. Explanatory Notes to Sheet 7.

Beard, J.S. (1990). *Plant life of Western Australia*. Kangaroo Press, Kenthurst, NSW.

Bennett Brook Catchment Group (2002). Species lists from flora surveys during 2001/2003. Unpublished data received from Bennett Brook Catchment Group.

Brooker, M. (2004). Whiteman Park Bird Surveys 1990 – 2003. Whiteman Park Technical Report Series No. 3. Western Australian Planning Commission, Perth.

BSD Consultants Pty Ltd (2002). Environmental Scoping Report Industrial Sub-division Lots 300-303 and 14 & 15 Beringarra Avenue, Malaga. BSD Consultants, Subiaco.

BSD Consultants Pty Ltd (2004). Draft Public Environmental Review Industrial Sub-division Lots 300-303 and 14 & 15 Beringarra Avenue, Malaga. BSD Consultants, Subiaco.

Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. (1995). A Guide to the Reptiles and Frogs of the Perth Region. University of Western Australia Press, Perth.

Christidis, L. and Boles, W.E. (1994). The Taxonomy and Species of Birds of Australia and its Territories. Royal Australasian Ornithologists Union, Monograph 2.

Churchward, H.M. and McArthur, W.M. (1980). Landforms and Soils of the Darling System. In: *Atlas of Natural Resources, Darling System, Western Australia*. Department of Conservation and Environment, Western Australia.

Cogger, H.G., Cameron, E.E., Sadlier, R.A. and Eggler, P. (1993). The Action Plan for Australian Reptiles. Endangered Species Programme Project Number 124, Australian Nature Conservation Agency, Canberra.

Cooper, N.K. (1995). Vertebrate fauna of an isolated bushland reserve (No 18325) in inner Perth. West. Aust. Nat. 20: 21-28.

Cooper, N.K., Dell, J. and Cowan, M.A. (1999). The Vertebrate Fauna of Bennett Brook and Success Hill Reserve, Caversham. West. Aust. Nat. 22: 179-190.

Cooper, C.E., Withers P.C., Mawson, P.R., Bradshaw, S.D., Prince, J. and Robertson, H. (2002). Metabolic ecology of cockatoos in the south-west of Western Australia. Aust. J. Ecol. 50: 67-76.

Dell, J. and How, R. (1995). Faunal response to fire in urban bushland. In: ed. J. Harris. *Burning Our Bushland*. Urban Bushland Council, WA. pp. 35-41.

Department of Conservation and Environment (1983). *The Darling System – System 6.* Conservation Reserves for Western Australi as recommended by the Environmental Proteciton Authority, 1983.

Department of Conservation and Land Management (2003). *Declared Rare and Priority Flora List.* Publicly available list prepared by the Department of Conservation and Land Management, Western Australia.

Department of Conservation and Land Management (1985a). *The Impact of Proposed Roads on Wetlands in the Perth Metropolitan Region*. Bulletin 232. Perth, WA.

Department of Conservation and Land Management (1985b). *Roadworks and Wetlands in the Perth Metropolitan Region: Recommendations for Conflict Resolution*. Bulletin 233. Perth, WA.

Department of Environmental Protection (2000). Bush Forever. Govt. of Western Australia, Perth.

Duncan, A., Baker, G.B. and Montgomery, N. (1999). The Action Plan for Australian Bats. Environment Australia, Canberra.

English, V. and Blyth, J. (1997). *Identifying and conserving threatened ecological communities (TECS) in the South West Botanical Province*. Unpublished Report, Western Australian Threatened Species and Communities unit, Department of Conservation and Land Management.

Environment Australia (2002). *National list of Threatened Species, Ecological Communities and Threatening Processes*. Commonwealth of Australia. Threatened Ecological Communities List:
http://www.ea.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl

Environmental Protection Authority (1999). *Position Statement No. 2 (Environmental Protection of Native Vegetation in Western Australia).* EPA, Perth.

Environmental Protection Authority (2001a). *Position Statement No. 3 (Terrestrial biological surveys as an element of biodiversity protection).* EPA, Perth.

Environmental Protection Authority (2001b). *Environmental Protection of Wetlands.* Position Statement No. 4. EPA, Perth.

Environmental Protection Authority (2003a). *Guidance Statement No. 10 (Level of assessment for proposals affecting natural areas within the System 6 region and Swan Coastal Plain portion of the System 1 Region).* EPA, Perth.

Environmental Protection Authority (2004). *Guidance Statement No. 51 (Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia).* EPA, Perth.

Environmental Protection Authority (2004). *Guidance Statement No. 56 (Terrestrial fauna surveys for environmental impact assessment in Western Australia).* EPA, Perth.

Garnett, S. and Crowley, G. (2000). The Action Plan for Australian Birds. Environment Australia and the Royal Australasian Ornithologists Union

Government of Australia. *Environment Protection and Biodiversity Conservation Act 1999.*

Government of Western Australia (1997). *Wetlands Conservation Policy for Western Australia*. Government of Western Australia, Perth

Government of Western Australia. *Wildlife Conservation Act 1950.*

Government of Western Australia (1998). *Perth's Bushplan*. DEP, Perth.

Government of Western Australia (2000). *Bush Forever, Volumes 1 and 2*. DEP, Perth.

Garnett, S. (Ed.) (1992). *Threatened and extinct birds of Australia*. Royal Australasian Ornithologists Union, Report No. 82.

Garnett, S.T and G.M. Crowley (2000). *The Action Plan for Australian Birds*. Environment Australia, Canberra.

Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. (1984). *A Floristic Survey of the southern Swan Coastal Plain.* Department of Conservation and Land Management, Perth.

Hart, Simpson and Associates Pty Ltd (2002). Malaga Industrial Development Wetland Replacement - Vertebrate Fauna.

Heddle, E.J., Loneragan, O.W. and Havel, J.J. (1980). Vegetation of the Darling System. In: Atlas of Natural Resources, Darling System, Western Australia. Department of Conservation and Environment, Western Australia.

Hill, A.L, Semeniuk, C.A, Semeniuk, V and Del Marco, A. (1996a). *Wetlands of the Swan Coastal Plain Vol 12B: Wetland Atlas*. Department of Environmental Protection/Water and Rivers Commission, Perth.

Hill, A.L, Semeniuk, C.A, Semeniuk, V and Del Marco, A. (1996b). *Wetlands of the Swan Coastal Plain Vol 12A: Wetland Mapping, Classification and Evaluation.* Department of Environmental Protection/Water and Rivers Commission. Perth.

How, R. and Dell, J. (1993). Vertebrate fauna of the Perth metropolitan region: consequences of a modified environment. In: ed. M. Hipkins. *Urban Bush Management*. Australian Institute of Urban Studies, WA. pp. 28-47.

How, R. and Dell, J. (2000). *Ground vertebrate fauna of Perth's vegetation remnants: impact of 170 years of urbanisation*. Pac. Cons. Biol**. 6**:198-217.

How, R., Harvey, M.S., Dell, J. and Waldock, J.M. (1996). *Ground Fauna of Urban Bushland Remnants in Perth*. Report to the Australian Heritage Commission. WA Museum, Perth.

How, R.A. (1978). *The Environment of the Northern Swan Coastal Plain: consideration of faunal changes and recommendations in Western Australian Museum.* Fauna Studies of the Northern Swan Coastal Plain - a consideration of past and future changes. Western Australian Museum for the Department of Conservation and Environment.

Johnstone, R.E. and G.M. Storr (1998). *Handbook of Western Australian Birds*. Volume 1. Non-Passerines. W.A. Museum, Perth.

Lee, A.K. (1995). The Action Plan for Australian Rodents. Environment Australia, Canberra.

Keighery, B.J. (1994). *Bushland Plant Survey, A Guide to Plant Communities Survey*. Wildflower Society of WA (Inc), Nedlands.

Kennedy, M. (Ed.) (1990). *A Complete Reference to Australia's Endangered Species*. Simon and Schuster, Sydney.

Kitchener D.J., Chapman, A. and Barron, G. (1978). Mammals of the Northern Swan Coastal Plain. In: *Fauna Studies of the Northern Swan Coastal Plain*. A consideration of past and future changes. Western Australian Museum for the Department of Conservation and Environment, Perth.

Maryan, B. Browne-Cooper, R. and Bush, B. (2002). Herpetofauna survey of Maralla Road bushland. West. Aust. Nat. 23: 197-206.

Maxwell, S., Burbidge, A.A. and Morris, K. (1996). Action Plan for Australian Marsupials and Monotremes. Environment Australia, Canberra.

Murdoch University (1996). Management Proposal for Lightning Swamp in the Shire of Swan.

Nuystia (2001). *A revision of the genus* Calectasia. Volume **13**; 431-433.

Semeniuk, C.A. (1987). *Wetlands of the Darling System - A Geomorphic approach to habitat classification*. Journal of the Royal Society of WA. Volume **69**, 95-112.

Semeniuk, C.A. (1988). *Consanguineous Wetlands and their Distribution into the Darling System, Southwestern Australia*. Journal of the Royal Society of WA. Volume **70(3)** , 69-82.

Serventy, D.L. and Whittell, H.M. (1976). *Handbook of the Birds of Western Australia*. Perth.

Storr, G.M. (1984). *Birds of the Eucla Division of Western Australia*. Rec, W,A, Mus. Suppl. No. **27**.

Storr, G.M., Harold, G. and Barron, G. (1978). The Amphibians and Reptiles of the Northern Swan Coastal Plain. In: *Fauna Studies of the Northern Swan Coastal Plain*. A consideration of past and future changes. Western Australian Museum for the Department of Conservation and Environment, pp 172-203.

Storr, G.M., Johnstone, R.E. and Harold, G. (1978). Birds of the Northern Swan Coastal Plain, Western Australia. In: *Fauna Studies of the Northern Swan Coastal Plain*. A consideration of past and future changes. Western Australia Museum for the Department of Conservation and Environment, pp 93-171.

Turpin, M.C. (1990). Ecological appraisal of an isolated woodland reserve No. 3694 south of the Swan River, Perth. West. Aust. Nat. 18: 131-138.

Turpin, M.C. (1991a). Additions to the fauna of reserve No. 3694, Victoria Park. West. Aust. Nat. 18: 168-169.

Turpin, M.C. (1991b). Notes on fauna of a remnant bushland in Victoria Park. West. Aust. Nat. 18: 233-234.

Tyler, M.J., Smith, L.A. and Johnstone, R.E. (2000). Frogs of Western Australia. W.A. Museum, Perth.

UNESCO (1971). The Contracting Parties to the Convention on Wetlands of Importance Especially as Waterfowl Habitat.

Van Delft, R. (1997). Birding Sites Around Perth. 2nd Edition. Birds Australia – WA Group.

WA Museum. (2001). Checklists of the Vertebrates of Western Australia. Records of the WA Museum Supplement No. 63.

Water and Rivers Commission (2002). *Geomorphic wetlands database*. WRC, Perth.

Western Australian Herbarium (1998-2003). *Florabase*. Information on the Western Australian Flora. Department of Conservation and Land Management. http://www.calm.wa.gov.au/science/florabase.html

Wykes, B. (1991). Perth Wildlife Watch. World Wide Fund for Nature Project 134.

FIGURES

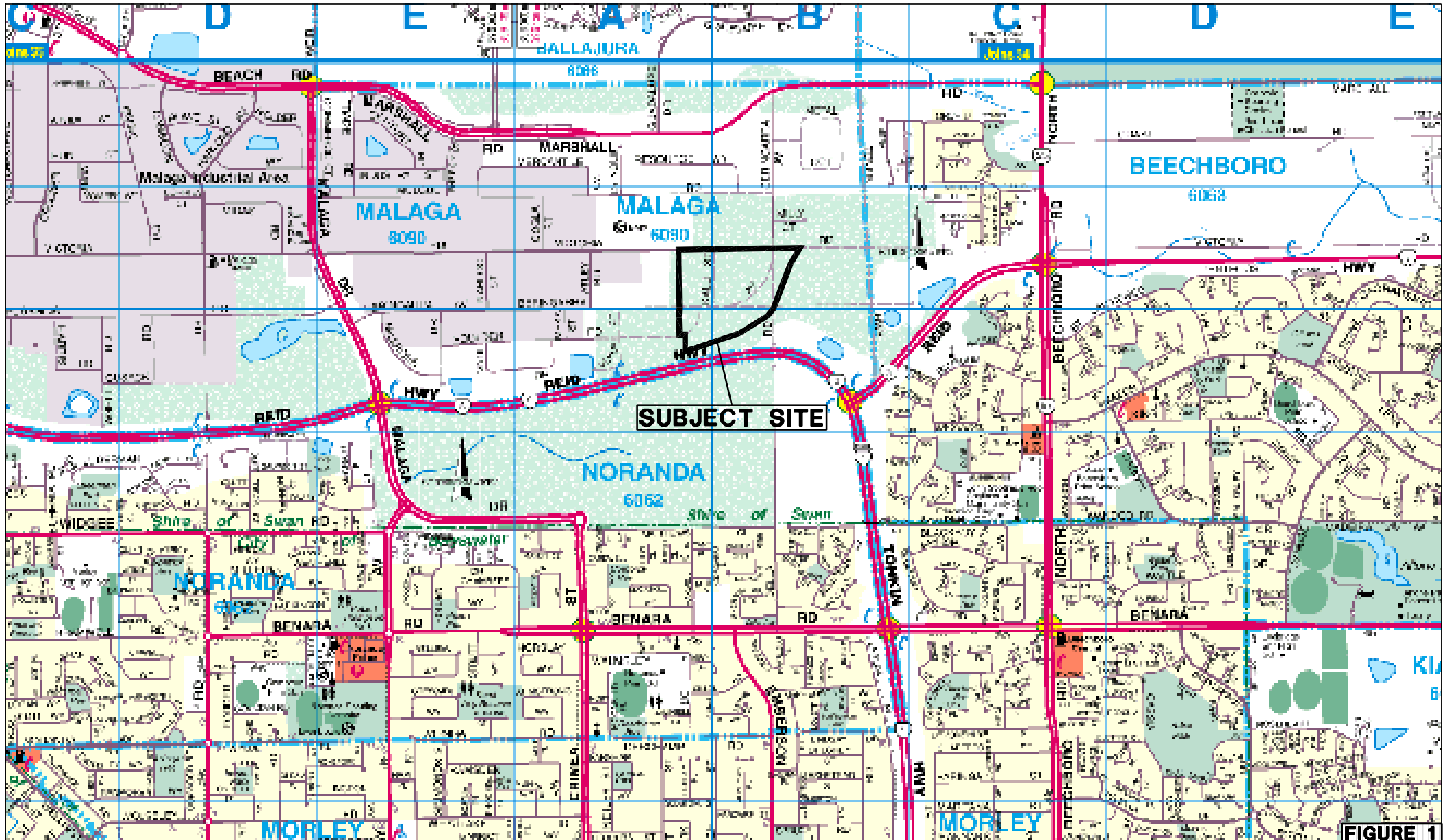


FIGURE 1

PROJECT FREEWAY INDUSTRIAL PARK

DRAWING TITLE LOCALITY PLAN

PRINCIPAL SANDBOURNE HOLDINGS PTY LTD

SCALE: N.T.S.

