ENVIRONMENTAL ASSESSMENT REPORT

Branch Circus and Hammond Road, Success

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Report No: L07012
Version/Date: Rev 0, March 2008

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Document Status

Version	Purpose of Document	Orig	Review	Review Date	Format Review	RPS Release Approval	Issue Date
Draft A	Draft for Client Review	KarGod	SteRol	17.03.08	DC 18.03.08		
Rev 0	Final for Issue	KarGod	SteRol	20.03.08	DC 20.03.08	B. Hollyock	20.03.08

Disclaimer

EXECUTIVE SUMMARY

Muntoc Pty Ltd and Silverstone Asset Pty Ltd, collectively known as the Branch Circus Landowner Group wishes to develop a number of landholdings within the area generally bound by Branch Circus to the north and west, the Bartram Road buffer lakes to the south and Hammond Road to the east for the purposes of residential development ("the site").

The site is comprised of Lots 2, 3 and 4 Branch Circus; Lots 760, 761 and 767 Gadd Street; and Lots 3, 4, 5, 12, 13 and 22 Hammond Road and represents a mosaic of ownership. The 12 lots represent a total area of approximately 34ha.

At this stage, only the owners of Lots 4 and 22 Hammond Road and Lot 760 Gadd Street are active participants of the structure planning process for the site. However, the City of Cockburn has instructed the developer to prepare a structure plan submission for the entire site.

In order to progress the lifting of "Urban Deferment" and ultimate development of the site, a structure plan design and associated report will need to be prepared.

As part of the structure planning process, an Environmental Assessment Report (EAR) will need to be prepared to support the structure plan design.

Given the site was zoned "Urban Deferred" prior to August 1996 (enactment of the *Planning Legislation Amendment Act 1996*), it would not have been subject to environmental review by the Environmental Protection Authority (EPA).

Therefore, the purpose of the EAR will be two-fold:

- Provision of detailed environmental information to the City of Cockburn and WAPC to enable initiation and review for the lifting of "Urban Deferment"; and

- Provision of detailed environmental information to allow the EPA to provide a report to the WAPC under Section 16(j) of the *Environmental Protection Act 1986* prior to the WAPC considering the lifting of "Urban Deferment", to ensure that environmental issues have been appropriately identified.

In summary, and taking the structure plan design into account, the key environmental planning issues in need of consideration include:

- Wetland management;
- Groundwater management;
- Drainage management;
- Midge Exclusion Zone;
- Acid Sulfate Soils Preliminary Site Assessment (PSA); and
- Contamination Preliminary Site Investigation (PSI).

In order to protect the key environmental features and satisfy the government agencies that the proposed structure plan design enhances the overall area and provides an overall net environmental benefit, the following management commitments will be adopted.

- A Local Water Management Strategy and subsequent Urban Water Management Plan(s) will outline Water Sensitive Urban Design commitments;
- Stormwater drainage will not be directed towards wetland areas;
- Drainage will involve at source infiltration, where possible and swale systems within public open space areas, which will be designed to promote nutrient stripping;
- Drainage design will be consistent with -
  - *EPA Guidance on the Assessment of Environmental Factors – Groundwater Management Areas* (EPA, 1998);
  - South Jandakot Drainage Management Plan (GB Hill & *Partners*, 1990);
  - Statement of Planning Policy No. 2.3 - Jandakot Groundwater Protection Policy (Western Australian Planning Commission, 1998).
- The majority of the Resource Enhancement Wetland (REW) will be protected in a "Conservation Zone", with the remaining southern portion of the REW proposed for retention within a "Park/Reserve" zone;
- The REW and the area to the north of the REW will be revegetated with local native species to improve its natural attributes and quality. The area north of the wetland will provide a buffer to the REW;
- The R40 area in the northern portion of the site will be developed so as to not impact negatively on the wetland attributes or function of the REW;
- The majority of the degraded Conservation Category Wetland (CCW) will be retained in the "Park" zone, pending the outcome of the wetland assessment*. A suitable buffer will be determined at this time;
- A hard edge between residential areas and the wetland areas will be constructed where possible, to limit weed and litter invasion from future residential areas;
- The 'Very Good' quality vegetation in the north will be retained as part of the overall protection of the REW area within the 'Conservation Zone';

- In order to minimise the risk of nuisance midge plagues negatively impacting on future residents, the following will be implemented:

  - existing native vegetation will be retained within the portions of Lots 2 and 3 Branch Circus that fall inside the City of Cockburn's 500m 'Midge Exclusion Zone';

  - This area will also be revegetated using local native species to improve the screening capacity for future residents;

  - Memorials on Titles will be adopted for residents between the 500m Midge Exclusion Zone and the 800m Notification Zone;

  - A Revegetation Management Plan will be prepared and implemented to guide revegetation activities aimed at midge screening and improved vegetation quality in the northern area of the site.

- An Acid Sulfate Soils Preliminary Site Assessment will be undertaken prior to ground disturbing activities; and

- A Preliminary Site Investigation will be undertaken prior to ground disturbing activities to determine the presence or otherwise of soil and/or groundwater contamination.

* RPS is currently undertaking a wetland investigation of both the RE and CC wetlands, with a view to defining the correct management status and wetland boundaries of each. The outcome of this study will provide further detail on the wetland conditions on site and will direct detailed subdivision design, including providing information to determine suitable wetland buffers.

Based on preliminary knowledge, a Wetland Management Plan is proposed for the REW in the north of the site to ensure it's ultimate protection, provided the wetland assessment and negotiation with the DEC indicates this area is correctly classified.

At this stage, no Wetland Management Plan is proposed for the CCW as preliminary site investigations suggest that this area may be incorrectly mapped by the DEC.

This Wetland Management Plan proposed for the REW could be prepared jointly with the Revegetation Management Plan that is proposed to guide midge screening in this area. Together, the two could be called a "Conservation Zone" Management Plan.

Please note that all management commitments proposed for the wetland areas will be reviewed once the outcomes of the wetland assessments are known.

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1.0 INTRODUCTION

1.1 Background & Location

Muntoc Pty Ltd and Silverstone Asset Pty Ltd, collectively known as the Branch Circus Landowner Group (referred to herein as "the developer") wishes to develop a number of landholdings within the area generally bound by Branch Circus to the north and west, the Bartram Road buffer lakes to the south and Hammond Road to the east for the purposes of residential development (Figure 1).

This development area is commonly referred to as the Branch Circus Structure Plan area (referred to herein as "the site"). The site is located in the suburb of Success, within the City of Cockburn municipality.

The site is comprised of Lots 2, 3 and 4 Branch Circus; Lots 760, 761 and 767 Gadd Street; and Lots 3, 4, 5, 12, 13 and 22 Hammond Road and represents a mosaic of ownership (Figure 2). The 12 lots represent a total area of approximately 34ha.

At this stage, only the owners of Lots 4 and 22 Hammond Road and Lot 760 Gadd Street are active participants of the structure planning process for the site. However, the City of Cockburn has instructed the developer to prepare a structure plan submission for the entire site.

Koltasz Smith acts on behalf of the developer in order to progress the structure planning for the site and is referred to in this report as "the client".

1.2 Zoning

The site is currently zoned "Urban Deferred" under the Western Australian Planning Commission's (WAPC) Metropolitan Region Scheme and "Development" under the City of Cockburn's Town Planning Scheme No.3.

The "Urban Deferred" zone provides a *"strong indication that the land is physically and locationally suitable for urban purposes.....…".* (WAPC, 2007).

The objective of the "Development" zone under the City of Cockburn's Town Planning Scheme No.3 is *"To provide for future residential, industrial or commercial development in accordance with a comprehensive Structure Plan prepared under the Scheme."*

In order to progress ultimate development of the site, the "Urban Deferred" status of the site will need to be lifted under the Metropolitan Region Scheme to "Urban".

1.3 Purpose of Report

In order to progress the lifting of "Urban Deferment" and ultimate development of the site, a structure plan design and associated report will need to be prepared.

As part of the structure planning process, an Environmental Assessment Report (EAR) will need to be prepared to support the structure plan design. The EAR will need to provide "evidence (to the WAPC) that:……..any constraints to urban development can be satisfactorily addressed", by demonstrating how the structure plan design responds to the environmental characteristics of the site (WAPC, 2007).