Cardno BSD
CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS
BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK1	A	A4

Designed — Checked — Date 14.08.02
Drawn NAP — Approved — Sheet Of
Local Authority CITY OF SWAN

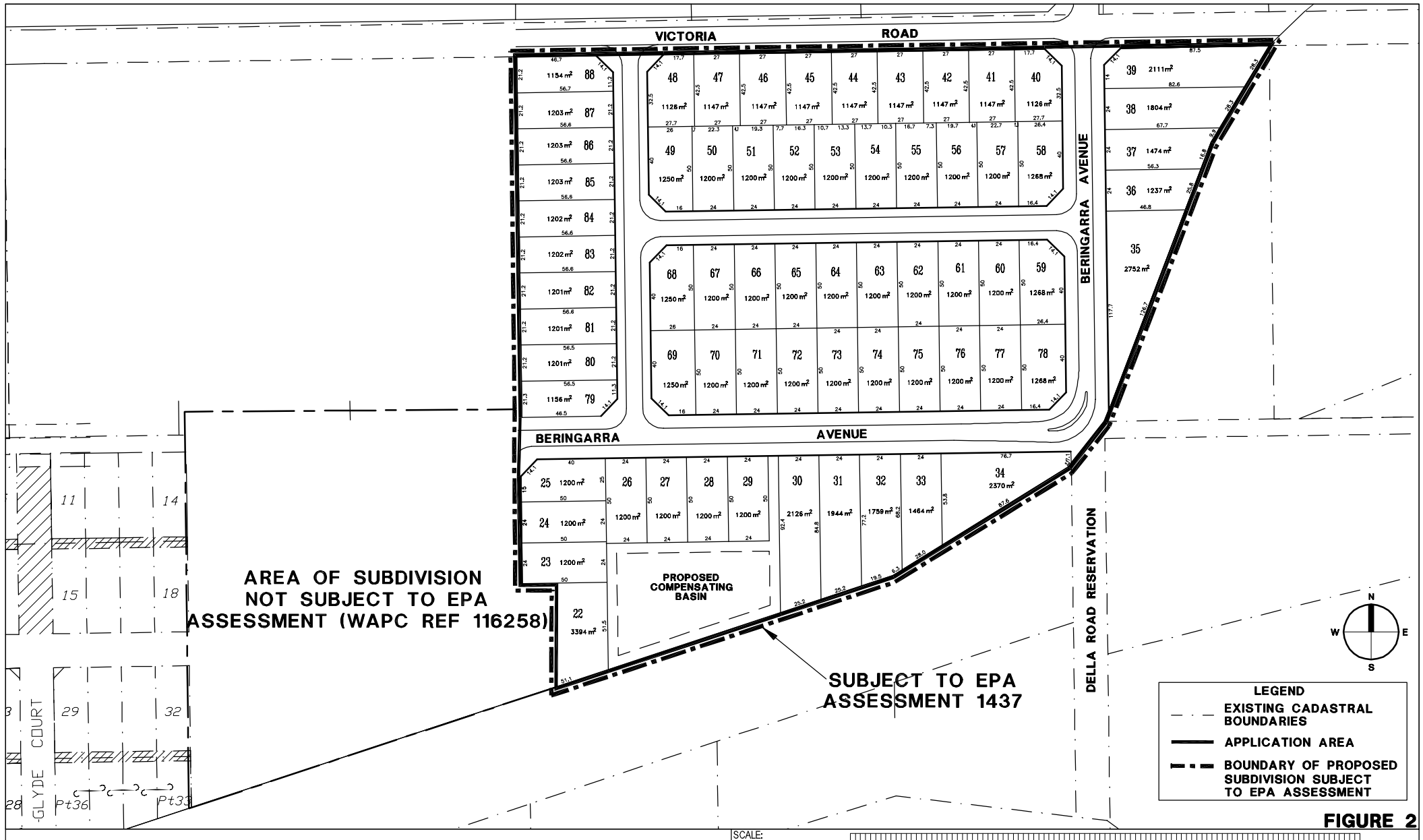


FIGURE 2

PROJECT **FREEWAY INDUSTRIAL PARK**

DRAWING TITLE **PROPOSED SUBDIVISION PLAN - WAPC REF: 115108**

PRINCIPAL **SANDBOURNE HOLDINGS PTY LTD**

SCALE: 1:8000 (0 80m 160 240 320 400 480 560 640 720 800)

Cardno BSD
CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS
BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK3		A4

Designed BMC Checked VC Date 08.11.02
Drawn NAP Approved AV Sheet Of
Local Authority CITY OF SWAN

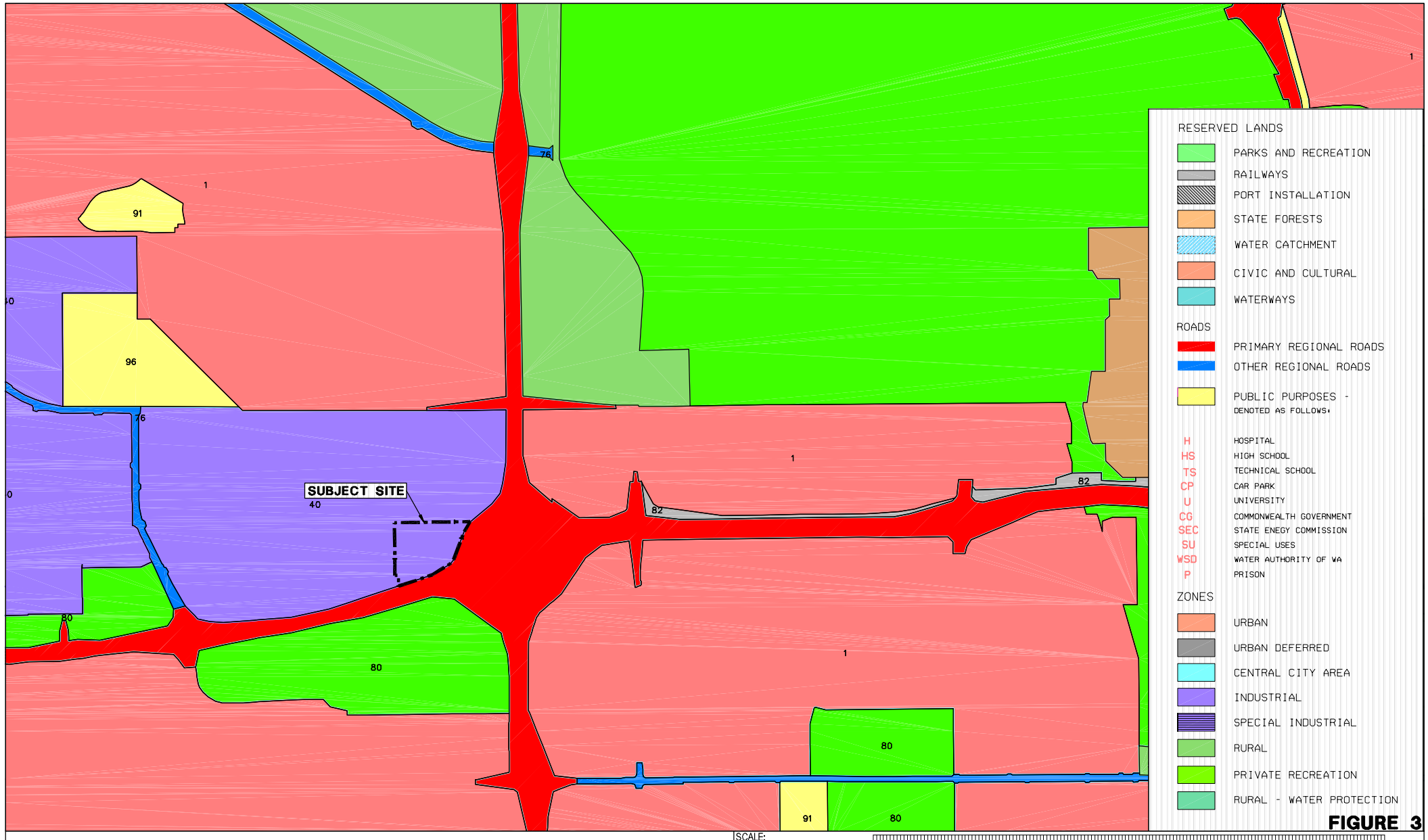


FIGURE 3

PROJECT **FREEWAY INDUSTRIAL PARK**

DRAWING TITLE **MRS ZONING**

PRINCIPAL **SANDBOURNE HOLDINGS PTY LTD**

N W E S

SCALE: 1:30000

0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3Km

Cardno BSD
CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS
BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK5	A	A4

Designed — Checked — Date 03.01.03
Drawn NAP — Approved — Sheet Of
Local Authority CITY OF SWAN

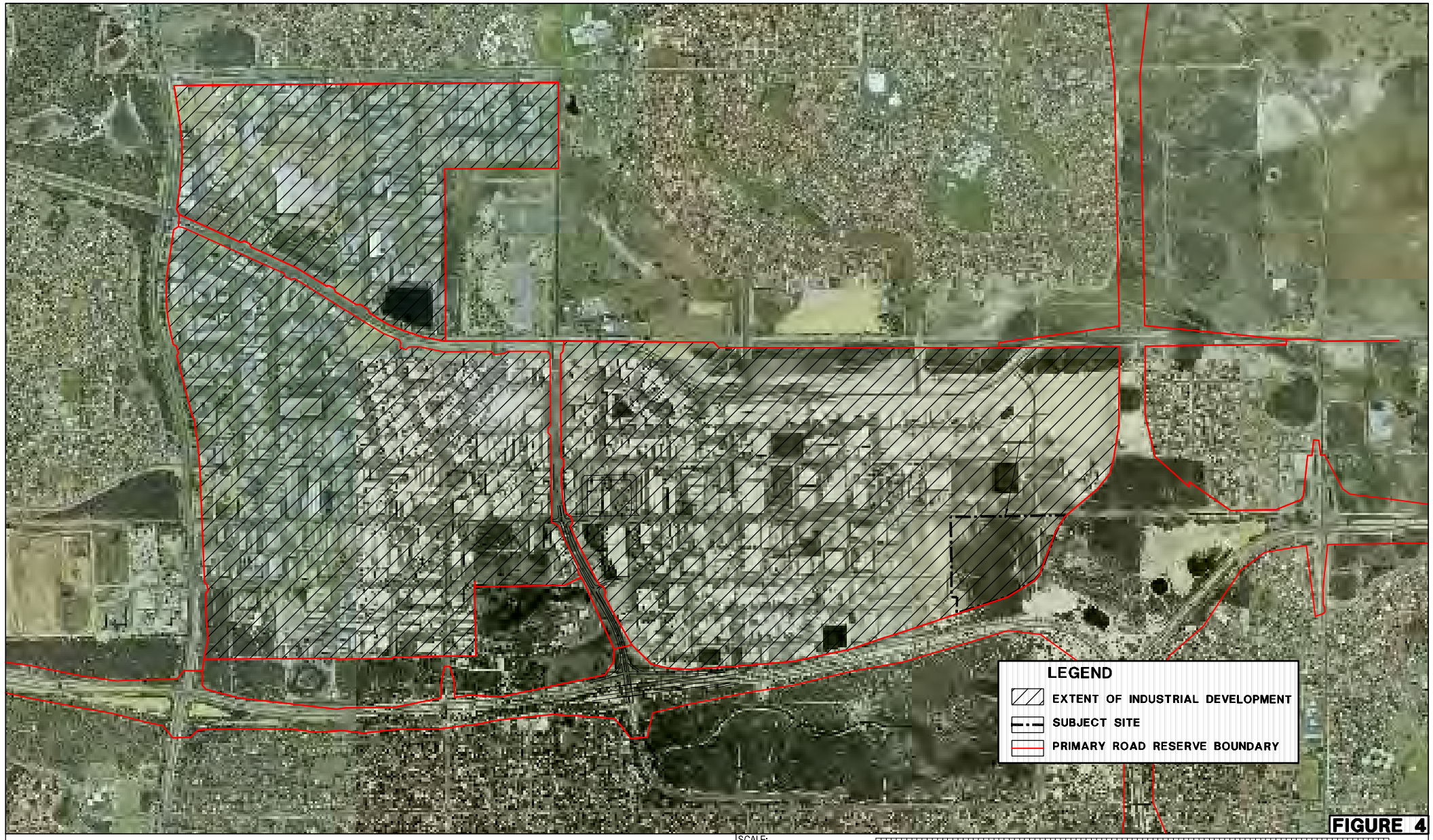


FIGURE 4

PROJECT **FREEWAY INDUSTRIAL PARK**

DRAWING TITLE **EXTENT OF INDUSTRIAL DEVELOPMENT**

PRINCIPAL **SANDBOURNE HOLDINGS PTY LTD**

N W E S

SCALE: 1:20000

0 0.2km 0.4 0.6 0.8 1.0km 1.2 1.4 1.6 1.8 2.0km

Cardno BSD
CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS

BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK4	A	A4

Designed — Checked — Date 03.01.03

Drawn NAP — Approved — Sheet Of

Local Authority CITY OF SWAN

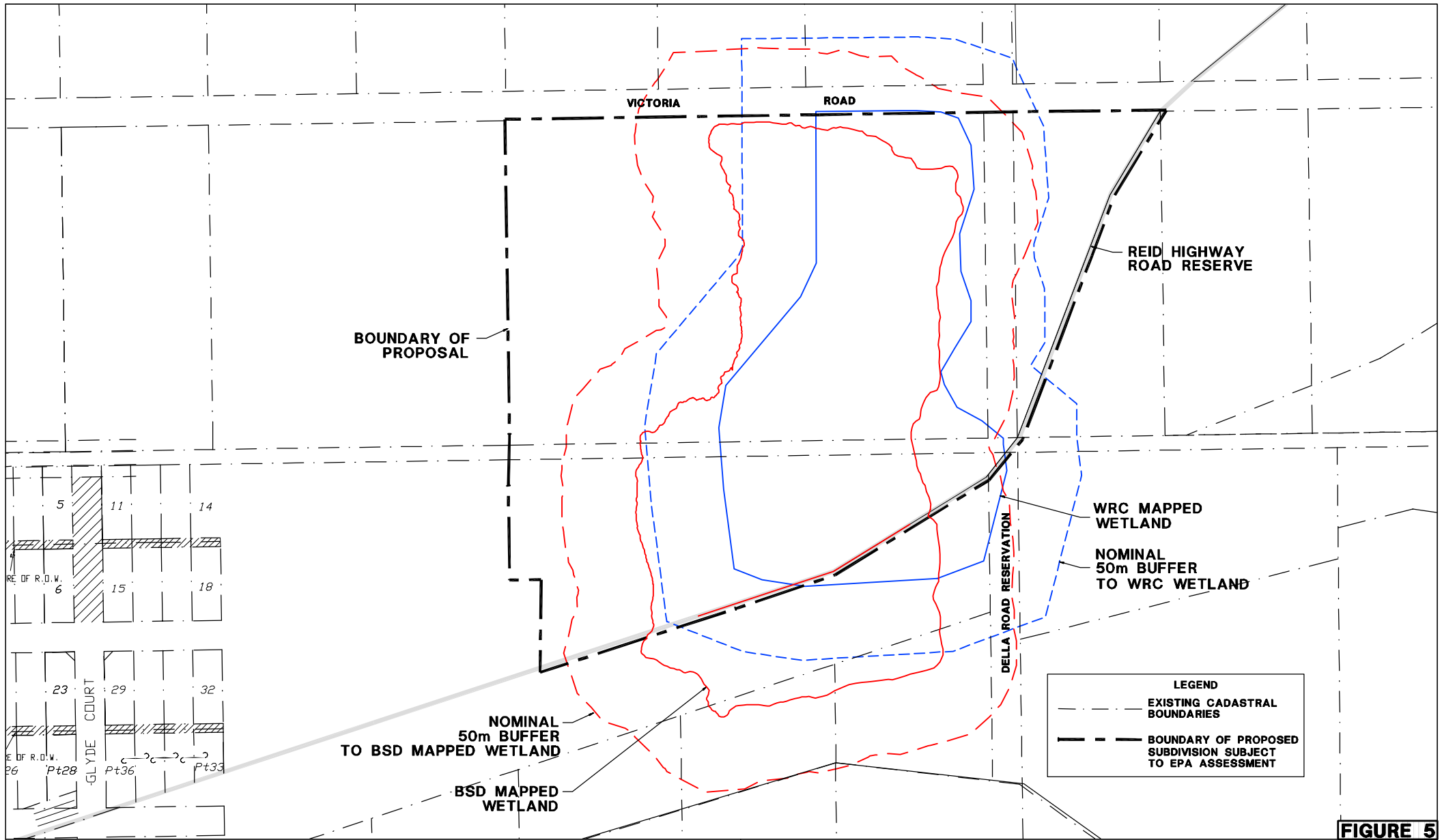


FIGURE 5

PROJECT FREEWAY INDUSTRIAL PARK

DRAWING TITLE WETLAND MAPPING

PRINCIPAL SANDBOURNE HOLDINGS PTY LTD

SCALE: 1:3500 (0 40 80 120 160 200 240 280 320 360m)

Cardno BSD
CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS
BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK2	B	A4

Designed — Checked — Date 14.08.02
Drawn NAP — Approved — Sheet Of
Local Authority CITY OF SWAN

VICTORIA ROAD

BERINGARRA AVENUE

REID HIGHWAY

1

2

3

4

LEGEND

- PRISTINE
- EXCELLENT
- VERY GOOD
- GOOD
- DEGRADED
- COMPLETELY DEGRADED
- QUADRAT LOCATIONS

FIGURE 7

PROJECT FREEWAY INDUSTRIAL PARK

DRAWING TITLE VEGETATION CONDITION MAPPING

PRINCIPAL SANDBOURNE HOLDINGS PTY LTD

N W E S

SCALE: 1:3000

0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300

Cardno BSD

CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS

BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK6	D	A4

Designed | Checked | Date 04.02.03

Drawn NAP | Approved | Sheet Of

Local Authority CITY OF SWAN

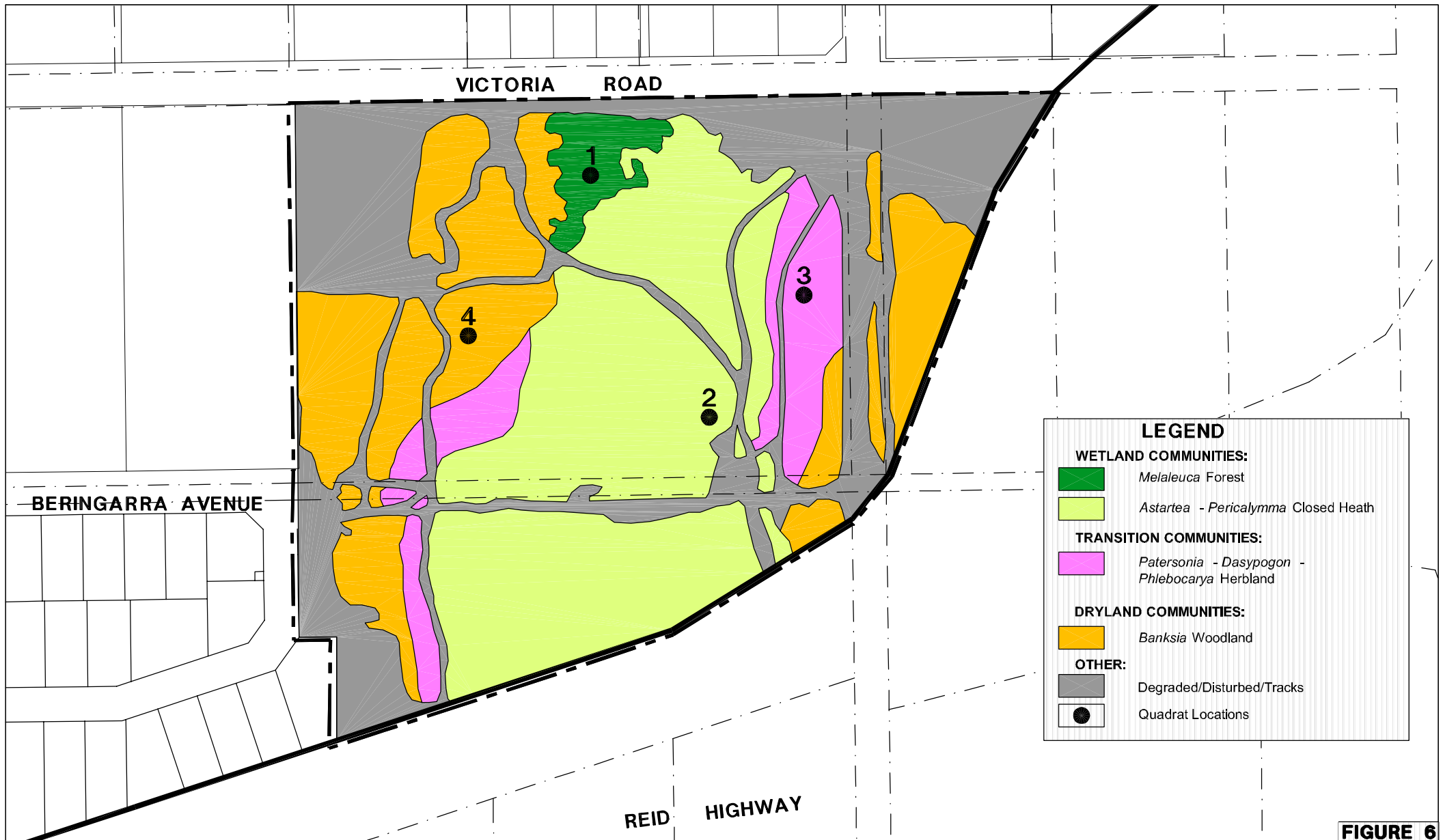


FIGURE 6

PROJECT FREEWAY INDUSTRIAL PARK

DRAWING TITLE VEGETATION COMMUNITY MAPPING

PRINCIPAL SANDBOURNE HOLDINGS PTY LTD

N W E S

SCALE: 1:3000

0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300

Cardno BSD
CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS
BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK7	E	A4

Designed — Checked — Date 04.02.03

Drawn NAP — Approved — Sheet Of

Local Authority CITY OF SWAN

JANUARY 2000

DECEMBER 2003

SUBJECT SITE

PRIMARY ROAD RESERVE BOUNDARY

FIGURE 8

PROJECT **FREEWAY INDUSTRIAL PARK**

DRAWING TITLE **COMPARISON OF CONDITION**

PRINCIPAL **SANDBOURNE HOLDINGS PTY LTD**

N W E S

SCALE: 1:10000

0 0.1km 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0km

Cardno BSD

CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS

BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK9		A4

Designed — Checked — Date 03.01.03

Drawn NAP — Approved — Sheet Of

Local Authority CITY OF SWAN

APPENDICES

APPENDIX A

ENVIRONMENTAL SCOPING REPORT

Environmental Scoping Report
Public Environmental Review

Industrial Subdivision - Lots 300-303 and 14 & 15 Beringarra Avenue, Malaga.

Prepared for: Sandbourne Holdings Pty Ltd

Prepared by: **BSD CONSULTANTS PTY LTD**
BSD Centre, 2 Bagot Road
PO Box 155,Subiaco, WA, 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

November 2002

DOCUMENT ISSUE AUTHORISATION

Issue	Rev	Date	Description	Checked By	Approved By
1	**A**	**23 August 2002**	**Environmental Scoping Report**	**BJM**	**ASV**
2	**0**	**10 October 2002**	**Environmental Scoping Report**	**BJM**	**ASV**
3	**0**	**18 October 2002**	**Environmental Scoping Report**	**BJM**	**ASV**
3	**1**	**8 November 2002**	**Environmental Scoping Report**		

BSD Consultants Pty Ltd

TABLE OF CONTENTS

PAGE

1. PURPOSE

This Environment Scoping Report (ESR) provides information and outlines the scope, content and detail to be documented in the Public Environmental Review (PER). At this preliminary stage the ESR will define the proposal and the proponent and outline:

- Why the proposal has been initiated;
- Why it is being assessed formally by the EPA;
- The existing environment;
- The potential impacts;
- How impacts will be mitigated;
- The preliminary environmental factors;
- The proposed technical investigations and studies with regard to each preliminary environmental factor;
- Other development approvals;
- Project milestones and timing; and
- The study team.

2. PROPONENT

The proponent for the proposal is Sandbourne Holding Pty Ltd. BSD Consultants will be acting on behalf of Sandbourne Holdings and will be responsible for the preparation of the PER and liaison with the EPA.

3. PROPOSAL

The proposal involves the industrial subdivision of lots 300-303, 14 &15 Beringarra Avenue, Malaga, seen on the locality plan **Figure 1**. A subdivision application has been lodged with the Western Australian Planning Commission (WAPC), reference 115108. **Figure 2** shows the proposed subdivision plan. The subdivision proposal is consistent with the objectives of the City of Swan's Town Planning Scheme (TPS) No 14: East Malaga Industrial Development Scheme. It involves the following:

- Vegetation clearing;
- Earthmoving work (cut to fill);
- Construction of roads, signs, mounted kerbing and lighting;
- Construction of drainage basins and drainage infrastructure;
- Installation of all services (ie. gas, water, electricity, telecommunications and sewer); and
- Landscaping.

The proposal will result in the creation of industrial lots, but not their individual development or use.

3.1 EPA ASSESSMENT

It has been determined by the EPA that the proposal's level of assessment is to be a PER.

3.2 ALTERNATIVE OPTIONS

The PER will discuss the implications if the proposal is not approved (in part or whole) and the various options and opportunities with regard to wetland mitigation.

3.3 PROPOSAL JUSTIFICATION

The proposal is situated on land zoned 'industrial' in the Metropolitan Regional Scheme and the City of Swan's TPS. The proposal, if given approval would be the last stage of the Malaga Industrial Estate development, contemplated by Scheme No 14 fulfilling the eastern portion of the estate, north of the future Reid Highway road reserve.

4. REGIONAL ENVIRONMENT

The proposal lies on the Swan Coastal Plain within the Drummond Botanical Subdistrict, of the Southwestern Botanical province, as described by Beard (1981). The climate for this district is described as warm Mediterranean climate with warm dry summers of approximately 5-6 months per year and an annual rainfall between 869-888mm (Beard 1981). The proposal is situated on the Pinjarra Plain, within the Guildford Formation and is part of the Bassendean Dune System.

The proposal lies within the Jandakot Suite of natural wetlands (DEP and WAPC 2000), and the area generally consists of low-lying sumplands. The groundwater is located very close to the surface, and is usually expressed in depressions to develop water table basins.

The flora that generally makes up the region for the proposal is of the Southern River Complex, and is largely made up of open woodland, with Banksia species (DEP and WAPC 2000).

The proposal is located within the City of Swan, and more specifically the suburb of Malaga in the Perth Metropolitan Region.

5. ENVIRONMENTAL IMPACTS

A Conservation Category Wetland (CCW) is partially situated within the boundaries of the proposal. The wetland is the last remaining piece of what was a larger wetland, described on Map 2034 II NE in *The Wetlands of the Swan Coastal Plain Vol. 2B* as 43Sc, and is named Victoria Road Sumpland. The wetland, since originally being identified as a CCW by the DEP in 1996, has been the subject of numerous studies and has had its CCW status reconfirmed in 1997, 1999 and twice in 2000. Although the wetland suffers from minor weed invasion, the wetland is intact and the overall vegetation for the wetland is in very good condition (WRC, 2001). The proposal involves the clearing of the wetland and

the removal of all associated flora and fauna habitats. Once cleared, the land will be cut and filled and be re-contoured to create industrial lots.

Waters and Rivers Commission (WRC) mapping of wetlands has been produced by interpretation of aerial photographs. Using a differential GPS, BSD Consultants have accurately mapped the wetland on 13 March 2001. The position of the wetland mapped with the differential GPS in relation to WRC data and the boundaries of the proposal can be seen on **Figure 3**. Based on the GPS mapping, approximately 6.35 hectares of wetland will be cleared. The majority of the remaining portion of wetland is within the future proposed Reid Highway Road Reserve, adjacent to the southern boundary of the proposal.

The level of assessment was set at PER by the EPA because of the impacts upon the CCW, as reflected in the WRC correspondences of 12 January 2001 and 20 March 2001, and the EPA correspondence of 22 February 2001 (**Appendix A**).

The EPA is moving towards a less 'factor' based assessment approach to one that considers 'environmental issues'. In this case, the environmental issue is the impact to and the loss of wetland. Intrinsically, this relates to impacts to flora, fauna and biodiversity.

6. PROPOSED STUDIES AND INVESTIGATIONS

The PER will assess and document all wetland values including vegetation and flora, habitat and fauna and biodiversity. This will be done via a number of investigations:

Wetlands:

- The wetland boundary has already been accurately mapped using a differential GPS;
- The revised boundary of the wetland will be referred to the WRC in preparing the PER, for endorsement and record of the new boundary in the regional wetlands database;
- The PER will describe the values, functions and attributes of the wetland;
- The PER will describe how the CCW will be directly impacted by the proposal;
- The PER will describe how the removal of this wetland may indirectly impact other wetlands and ecosystems nearby;
- The PER will assess the wetland's future if the proposal is not approved, considering recent development to the north, the other planned developments for the land directly south of the proposal and current environmental management plans; and
- The PER will describe how drainage infrastructure will be constructed and managed to ensure the existing hydrological system are not adversely affected.

Vegetation and Flora:

- Suitably qualified personnel will conduct baseline studies within the appropriate season, to identify the diversity, distribution and condition of existing vegetation, which will be directly and indirectly impacted by the proposal;
- The vegetation will be mapped and described, relating to soil/landform units;

- The assessment will be at a level, consistent with the methodology outlined in Bush Forever Volume 2 (DEP and WAPC 2000). The assessment will also be consistent with the EPA's Position Statement No. 3 (March 2002) "Terrestrial Biological Survey as an Element of Biodiversity Protection" and will include a desktop study, a reconnaissance survey and a comprehensive flora survey;
- The site will be specifically surveyed for Declared Rare and Priority Flora. The presence/absence of Threatened Ecological Communities should also be determined and the Department if Conservation and Land Management (CALM) and Environment Australia consulted in accordance with the Wildlife Protection Act 1950 and the Environmental Protection and Biodiversity Conservation Act 1999, as required; and
- The PER will describe the area of each vegetation complex and floristic community type to be cleared and provide details of offsets for the loss of significant vegetation.

Habitat and Fauna:

- The PER will involve baseline studies to identify the existing fauna and habitats in the proposal area;
- Surveys will be conducted in accordance with the EPA Position Statement No. 3 (March 2002) Terrestrial Biological Surveys as an Element of Biodiversity Protection, and include a desktop, a reconnaissance survey and a comprehensive fauna survey. The site will be specifically surveyed for Specially Protected (Threatened) Fauna and CALM and Environment Australia will be consulted in accordance with the Wildlife Protection Act 1950 and the Environmental Protection and Biodiversity Conservation Act 1999, as required; and
- The PER will discuss the direct and indirect impacts of the proposal on the existing fauna and their habitats.

Wetland Mitigation Plan:

With an accurate assessment of the current wetland's ecological value (including flora and fauna values), a Wetland Mitigation Plan will be developed to offset the impacts arising from the proposal. The Wetland Mitigation Plan will be developed in consultation with the DEP and WRC, conducted in a manner consistent with EPA principles, described below (EPA Bulletin 1043, p. 31-34).

The Wetland Mitigation Plan will consider:

- The biological and environmental values of the wetland impacted by the proposal as agreed by the WRC/DEP;
- An appropriate mechanism for compensating the loss of the CCW; and,
- Measures, including actions or acquisition of potential sites to mitigate the loss of any biological and environmental values caused by the proposal.

Subject to agreement with DEP and WRC and should other mitigation options be problematic, the PER will also explore mitigation through cash in lieu.

Table 1Environmental Factors with Scope of Investigations

Environmental Issue	Environmental Factor (Biophysical)	Relevant Area	Environmental Objective	Potential Impacts (Section 5)	Investigations (Section 6)	Potential Management (Section 6)
Impact/loss of biodiversity	• Wetlands • Vegetation and flora • Fauna and habitat	• Within the Swan Coastal Plain.	To avoid adverse impacts on biological diversity, comprising the different plants and animals and the ecosystems they form, at the levels of genetic diversity, species diversity and ecosystem diversity.	6.35 hectares of wetland will be cleared. 3.68 hectares of upland wetland buffer and associated vegetation will be cleared.	Baseline studies will be conducted to identify the diversity, distribution and condition of existing biodiversity, vegetation and flora and fauna and habitat, which will be directly and indirectly impacted by the proposal.	Preparation and implementation of a Wetland Mitigation Plan.

In considering the suitability of other wetlands to mitigate the loss of any biological and environmental values caused by the proposal, the EPA would be particularly cognisant of:

- The specific category of wetland to be affected by the proposal;
- Vesting and proposed management of wetland areas proposed for acquisition to mitigate against the loss of any biological and environmental values caused by the proposa; and,
- Values and role of these wetlands in maintaining conservation values in the Swan Coastal Plain.

The Wetland Mitigation Plan will be detailed and presented as a part of the PER.

12. REFERENCES

Beard, J.S. (1981) Vegetation Survey of Western Australia: Swan. Explanatory Notes to Sheet 7. University of Western Australia Press, Perth WA.

Department of Environmental Protection & Western Australian Planning Commission. (2000) Bush Forever, Western Australian Government, Perth WA.

Environmental Protection Authority (June 2001) A Policy Framework for the Establishment of Wetland Banking Instruments in Western Australia. Draft for Public Comment, Perth WA.

Environmental Protection Authority (September 2000) Environmental Protection (Swan Coastal Plain Wetlands) Policy 2000. Administrative Procedures. Draft for Public Comment. Environmental Protection Authority, Perth WA.

Environmental Protection Authority (June 2001) Environmental Protection of Wetlands Preliminary Position Statement No. 4. Perth WA.

Environmental Protection Authority (February 2002) Tonkin Highway Extension from Mills Road West Gosnells to South Western Highway Mundijong: Report and Recommendations, EPA Bulletin 1043. Perth WA.

Environmental Protection Authority (2002) [1] Guide to Preparing and Environmental Scoping Document, June 2002, Western Australian Government, Perth WA.

Environmental Protection Authority (2002) [2] Guidelines for Preparing a Public Environmental Review/Environmental Review and Management Programme (Draft). June 2002, Western Australian Government, Perth WA.

Government of Western Australia (1997) Wetlands Conservation Policy for Western Australia. Perth, WA.

Hill A., Semeniuk C. A., Semeniuk V., Del Marco A. (1996) Wetlands of the Swan Coastal Plain Volume 2b. Wetland Mapping, Classification and Evaluation. Wetland Atlas. Waters and Rivers Commission, Perth WA.

Waters and Rivers Commission (2001) Personal correspondence from Roger Payne to Mr G Prattley: Ministry of Planning, dated 12 January 2001, WRC ref 13668v2.

7. APPLICABLE LEGISLATION

- Environmental Protection Act 1986.
- Wildlife Conservation Act 1950.
- Environment Protection and Biodiversity Act 1999.
- Town Planning and Development Act 1928.

8. COMMUNITY AND OTHER STAKEHOLDER CONSULTATON PROGRAMME

Where appropriate, the proponent will consult with the WRC, the City of Swan, the Department for Planning and Infrastructure, Main Roads Western Australia, the Conservation Council, Environment Australia and the community, in preparation of the PER.

The proponent will invite the public to make submissions on the PER.

The proponent will advertise the PER in a manner that satisfies DEP requirements (EPA 2002 [2]), and will allow submissions to be made by the public for a period of eight weeks. BSD will be available to answer any questions the public may have in regards to the proposal.

9. PROJECT MILESTONES AND SCHEDULE

PER Tasks/ Milestones	Weeks	Milestone
Submit draft Environmental Scoping Report (ESR)	1	23 August 2002
EPA Service Unit comment on ESR	5	27 September 2002
BSD revise ESR	1	30 September 2002
Submit ESR for approval to EPA	2	15 October 2002
Prepare PER	8	6 December 2002
Submit draft PER to EPA for comment	5	10 January 2003
BSD revise PER	1	17 January 2003
Submit final PER for release	2	31 January 2003
Advertise PER (outside of the holiday period)	8	28 March 2003
BSD summarise public submissions	2	11 April 2003
BSD respond to public submissions	2	25 April 2003
EPA assessment and meeting	4	23 May 2003
EPA bulletin published	6	4 July 2003
Minister's statement issued	4	1 August 2003
Completion Date	**51**	**1 August 2003**

Note: Does not include appeals on EPA bulletin.

10. PEER REVIEW

There will be no peer review.