RPS has been informed that the Branch Circus area was rezoned "Urban Deferred" as part of MRS Amendment 938/33, which was gazetted on 30 December 1994.

Given the site was zoned "Urban Deferred" prior to August 1996 (enactment of the *Planning Legislation Amendment Act 1996*), it would not have been subject to environmental review by the Environmental Protection Authority (EPA).

Therefore, the purpose of the EAR will be two-fold:

- Provision of detailed environmental information to the City of Cockburn and WAPC to enable initiation and review for the lifting of "Urban Deferment"; and

- Provision of detailed environmental information to allow the EPA to provide a report to the WAPC under Section 16(j) of the *Environmental Protection Act 1986* prior to the WAPC considering the lifting of "Urban Deferment", to ensure that environmental issues have been appropriately identified.

1.4 Scope of Report

According to WAPC (2007), the supporting documentation to the structure plan should address the natural environment and specifically the following information:

- *"an accurate description of the land including the natural environment;*

- *description of the physical conditions of the land;*

- *identification of the means by which natural features (such as foreshores, wetlands, remnant vegetation) will be protected; and*

- *identification of any environmental issues which may impact on future development (such as noise, water catchment, contaminated land and air pollution)."*

This EAR clearly describes the environmental characteristics of the site, identifies any environmental opportunities and constraints for development, outlines the structure plan design and describes how it accommodates any key environmental constraints, and proposes management strategies to facilitate environmentally responsive development.

More specifically, the EAR addresses the following environmental factors:

- Soils and landforms and their suitability for development;
- Vegetation type and condition (including Department of Environment and Conservation (DEC) database search for Declared Rare and Priority Flora);
- Fauna (including DEC database search for Threatened Fauna) and in particular a discussion on midges;
- Groundwater hydrology (based on regional mapping);
- Wetland boundaries, management categories, generic (DEC) buffers which may impact the development site and likely interface requirements between wetlands and the development and other key surface water features;
- Aboriginal Heritage Sites (Department of Indigenous Affairs (DIA) database);
- Acid Sulfate Soil risk (from WAPC's Regional ASS Mapping);
- Potential soil and groundwater contamination areas / sources;
- Surrounding land uses and generic buffers;
- Review of relevant environmental legislation and policies;
- Outline the key features of the proposed development;
- Identification of any potential environmental constraints that need to be considered and any potential impacts to the natural environment resulting from the proposed development; and
- Description of how the proposed development intends to address the key environmental constraints and potential negative impacts, including all proposed management commitments.

2.0 ENVIRONMENTAL PLANNING PROCESS AND RELEVANT DOCUMENTS

2.1 Federal Context

A proposed development would trigger assessment by the Federal Department of Environment & Water Resources (DEW) under the *Environmental Protection & Biodiversity Conservation Act 1999* if the proposal was likely to result in a significant impact on one of the seven "Matters of National Environmental Significance":

- Listed threatened species and communities
- Listed migratory species
- Ramsar wetlands of international importance
- The Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Nuclear actions

If the development proposal is likely to impact significantly on a "Matter of National Environmental Significance", a detailed referral is required to be submitted to the DEW, outlining, amongst other things, the proposal, the "Matter of National Environmental Significance", the potential impact and the proposed management strategies to minimise the adverse impact.

The occurrence (or otherwise) of these "Matters of National Environmental Significance" is discussed in Section 3 of this report.

2.2 State Context

2.2.1 WAPC Metropolitan Region Scheme (MRS)

The Metropolitan Region Scheme (MRS) defines the future use of land, dividing it into broad zones and reservations. Currently, the subject land is zoned "Urban Deferred" under the MRS.

According to the WAPC website, "Urban Deferred", as detailed under the MRS, is described as *"Land identified for future urban uses following the extension of urban services, the progressive development of adjacent urban areas, and resolution of any environmental and planning requirements relating to development."*

The intention is for the lifting of the "Urban Deferred" status to "Urban".

2.2.2 WAPC Guidelines for the Lifting of Urban Deferment (November 2007)

According to the WAPC's Guidelines for the Lifting of Urban Deferment (WAPC, 2007), the "Urban Deferred" zone *"provides a strong indication that the land is physically and locationally suitable for urban purposes, although certain requirements have to be met before the Western Australian Planning Commission (WAPC) will agree to the land being transferred to the urban zone."*

Where land was included in the urban deferred zone prior to the promulgation of the Planning Legislation Amendment Act 1996 (now part of the Planning and Development Act 2005) the WAPC will seek the advice and a report from the EPA under section 16(j) of the Environmental Protection Act 1986 prior to considering the lifting of urban deferment to ensure that environmental issues have been identified.

Where land has not been assessed under the regional planning scheme, yet significant environmental issues have been identified, any necessary environmental review should be undertaken as part of the process of amending the district planning scheme."

The environmental information prepared to support the structure plan should include details on the existing environment, means by which the existing environment will be protected and identification of any environmental issues that may impact on development, as outlined in detail in Section 1.4 of this EAR.

2.2.3 State Environmental Impact Assessment Process and the *Environmental Protection Act 1986*

Proposals to lift "Urban Deferment" will be referred to the Local Council and WAPC for comment (WAPC, 2007). Generally, the WAPC will determine whether the lifting of the "Urban Deferment" is appropriate.

Given the site was zoned "Urban Deferred" prior to August 1996 (enactment of the *Planning Legislation Amendment Act 1996*), it would not have been subject to environmental review by the Environmental Protection Authority (EPA).

Therefore, the WAPC will seek advice and a report from the EPA under Section 16(j) of the *Environmental Protection Act 1986* prior to considering the lifting of the "Urban Deferred" status.

This EAR will provide sufficient detail for the EPA to provide their report to the WAPC, and for the WAPC to consider the lifting of "Urban Deferment".

2.2.4 EPA Guidance Statement for Groundwater Environmental Management Areas - Guidance Statement No. 48

Groundwater Environmental Management Areas (Groundwater EMAs) are defined as the groundwater catchments of environmentally significant wetlands, the hydrology of which is dominated by groundwater and not surface water sources (EPA, 1998).

The site is located within the 'Category A' portion of the Jandakot Groundwater EMA.

The EPA has formulated EMAs to ensure that where land use changes are proposed within the groundwater catchment of important wetlands, such changes will not lead to detrimental impacts either to water quality or to the hydrology of the wetland (EPA, 1998).

The document *Guidance on the Assessment of Environmental Factors – Groundwater Management Areas* (EPA, 1998) states in general, there will be a presumption against further urbanisation and new industrial land uses in 'Category A' EMAs.

The City of Cockburn has previously advised that implementation of Water Sensitive Urban Design in drainage planning would meet its requirements in regard to this policy (P. Strano, pers comm., April 2004).

2.2.5 WAPC Jandakot Groundwater Protection Policy

According to the WAPC website, the main purpose of the Jandakot Groundwater Protection Policy ("the Policy") is "to ensure development over the Jandakot Public Groundwater Supply Mound is compatible with the long-term use of the groundwater for human consumption".

The Policy constitutes the Jandakot Underground Water Pollution Control Area (UWPCA), which aims to restrict activities that may cause groundwater contamination.

The Policy is "to ensure that land use changes within the policy area that are likely to cause detrimental effects to the groundwater are brought under planning control and prevented or managed."

"The objectives of the Policy are:

- to ensure that all changes to land use within the policy area are compatible with long-term protection and maintenance of groundwater for public supply and maintenance of associated ecosystems;

- to prevent land uses likely to result in contamination of groundwater through nutrient or contaminant export;

- to balance environmental protection with the economic viability of the existing land uses;

- to maintain or increase natural vegetation cover over the policy area; and

- to protect groundwater quality and quantity in the Policy area in order to maintain the ecological integrity of important wetlands hydraulically connected to that groundwater, including wetlands outside the Policy area."

2.2.6 South Jandakot Drainage Management Plan

The South Jandakot Drainage Management Plan (SJDMP) (GB Hill & Partners, 1990) is a drainage plan formulated to ensure that the regional drainage system will be capable of meeting environmental objectives for the Beeliar wetlands, and most importantly Thomsons Lake (located west of the site).

The principal drainage requirements of the plan are:

- Local drainage works to cater for surface runoff from the area;

- Local drainage works to control groundwater levels in areas of shallow water table; and

- Main drainage works to convey water from the catchment.