11. STUDY TEAM

BSD Consultants will be acting for the proponent as the study team, comprising of:

- Adrian Vlok (Environmental Scientist)
- Ben McCarthy (Environmental Scientist)
- Vanessa Clarke (Botanist)
- Ray Hart (Zoologist)
- Jenny Smithson (Planner)
- Frank Bryant (Engineer)

FIGURES

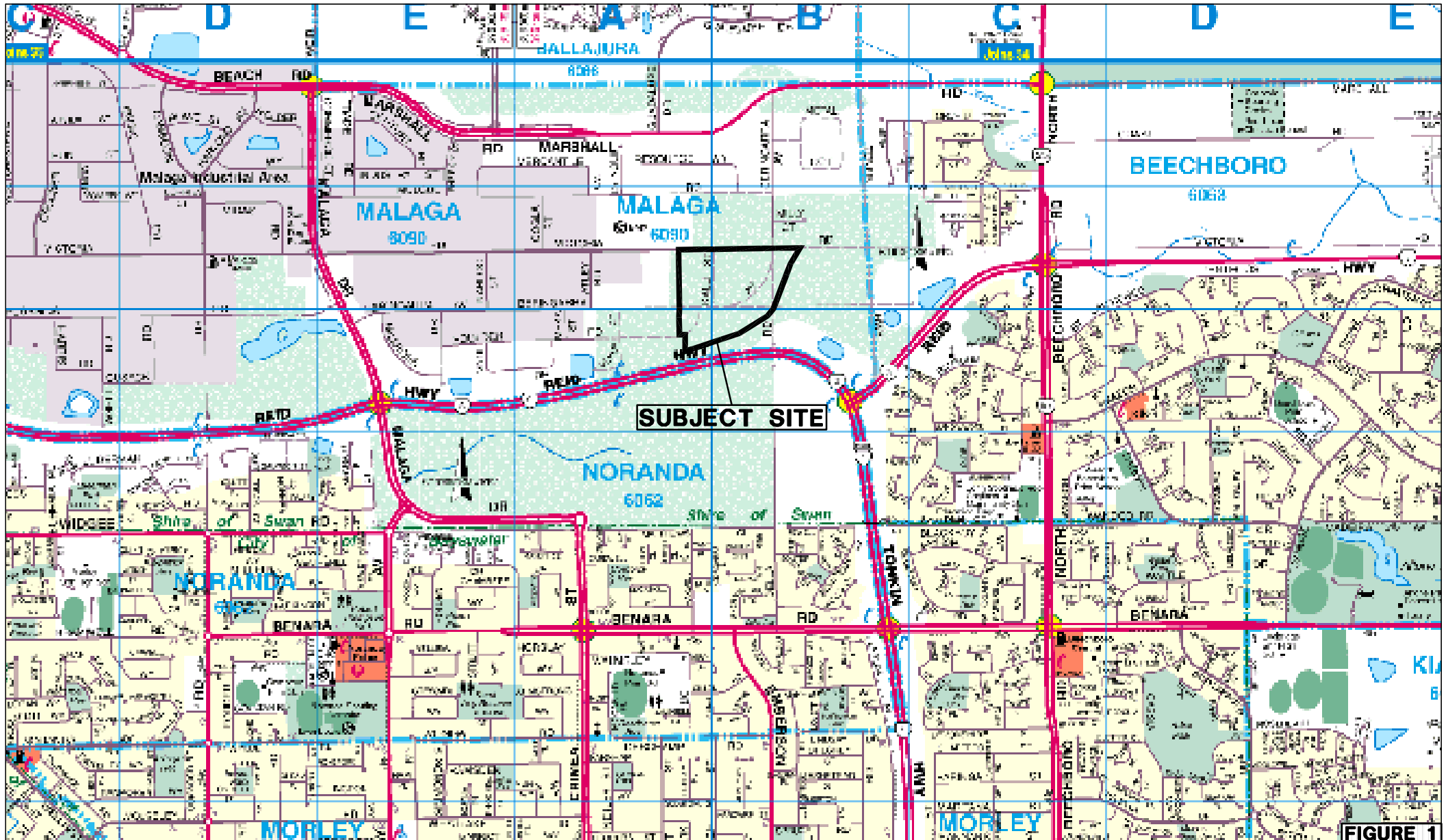


FIGURE 1

PROJECT FREEWAY INDUSTRIAL PARK

DRAWING TITLE LOCALITY PLAN

PRINCIPAL SANDBOURNE HOLDINGS PTY LTD

SCALE: N.T.S.

Cardno BSD
CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS
BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK1	A	A4

Designed — Checked — Date 14.08.02
Drawn NAP — Approved — Sheet Of
Local Authority CITY OF SWAN

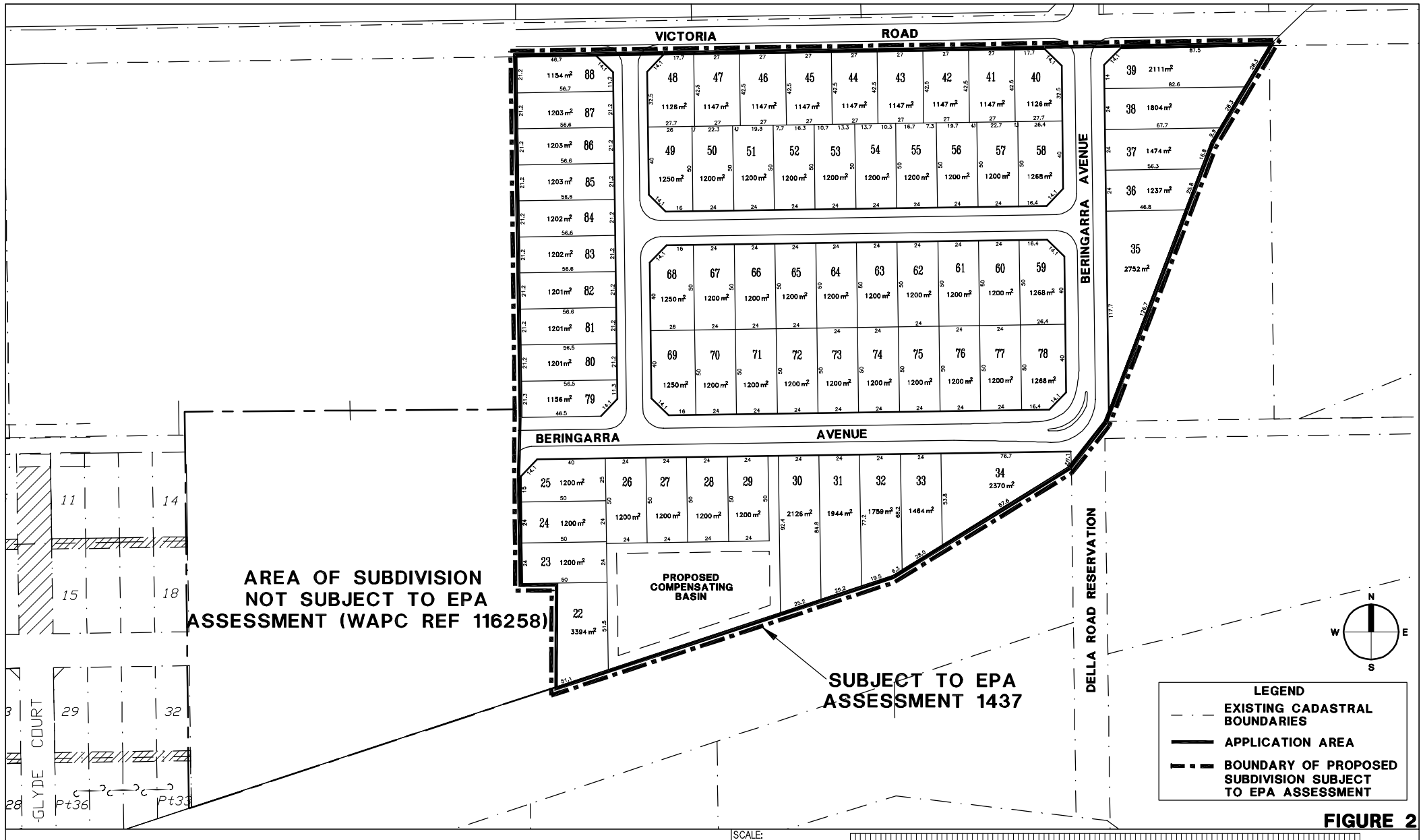


FIGURE 2

PROJECT **FREEWAY INDUSTRIAL PARK**

DRAWING TITLE **PROPOSED SUBDIVISION PLAN - WAPC REF: 115108**

PRINCIPAL **SANDBOURNE HOLDINGS PTY LTD**

SCALE: 1:8000 (0 80m 160 240 320 400 480 560 640 720 800)

Cardno BSD
CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS
BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK3		A4

Designed BMC Checked VC Date 08.11.02
Drawn NAP Approved AV Sheet Of
Local Authority CITY OF SWAN

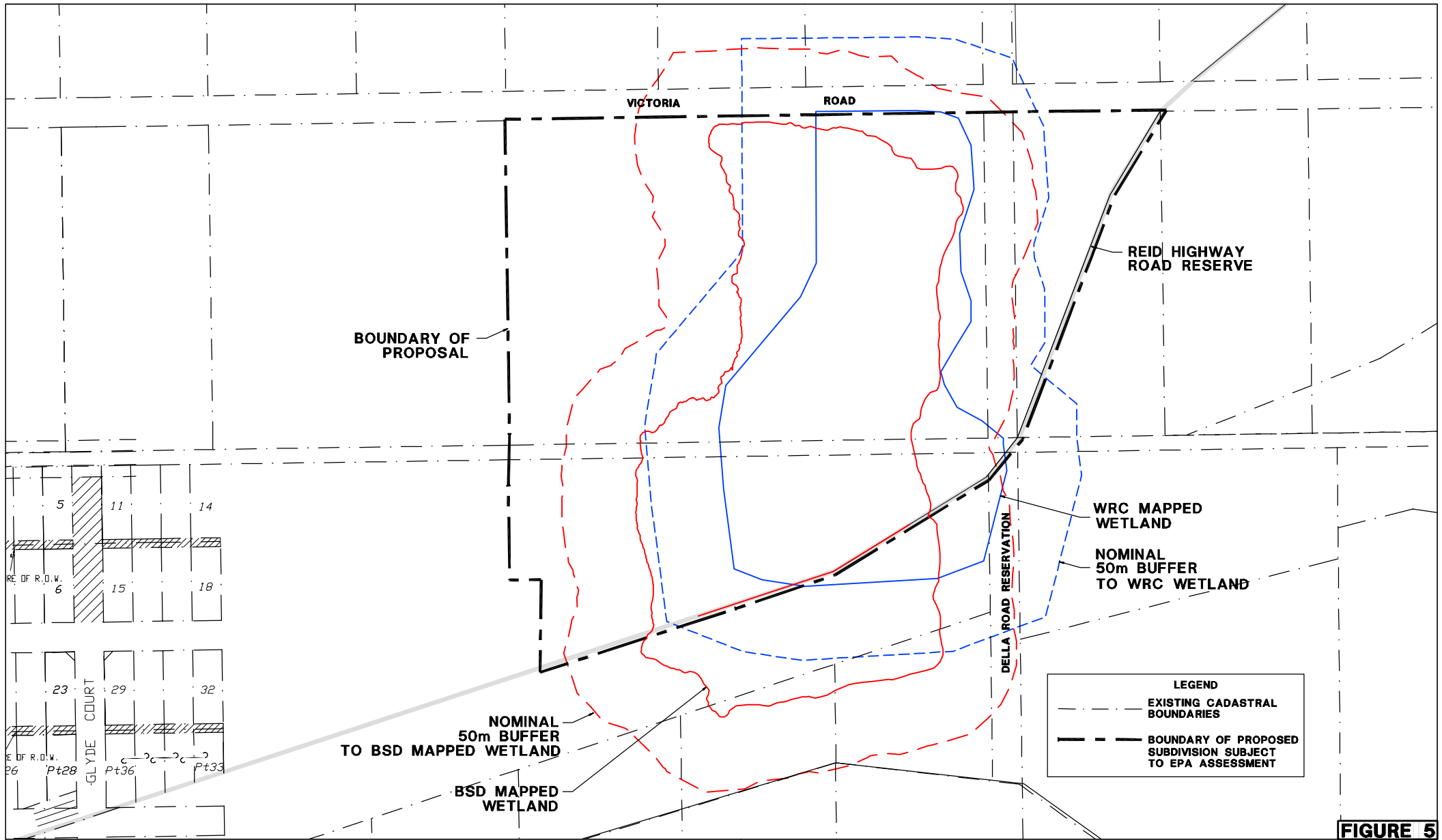


FIGURE 5

PROJECT FREEWAY INDUSTRIAL PARK

DRAWING TITLE WETLAND MAPPING

PRINCIPAL SANDBOURNE HOLDINGS PTY LTD

SCALE: 1:3500 (0 40 80 120 160 200 240 280 320 360m)

Cardno BSD
CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS
BSD Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Project Number	Drawing Number	Revision	Original
V02017	V142-SK2	B	A4

Designed — Checked — Date 14.08.02
Drawn NAP — Approved — Sheet Of
Local Authority CITY OF SWAN

APPENDIX A

Environmental Protection Authority

Ms Jenny Smithson
Director
BSD Consultants
PO Box 155
SUBIACO WA 6904

Dear Ms Smithson

INDUSTRIAL SUBDIVISION LOTS 300-303, 14 & 15 BERINGARRA AVENUE, MALAGA (Sandbourne Holdings Pty Ltd)

I refer to our recent meeting on 7 February 2001 in relation to the above proposal which has been referred to the Environmental Protection Authority (EPA) under Section 38 of the Environmental Protection Act by the Western Australian Planning Commission (WAPC).

At that meeting, I offered to provide further advice to you in relation to the proposal once I was in receipt of advice from the Crown Solicitor's office in relation to the matter. I am now in receipt of this advice, which indicates that the EPA is not constrained from considering the proposal as referred by the WAPC, under Section 40 of the Environmental Protection Act.

Whilst I understand and acknowledge the long history associated with the planning of the site, the EPA has consistently required the protection of conservation category wetlands in the consideration of subdivision and other land use proposals. This EPA position, together with my understanding of the incoming Government's position in relation to environmental assessment, would suggest that it is likely that formal assessment of the proposal under the Environmental Protection Act will be necessary.

Prior to finalising the level of assessment for the proposal, however, I am providing you with an opportunity to forward a formal submission to the EPA outlining how the proposal may be undertaken in a manner which meets the objective of the EPA to protect conservation category wetlands. Alternatively, if it is your view that it is not possible to subdivide the land in a manner which allows this to occur, I would be interested to know whether you are able to put in place measures which may avoid unacceptable environmental impacts of the subdivision on the wetland.

Westralia Square, 141 St Georges Terrace, Perth, Western Australia 6000. Telephone: (08) 9222 7000. Facsimile: (08) 9222 7155.
Postal Address: PO Box K822, Perth, Western Australia 6842.

Please be assured that I do understand the difficulties associated with a proponent's desire to take maximum advantage of subdivision opportunities and the responsibility of the EPA to provide appropriate conservation of the environment.

I look forward to your response in a manner which allows the subdivision to proceed within the constraints of protecting the conservation wetland identified by the Water and Rivers Commission.

Yours sincerely

Bernard Bowen.

Bernard Bowen
CHAIRMAN

22 February 2001

Cc City of Swan
Ministry for Planning

NTH 164473

WATER AND RIVERS
COMMISSION

YOUR REF
OUR REF 14584
ENQUIRIES Sharon Stratico
DIRECT TEL 9278 0372

Mr Kim Taylor
Director, Evaluation Division
Department of Environmental Protection
Westralia Square
141 St Georges Terrace
PERTH WA 6000

ATTENTION: DARREN WALSH

PREVIOUS REC 157245
167342

Dear Kim

Proposed Industrial Subdivision Lots 300–303, 14 & 15 Beringarra Avenue, Malaga and City of Swan TPS 9 Amendment 394.

I am writing in response to your letter dated 17 January 2000. My apologies for the delay in responding. The Commission is pleased that the Department of Environmental Protection recognises the significance of the Malaga wetland and requested referral of the proposed industrial subdivision. As you are aware the Commission has been very concerned with the continued loss of conservation category wetlands (CCWs) and the current lack of ability to effectively protect them.

Although the Commission would like to assist the DEP, as Sharon Stratico has discussed with Darren Walsh, we are unable to provide further detail on the protection of other wetlands in the suite, without considerable and costly data analysis. However, there is no disputing the wetlands significance. It is likely the wetland has become more significant due to the loss of other wetlands. The wetland has always been ranked highly because of its vegetation condition. A rough assessment of the available data shows that the conservation category wetlands which did occur in the Malaga area (as recorded in "The Wetlands of the Swan Coastal Plain, Volume 2") have been reduced to approximately 20 percent of the original coverage.

The Commissions position is that all remaining CCWs should be conserved. They represent the top 25-30 percent of the wetlands remaining on the Swan Coastal Plain.

Yours sincerely

Marnie Leybourne

Dr Marnie Leybourne
MANAGER, CATCHMENT AND WATERWAYS

20 March 2001

INFO

HYATT CENTRE 3 PLAIN STREET EAST PERTH WA 6004
PO BOX 6740 HAY STREET EAST PERTH WA 6892 TEL (08) 9278 0300 FAX (08) 9278 0301
EMAIL ADDRESS correspondence@wrc.wa.gov.au
NATIONAL RELAY SERVICE (AUSTRALIAN COMMUNICATION EXCHANGE) 132 544

WATER AND RIVERS
COMMISSION

YOUR REF
OUR REF 13668v2
ENQUIRIES Melissa Patt
DIRECT TEL. (08) 9278 0451

Mr G Prattley
Ministry for Planning
Albert Facey House
469 Wellington Street
PERTH WA 6000

Dear Gary

MALAGA WETLANDS - LOT 301 VICTORIA ROAD

Thank you for giving the Water and Rivers Commission the opportunity to demonstrate the value of the wetland on Lot 301 Victoria Road, Malaga. The wetland covers not only the majority of Lot 301 Victoria Rd but also part of Lot 302 Victoria Rd and also extends south towards Reid Highway. For your information, a site visit was undertaken by Mr David Nunn, Mrs Shelley Shepherd and Ms Candice Ringrose from the Ministry for Planning and Ms Melissa Patt, an officer of the Commission, on Thursday, 21 December 2000.