This SJDMP has been approved by Parliament. The Environmental Management Programme (EMP) for the South Jandakot Drainage Scheme (GB Hill & Partner, 1991) outlines the drainage management principles for the catchment and the main drainage system and details the monitoring programs for buffer lakes.

Minor drainage systems must be designed to accommodate a 1 in 5 year storm event, with a minimum retention time of 6 minutes and road pavement runoff collected in side entry pits.

2.3 Local Context

2.3.1 City of Cockburn Town Planning Scheme No. 3 (December 2002)

According to the City of Cockburn's Town Planning Scheme No.3 (TPS), the aims of the TPS are to:

(a) ensure that development and the use of land within the district complies with accepted standards and practices for public amenity and convenience;

(b) ensure that the future development and use of land within the district occurs in an orderly and proper way so that the quality of life enjoyed by its inhabitants is not jeopardised by poor planning, unacceptable development and the incompatible use of land.

Under the TPS, the site is currently zoned "Development". According to the City of Cockburn's website, this zone is defined as "To provide for future residential, industrial or commercial development in accordance with a comprehensive Structure Plan prepared under the Scheme."

2.3.2 City of Cockburn Residential Rezoning and Subdivision Adjoining Midge Infested Lakes Policy (March 2005)

The City of Cockburn has prepared a Policy for Residential Rezoning and Subdivision Adjoining Midge Infested Lakes ("the Policy") (last reviewed by the City of Cockburn, 15 March 2005) to address seasonal midge nuisance issues within its locality.

The Policy aims to "restrict residential subdivision, stratas and development in areas considered most likely to be subjected to midge nuisance and to advise nearby residents of the potential midge nuisance prior to purchase." (the Policy, 2005).

The Policy recognises that wetlands that experience midge nuisance tend to display degradation, eutrophication, and associated water quality problems and hold water during spring and summer. Kogoloup Lake and Thomsons Lake (to the west of the site) are recognised by the City of Cockburn as potential problem lakes for midge infestation.

It also recognises the potential for midge nuisance to residential development tends to occur within 800m of wetlands. However, Council is prepared to approve residential subdivision between 500m and 800m from the wetland on the basis that a memorial is placed on land titles disclosing the possible presence of midges.

Similarly, residential development within 500 metres of the wetland may be considered acceptable if *"it can be demonstrated that the lake or wetland does not have or can be prevented from midge infestation or where the application involves infill residential development on land zoned for residential development."*

3.0 EXISTING ENVIRONMENT

3.1 Topography, Soils and Landform

Elevation at the site ranges from 18mAHD in the low lying northern wetland area to 33mAHD along the northern section of the eastern boundary, with a localised high point of 24mAHD along the western boundary, just north of Gadd Street (Figure 2). The south-western corner of the site is also low lying, with a contour level of 20mAHD.

Gozzard (1983) has mapped the geological units present at the site at regional scale (Figure 2). These include:

- Sandy Silt (M_{s5}) – Dark brownish grey silt with disseminated fine grained quarts sand with variable clay content. This soil type is located in areas identified as geormorphic wetlands. Gozzard (1983) has identified this unit as being unsuitable for urbanisation and road construction.

- Sand (S_8) – Very light grey at surface to yellow at depth fine to medium grained Bassendean Sand. This soil type is considered suitable for both urbanisation and road construction (Gozzard, 1983).

Geotechnical advice should be sought regarding the constraints related to development upon these soils types, particularly Ms5, within the site.

3.2 Vegetation and Flora

3.2.1 Vegetation

The vegetation complex originally present on the site is the Bassendean Complex - Central and South, which is described as vegetation ranging from *Eucalyptus marginata - Allocasuarina fraseriana – Banksia spp* Woodland*.,* to *Melaleuca spp*. Low Woodland and sedgelands on the moister sides.

The reservation status of this vegetation complex within the Perth Metropolitan Region portion of the Swan Coastal Plain is presented in Table 1. This complex meets the State Government target of at least 10% of the original extent proposed for protection, as detailed in Bush Forever (WAPC, 2000).

Table 2 represents the remaining extent of this vegetation complex over the entire Swan Coastal Plain, as indicated in Del Marco *et al.* (2004). Table 2 indicates that 27% of the original (pre-European) extent of this complex still remains within the entire Swan Coastal Plain.

Table 1: Conservation Status of Bassendean Complex – Central and South (Perth Metropolitan Region of the Swan Coastal Plain)

Description	Area	Percentage of Original Area
Original extent	46,220 ha	100 %
Remaining area	10,919 ha	24 %
Area proposed for protection (some existing protection + Bush Forever sites)	5,883 ha	13 %

Source: WAPC, 2000

Table 2: Remaining Extent of Bassendean Complex – Central and South throughout entire Swan Coastal Plain

Description	Area	Percentage of Original Area
Pre-European extent	87,626 ha	100 %
Remaining area (based on 1997 extent)	23,635 ha	27 %

Source: Del Marco et. al., 2004

The site is mostly cleared with scattered pockets of remnant mature trees in certain areas across the site (Figure 3). There is virtually no understorey across the entire site, except in a couple of distinct locations at the rear of Lots 4 and 5 Hammond Road and parts of Lot 3 Branch Circus and Lot 761 Gadd Street (Figure 3).

The vegetation units on the site, as identified through a preliminary site inspection by RPS in March 2007, are as follows:

Vegetated Areas (Bassendean Dunes)

Wetlands

1. *Melaleuca preissiana* over Buffalo Grass **Stenotaphrum secundatum*
2. Mosaic Damplands

2a *Eucalyptus rudis* subsp. *rudis* (Flooded Gum) over *Astartea affinis*.

2b *Eucalyptus rudis* subsp. *rudis* (Flooded Gum) over *Kunzea glabrescens* (Spearwood)

Dunes

Eucalyptus marginata (Jarrah) Woodland of *Eucalyptus todtiana, Banksia attenuata, B. menziesii* with scattered *B. ilicifolia* over *Adenanthos cygnorum subsp. cygnorum* and mixed Low Shrubland.

Cleared Areas

Remnant overstorey species and/or introduced trees over cleared ground, pasture or urban development.

The location of these units and the condition of the vegetation across the site is shown in Figure 3.

This figure illustrates that the majority of the site is in a generally 'Degraded' condition, except some 'Good' and 'Very Good' quality areas within the wetland in the northern portion of the site, and other pockets of remnant mature trees in the centre of the site. This condition is based on the Bush Forever 2000 rating scale (WAPC, 2000).

3.2.2 State Listed Significant Flora Species

A search of DEC databases returned six Declared Rare Flora (DRF) and 18 Priority flora species for the area bound by 385287mE 6448900mN and 396232mE 6437835mN.

Some species that were identified within the search area are restricted to the Darling Range, lateritic soils or saline areas and therefore these were considered unlikely to occur at the site. Four DRF and 15 Priority flora species could potentially occur within the site.

The four DRF species that potentially occur are all ephemeral (seasonal) orchids; *Caladenia huegelii*, *Diuris purdiei* and *Drakaea micrantha ms* and *Diuris drummondii*. The first three species generally flower between September and October and *D.drummondii* generally flowers between November and January.

3.2.3 EPBC Matters of National Environmental Significance - Flora

A search of the Department of Environment, Water, Heritage and the Arts' (DEWHA) *Environmental Protection & Biodiversity Conservation Act 1999 (EPBC Act)* "Protected Matters Search for Matters of National Environmental Significance" identified three flora species that could potentially occur on the site. These species are included in Table 3, as well as a brief outline of whether the local environment could potentially support these species.

Table 3: EPBC Matters of National Environmental Significance – Flora Species

Protected Species	Status	Potential to Occur on Site
Caladenia huegelii (King Spider Orchid, Grand Spider Orchid, Rusty Spider Orchid)	Endangered	High Potential to occur on site. Known from the area.
Drakaea elastica (Glossy-leaved Hammer Orchid, Praying Virgin)	Endangered	Potential to Occur on site. White or grey sand. Low-lying situations adjoining winter-wet swamps.
Lepidosperma rostratum (Beaked Lepidosperma)	Endangered	Lower Potential to Occur on site. Not in the known range – Eastern Swan Coastal Plain

A Level 2 flora and vegetation survey was conducted in accordance with the EPA's Guidance Statement No. 51 - *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* during spring 2007 and the results of this are being collated and analysed at this time. The Level 2 survey will determine the presence or otherwise of Rare or Priority flora species within the site.