I refer to questions that were raised specifically regarding the wetland values and to the request for suggestions to assist the MFP in protecting the wetland:

Lot 301 is the last remaining piece of what was once a much larger wetland described on Map 2034 II NE in the *Wetlands of the Swan Coastal Plain Vol. 2B* as 43Sc - Victoria Road Sumpland.

It was identified as a conservation category wetland (CCW) in 1996 in the Department of Environmental Protection and Commission's report, *Wetlands of the Swan Coastal Plain*. The wetland belongs to the Bennett Brook suite, of which there were only 154 wetlands of this type in the Swan Coastal Plain in 1996. Within this type, Lot 301 was ranked in the top 10% based on using recognised values and other wetland evaluations. It is also highlighted in the 1st Tier recognition as being an 'outstanding wetland recognised in other regional studies', this study being the wetland vegetation assessment project undertaken from Moore River to Mandurah area in 1993

In 1997, as part of wetland verification work undertaken by the V&C Semeniuk Research Group for the draft of Perth's Bushplan, the boundaries of 43Sc were redrawn to reflect the cleared portions and the conservation status reaffirmed for the remaining wetland. Lot 301 Victoria Road was again confirmed as a CCW.

In 1999, Alan Tingay and Associates was commissioned by the Commission to assess the risk of CCWs no longer being conservation category.

Hyatt Centre 3 Plain Street East Perth WA 6004
PO Box 6740 Hay Street East Perth WA 6892 Tel (08) 9278 0300 Fax (08) 9278 0301
Email Address correspondence@wrc.wa.gov.au

Lot 301 Victoria Road was assessed in this report, found not to be at risk and once more the conservation category status was confirmed.

Finally, in September 2000, as part of the final Perth's Bushplan wetland verification work undertaken by the Commission, Lot 301 Victoria Road was again found to be of conservation category status.

The wetland is intact and its current status is conservation category. At the time of the site visit, it was observed that, although there was minor weed invasion around the edges and a few tracks through the wetland, the overall vegetation was in very good condition and free of weeds. The area was very wet and there were large areas of open water in the southern part of the wetland. There appeared to be no justification for altering the management category from conservation or to reduce the boundaries.

Sumplands are defined as seasonally inundated basins and Perth has lost 80 to 90% of its seasonally inundated or waterlogged areas. Vegetated seasonal wetlands are often more botanically rich than other wetland types. There are 12,000 wetlands remaining on the Swan Coastal Plain of which approximately 4,500 have values high enough to be considered CCWs. Of these, 2,800 are not currently protected in reserves nor covered by the existing Lakes EPP. In other words, 62% of CCWs currently have no form of protection.

The biggest pressure on the survival of CCWs exists in the Perth metropolitan area. According to the report by Peter Browne Cooper in 1998, there are 485 CCWs in the Perth metropolitan area not protected by the Lakes EPP or in reserves. Approximately half of these are in "Bush Forever" sites leaving approximately 200 CCWs requiring urgent protection. The Victoria Road wetland is one of these.

The Commission has recently completed wetland verification for Bush Forever. This work has highlighted the loss of CCWs occurring throughout Perth since the first draft of Perth's Bushplan in 1997 and today. Approximately 66 CCWs have been lost and 60 of those were outside "Bush Forever" boundaries. At this rate, the current unprotected CCWs in the metropolitan area will be lost within seven years.

The Victoria Road wetland's significance is not only because of its CCW status and that we need to reverse further loss of CCWs but also that it is within the top 10% of wetlands in the Bennett Brook suite.

In reference to the query raised regarding suggestions to aid you in protecting the wetland, I understand that Lot 321 Truganina Road is proposed to be rezoned from Local Recreation Reserve to General Industrial and is owned by the Metropolitan Region Planning Authority. There is a resource enhancement wetland on this site which has experienced neglect and degradation and its values are far below that of Lot 301. It may be possible to investigate selling this and using the proceeds to purchase Lot 301. This would ensure the survival of the wetland and make it easier to provide the necessary buffer.

APPENDIX B

VASCULAR PLANT SPECIES RECORDED AT LOTS 300 – 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA

APPENDIX B: VASCULAR PLANT SPECIES RECORDED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

*Note: * denotes introduced or weed taxa*
BSD denotes BSD Consultants Pty Ltd survey undertaken October 2002
BBCG denotes Bennett Brook Catchment Group surveys undertaken between 09/06/01 and 17/11/02

Family		Genus & Species	BSD Oct 2002	BBCG 2001-2002
AIZOACEAE	*	*Carpobrotus edulis*	+	
AMARANTHACEAE		*Alternanthera nodiflora*	+	+
ANACARDIACEAE	*	*Schinus terebinthifolia*	+	
ANTHERICACEAE		*Agrostocrinum scabrum*	+	
		Arnocrinum preissii	+	+
		Chamaescilla corymbosa	+	
		Corynotheca micrantha	+	
		Johnsonia sp.		+
		Laxmannia ramosa	+	+
		Laxmannia sessiliflora subsp. *sessiliflora*	+	
		Laxmannia squarrosa	+	
		Thysanotus manglesianus	+	+
		Thysanotus multiflorus	+	+
		Thysanotus sparteus	+	+
		Thysanotus thyrsoideus	+	+
		Tricoryne elatior	+	+
		Tricoryne tenella	+	
APIACEAE		*Centella asiatica*	+	+
		Homalosciadium homalocarpum	+	
		Trachymene pilosa	+	+
		Xanthosia huegelii	+	
ASTERACEAE	*	*Arctotheca calendula*	+	
	*	*Hypochaeris glabra*	+	
		Lagenophora huegelii		+
		Podotheca angustifolia	+	
		Podotheca chrysantha	+	
		Quinetia urvillei	+	
		Siloxerus humifusus	+	+
	*	*Sonchus oleraceus*	+	
	*	*Ursinia anthemoides*	+	
BRASSICACEAE	*	*Brassica tournefortii*	+	
CAMPANULACEAE	*	*Wahlenbergia capensis*	+	
		Wahlenbergia preissii	+	
CARYOPHYLLACEAE	*	*Petrorhagia dubia*	+	

APPENDIX B: VASCULAR PLANT SPECIES RECORDED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

*Note: * denotes introduced or weed taxa*
BSD denotes BSD Consultants Pty Ltd survey undertaken October 2002
BBCG denotes Bennett Brook Catchment Group surveys undertaken between 09/06/01 and 17/11/02

Family	Genus & Species	BSD Oct 2002	BBCG 2001-2002
CASUARINACEAE	*Allocasuarina fraseriana*	+	+
	Allocasuarina humilis	+	+
CENTROLEPIDACEAE	*Centrolepis aristata*	+	+
	Centrolepis drummondiana	+	+
	Centrolepis polygyna	+	
COLCHICACEAE	*Burchardia bairdiae*	+	+
	Burchardia umbellata	+	+
CRASSULACEAE	*Crassula colorata* var. *colorata*	+	
CYPERACEAE	?*Schoenus efoliatus*	+	
	Baumea arthrophylla		+
	Baumea articulata	+	+
	Baumea juncea		+
	Baumea vaginalis		+
	Cyathochaeta avenacea		+
	Cyathochaeta teretifolia (P3)		+
	* *Cyperus tenuiflorus*	+	
	Isolepis cyperoides		+
	* *Isolepis marginata*	+	
	Lepidosperma effusum	+	
	Lepidosperma leptostachyum		+
	Lepidosperma longitudinale	+	+
	Lepidosperma pubisquameum	+	
	Lepidosperma pubisquameum /squamatum		+
	Lepidosperma squamatum	+	
	Lepidosperma striatum		+
	Lepidosperma tenue	+	
	Mesomelaena pseudostygia	+	+
	Schoenus ?latitans		+
	Schoenus brevisetis	+	
	Schoenus curvifolius	+	+
	Schoenus efoliatus		+
	Schoenus laevigatus		+
	Schoenus subfascicularis	+	+
DASYPOGONACEAE	*Calectasia cyanea* (R)		+
	Calectasia narragara	+	+
	Dasypogon bromeliifolius	+	+
	Lomandra caespitosa	+	+
	Lomandra hermaphrodita	+	
DASYPOGONACEAE (Cont.)	*Lomandra nigricans*	+	

APPENDIX B: VASCULAR PLANT SPECIES RECORDED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

*Note: * denotes introduced or weed taxa*
BSD denotes BSD Consultants Pty Ltd survey undertaken October 2002
BBCG denotes Bennett Brook Catchment Group surveys undertaken between 09/06/01 and 17/11/02

Family		Genus & Species	BSD Oct 2002	BBCG 2001-2002
.		*Lomandra preissii*	+	+
		Lomandra sericea		+
		Lomandra suaveolens		+
		Lomandra sp.		+
DILLENIACEAE		*Hibbertia huegelii*	+	+
		Hibbertia hypericoides	+	+
		Hibbertia racemosa	+	+
		Hibbertia stellaris		+
		Hibbertia subvaginata	+	+
DROSERACEAE		*Drosera erythrorhiza*	+	+
		Drosera menziesii subsp. *menziesii*	+	
		Drosera paleacea		+
		Drosera platystigma	+	
		Drosera sp.		+
EPACRIDACEAE		*Astroloma xerophyllum*	+	+
		Conostephium minus	+	
		Conostephium pendulum	+	+
		Conostephium preissii	+	
		Leucopogon ?*polymorphus*		+
		Leucopogon australis	+	
		Leucopogon conostephioides	+	+
EUPHORBIACEAE		*Poranthera microphylla*	+	
GERANIACEAE	*	*Erodium botrys*	+	
	*	*Pelargonium capitatum*	+	
GOODENIACEAE		*Dampiera linearis*	+	+
		Goodenia filiformis (P3)		+
		Goodenia pulchella		+
		Lechenaultia expansa	+	+
		Lechenaultia floribunda	+	+
		Scaevola repens var. *repens*	+	+
HAEMODORACEAE		*Conostylis aculeata*	+	
		Conostylis aurea	+	+
		Conostylis juncea	+	+
		Conostylis setigera	+	+
HAEMODORACEAE (Cont.)		*Haemodorum* ?*laxum*	+	
		Haemodorum laxum		+

APPENDIX B: VASCULAR PLANT SPECIES RECORDED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

*Note: * denotes introduced or weed taxa*
BSD denotes BSD Consultants Pty Ltd survey undertaken October 2002
BBCG denotes Bennett Brook Catchment Group surveys undertaken between 09/06/01 and 17/11/02

Family		Genus & Species	BSD Oct 2002	BBCG 2001-2002
		Haemodorum sparsiflorum		+
		Haemodorum spicatum	+	
		Phlebocarya ciliata	+	+
HALORAGACEAE		*Gonocarpus* ?*pithyoides*		+
		Gonocarpus cordiger	+	
		Gonocarpus pithyoides	+	
IRIDACEAE	*	*Freesia alba* x *leichtlinii*	+	
	*	*Gladiolus caryophyllaceus*	+	
		Patersonia juncea		+
		Patersonia occidentalis	+	+
		Patersonia sp. Swamp form	+	
	*	*Romulea rosea*	+	
JUNCACEAE		?*Juncus subsecundus* (sterile)	+	
	*	*Juncus capitatus*	+	
		Juncus pallidus	+	+
LAMIACEAE		*Hemiandra pungens*	+	+
LAURACEAE		*Cassytha glabella*	+	+
		Cassytha racemosa	+	
LOBELIACEAE		*Lobelia alata*	+	+
		Lobelia tenuior	+	
LOGANIACEAE		*Phyllangium paradoxum*	+	+
LORANTHACEAE		*Nuytsia floribunda*	+	+
MENYANTHACEAE		*Villarsia albiflora*	+	+
MIMOSACEAE		*Acacia huegelii*	+	+
		Acacia pulchella		+
		Acacia pulchella var. *pulchella*	+	
		Acacia saligna	+	+
		Acacia sessilis		+
		Acacia stenoptera	+	+
		Acacia willdenowiana	+	+
MOLLUGINACEAE		*Macarthuria australis*	+	+
MYRTACEAE		*Astartea fascicularis*	+	+

APPENDIX B: VASCULAR PLANT SPECIES RECORDED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

*Note: * denotes introduced or weed taxa*
BSD denotes BSD Consultants Pty Ltd survey undertaken October 2002
BBCG denotes Bennett Brook Catchment Group surveys undertaken between 09/06/01 and 17/11/02

Family	Genus & Species	BSD Oct 2002	BBCG 2001-2002
	Calothamnus lateralis		+
	Calytrix angulata	+	
	Calytrix flavescens	+	+
	Calytrix fraseri	+	+
	Eremaea pauciflora	+	+
	Eucalyptus marginata	+	
	Eucalyptus rudis	+	+
	Eucalyptus todtiana	+	+
	Hypocalymma angustifolium	+	+
	Hypocalymma robustum	+	+
	Melaleuca lateritia	+	+
	Melaleuca preissiana	+	+
	Melaleuca scabra	+	+
	Melaleuca teretifolia		+
	Melaleuca trichophylla /scabra		+
	Pericalymma ellipticum	+	+
	Regelia ciliata	+	+
	Scholtzia involucrata	+	+
	Verticordia densiflora		+
	Verticordia densiflora var. *densiflora*	+	
	Verticordia nitens		+
ORCHIDACEAE	*Caladenia flava* subsp. *flava*	+	
	Caladenia sp. (aestivating)	+	
	Diuris corymbosa	+	
	Epiblema grandiflorum var. *grandiflorum*	+	+
	Leporella fimbriata	+	
	Microtis brownii	+	
	Microtis sp.		+
	Pterostylis aff. *pyramidalis*	+	
	Pterostylis vittata	+	
	Pyrorchis nigricans	+	
	Orchidaceae sp.	+	
PAPILIONACEAE	*Aotus gracillima*	+	
	Bossiaea eriocarpa	+	+
	Daviesia divaricata		+
	Daviesia divaricata subsp. *divaricata* (ms)	+	
	Daviesia physodes	+	+
	Daviesia triflora	+	+
PAPILIONACEAE (Cont.)	*Euchilopsis linearis*	+	
	Eutaxia virgata	+	+
	Gastrolobium capitatum	+	+
	Gompholobium tomentosum	+	+

APPENDIX B: VASCULAR PLANT SPECIES RECORDED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

*Note: * denotes introduced or weed taxa*
BSD denotes BSD Consultants Pty Ltd survey undertaken October 2002
BBCG denotes Bennett Brook Catchment Group surveys undertaken between 09/06/01 and 17/11/02

Family		Genus & Species	BSD Oct 2002	BBCG 2001-2002
		Hovea pungens	+	+
		Hovea trisperma		+
		Jacksonia floribunda	+	+
		Jacksonia furcellata	+	+
		Jacksonia sternbergiana	+	+
	*	*Lupinus cosentinii*	+	
POACEAE		?*Agrostis* sp.		+
	*	*Aira caryophyllea*	+	
		Amphipogon laguroides		+
		Amphipogon turbinatus	+	+
		Austrodanthonia occidentalis	+	+
		Austrostipa compressa	+	
		Austrostipa elegantissima		+
		Austrostipa flavescens	+	+
	*	*Avena fatua*	+	
	*	*Briza maxima*	+	
	*	*Briza minor*	+	
	*	*Bromus diandrus*	+	
	*	*Cynodon dactylon*	+	
	*	*Ehrharta calycina*	+	
	*	*Ehrharta longiflora*	+	
		Eragrostis elongata		+
	*	*Lolium perenne*	+	
		Neurachne alopecuroidea	+	
	*	*Pentaschistis airoides*	+	
	*	*Stenotaphrum secundatum*	+	
POLYGALACEAE		*Comesperma calymega*	+	
		Comesperma flavum		+
		Comesperma virgatum	+	+
PORTULACACEAE		*Calandrinia* sp.		+
PRIMULACEAE	*	*Anagallis arvensis*	+	
PROTEACEAE		*Adenanthos cygnorum*	+	+
		Banksia attenuata	+	+
		Banksia ilicifolia	+	+
PROTEACEAE (Cont.)		*Banksia menziesii*	+	+
		Conospermum stoechadis		+
		Dryandra lindleyana	+	
		Hakea varia	+	+
		Persoonia saccata		+

APPENDIX B: VASCULAR PLANT SPECIES RECORDED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

*Note: * denotes introduced or weed taxa*
BSD denotes BSD Consultants Pty Ltd survey undertaken October 2002
BBCG denotes Bennett Brook Catchment Group surveys undertaken between 09/06/01 and 17/11/02

Family	Genus & Species	BSD Oct 2002	BBCG 2001-2002
	Petrophile linearis	+	+
	Stirlingia latifolia	+	+
RESTIONACEAE	*Alexgeorgea nitens*	+	+
	Chaetanthus aristatus	+	+
	Desmocladus fasciculatus		
	Desmocladus flexuosus	+	
	Hypolaena exsulca	+	+
	Lepyrodia muirii		+
	Loxocarya cinerea	+	
	Lyginia barbata	+	+
	Lyginia imberbis		+
	Meeboldina cana	+	
	Meeboldina scariosa		+
	Meeboldina tephrina (ms)		+
RUBIACEAE	*Opercularia vaginata*	+	+
RUTACEAE	*Boronia ramosa*	+	
	Philotheca spicata	+	+
STACKHOUSIACEAE	*Stackhousia monogyna*		+
STYLIDIACEAE	*Levenhookia pusilla*	+	
	Levenhookia stipitata		+
	Stylidium adpressum		+
	Stylidium brunonianum		+
	Stylidium brunonianum subsp. *brunonianum*	+	
	Stylidium calcaratum	+	+
	Stylidium dichotomum	+	
	Stylidium junceum	+	
	Stylidium leptophyllum		+
	Stylidium piliferum	+	
	Stylidium repens	+	+
	Stylidium schoenoides	+	
	Stylidium utricularioides		+

APPENDIX B: VASCULAR PLANT SPECIES RECORDED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

*Note: * denotes introduced or weed taxa*
BSD denotes BSD Consultants Pty Ltd survey undertaken October 2002
BBCG denotes Bennett Brook Catchment Group surveys undertaken between 09/06/01 and 17/11/02

Family	Genus & Species	BSD Oct 2002	BBCG 2001-2002
THYMELAEACEAE	*Pimelea sulphurea*		+
	Pimelea sp.	+	
TREMANDRACEAE	*Platytheca galioides*	+	+
VIOLACEAE	*Hybanthus calycinus*	+	
XANTHORRHOEACEAE	*Xanthorrhoea ?brunonis*	+	
	Xanthorrhoea brunonis		+
	Xanthorrhoea preissii	+	+
ZAMIACEAE	*Macrozamia riedlei*	+	+

APPENDIX C

DECLARED RARE AND PRIORITY VASCULAR PLANT SPECIES POTENTIALLY OCCURRING IN THE MALAGA AREA (CALM 2003)

APPENDIX C: DECLARED RARE AND PRIORITY VASCULAR PLANT SPECIES POTENTIALLY OCCURRING IN THE MALAGA AREA (CALM 2003)

		CONSERVATION CODE	
Family	**Genus & Species**	**State**	**Federal**
ORCHIDACEAE	*Caladenia huegelii*	R	3
	Epiblema grandiflorum var. *cyaneum* (ms)	R	3
CYPERACEAE	*Cyathochaeta teretifolia*	P3	
DROSERACEAE	*Drosera occidentalis* subsp. *occidentalis*	P4	
PAPILIONACEAE	*Jacksonia sericea*	P4	
EPACRIDACEAE	*Conostephium minus*		

APPENDIX D

VEGETATION COMMUNITIES DESCRIBED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA – OCTOBER 2002

APPENDIX D: VEGETATION COMMUNITIES DESCRIBED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

Vegetation Community 1

Description: Low Closed Forest of *Melaleuca preissiana* over an Open Shrubland of *Astartea fascicularis*, *Regelia ciliata* and *Acacia pulchella* var. *pulchella* over a Sedgeland dominated by ?*Schoenus efoliatus* in low-lying grey sands.

Inferred Gibson *et al*. FCT: 4

Recorded Species:

Weeds	**Native Species**
**Aira caryophyllea*	*Acacia pulchella* var. *pulchella*
**Anagallis arvensis*	*Acacia willdenowiana*
**Avena fatua*	*Alternanthera nodiflora*
**Briza maxima*	*Astartea fascicularis*
**Briza minor*	*Burchardia bairdiae*
**Bromus diandrus*	*Caladenia flava* subsp. *flava*
**Cynodon dactylon*	*Cassytha glabella*
**Ehrharta calycina*	*Centrolepis aristata*
**Freesia alba* x *leichtlinii*	*Chamaescilla corymbosa*
**Hypochaeris glabra*	*Conostylis juncea*
**Isolepis marginata*	*Dampiera linearis*
**Lolium perenne*	*Daviesia triflora*
**Pelargonium capitatum*	*Diuris corymbosa*
**Petrorhagia dubia*	*Drosera menziesii* subsp. *menziesii*
**Schinus terebinthifolia*	*Epiblema grandiflorum* var. *grandiflorum*
**Sonchus oleraceus*	*Gonocarpus pithyoides*
	Haemodorum spicatum

APPENDIX D: VEGETATION COMMUNITIES DESCRIBED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

Native Species (Cont.)
Vegetation Community 1

?Juncus subsecundus
Lepidosperma longitudinale
Lobelia tenuior
Melaleuca preissiana
Microtis brownii
Patersonia occidentalis
Patersonia sp. Swamp form
Pericalymma ellipticum
Phyllangium paradoxum
Podotheca angustifolia
Pyrorchis nigricans
Regelia ciliata
?*Schoenus efoliatus*
Schoenus subfascicularis
Siloxerus humifusus
Stylidium dichotomum
Stylidium junceum
Thysanotus thyrsoideus

APPENDIX D: VEGETATION COMMUNITIES DESCRIBED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

Vegetation Community 2

Description: *Astartea fascicularis-Pericalymma ellipticum* Closed Heath with occasional *Melaleuca preissiana* over a Low Open Shrubland of *Hypocalymma angustifolium, Calothamnus lateralis* and *Melaleuca lateritia* over an Open Sedgeland of *Lepdiosperma effusum, Baumea articulata* and *Schoenus subfascicularis* in inundated humus rich sandy soils.

Inferred Gibson *et al*. FCT: 4

Recorded Species:

Weeds
**Aira caryophyllea*
**Arctotheca calendula*
**Avena fatua*
**Briza maxima*
**Briza minor*
**Cynodon dactylon*
**Ehrharta calycina*
**Isolepis marginata*
**Sonchus oleraceus*
**Stenotaphrum secundatum*

Native Species
Adenanthos cygnorum
Agrostocrinum scabrum
Alternanthera nodiflora
Amphipogon turbinatus

Native Species (Cont.)
Astartea fascicularis
Astroloma xerophyllum
Austrodanthonia occidentalis
Banksia ilicifolia
Baumea articulata
Bossiaea eriocarpa
Burchardia bairdiae
Burchardia umbellata
Caladenia flava subsp. *flava*
Calothamnus lateralis
Calytrix flavescens
Cassytha glabella
Chamaescilla corymbosa
Comesperma calymega
Comesperma virgatum
Conostylis juncea

APPENDIX D: VEGETATION COMMUNITIES DESCRIBED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

Native Species (Cont.)
Vegetation Community 2

Crassula colorata var. *colorata*
Cyathochaeta avenacea
Dampiera linearis
Dasypogon bromeliifolius
Desmocladus fasciculatus
Drosera erythrorhiza
Drosera platystigma
Ehrharta longiflora
Euchilopsis linearis
Eutaxia virgata
Gompholobium tomentosum
Haemodorum spicatum
Hakea varia
Hibbertia subvaginata
Hypocalymma angustifolium
Hypolaena exsulca
Jacksonia furcellata
Laxmannia ramosa
Laxmannia sessiliflora subsp. *sessiliflora*
Lepidosperma effusum
Lepidosperma longitudinale
Levenhookia pusilla
Lobelia tenuior
Lomandra caespitosa
Lomandra hermaphrodita
Lyginia barbata
Melaleuca lateritia
Melaleuca preissiana
Patersonia occidentalis
Pericalymma ellipticum
Pyrorchis nigricans
Regelia ciliata
Schoenus subfascicularis
Siloxerus humifusus
Stylidium dichotomum
Stylidium junceum
Thysanotus thyrsoideus
Villarsia albiflora

APPENDIX D: VEGETATION COMMUNITIES DESCRIBED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

Vegetation Community 3

Description: *Patersonia occidentalis*, *Dasypogon bromeliifolius* and *Phlebocarya ciliata* Herbland with occasional *Jacksonia furcellata*, *Calytrix fraseri* and *Hypocalymma angustifolium* over an Open Sedgeland of *Lyginia barbata*, *Lepidosperma pubisquameum* and *Alexgeorgea nitens* in grey sands on gentle sandy rises from wetland areas.

Inferred Gibson *et al*. FCT: Not a FCT, intergrade between inferred FCT 23a and FCT 4.

Recorded Species:

Weeds
**Ehrharta calycina*
**Gladiolus caryophyllaceus*
**Hypochaeris glabra*
**Pentaschistis airoides*
**Stenotaphrum secundatum*
**Ursinia anthemoides*

Native Species
Acacia pulchella var. *pulchella*
Adenanthos cygnorum
Alexgeorgea nitens
Allocasuarina fraseriana
Astroloma xerophyllum
Banksia attenuata

Native Species (Cont.)
Banksia ilicifolia
Banksia menziesii
Bossiaea eriocarpa
Burchardia bairdiae
Burchardia umbellata
Calytrix fraseri
Chaetanthus aristatus
Conostephium pendulum
Conostylis juncea
Dampiera linearis
Dasypogon bromeliifolius
Dryandra lindleyana
Eremaea pauciflora
Eucalyptus rudis
Gompholobium tomentosum

APPENDIX D: VEGETATION COMMUNITIES DESCRIBED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

Native Species (Cont.)
Vegetation Community 3

Gonocarpus cordiger
Hakea varia
Hibbertia racemosa
Hibbertia subvaginata
Hovea pungens
Hypocalymma angustifolium
Hypolaena exsulca
Jacksonia floribunda
Jacksonia furcellata
Laxmanniana sessiliflora subsp. *sessiliflora*
Lechenaultia floribunda
Lepidosperma pubisquameum
Lepidosperma squamatum
Leucopogon conostephioides
Levenhookia pusilla
Lomandra hermaphrodita
Lomandra preissii
Lyginia barbata
Macarthuria australis
Macrozamia riedlei
Nuytsia floribunda
Opercularia vaginata
Patersonia occidentalis
Petrophile linearis
Philotheca spicata
Phlebocarya ciliata
Pimelea sp.
Platytheca galioides
Schoenus brevisetis
Schoenus curvifolius
Scholtzia involucrata
Stylidium brunonianum subsp. *brunonianum*
Stylidium piliferum
Stylidium repens
Thysanotus thyrsoideus
Trachymene pilosa
Tricoryne elatior
Tricoryne tenella
Xanthorrhoea ?brunonis
Xanthorrhoea preissii

APPENDIX D: VEGETATION COMMUNITIES DESCRIBED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

Vegetation Community 4

Description: *Banksia menziesii, B. attenuata* and *B. ilicifolia* with occasional *Eucalyptus todtiana* Low Woodland over a Shrubland of *Allocasuarina humilis*, *Daviesia divaricata* subsp. *divaricata* and *Conostephium pendulum* over an Open Herb/Sedgeland of *Mesomelaena pseudostygia*, *Alexgeorgea nitens* and *Conostylis aurea* on deep pale grey sands.

Inferred Gibson *et al*. FCT: 23a but highly similar to both 23b and 21a

Recorded Species:

Weeds
**Aira caryophyllea*
**Briza maxima*
**Ehrharta calycina*
**Gladiolus caryophyllaceus*
**Hypochaeris glabra*
**Ursinia anthemoides*

Native Species
Acacia huegelii
Adenanthos cygnorum
Alexgeorgea nitens
Agrostocrinum scabrum
Allocasuarina humilis
Amphipogon turbinatus
Arnocrinum preissii
Astroloma xerophyllum
Austrodanthonia occidentalis

Native Species (Cont.)
Austrostipa compressa
Austrostipa flavescens
Banksia attenuata
Banksia ilicifolia
Banksia menziesii
Boronia ramosa
Bossiaea eriocarpa
Burchardia umbellata
Calytrix angulata
Calytrix flavescens
Calytrix fraseri
Cassytha glabella
Centrolepis drummondiana
Comesperma calymega
Conostephium minus
Conostephium pendulum
Conostephium preissii

APPENDIX D: VEGETATION COMMUNITIES DESCRIBED AT LOTS 300 - 303 AND 14 & 15 BERINGARRA AVENUE, MALAGA - OCTOBER 2002

Native Species (Cont.)
Vegetation Community 4

Conostephium pendulum
Conostylis aculeata
Conostylis aurea
Conostylis juncea
Conostylis setigera
Corynotheca micrantha
Crassula colorata var. *colorata*
Dampiera linearis
Dasypogon bromeliifolius
Daviesia divaricata subsp. *divaricata*
Desmocladus flexuosus
Eremaea pauciflora
Eucalyptus todtiana
Gastrolobium capitatum
Gompholobium tomentosum
Gonocarpus ?pithyoides
Haemodorum spicatum
Hemiandra pungens
Hibbertia huegelii
Hibbertia hypericoides
Hybanthus calycinus
Hypocalymma robustum
Isolepis marginata
Jacksonia floribunda
Jacksonia sternbergiana
Laxmannia ramosa
Laxmannia squarrosa
Lepidosperma tenue
Leporella fimbriata
Levenhookia pusilla
Lomandra caespitosa
Lomandra hermaphrodita
Loxocarya cinerea
Lyginia barbata
Macrozamia riedlei
Melaleuca scabra
Mesomelaena pseudostygia
Neurachne alopecuroidea
Nuytsia floribunda
Opercularia vaginata
Patersonia occidentalis
Petrophile linearis
Philotheca spicata
Phlebocarya ciliata
Phyllangium paradoxum
Podotheca angustifolia
Podotheca chrysantha
Poranthera microphylla
Pterostylis aff. *pyramidalis*
Pterostylis vittata
Pyrorchis nigricans
Quinetia urvillei
Schoenus curvifolius
Scholtzia involucrata
Siloxerus humifusus
Stirlingia latifolia
Stylidium brunonianum
Stylidium calcaratum
Stylidium junceum
Stylidium piliferum
Stylidium repens
Stylidium schoenoides
Thysanotus sparteus
Trachymene pilosa
Tricoryne elatior
Tricoryne tenella
Ursinia anthemoides
Wahlenbergia preissii
Xanthorrhoea preissii
Xanthosia huegelii

APPENDIX E

WATER AND RIVERS COMMISSION LETTER OF 12TH JANUARY 2001

Annexure NCT 4 21

WATER AND RIVERS
COMMISSION

YOUR REF
OUR REF 13668v2
ENQUIRIES Melissa Patt
DIRECT TEL. (08) 9278 0451

Mr G Prattley
Ministry for Planning
Albert Facey House
469 Wellington Street
PERTH WA 6000

Dear Gary

MALAGA WETLANDS - LOT 301 VICTORIA ROAD

Thank you for giving the Water and Rivers Commission the opportunity to demonstrate the value of the wetland on Lot 301 Victoria Road, Malaga. The wetland covers not only the majority of Lot 301 Victoria Rd but also part of Lot 302 Victoria Rd and also extends south towards Reid Highway. For your information, a site visit was undertaken by Mr David Nunn, Mrs Shelley Shepherd and Ms Candice Ringrose from the Ministry for Planning and Ms Melissa Patt, an officer of the Commission, on Thursday, 21 December 2000.

I refer to questions that were raised specifically regarding the wetland values and to the request for suggestions to assist the MFP in protecting the wetland:

Lot 301 is the last remaining piece of what was once a much larger wetland described on Map 2034 II NE in the *Wetlands of the Swan Coastal Plain Vol. 2B* as 43Sc - Victoria Road Sumpland.

It was identified as a conservation category wetland (CCW) in 1996 in the Department of Environmental Protection and Commission's report, *Wetlands of the Swan Coastal Plain*. The wetland belongs to the Bennett Brook suite, of which there were only 154 wetlands of this type in the Swan Coastal Plain in 1996. Within this type, Lot 301 was ranked in the top 10% based on using recognised values and other wetland evaluations. It is also highlighted in the 1st Tier recognition as being an 'outstanding wetland recognised in other regional studies', this study being the wetland vegetation assessment project undertaken from Moore River to Mandurah area in 1993

In 1997, as part of wetland verification work undertaken by the V&C Semeniuk Research Group for the draft of Perth's Bushplan, the boundaries of 43Sc were redrawn to reflect the cleared portions and the conservation status reaffirmed for the remaining wetland. Lot 301 Victoria Road was again confirmed as a CCW.

In 1999, Alan Tingay and Associates was commissioned by the Commission to assess the risk of CCWs no longer being conservation category.

HYATT CENTRE 3 PLAIN STREET EAST PERTH WA 6004
PO BOX 6740 HAY STREET EAST PERTH WA 6892 TEL (08) 9278 0300 FAX (08) 9278 0301
EMAIL ADDRESS correspondence@wrc.wa.gov.au

Lot 301 Victoria Road was assessed in this report, found not to be at risk and once more the conservation category status was confirmed.

Finally, in September 2000, as part of the final Perth's Bushplan wetland verification work undertaken by the Commission, Lot 301 Victoria Road was again found to be of conservation category status.

The wetland is intact and its current status is conservation category. At the time of the site visit, it was observed that, although there was minor weed invasion around the edges and a few tracks through the wetland, the overall vegetation was in very good condition and free of weeds. The area was very wet and there were large areas of open water in the southern part of the wetland. There appeared to be no justification for altering the management category from conservation or to reduce the boundaries.

Sumplands are defined as seasonally inundated basins and Perth has lost 80 to 90% of its seasonally inundated or waterlogged areas. Vegetated seasonal wetlands are often more botanically rich than other wetland types. There are 12,000 wetlands remaining on the Swan Coastal Plain of which approximately 4,500 have values high enough to be considered CCWs. Of these, 2,800 are not currently protected in reserves nor covered by the existing Lakes EPP. In other words, 62% of CCWs currently have no form of protection.

The biggest pressure on the survival of CCWs exists in the Perth metropolitan area. According to the report by Peter Browne Cooper in 1998, there are 485 CCWs in the Perth metropolitan area not protected by the Lakes EPP or in reserves. Approximately half of these are in "Bush Forever" sites leaving approximately 200 CCWs requiring urgent protection. The Victoria Road wetland is one of these.

The Commission has recently completed wetland verification for Bush Forever. This work has highlighted the loss of CCWs occurring throughout Perth since the first draft of Perth's Bushplan in 1997 and today. Approximately 66 CCWs have been lost and 60 of those were outside "Bush Forever" boundaries. At this rate, the current unprotected CCWs in the metropolitan area will be lost within seven years.