3.3 Wetlands

The site contains two areas mapped by the DEC as wetland. A Conservation Category Wetland (CCW) extends north from the Bartram Buffer Lakes to the south of the site and a boot-shaped Resource Enhancement Wetland (REW) exists in the north of the site (Figure 5).

Conservation Management Category Wetlands

CCWs are the highest priority wetlands, supporting a high level of ecological attributes and functions.

According to the EPA Guidance Statement No. 3 - *Separation Distances between Industrial and Sensitive Land Uses* (June 2005), the "EPA urges that all conservation category wetland and their buffers are fully protected……Schemes and proposals that are likely to lead to a significant adverse impact on these wetlands are likely to be formally assessed by the EPA".

A site analysis conducted on the 22nd March 2007 revealed that the CCW wetland in the south of the site is degraded and has been considerably altered through human associated clearing and weed invasion. A large portion of the area mapped as wetland contains kikuyu grass and upland species such as *Xanhorrhoea presseii* (Grass Trees).

Plates 1-5 display photographs of the degraded CCW in the south.

Plate 1: Northern Portion of Conservation Category Wetland – looking east (Photo 6)

Plate 2: Central Northern Portion of Conservation Category Wetland – looking east (Photo 7)

Plate 3: Central Portion of Conservation Category Wetland – looking north (Photo 8)

Plate 4: Southern Portion of Conservation Category Wetland – looking southwest (Photo 9)

Plate 5: Southern Portion of Conservation Category Wetland – looking east (Photo 10)

Guidance Statement No. 3 states that buffers to wetlands depend on a number of factors, including:

- The wetland's values;
- The management objectives for the wetland and any adjoining environmentally sensitive areas;
- The activities, land uses or development near the wetland, existing and proposed;
- The threats posed by the adjacent activities, land uses or development; and
- The management that will be applied to the activities, land uses or development near the wetland.

Resource Enhancement Management Category Wetlands

Guidance Statement No. 3 identifies the management objective for REWs as "all reasonable measures are taken to minimise the potential impacts on REW and their buffers. These wetland have the potential to be restored to Conservation Category, and rehabilitation is encouraged."

The DEC has previously accepted a minimum 30m buffer between development and REWs, although in some instances it has requested greater buffers. The DEC does not generally support development or drainage within the buffer of REWs, although this has been approved in some cases.

Following site investigations on 22 March 2007 by RPS, the REW wetland was considered to be in better condition than the CCW to the south. The upper storey vegetation was more intact than the CCW. However, the understorey vegetation in most areas was still highly degraded, with a significant weed infestation.

Plates 6-10 display the condition of the REW in the northern portion of the site.

Plate 6: Northern Portion of Resource Enhancement Wetland – looking northeast (Photo 1)

Plate 7: Central Portion of Resource Enhancement Wetland – looking north (Photo 2)

Plate 8: Central Portion of Resource Enhancement Wetland – looking south (Photo 3)

Plate 9: South-eastern Portion of Resource Enhancement Wetland – looking west (Photo 4)

Plate 10: Southern Portion of Resource Enhancement Wetland – looking north (Photo 5)

3.4 Groundwater and Drainage

Depth to groundwater varies across the site between 1-1.3m below ground level in the lower lying wetland parts in the south-western and north-western sections of the site, to approximately 13-14m below ground level in the higher woodland portion near the north-eastern corner of the site (Department of Water, 2004).

The site is located within the 'Category A' portion of the Jandakot Groundwater Environmental Management Area (EMA), according to the *EPA Guidance on the Assessment of Environmental Factors – Groundwater Management Areas* (EPA, 1998) (Guidance Statement No. 48).

Groundwater EMAs are defined as the groundwater catchments of environmentally significant wetlands, the hydrology of which is dominated by groundwater and not surface water sources (EPA, 1998).

Guidance Statement No. 48 states in general, there will be a presumption against further urbanisation and new industrial land uses in 'Category A' EMAs. The City of Cockburn has previously advised that implementation of Water Sensitive Urban Design in drainage planning would meet its requirements in regard to this policy (P. Strano, pers comm., April 2004).

3.5 Fauna

Some areas of native fauna habitat exist on the site, especially within the scattered remnant areas of better condition vegetation. Parts of the site are used for horse agistment.

The Resource Enhancement Wetland in the northern portion of the site has the potential for aquatic fauna habitat during winter and provides suitable habitat for other species during the remainder of the year, predominantly due to the better condition of vegetation in this area. Some of the degraded bushland areas within other parts of the site may offer habitat for opportunistic fauna, especially more mobile fauna such as birds.

3.5.1 State Listed Significant Fauna Species

A search of the DEC threatened and priority fauna databases returned two Schedule 1 species, 1 Schedule 4 species and 7 other species of varying conservation significance as potentially utilising the site.

The two Schedule 1 species, the Numbat (*Myrmecobius fasciatu*) and the Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), could potentially utilise the site. However, given the degraded nature of the site and thus the lack of appropriate specific habitat for both of these species, it is considered unlikely that they would use the site.

The Schedule 4 species, Peregrine Falcon (*Falco peregrinus*), prefers habitat with cliffs or rocky ledges, watercourses, open woodland or cleared land. As such, the site is not considered a preferential habitat for this species.

In addition, surrounding uncleared bushland, particularly within the Thomsons Lake Nature Reserve, which abuts the western boundary of the site, would provide more significant habitat areas for these species and the other seven Priority species listed on the DEC's database search results.

3.5.2 EPBC Matters of National Environmental Significance - Fauna

A search of the DEWHA's EPBC Act "Protected Matters Search for Matters of National Environmental Significance" identified five threatened fauna species that could potentially occur on the site. These species are included in Table 4, as well as a brief outline of whether the local environment could potentially provide suitable habitat for these species.

Table 4: EPBC Matters of National Environmental Significance – Threatened Fauna

Protected Species	Status	Potential to Occur on Site
THREATENED SPECIES		
BIRDS		
Calyptorhunchus baudinii (Baudin's Black Cockatoo, Long-Billed Black Cockatoo)	Vulnerable	Potential to occur on site due to presence of Jarrah *(Eucalyptus marginata)* Woodland. However, due to degraded nature of vegetation, it is likely this species will utilise neighbouring Thomson Lake Nature Reserve in preference.
Calyptorhunchus latirostris (Carnaby's Black Cockatoo, Short-Billed Black Cockatoo)	Endangered	Degraded nature of the site unlikely to provide appropriate specific habitat
MAMMALS		
Dasyurus geoffroii (Chuditch, Western Quoll)	Vulnerable	Potential to occur on site due to presence of Jarrah *(Eucalyptus marginata)* Woodland. However, due to degraded nature of vegetation, it is unlikely this species will exist.
Phascogale calura (Red-Tailed Phascogale)	Endangered	Unlikely to occur on site. Inhabits Wandoo *(Eucalyptus wandoo)* and Sheoak *(Allocasuarina huegeliana)*, which isn't represented within the Bassendean – Central and South vegetation complex. Preference for areas with continuous canopies.
Setonix brachyurus (Quokka)	Vulnerable	Not on site. Only on Rottnest Island.

The degraded nature of most of the site is likely to restrict the preference of the site for the EPBC listed species in Table 4.

In addition, seven migratory fauna species were identified from the EPBC Search. However, it is expected that migratory birds would utilise the adjacent Thomsons Lake Nature Reserve and RAMSAR-listed Thomsons Lake as potential food sources, habitat and/or breeding in preference to the site being proposed for development due to its degraded nature.

3.6 Nuisance Midges

The City of Cockburn has prepared a Policy for Residential Rezoning and Subdivision Adjoining Midge Infested Lakes (APD6) (City of Cockburn, 2002) to address midge issues in this locality. The document recognises that wetlands associated with midge nuisance tend to display degradation, eutrophication and associated water quality problems and holds water during spring and summer.

The midge policy discourages residential development within 500m of wetlands identified as having the potential for nuisance midge. The policy states that Council is prepared to approve residential subdivision between 500m and 800m from the wetland on the basis that a Memorial is placed on land titles disclosing the possible presence of midges.