The Victoria Road wetland's significance is not only because of its CCW status and that we need to reverse further loss of CCWs but also that it is within the top 10% of wetlands in the Bennett Brook suite.

In reference to the query raised regarding suggestions to aid you in protecting the wetland, I understand that Lot 321 Truganina Road is proposed to be rezoned from Local Recreation Reserve to General Industrial and is owned by the Metropolitan Region Planning Authority. There is a resource enhancement wetland on this site which has experienced neglect and degradation and its values are far below that of Lot 301. It may be possible to investigate selling this and using the proceeds to purchase Lot 301. This would ensure the survival of the wetland and make it easier to provide the necessary buffer.

I would reiterate, however, that, of the three conservation category wetlands in this area outside "Bush Forever", only the one on Lot 301 Victoria Road remains. The State Wetlands Conservation Policy for Western Australia 1997 has, as its first objective, "To prevent the further loss or degradation of valuable wetlands and wetland types, and promote wetland conservation, creation and restoration." It is therefore imperative that this remaining wetland and its subsequent buffer is fully protected to be consistent with the state government policy.

If you have any further queries, please contact Ms Melissa Patt on 9278 0451.

Yours sincerely

Roger F Payne
CHIEF EXECUTIVE

12 January 2001

APPENDIX F

LIST OF RARE VERTEBRATE FAUNA SPECIES RECORDED FOR THE MALAGA AREA IN THE CALM RARE FAUNA DATABASE

APPENDIX F: LIST OF THE RARE VERTEBRATE FAUNA SPECIES RECORDED FOR THE MALAGA AREA IN THE CALM RARE FAUNA DATABASE.

Schedule 1 (Fauna which is Rare or likely to become Extinct)

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) This species moves around in flocks to feeding areas through the Perth metropolitan area but breeding occurs mainly in the eastern forests and wheatbelt.

Schedule 4 (Fauna which is Otherwise Specially Protected)

Peregrine Falcon (*Falco peregrinus*) This species is an occasional visitor to urban areas including semi-rural and industrial areas.

Priority Taxa

Quenda (*Isoodon obesulus fusciventer*) P4 This species still occurs in parts of the coastal plain where dense understorey vegetation occurs, particularly around creeks and swamps. It has been recorded near Caversham and may possibly occur in the area in question.

APPENDIX G

ENVIRONMENTAL PROTECTION AUTHORITY LETTER OF JUNE 1989

AN ENVIRONMENT WORTH PROTECTION

CHIEF EXECUTIVE
DEPARTMENT OF PLANNING &
URBAN DEVELOPMENT

Your Ref:
Our Ref: 159/77 032520 FILT
Enquiries: G FRENCH

TOWN PLANNING SCHEME NO 14 - EAST MALAGA INDUSTRIAL DEVELOPMENT SCHEME SHIRE OF SWAN

The above matter has been referred to the Environmental Protection Authority from Shire of Swan for consideration of the potential environmental impact. The Environmental Protection Authority has decided that the overall environmental impact is not so severe as to require a full, formal assessment and the subsequent setting of formal conditions by the Minister for Environment. However, the staff of the Authority will look at the proposal and provide advice and make recommendations to you and other relevant decision-making authorities on environmental aspects of the proposal.

This is an interim response only. A final response giving the Environmental Protection Authority's advice and recommendations related to this proposal, will be forwarded as soon as possible.

You should be aware that when the Authority provides its advice to decision-making authorities that advice will be made available to the public.

Some members of the public may have preferred the Environmental Protection Authority to undertake a full, formal assessment of this proposal. By law, they have a 14 day appeal period, closing 2 February 1990, when they may ask the Minister for Environment to order the Authority to conduct a formal assessment. You should not make any decisions that could allow the proposal to be implemented until the appeal period has closed and any appeals have been determined.

R A D Sippe
DIRECTOR
EVALUATION DIVISION

18FMFILT606:fh

Environmental Protection Authority
1 Mount Street Perth
Western Australia 6000
Telephone (09) 222 7000

10

ENVIRONMENTAL PROTECTION AUTHORITY
1 MOUNT STREET, PERTH, WESTERN AUSTRALIA 6000
Telephone (09) 222 7000

Shire Clerk
Shire of Swan
PO Box 196
MIDLAND WA 6056

Your Ref: AL:DMC M493
Our Ref: 227/74/89.56
Enquiries: Michelle Andrews

Dear Sir

TOWN PLANNING SCHEME NO.14 - MALAGA

I refer to your letter dated the 1st of June advising us of Council's resolution to prepare a Town Planning Scheme for the Malaga Area and requesting information that could be pertinent to scheme preparation.

There are a number of matters that the Authority believes should receive careful consideration during preparation of the scheme and these are briefly discussed hereunder.

1. DRAINAGE DESIGN

There are a number of low lying wetland areas to the east of the proposed scheme area. Although these wetlands are semi-degraded they are suitable for rehabilitation to important landscape features as well as retaining a drainage function. Land use planning in the scheme area should take this into account in the form of appropriate landscaping and drainage strategies, giving consideration to both water quantity and quality. The EPA would support development design features which encourage reduced per capita water consumption, increased water retention and groundwater recharge at source.

As the area lies within the Gnangara Underground Water Pollution Control Area and one of the Public Water Supply Areas, appropriate planning to ensure protection of the water resource is essential. This should include limitations on groundwater usage from private bores in the area and also appropriate control mechanisms for land use, stock numbers and effluent disposal, the object being to protect the water resource from pollution and depletion.

2. REVEGETATION PROGRAMMES

As the scheme area lies on the Bassendean Sands where soil stability is poor and the majority of the land is cleared, the Authority suggests that a revegetation programme be integrated into your Town Planning Scheme. This would involve not only the re-establishment of native vegetation but also the retention of existing vegetation. Any potential erosion and dust problems could be minimised by such an exercise.

3. PROXIMITY TO INDUSTRIAL AREAS

To the east of the proposed scheme area is an area zoned General Industry. This zone may impose limitations on development in the scheme area in terms of dust and noise pollution. The effects of this industrial area should be addressed in land use planning with consideration given to the inclusion of a buffer zone between incompatible land uses.

4. DEVELOPMENT

In reference to previous land development to the north-east of the scheme area on Beach Road, the Authority noted a number of problems that arose. These were as follows:

(i) Total removal of existing vegetation.

(ii) Flooding during site dewatering for drainage control.

(iii) Dust pollution of nearby housing and industrial areas.

(iv) Wetland encroachment and destruction.

Future development within the scheme area will require onsite investigation and controls to limit any potential problems experienced with the previous development. Consideration of appropriate noise and dust controls during development is of special concern. It may be necessary to prevent clearing during the drier months (ie October through to April) adopt staged clearing procedures and/or undertake seeding or hydromulching of the soil.

I do trust the preceding comments will be helpful to your planning considerations and that if you feel the Authority could advise further in these matters you would not hesitate to contact us.

RADS

R A D Sippe
A/DIRECTOR
EVALUATION DIVISION

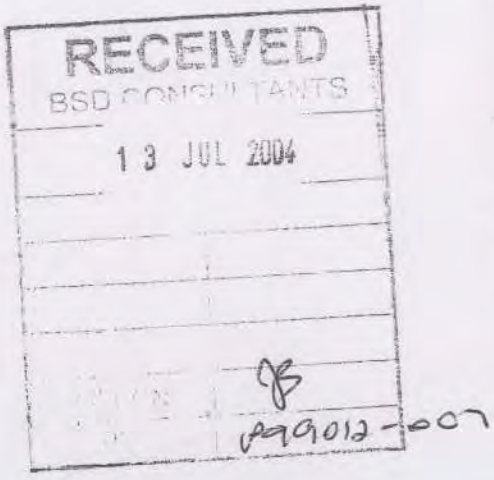
12 June 1989

0163CSTOW:dc

APPENDIX H

CITY OF SWAN LETTER OF APPROVAL TO CONSTRUCT SCHEME ROADS OF JUNE 2004

Enquiries: Michaela Trlin
Fax: 9267 9444
Our Ref: MT:DMC S115018 / TPS14
Web Address: www.cityofswan.com



CITY OF SWAN

Let's make it happen

7 July 2004

BSD Consultants Pty Ltd
P O Box 155
SUBIACO WA 6008

Dear Sir/Madam

CONSTRUCTION OF SUBDIVISIONAL ROADS – LOTS PT 300, 301, 302, 303, PT 14 & PT 15 BERINGARRA AVENUE, MALAGA
OWNER: SANDBOURNE HOLDINGS PTY LTD

I refer to your application for approval to commence development on the above lot received on 14 June 2004.

In accordance with the provisions of the City's District Town Planning Scheme approval to commence development has been granted. This application has been determined by delegated authority of Council in accordance with Clause 2.6.10 of the Scheme. Attached is the form of approval stating the conditions that must be complied with.

Should any of these conditions be unacceptable, you may have a right of appeal under the provisions of Town Planning Scheme No. 9. Any such appeal should be lodged with the Town Planning Appeal Tribunal (Level 4, 12 St George Terrace, Perth) in accordance with Part V of the Town Planning and Development Act, within sixty days of the date of this approval. The necessary appeal forms are available from Council's information counter or from the Western Australian Planning Commission, 469 Wellington Street, Perth.

Should you have any further queries, please do not hesitate to contact MICHAELA TRLIN of Council's Development Services Section on 9267 9451 or swan@swan.wa.gov.au

Yours faithfully

E W T Lumsden
CHIEF EXECUTIVE OFFICER

Enc:

CITY OF SWAN
TOWN PLANNING SCHEME NO. 9
DISTRICT ZONING SCHEME

FILE NO: S115108
DATE: 7 JUL 2004
ESTIMATED VALUE: $2,000,000

APPROVAL TO COMMENCE DEVELOPMENT

DEVELOPMENT: CONSTRUCTION OF SUBDIVISIONAL ROADS

ADDRESS: LOT PT 300, 301, 302, 303, PT 14 & PT 15 BERINGARRA AVENUE, MALAGA

Approval to commence development in accordance with the application and plans received on 14 June 2004 subject to the following conditions:

1. No site works are to be commenced prior to the subdivision construction drawings being approved by the Local Authority.

ADVICE TO APPLICANT:

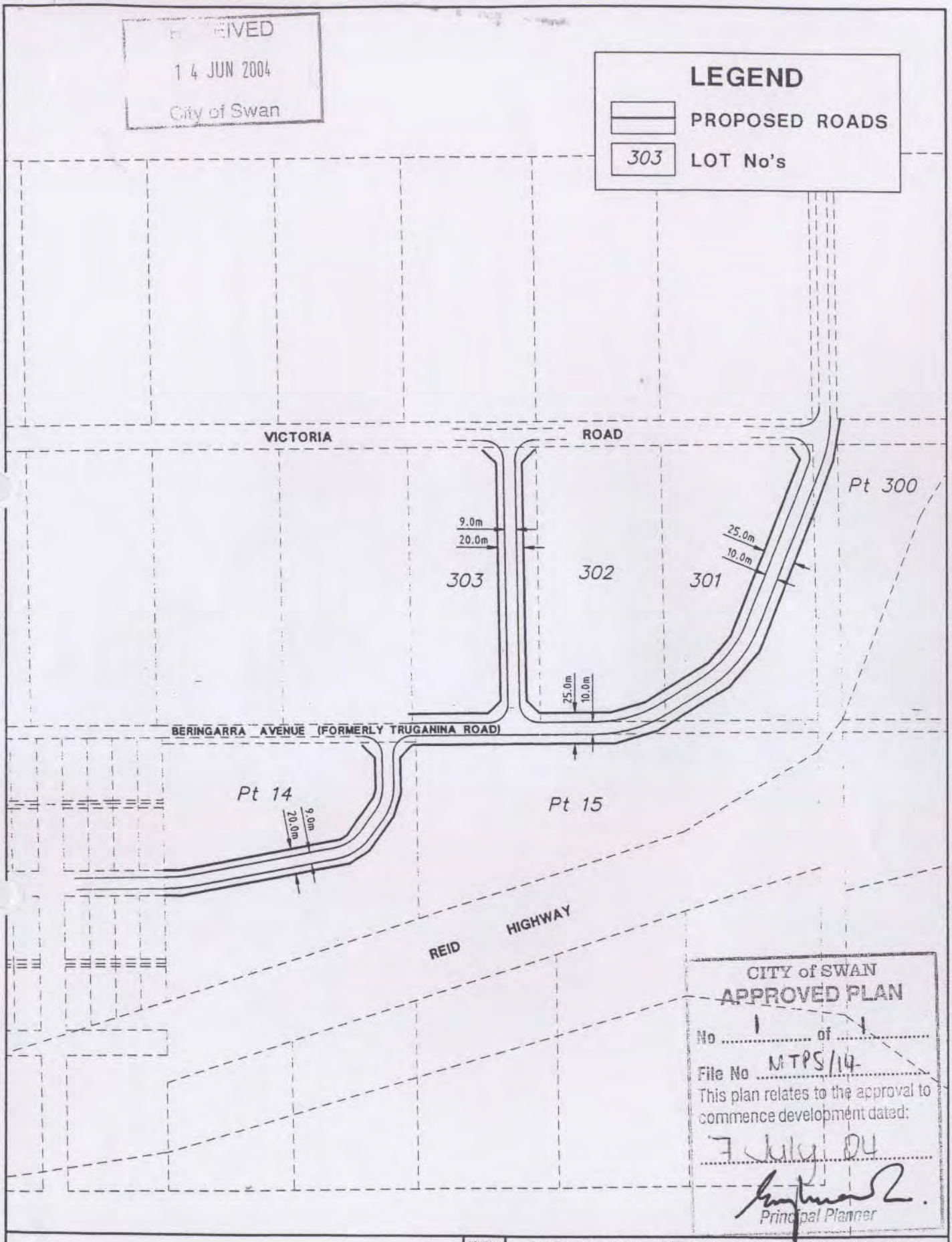
1. The noise generated by activities on-site, including machinery motors or vehicles is not to exceed the levels as set out under the Environmental Protection (Noise) Regulations 1997 at the property boundary.

   All development works are to be carried out in accordance with control of noise practices set out in Section 6 of AS 2436-1981 or the equivalent current Australian Standard.

   No works shall commence prior to 7.00 am without the City's approval.

If this development is not substantially commenced within a period of 2 years, approval will lapse and be of no further effect. Where an approval has lapsed, no development shall be carried out without the further approval of the responsible authority having first been sought and obtained.

for E W T Lumsden
CHIEF EXECUTIVE OFFICER



CITY of SWAN
APPROVED PLAN
No 1 of 1
File No MTPS/14
This plan relates to the approval to commence development dated:
7 July 04
Principal Planner

PROJECT **FREEWAY INDUSTRIAL PARK**

DRAWING TITLE **SITE PLAN - PRIVATE SCHEME ROADS**

PRINCIPAL **SANDBOURNE HOLDINGS**

ORIGINAL A4

BSD CONSULTANTS
CONSULTING ENGINEERS
TOWN PLANNERS
PROJECT MANAGERS
ENVIRONMENTAL CONSULTANTS
880 Centre 2 Bagot Road
P.O. Box 155 Subiaco
Western Australia 6904
Telephone (08) 9273 3888
Facsimile (08) 9388 3831

Date 14.05.02	Scale	1:4000	
Designed	Checked		
Drawn NAP	Approved		
Local Authority SHIRE OF SWAN	Sheet	Of	
Project Number P99012-007	Drawing Number P634-SK4	Revision	

APPENDIX I

CATEGORIES USED IN THE ASSESSMENT OF CONVERSATION STATUS

Categories used in the assessment of conservation status.

Environmental Protection and Biodiversity Conservation (EPBC) Act and the WA Wildlife Conservation Act (categories from IUCN, based on review by Mace and Stuart (1994)).

Extinct. Taxa not definitely located in the wild during the past 50 years.

Extinct in the Wild. Taxa known to survive only in captivity.

Critically Endangered. Taxa facing an extremely high risk of extinction in the wild in the immediate future.

Endangered. Taxa facing a very high risk of extinction in the wild in the near future.

Vulnerable. Taxa facing a high risk of extinction in the wild in the medium-term future.

Near Threatened. Taxa that risk becoming Vulnerable in the wild.

Conservation Dependent. Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.

Data Deficient (Insufficiently Known). Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.

Least Concern. Taxa that are not Threatened.

WA Department of Conservation and Land Management Priority species (species not listed under the Conservation Act, but for which there is some concern).

Priority 1. Taxa with few, poorly known populations on threatened lands.

Priority 2. Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.

Priority 3. Taxa with several, poorly known populations, some on conservation lands.

Priority 4. Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Priority 5. Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservatin program, the cessation of which would result in the species becoming threatened within five years.

APPENDIX J

FAUNA OCCURING IN THE MALAGA REGION

Table J1. Amphibians of the Malaga region, indicating those expected to occur on the site. The status column indicates:
* Species recorded on the site by Hart, Simpson and Assoc. (2002) and/or during the current study.
+ Species not recorded but expected to be present on the basis of habitats and the persistence of this species elsewhere.
- Species probably not present on the Malaga site.

Key sources of information are indicated as WAM (WA Museum) and WP (Whiteman Park). The conservation significance (Cons. Sign.) of each species is assigned as described in Methods, and these species are discussed in the text.

Species		Status	Cons. Sign.	WAM	WP
Myobatrachidae (burrowing frogs)					
Quacking Frog	*Crinia georgiana*	+	CS3	+	+
Glauert's Frog	*Crinia glauerti*	*		+	+
Sandplain Froglet	*Crinia insignifera*	*		+	+
Moaning Frog	*Heleioporus eyrei*	+		+	+
Marbled Frog	*Heleioporus psammophilus*	-	CS3	+	
Pobblebonk Frog	*Limnodynastes dorsalis*	+		+	+
Turtle Frog	*Myobatrachus gouldii*	+	CS3	+	+
Guenther's Toadlet	*Pseudophryne guentheri*	+		+	+
Hylidae (tree-frogs)					
Slender Tree Frog	*Litoria adelaidensis*	+		+	+
Motorbike Frog	*Litoria moorei*	+		+	+
Number of frogs observed or expected:		9			

Table J2. Reptiles of the Malaga region, indicating those expected to occur on the site. The status column indicates:
* Species recorded on the site by Hart, Simpson and Assoc. (2002) and/or during the current study.
+ Species not recorded but expected to be present on the basis of habitats and the persistence of this species elsewhere.
- Species probably not present on the Malaga site.

Primary sources for the inclusion of species are indicated in the source column as: WAM (WA Museum), WP (Whiteman Park), NC (Cooper 1995), BCE (Bamford Consulting Ecologists database) and Bush (Bush *et al.* 1995). The conservation significance (Cons. Sign.) of each species is assigned as described in Methods, and these species are discussed in the text.

Species		Status	Cons. Sign.	Source
Chelidae (side-necked tortoises)				
Long-necked Tortoise	*Chelodina oblonga*	+		WP
Gekkonidae (geckoes)				
Marbled Gecko	*Christinus marmoratus*	+		WAM
Southern Spiny-tailed Gecko	*Strophurus spinigerus*	+		Bush
Pygopodidae (legless-lizards)				
Sand-Plain Worm-Lizard	*Aprasia repens*	+		WAM
Fraser's Legless Lizard	*Delma fraseri*	-	CS3	Bush
Gray's Legless Lizard	*Delma grayii*	-	CS3	WAM
Burton's Legless Lizard	*Lialis burtonis*	+	CS3	WAM
Keeled Legless Lizard	*Pletholax gracilis*	-	CS3	WAM
Common Scaleyfoot	*Pygopus lepidopodus*	-	CS3	BCE
Agamidae (dragon lizards)				
Western Bearded Dragon	*Pogona minor*	+	CS3	WAM
Sandhill Dragon	*Rankinia adelaidensis*	-	CS3	WP
Varanidae (monitors or goannas)				
Gould's Sand Goanna	*Varanus gouldii*	*	CS3	WAM
Rosenberg's Goanna	*Varanus rosenbergi*	-	CS3	WAM
Black-heaed Tree Goanna	*Varanus tristis*	-	CS3	BCE
Scincidae (skink lizards)				
South-West Cool Skink	*Acritoscincus trilineatum*	+		WAM
Fence Skink	*Cryptoblepharus plagiocephalus*	*		WAM
Western Limestone Ctenotus	*Ctenotus australis*	+	CS3	WAM
West Coast Ctenotus	*Ctenotus fallens*	*	CS3	WAM
Jewelled Ctenotus	*Ctenotus gemmula*	-	CS3	Bush
Odd-striped Ctenotus	*Ctenotus impar*	-	CS3	WP
King's Skink	*Egernia kingii*	-		WAM
Salmon-bellied Skink	*Egernia napoleonis*	+	CS3	WAM
Two-toed Earless Skink	*Hemiergis quadrilineata*	*		WAM
West Coast Four-toed Lerista	*Lerista elegans*	+		WAM
Worm Lerista	*Lerista praepedita*	+		WAM
Dwarf Skink	*Menetia greyii*	+		WAM

Table J2 (cont.)

Species		Status	Cons. Sign.	Source
West Coast Morethia	*Morethia lineoocellata*	+	CS3	WAM
Dusky Morethia	*Morethia obscura*	*	CS3	WAM
Western Blue-tongue	*Tiliqua occipitalis*	+	CS3	WAM
Bobtail	*Tiliqua rugosa*	*	CS3	WAM
Typhlopidae (blind-snakes)				
Southern Blind Snake	*Ramphotyphlops australis*	+	CS3	WAM
Elapidae (front-fanged snakes)				
Narrow-banded Snake	*Brachyurophis fasciolata*	-	CS3	WAM
Half-ringed Snake	*Brachyurophis semifasciata*	+	CS3	WAM
Yellow-faced Whip-Snake	*Demansia psammophis*	-	CS3	WAM
Crowned Snake	*Elapognathus coronatus*	-	CS3	WAM
Bardick	*Echiopsis curta*	-	CS3	WAM
Black-naped Snake	*Neelaps bimaculatus*	-	CS3	WP
Black-striped Snake	*Neelaps calonotos*	-	CS2	WAM
Western Tiger Snake	*Notechis scutatus*	+		WAM
Gould's Snake	*Parasuta gouldii*	+	CS3	WAM
Dugite	*Pseudonaja affinis*	*		WAM
Jan's Bandy-Bandy	*Simoselaps bertholdi*	+	CS3	WAM
Number of reptiles observed or expected:		26		

Table J3. Birds of the Malaga region (excluding vagrants), indicating those expected to occur on the site. The status column indicates:
* Species recorded on the site by Hart, Simpson and Assoc. (2002) and/or during the current study.
+ Species not recorded but expected to be present on the basis of habitats and the persistence of this species elsewhere.
- Species probably not present on the Malaga site.

Primary sources for the inclusion of species are indicated in the source column as: WAM (WA Museum), BA (Birds Australia Atlas Database), WP (Whiteman Park), and BCE (Bamford Consulting Ecologists database). The conservation significance (Cons. Sign.) of each species is assigned as described in Methods, and these species are discussed in the text. Int. indicates introduced species.

Species		Status	Cons. sign.	Source
Anatidae (ducks, geese and swans)				
Pacific Black Duck	*Anas superciliosus*	+		BA, WP
Grey Teal	*Anas gibberifrons*	+		BA, WP
Ardeidae (herons and egrets)				
White-faced Heron	*Egretta novaehollandiae*	*		BA, WP
Great Egret	*Ardea alba*	+		BA, WP
Nankeen Night Heron	*Nycticorax caledonicus*	+		BA, WP
Little Bittern	*Ixobrychus minutes*	-		BA
Accipitridae (kites, hawks and eagles)				
Black-shouldered Kite	*Elanus axillaris*	+		BA, WP
Whistling Kite	*Haliastur sphenurus*	*	CS3	BA, WP
Swamp Harrier	*Circus approximans*	+		BA, WP
Brown Goshawk	*Accipiter fasciatus*	+	CS3	BA, WAM
Collared Sparrowhawk	*Accipiter cirrhocephalus*	+	CS3	BA, WAM
Wedge-tailed Eagle	*Aquila audax*	-	CS3	BA, WP
Little Eagle	*Hieraaetus morphnoides*	-	CS3	BA, WP
Square-tailed Kite	*Hamirostra isura*	+	CS3	WP
Falconidae (falcons)				
Peregrine Falcon	*Falco peregrinus*	+	CS1	BA, WAM
Australian Hobby	*Falco longipennis*	+		BA, WAM
Brown Falcon	*Falco berigora*	-		BA, WP
Nankeen Kestrel	*Falco cenchroides*	+		BA, WP
Turnicidae (button-quails)				
Painted Button-quail	*Turnix varia*	-		BCE, WP
Charadriidae (lapwings and plovers)				
Banded Lapwing	*Vanellus tricolor*	-		BA, WP
Columbidae (pigeons and doves)				
Rock Dove (Domestic Pigeon)	*Columba livia*	*	Int.	BA, WP
Spotted Turtle-Dove	*Streptopelia chinensis*	*	Int.	BA, WP
Laughing Turtle-Dove	*Streptopelia senegalensis*	*	Int.	BA, WP
Common Bronzewing	*Phaps chalcoptera*	-		BA, WP
Crested Pigeon	*Ocyphaps lophotes*	-		BA, WP

Table J3 (cont.)

Species		Status	Cons. sign.	Source
Cacatuidae (cockatoos)				
Carnaby's Black-Cockatoo	*Calyptorhynchus latirostris*	+	CS1	BA, WAM
Galah	*Cacatua roseicapilla*	+		BA, WP
Corella species	*Cacatua spp.*	+	Int.	BA, WP
Psittacidae (lorikeets and parrots)				
Rainbow Lorikeet	*Trichoglossus haematodus*	*	Int.	BA, WP
Red-capped Parrot	*Purpureicephalus spurius*	*		BA, WAM
Australian Ringneck	*Barnardius zonarius*	+		BA, WAM
Elegant Parrot	*Neophema elegans*	+		BA, WAM
Cuculidae (cuckoos)				
Pallid Cuckoo	*Cuculus pallidus*	+		BA, WAM
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	+		BA, WP
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	+		BA, WP
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	+		BA, WAM
Strigidae (hawk-owls)				
Southern Boobook Owl	*Ninox novaeseelandiae*	+		BA, WAM
Tytonidae (barn owls)				
Barn Owl	*Tyto alba*	+		BA, WAM
Podargidae (frogmouths)				
Tawny Frogmouth	*Podargus strigoides*	+		WAM
Caprimulgidae (nightjars)				
Spotted Nightjar	*Eurostopodus argus*	-		BA, WP
Aegothelidae (owlet-nightjars)				
Australian Owlet-nightjar	*Aegotheles cristatus*	-		BA, WP
Apodidae (swifts)				
Fork-tailed Swift	*Apus pacificus*	-	CS1	BA
Halcyonidae (forest kingfishers)				
Laughing Kookaburra	*Dacelo novaeguineae*	+	Int.	BA, WAM
Sacred Kingfisher	*Todiramphus sanctus*	+		BA, WAM
Meropidae (bee-eaters)				
Rainbow Bee-eater	*Merops ornatus*	+	CS1	BA, WP
Maluridae (fairy-wrens)				
Splendid Fairy-wren	*Malurus splendens*	*	CS3	BA, WP
Pardalotidae (pardalotes and thornbills)				
Spotted Pardalote	*Pardalotus punctatus*	+		BA, WP
Striated Pardalote	*Pardalotus striatus*	*		BA, WAM
White-browed Scrubwren	*Sericornis frontalis*	+	CS3	BA, WP
Weebill	*Smicrornis brevirostris*	-		BA, WP
Western Gerygone	*Gerygone fusca*	+		BA, WP
Inland Thornbill	*Acanthiza apicalis*	-	CS3	BA, WP
Western Thornbill	*Acanthiza inornata*	*	CS3	BA, WP
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	*	CS3	BA, WP

Table J3 (cont.)

Species	Status	Cons. sign.	Source
Meliphagidae (honeyeaters)			
Red Wattlebird *Anthochaera carunculata*	*		BA, WAM
Western Wattlebird *Anthochaera lunulata*	*		BA, WP
Yellow-throated Miner *Manorina flavigula*	-		BA, WP
Singing Honeyeater *Lichenostomus virescens*	*		BA, WP
Brown-headed Honeyeater *Melithreptus brevirostris*	-		BA, WP
White-naped Honeyeater *Melithreptus lunatus*	-	CS3	BA, WP
Brown Honeyeater *Lichmera indistincta*	*		BA, WP
New Holland Honeyeater *Phylidonyris novaehollandiae*	*	CS3	BA, WP
White-cheeked Honeyeater *Phylidonyris nigra*	*	CS3	BA, WP
Tawny-crowned Honeyeater *Phylidonyris melanops*	+	CS3	BA, WP
Western Spinebill *Acanthorhynchus superciliosus*	*		BA, WP
White-fronted Chat *Epthianura albifrons*	+		BA, WP
Petroicidae (Australian robins)			
Scarlet Robin *Petroica multicolor*	-	CS3	BA, WP
Red-capped Robin *Petroica goodenovi*	-	CS3	BA, WP
Hooded Robin *Melanodrya cucullata*	-	CS3	BA, WP
Neosittidae (sittellas)			
Varied Sittella *Daphoenositta chrysoptera*	+	CS3	BA, WAM
Pachycephalidae (whistlers)			
Rufous Whistler *Pachycephala rufiventris*	+		BA, WP
Golden Whistler *Pachycephala pectoralis*	-	CS3	BA, WP
Grey Shrike-thrush *Colluricincla harmonica*	-	CS3	BA, WP
Dicruridae (flycatchers)			
Magpie-lark *Grallina cyanoleuca*	+		BA, WP
Grey Fantail *Rhipidura fuliginosa*	+		BA, WP
Willie Wagtail *Rhipidura leucophrys*	+		BA, WP
Campephagidae (cuckoo-shrikes)			
Black-faced Cuckoo-shrike *Coracina novaehollandiae*	+		BA, WP
White-winged Triller *Lalage sueurii*	+		BA, WP
Artamidae (woodswallows)			
Black-faced Woodswallow *Artamus cinereus*	+	CS3	BA, WP
Dusky Woodswallow *Artamus cyanopterus*	-		BA, WP
Grey Butcherbird *Cracticus torquatus*	*		BA, WP
Australian Magpie *Gymnorhina tibicen*	*		BA, WAM
Corvidae (ravens and crows)			
Australian Raven *Corvus coronoides*	*		BA, WAM
Motacillidae (pipits and true wagtails)			
Richard's Pipit *Anthus novaeseelandiae*	+		BA, WP
Dicaeidae (flower-peckers)			
Mistletoebird *Dicaeum hirundinaceum*	+		BA, WP

Table J3 (cont.)

Species	Status	Cons. sign.	Source
Hirundinidae (swallows)			
White-backed Swallow *Cheramoeca leucosternus*	*		BA, WP
Welcome Swallow *Hirundo neoxena*	*		BA, WP
Tree Martin *Hirundo nigricans*	*		BA, WP
Sylviidae (Old World warblers)			
Rufous Songlark *Cincloramphus mathewsi*	-		
Brown Songlark *Cincloramphus cruralis*	-		
Zosteropidae (white-eyes)			
Silvereye *Zosterops lateralis*	*		WAM
Number of birds observed or expected:	91		

Table J4. Mammals that are expected to occur at the Malaga site. Species observed during the site visit are indicated by (+), and species recorded by the WA Museum are indicated by WAM.

Species	Status	Cons. Sign.	Source
Tachyglossidae (echidnas)			
Echidna *Tachyglossus aculeatus*	-		WAM, WP
Dasyuridae (dasyurids)			
Chuditch *Dasyurus geoffroyii*	-	CS1	BCE
Peramelidae (bandicoots)			
Quenda or Southern Brown Bandicoot *Isoodon obesulus*	*	CS2	WAM, WP
Phalangeridae (possums)			
Brush-tailed Possum *Trichosurus vulpecula*	+		WAM
Tarsipedidae (honey possum)			
Honey Possum *Tarsipes rostratus*	-		WP
Macropodidae (kangaroos and wallabies)			
Western Grey Kangaroo *Macropus fuliginosus*	-		WAM, WP
Brush or Black-gloved Wallaby *Macropus irma*	-		WAM, WP
Mollosidae (mastiff bats)			
White-striped Bat *Tadarida australis*	+		WAM, WP
Vespertilionidae (vesper bats)			
Gould's Wattled Bat *Chalinolobus gouldii*	+		WAM, WP
Chocolate Wattled Bat *Chalinolobus morio*	-		?
Southern Forest Bat *Vespadelus (Eptesicus) regulus*	-		WAM, WP
Lesser Long-eared Bat *Nyctophilus geoffroyi*	-		?
Greater Long-eared Bat *Nyctophilus timoriensis*	-		?
Muridae (rats and mice)			
House Mouse *Mus musculus*	*	Int.	WAM, WP
Black Rat *Rattus rattus*	+	Int.	WAM
Rakali or Water Rat *Hydromys chrosogaster*	-		BCE
Leporidae (rabbits and hares)			
Rabbit *Oryctolagus cuniculus*	*	Int.	WP
Canidae (foxes and dogs)			
European Red Fox *Vulpes vulpes*	*	Int.	WP
Felidae (cats)			
Feral Cat *Felis catus*	*	Int.	WAM
Number of mammals observed or expected:	9		

APPENDIX K

BASIS FOR DETERMINING FLORA SIGNIFICANCE (WA WILDLIFE CONSERVATION ACT 1950 AND ENVIRONMENTAL PROTECTION BIADIVERSITY CONSERVATION ACT 1999)

Declared Rare and Priority Flora

Flora species acquire Declared Rare or Priority conservation status where populations are geographically restricted or threatened by local processes. CALM enforce regulations under the *Wildlife Conservation Act 1950* to conserve DRF and protect significant populations. Priority Flora species are potentially rare or threatened and are classified in order of threat. Declared Rare and Priority Flora definitions are listed in **Table K1**.

Table K1: Definition of Declared Rare and Priority Flora Species (CALM 2003)

Conservation Code	Category
R	**Declared Rare Flora – Extant Taxa**. Taxa that have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such.
P1	**Priority One – Poorly Known Taxa** Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	**Priority Two – Poorly Known Taxa** Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3	**Priority Three – Poorly Known Taxa** Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but need further survey.
P4	**Priority Four – Rare Taxa** Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Environment Protection and Biodiversity Conservation Act (1999)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) promotes the conservation of biodiversity by providing strong protection for plants at a species level. Section 178 and 179 provides the lists and categories of threatened species under the Act and is presented in **Table K2**

Table K2: Categories of Threatened Species (EPBC Act, Section 179, 1999)

Category
Extinct Taxa which is known only to survive in cultivation, in captivity or as a naturalised population, well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered Taxa which are facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
Endangered Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable Taxa which is not endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation Dependant A species that is the focus of a specific conservation program; the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The EPBC Act (1999) also provides for the strong protection of plant communities, or Threatened Ecological Communities (TECs). CALM defines a TEC as an ecological community which is found to fit into either ‘presumed totally destroyed”, “critically endangered”, “endangered” or “vulnerable”.