The City of Cockburn environmental constraints mapping indicates a requirement for a 500m midge buffer to the lakes within the Thomson's Lake Nature Reserve (known as the "Midge Exclusion Zone"). This buffer extends approximately 120m into the western section of the site (Figure 4).

The City of Cockburn has been consulted regarding its midge buffer requirements. Informal advice received from the City on another nearby project (Paddy Strano, previous Environmental Officer) is that development can occur within the 500m midge buffer if the following strategies are implemented to assist with midge management:

- Retention of existing natural vegetation within the 500m buffer area (this would apply in particular to Lots 2 and 3 Branch Circus);
- Reduction in buffer distance to be compensated for by providing a densely vegetated area to enhance screening; and
- Preparation and implementation of a Revegetation Plan (for the screening area). This will be submitted to council for approval with revegetation to commence early in the development process to allow vegetation to establish prior to residents moving into the site.

3.7 Acid Sulfate Soils

Regional mapping contained within Western Australian Planning Commission's Bulletin No. 64 – Acid Sulfate Soils (November 2003, mapping updated May 2007) indicates the following:

- The areas of Sandy Silt (which correspond with the wetland areas) represent a high to moderate risk of Acid Sulfate Soils occurring within 3 m of natural soil surface; and

- The remaining portion of the site, which comprises to sandy soils, represents a moderate to low risk of Acid Sulfate Soils occurring within 3 m of natural soil surface.

Figure 6 displays the WAPC's Regional Acid Sulfate Soils mapping.

3.8 Potential Contamination

The site has historically been used for a number of activities including horse agistment and industrial storage. These land uses and associated ancillary activities may have resulted in areas of potential contamination.

3.9 Aboriginal and European Heritage

A search of the Department of Indigenous Affairs Aboriginal Heritage Sites database and the Heritage Council of Western Australia State Register of Heritage Places were conducted to assess the potential presence of Aboriginal and European heritage sites (March 2007 and March 2008).

One site of Aboriginal significance, which is associated with the area within and surrounding the Thomsons Lake Nature Reserve, extends slightly into the site, just north of Gadd Street (Figure 4).

Aboriginal Heritage sites are usually mapped with a large buffer surrounding the actual site to be protected, in many circumstances to keep some discretion as to the exact site location. The heritage site is unlikely to be right on the boundary or corner of mapped areas and as such, the one associated with the Thomsons Lake Nature Reserve is not likely to be negatively impacted by development associated with the Branch Circus site.

No places of European Heritage were recorded on the State Register database.

3.10 Surrounding Land Uses

The Jandakot Groundwater Treatment Plant is located southeast of the site. Although the EPA does not recognise groundwater treatment plants as requiring a generic land use buffer, according to the EPA Guidance Statement No. 3 - *Separation Distances between Industrial and Sensitive Land Uses* (June 2005), the City of Cockburn recognises a 200m buffer for local strategic planning purposes.

Liaison with the City's Strategic Planning Section (12 March 2008) identified the majority of the 200m buffer is contained within the Water Corporation site itself and that it does not extend to the Branch Circus site (Figure 4).

In addition, a market garden is located approximately 450m to the south of the site. According to Guidance Statement No.3, the EPA recommends a generic buffer of 300-500m depending on size, to protect sensitive land uses, such as residential, from gaseous, noise, dust and odour emissions.

It is anticipate that, if the market garden is still in operation, it would not be considered a large scale operation and as such would attract a buffer closer to 300m. Given the 300m buffer falls outside the site, this land use is unlikely to impact on the proposed development.

Whilst there do not appear to be any nearby land uses that will conflict with potential development on the site, it is worthwhile considering the requirements for management of development adjacent to the Thomsons Lake Nature Reserve, which is a part of the larger DEC managed Beeliar Regional Park.

This should include consideration of interface management to prevent weed invasion and degradation, outbreak of fires and allowance for pedestrian access into the park including signage.

4.0 STRUCTURE PLAN RESPONSE AND MANAGEMENT COMMITMENTS

The proposed Structure Plan (Figure 7) has been designed to respond to key environmental constraints and considerations.

The proposed Structure Plan contains a mix of residential densities. The majority of the site is proposed for R20, with some R30 essentially around the central north-south road and central parkland area and R40 density in isolated areas throughout the development.

The proposed Structure Plan also incorporates a significant "Conservation Zone" in the northern area and a total of 4.36ha of parkland / drainage reserve.

This section of the EAR outlines how the proposed Structure Plan responds to the key environmental issues and presents information on how various management commitments for the development will be implemented.

4.1 Wetlands

The key points for consideration regarding wetlands on-site include:

- A Resource Enhancement Wetland (REW) exists in the north of the site;
- The upper storey vegetation within the REW was relatively intact. However, the understorey vegetation in most areas was highly degraded, with a large degree of weed infestation.
- A Conservation Category Wetland (CCW) exists in the south of the site, extending from the man-made Bartram Road Buffer Lakes.

Most of this wetland area is highly degraded and although it appears to still be functioning as a wetland, it is unlikely to be considered Conservation Category status when compared to the *Department of Environment and Conservation's Protocol for Proposing Modifications to the Geomorphic Wetlands Swan Coastal Plain dataset* (2007).

RPS is currently undertaking a wetland investigation of both the RE and CC wetlands, with a view to defining the correct management status and wetland boundaries of each. The outcome of this study will provide further detail on the natural environment on site and will direct detailed subdivision design, including providing information to determine suitable wetland buffers.

Based on the proposed Structure Plan, the following comments are provided:

- The majority of the REW is proposed to be retained in a "Conservation Zone", with the remaining southern portion of the REW proposed for retention within a "Park/Reserve" zone;
- A significant buffer has been adopted to much of the northern boundary of the REW. Darlot Avenue essentially represents the southern boundary of the REW proper;
- The R40 area in the northern portion of the site should be developed so as to not impact negatively on the wetland attributes or function of the REW;
- The REW will be rehabilitated using local native plant species;
- The majority of the degraded CCW is retained in the "Park" zone, pending the outcome of the wetland assessment. Only a portion in the north-eastern area is proposed for development;
- At this early stage (and still awaiting the details of the wetland assessment), it is questionable as to whether the CCW wetland is still linked hydrologically to the Bartram Road Buffer Lakes to the south. In addition, the strip of land along the southern boundary of the site is elevated and contains vegetation more typical of upland areas;
- A hard edge is proposed to residential areas surrounding the western, eastern and southern boundaries of the CCW area. This will limit weed and litter invasion from future residential areas;
- Stormwater drainage will be directed away from the CCW, toward the 3960m^2 "Park" area to protect the wetland;
- The structure plan design does not impact on the *Environmental Protection (Swan Coastal Plain) Lakes Policy 1992* (EPP) wetland to the south of the site.

4.2 Groundwater and Drainage

The *EPA Guidance on the Assessment of Environmental Factors – Groundwater Management Areas* (EPA, 1998) states, in general, there will be a presumption against further urbanisation and new industrial land uses in 'Category A' EMAs.

However, the City of Cockburn has previously advised that implementation of Water Sensitive Urban Design in drainage planning would meet its requirements in regard to this policy (P. Strano, pers comm., April 2004).

The South Jandakot Drainage Management Plan (SJDMP) (GB Hill & Partners, 1990) outlines the Environmental Management Programme (EMP) for the South Jandakot Drainage Scheme (GB Hill & Partner, 1991), which in turn outlines the drainage management principles for the catchment and the main drainage system and details the monitoring programs for buffer lakes.

Minor drainage systems must be designed to accommodate a 1 in 5 year storm event, with a minimum retention time of 6 minutes and road pavement runoff collected in side entry pits.

Such commitments will be detailed in a Local Water Management Strategy and an Urban Water Management Plan(s) for the site and will be compatible with the WAPC Jandakot Groundwater Protection Policy, which ensures development over the Jandakot Public Groundwater Supply Mound is compatible with the long-term use of the groundwater for human consumption.

On site drainage will not be directed towards wetland areas but rather will infiltrate at source, where possible. Where minimal depths to groundwater restrict the opportunity for at-source infiltration, stormwater will be directed to swale system within Public Open Space. Such swales will store and treat stormwater. As such, the swales will be revegetated with native vegetation to promote nutrient stripping.

Further information will need to be gained from the project engineers as to where the site's drainage will ultimately be directed as part of the structure planning phase, given the complex nature of the regional drainage systems in this area. This will ultimately result in the preparation of detailed Urban Water Management Plan(s) at the subdivision stage.

4.3 Vegetation and Flora

Figure 3 illustrates that the majority of the site is in a generally degraded condition, except the REW area in the northern portion of the site, and other isolated pockets of remnant mature trees in the centre of the site.

As previously indicated, RPS is currently finalising the results of a Level 2 flora and vegetation survey, conducted in spring 2007. Once analysis of the Level 2 work is complete, this will inform detailed subdivision design. Any Declared Rare or Priority Flora (DRF) will be identified and protected through an environmentally responsive subdivision design.

Early indications of the Level 2 work have been factored into the structure plan design where possible. The better quality vegetation in the northern wetland area has been reserved within a "Conservation Zone".

An approved Development Application for a "Special Use - Swimming Pool" does result in the loss of a small portion of 'Good' quality vegetation in the north-eastern corner of the site. However, overall, the vegetation is not considered to be in very good condition and as such, the impacts associated with the proposed urban development are considered to be minimal.

4.4 Nuisance Midges

It is recommended that existing vegetation within the portions of Lots 2 and 3 Branch Circus which are partly inside the City of Cockburn's 500m 'Midge Exclusion Zone 'be retained.

In addition, it is recommended that revegetation of this area be undertaken using local native species. Revegetation will increase the density of vegetation in this zone and will improve the screening capacity of the area for future residents.

Any revegetation for this purpose should be directed by a Revegetation Management Plan, which will require council approval. A Revegetation Management Plan will outline the type of species to be used for revegetation and the densities and approximate layout necessary to be most effective for screening purposes. This will be prepared in consultation with the City of Cockburn.

The City of Cockburn's Policy for Residential Rezoning and Subdivision Adjoining Midge Infested Lakes requires "revegetation to commence early in the development process to allow vegetation to establish prior to residents moving into the site."

In addition, a Memorial on Title is recommended for future residents that purchase lots located between the 500m Midge Exclusion Zone and the 800m Notification Zone, as per the City of Cockburn's Policy for Residential Rezoning and Subdivision Adjoining Midge Infested Lakes (City of Cockburn, 2002), disclosing the potential presence of nuisance midge.

The combination of these initiatives, the presence of dense vegetation within the Thomsons Lake Nature Reserve, together with the presence of a ridge between the lake and the site, should effectively manage any potential midge issues.

4.5 Acid Sulfate Soils

Due to the High to Moderate risk of some of the site for Acid Sulfate Soils, and the low lying nature of some of the site, it is recommended that a Preliminary Site Assessment (PSA) for Acid Sulfate Soils be undertaken, to identify the potential for Acid Sulfate Soil to be present on the site.

The PSA will assist at a local scale in determining the presence or otherwise of Acid Sulfate Soils on site.

The PSA will need to be undertaken prior to subdivision works, in accordance with the DEC's *Acid Sulfate Soils Guideline Series (2006) Draft Identification and Investigation of Acid Sulfate Soils*.

The Structure Plan concentrates areas of residential development to areas of Moderate to Low risk of Acid Sulfate Soils. The High to Moderate risk areas correspond to wetland areas, and these are not suitable for development.

However, given development is proposed within 500m of High to Moderate risk areas, and at this stage the developer is unsure of the outcomes of the wetland assessment (and thus whether development of the areas currently mapped as wetland will occur), RPS recommends undertaking the PSA.

4.6 Contamination

The site has historically been used for a number of activities including horse agistment and industrial storage. These land uses and associated ancillary activities may have resulted in areas of potential contamination.

To comply with the *Contaminated Sites Act 2003* and the Department of Environment and Conservation's requirements, a Preliminary Site Investigation (PSI) should be undertaken to determine the potential for on site contamination. The PSI will determine if any further work is required.

Given the current land uses, it is likely that approval for development within the site will incorporate the need for a PSI as a Condition of Subdivision.

This work can be undertaken at any time prior to ground disturbing works. However, it is recommended that it be undertaken early in the process to allow sufficient time should any further work be necessary.

4.7 Aboriginal Heritage and Surrounding Land Uses

Given that only the north-eastern corner of the Aboriginal Heritage Site extends within the site proposed for development, it is not considered that this issue will impact on ultimate development of the site.

However, to confirm or otherwise, it may be appropriate to seek the advice of a qualified Aboriginal Heritage specialist.

No off site land uses are anticipated to pose constraints to development. Buffers for both the Jandakot Groundwater Treatment Plan and the market garden to the south of the site do not extend within the Branch Circus structure plan area. In addition, existing residential development (east of the site) is closer to the Jandakot Groundwater Treatment Plan than the currently proposed site.

5.0 CONCLUSION

In summary, and taking the structure plan design into account, the key environmental planning issues in need of consideration include:

- Wetland management;
- Groundwater management;
- Drainage management;
- Midge Exclusion Zone;
- Acid Sulfate Soils Preliminary Site Assessment (PSA); and
- Contamination Preliminary Site Investigation (PSI).

In order to protect the key environmental features and satisfy the government agencies that the proposed structure plan design enhances the overall area and provides an overall net environmental benefit, the following management commitments will be adopted.

- Water Sensitive Urban Design will be implemented within the development and outlined in a Local Water Management Strategy and subsequent Urban Water Management Plan(s);

- On site drainage will not be directed towards wetland areas but rather will infiltrate at source, where possible. Where minimal depths to groundwater restrict the opportunity for at-source infiltration, stormwater will be directed to swale systems within public open space, which will be designed to promote nutrient stripping.

- Minor drainage systems must be designed to accommodate a 1 in 5 year storm event, with a minimum retention time of 6 minutes and road pavement runoff collected in side entry pits;

- Drainage design will have due regard for the intentions and objectives of the three documents below and as such, will be compatible with the long-term use of the groundwater for human consumption.

    - *EPA Guidance on the Assessment of Environmental Factors – Groundwater Management Areas* (EPA, 1998);

    - South Jandakot Drainage Management Plan (GB Hill & Partners, 1990);

    - Statement of Planning Policy No. 2.3 - Jandakot Groundwater Protection Policy (Western Australian Planning Commission, 1998).

- The majority of the REW will be retained in a "Conservation Zone", with the remaining southern portion of the REW proposed for retention within a "Park/Reserve" zone;

- The REW and the area to the north of the REW will be revegetated with local native species. The area north of the wetland will provide a buffer to the REW;

- The R40 area in the northern portion of the site will be developed so as to not impact negatively on the wetland attributes or function of the REW;

- The majority of the degraded CCW will be retained in the "Park" zone, pending the outcome of the wetland assessment. A suitable buffer will be determined at this time;

- A hard edge between residential areas and the wetland areas will be constructed where possible, to limit weed and litter invasion from future residential areas;

- Stormwater drainage will be directed away from the CCW, toward the 3960m^2 "Park" area to protect the wetland, pending the outcome of the wetland assessment.;

- The 'Very Good' quality vegetation in the north will be retained as part of the overall protection of the REW area within the 'Conservation Zone';

- In order to minimise the risk of nuisance midge plagues negatively impacting on future residents, the following will be implemented:

  - existing native vegetation will be retained within the portions of Lots 2 and 3 Branch Circus that fall inside the City of Cockburn's 500m 'Midge Exclusion Zone';

  - This area will also be revegetated using local native species to improve the screening capacity for future residents;

  - Memorials on Titles will be adopted for residents between the 500m Midge Exclusion Zone and the 800m Notification Zone;

  - A Revegetation Management Plan will be prepared and implemented to guide revegetation activities aimed at midge screening and improved vegetation quality in the northern area of the site.

- An Acid Sulfate Soils Preliminary Site Assessment will be undertaken prior to ground disturbing activities; and

- A Preliminary Site Investigation will be undertaken prior to ground disturbing activities to determine the presence or otherwise of soil and/or groundwater contamination.

At this stage, the outcomes of the wetland assessments for the site have yet to be determined. However, based on preliminary knowledge, a Wetland Management Plan is proposed for the Resource Enhancement Wetland in the north of the site to ensure it's ultimate protection, provided the wetland assessment and negotiation with the DEC indicates this area is correctly classified.

At this stage, no Wetland Management Plan is proposed for the CCW as preliminary site investigations suggest that this area may be incorrectly mapped by the DEC.

This Wetland Management Plan proposed for the REW could be prepared jointly with the Revegetation Management Plan that is proposed to guide midge screening in this area. Together, the two could be called a "Conservation Zone" Management Plan.

Please note that all management commitments proposed for the wetland areas will be reviewed once the outcomes of the wetland assessments are known.

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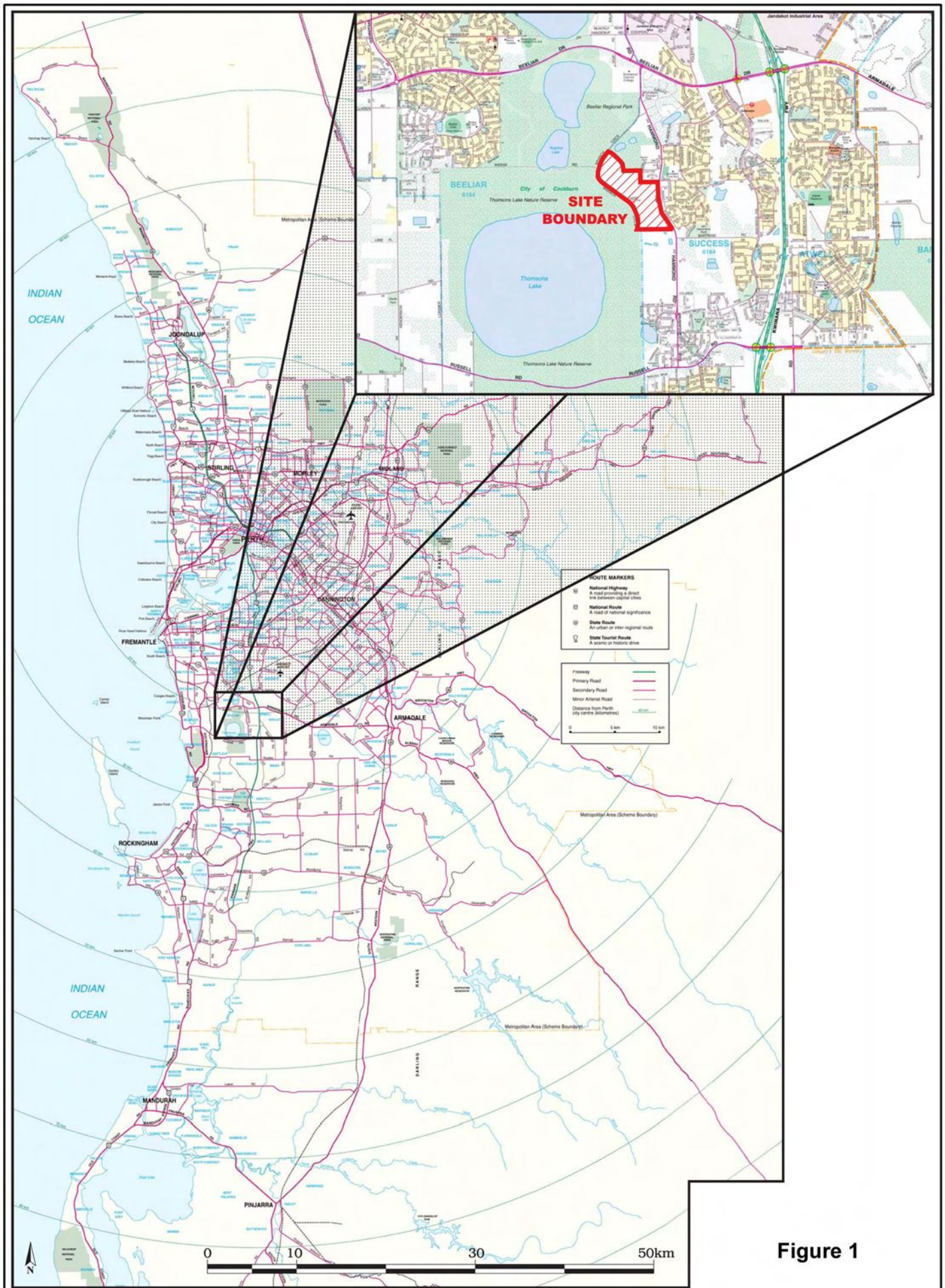
FIGURES



Source: DLI, 2007

Figure 1

Site Location

LE4012 12.03.08

RPS

LEGEND

- Site Boundary
- Cadastre
- Contour (mAHD)

GEOLOGICAL UNIT DESCRIPTIONS

Sandy Silt (Ms5) - Dark brownish grey silt with disseminated fine grained quartz sand with variable clay content. This soil type is located in areas identified as containing mapped wetlands. Gozzard (1983) has identified this unit as being unsuitable for urbanisation and road contstruction.

Sand (S8) - Very light grey at surface to yellow at depth fine to medium grained Bassendean Sand. This soil type is considered suitable for both urbanisation and road construction (Gozzard, 1983)

Water

0 50 100 150 200 250 m

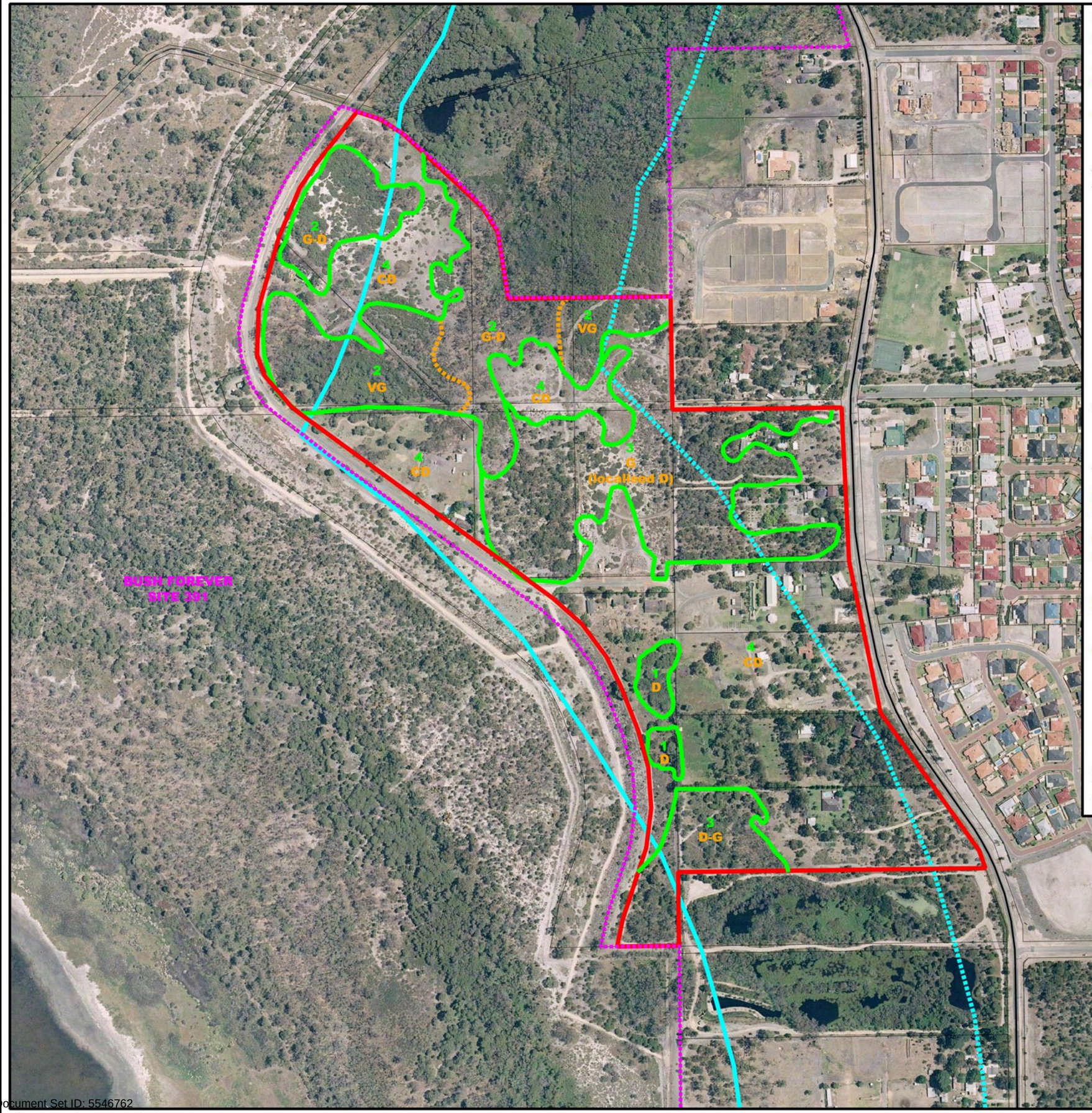
Scale 1: 5 000 @ A3

L07012 12.03.08

Figure 2

Topography and Soils

RPS



LEGEND

- Site boundary
- Existing cadastre
- Bush Forever Site boundary 391
- Vegetation unit boundary
- 1 Vegetation unit text
- Vegetation condition boundary
- G Vegetation condition text

VEGETATION UNIT DESCRIPTIONS

Vegetated Areas (Bassendean Dunes)

Wetlands

1 *Melaleuca preissiana* over Buffalo Grass **Stenotaphrum secundatum*

2 Mosaic Damplands

2a. Flooded Gum *Eucalyptus rudis* subsp. *rudis* over *Astartea affinis*.

2b. Gum *Eucalyptus rudis* subsp. *rudis* Spearwood *Kunzea glabrescens*

3 Dunes

(Jarrah *Eucalyptus marginata*) Woodland of *Eucalyptus todtiana, Banksia attenuata, B. menziesii* with scattered *B. ilicifolia* over *Adenanthos cygnorum* subsp. *cygnorum* and Low Shrubland (mixed).

Cleared Areas

4 Remnant overstorey species and/or introduced trees over cleared ground, pasture or urban development

VEGETATION CONDITION SCALE

P	Pristine	No obvious signs of disturbance.
E	Excellent	Vegetation structure intact, disturbance affecting individual species ; weeds are non-aggressive species
V	Very Good	Vegetation structure altered; obvious signs of disturbance
G	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance; basic vegetation structure or ability to regenerate it is retained
D	Degraded	Basic vegetation structure severely impacted by disturbance; scope for regeneration but not to a state approaching good (sic) condition without intensive management
CD	Completely Degraded	Vegetation structure not intact; the area completely or almost completely without native species ('parkland cleared').

N

0 50 150 250m

Scale 1: 5000

CAVEAT:

This map constitutes preliminary broad scale vegetation mapping only. Boundaries are drawn from aerial photography and are indicative.

Figure 3

Vegetation Units and Condition

07112 18.03.08

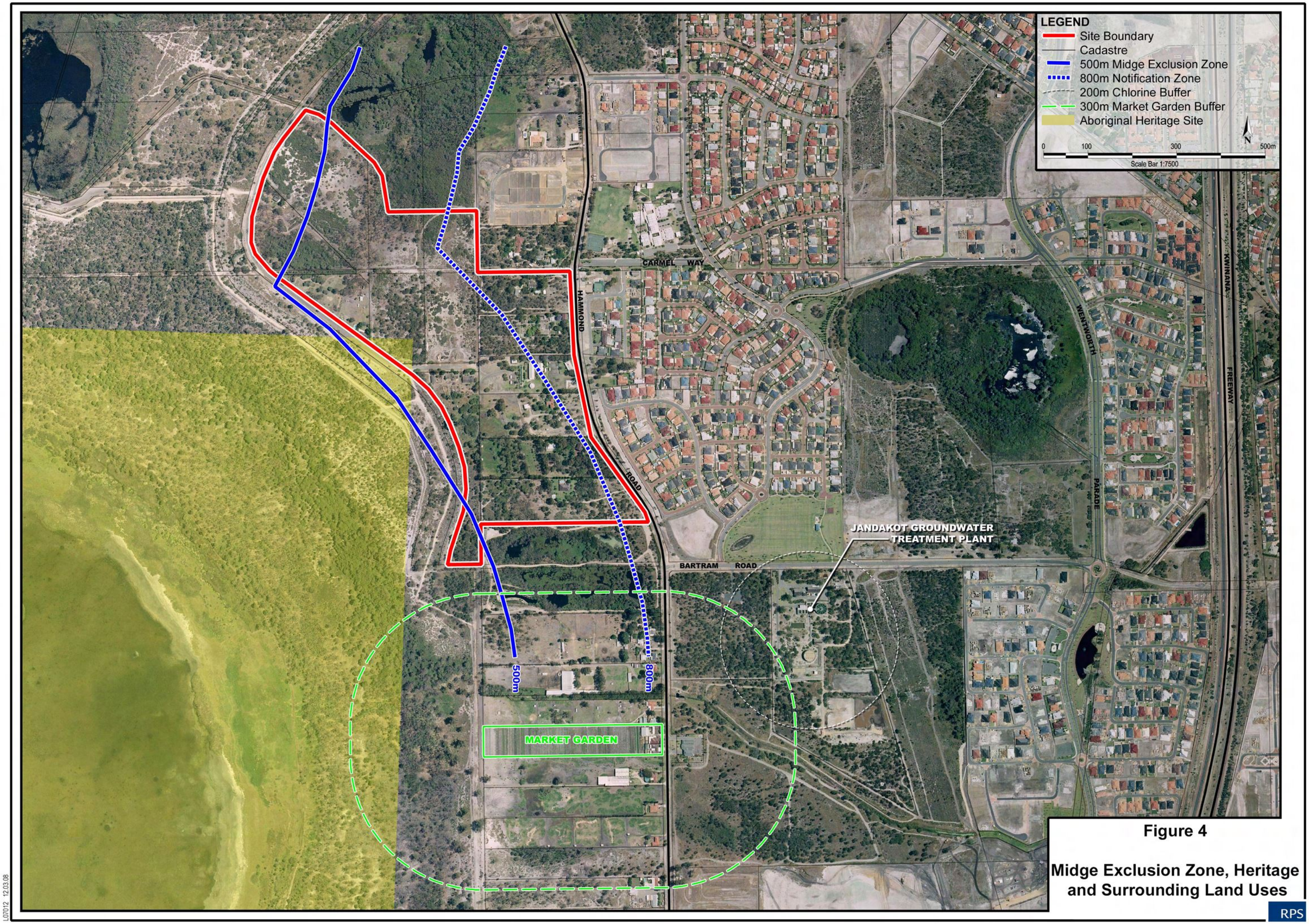


Figure 4

Midge Exclusion Zone, Heritage and Surrounding Land Uses

RPS

LEGEND

Site boundary

Photograph Number, Location and Direction

Groundwater contours (mAHD)

WETLAND MANAGEMENT CATEGORIES

Conservation

Resource enhancement

Multiple use

N

0 50 100 150 200 250 metres

Scale 1: 5 000 @ A3

Source: DoW and DEC, 2007

17 18 19 20 21 22 23 24 25

1 2 3 4 5 6 7 8 9 10

L07012 12.03.08

Figure 5

Groundwater Contours, DEC Wetland Mapping and Photo Locations

RPS

LEGEND

Site boundary

Existing cadastre

ACID SULFATE SOIL RISK MAPPING

High to moderate risk of ASS occuring within 3m of natural soil surface.

Moderate to low risk of ASS occuring within 3m of natural soil surface.

Source: DPI, May 2007

N

0 50 150 250m

Scale 1: 5000

L07012 12.03.08

Figure 6

WAPC Acid Sulfate Soils Regional Mapping

RPS

STRUCTURE PLAN AREA SUMMARY		
STRUCTURE PLAN AREA	35.27ha	
PARK/ RESERVE/ PUBLIC PURPOSES	4.96ha	(14.0%)
URBAN R20	9.54ha	(27.0%)
URBAN R30	2.13ha	(6.04%)
URBAN R40	2.39ha	(6.78%)
ROAD RESERVE	5.95ha	(16.9%)
CONSERVATION ZONE (R40)	9.18ha	(26.0%)
SPECIAL USE - SWIMMING POOL	0.86ha	(2.44%)

LEGEND

- STRUCTURE PLAN BOUNDARY
- URBAN R20
- URBAN R30
- PUBLIC PURPOSES
- URBAN R40
- BUSH FOREVER RESERVATION
- INDICATIVE DRAINAGE

METRES 0 50 100 150 200 250

N

Source: Koltasz Smith, 29th Feb 2008

L07012 12.03.08

Figure 7

Structure Plan

RPS