Practical Ecology Pty Ltd
Contracting and Consulting in Ecological
Restoration and Environmental Planning
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Biodiversity Assessment Report

C21 Business Park,

PSP Area 11

30 November 2011

Report prepared for Growth Areas Authority

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Biodiversity Assessment Report: C21 Business Park, PSP Area 11

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Report by Mark Shepherd, Joanne Henry, Annabelle Stewart and David Nance.

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Prepared for:	Growth Areas Authority	PE project number:	GAA 1087
Contact:	Bill Vasiliadis	PE file location:	R:\AAAA Major Clients - Projects\GAA\GAA Biodiversity Mapping Project 2009-2011\reports\PSP 11\Precinct_11.doc

External version control

Version	Date sent to client	Reviewed by:
1	21 April 2010	Biosis Research 31/05/10
		DSE 25 June 2010 (M and MB comments)
2	7 December 2010	DSE
3	12 July 2011	GAA/DSE
4	4 October 2011	DSE
5	30 November 2011	

Internal review and auditing of this report for quality control was conducted by Peter Gannon.

Acknowledgments

The following people and organisations contributed to the report, provided advice, information or provided technical support during the preparation of this report:

Practical Ecology

Staci Timms undertook GIS data processing and created maps for the report.

Greg James and Mark Shepherd undertook habitat hectare assessments.

Mark Shepherd, Gidja Walker and Jeremy Neal undertook targeted flora surveys.

Lincoln Kern provided project support and guidance.

Jane Juliff, Michael Reynolds and David Nance provided technical assistance.

Nic McCaffrey assisted with 'likelihood of occurrence' ratings of significant flora.

Annabelle Stewart, Joanne Henry, Zorza Goodman and David Nance undertook targeted and general fauna survey.

Mal's Ecological and Environmental Services

Malcolm Legg undertook general fauna survey and targeted survey for threatened fauna, reviewed fauna sections within this report and provided regional significance ratings for threatened fauna.

Rob Gration MWldMgt (Habitat); Certified Wildlife Biologist - Ecological Consulting Services

Rob Gration identified and analysed microbat calls recorded with AnaBat.

Ecocentric Environmental Consulting

Peter Gannon undertook habitat hectare assessments and reviewed the draft report.

Growth Areas Authority

Yong Zhou provided *Land Subject to Inundation Overlay* and *Precinct Structure Plan* areas as GIS layers.

Department of Sustainability and Environment

Clare White, Biodiversity Precinct Planner, provided project advice relating to the determination of conservation significance of habitat zones within the contract area.

Biodiversity Information Group provided access to their ecological databases; Victorian Flora Site Database (VFSD) and Atlas of Victorian Wildlife (AVW).

EXECUTIVE SUMMARY

Practical Ecology Pty Ltd was commissioned by Growth Areas Authority to undertake a habitat hectare assessment, and flora and fauna assessment within Precinct Structure Plan (PSP) area 11, *C21 Business Park,* Victoria. The purpose of this report is to provide information on the flora and fauna species and Ecological Vegetation Classes (EVCs) that occur within the precinct, as background information to a Precinct Structure Plan for the *C21 Business Park* PSP area 11.

C21 Business Park is located in the suburb of Berwick, within the City of Casey in Melbourne's south eastern growth corridor (Figure i). The precinct is approximately 314 hectares in area and is bounded by the Pakenham Bypass to the north, Soldiers Road to the west, Cardinia Creek to the east and by Grices Road to the south. The contract area is surrounded predominately by agricultural land to the south and east, and by residential areas to the north-west (Figure i). Parts of the contract area adjacent to Cardinia Creek are covered by Biosite 6888 *Cardinia Creek – Lower* (Figure 1).

Flora

One hundred and sixty-four flora species were recorded within the contract area. Seventy-three (45%) of these species are indigenous. No threatened flora species were recorded during the current assessment. Thirty-nine threatened flora species have been recorded within 10 kilometres of the contract area or are predicted to occur by DEWHA. Eight of these species are considered to have at least a medium likelihood of occurrence, based on nearby records and suitable habitat within the contract area.

A total of **8.28 hectares** of native vegetation comprising **3.0 habitat hectares** was recorded within the contract area (Figure ii). Native vegetation comprising Habitat Zones within Precinct 11 is confined primarily to the Cardinia Creek riparian corridor and floodplain in the east of the contract area. Most of this vegetation consists of Swamp Scrub of relative high quality. Other native vegetation within the Cardinia Creek corridor includes extensive areas of wetland EVCs. A woodland remnant occurs within the south of the contract area, adjacent to the riparian corridor. Native vegetation in the riparian corridor within the contract area is contiguous with extensive areas of native vegetation to the north and south. **Seven** scattered trees were recorded within the contract area.

Six EVCs were recorded and mapped within the contract area (Figure ii). EVCs occurring within the contract area have an *Endangered* or *Vulnerable* conservation status in the Gippsland Plains bioregion. All 38 patches of native vegetation recorded within the contract area have been assigned **very high** conservation significance, as per Appendix 3 of Victoria's *Native Vegetation Framework* (Figure iii).

The majority of the remainder of the contract area is currently being used for cropping and grazing, featuring large open paddocks with some indigenous scattered trees and planted vegetation.

Non-indigenous vegetation comprises planted non-indigenous Eucalypts and other established trees along fence-lines and roadsides. Drainage lines, wetlands and roadsides include areas of modified native vegetation that comprise the floristic components of Swamp Scrub and other EVCs, but do not meet DSE's native cover thresholds. In addition, there is a large area of planted non-indigenous vegetation adjacent to the riparian corridor which is likely to be the result of reforestation efforts in the 1980s. Large areas of agricultural land dominate the contract area and comprise little native vegetation. Non-native vegetation and Degraded Treeless Vegetation totals approximately **281 hectares** at the contract area.

Fauna

One hundred and six fauna species were recorded during the current assessment, including 92 indigenous species. A total of eleven threatened fauna species were recorded during the current assessment (Figure iv). An additional three species recorded during the current assessment are listed as either migratory and/or marine under the EPBC Act 1999. One additional threatened species; Feckled Duck *Stictonetta naevosa* was recorded within the study area during a previous assessment. Fourteen of the fifteen species were threatened wetland and/or migratory/marine birds. One targeted threatened amphibian; Southern Toadlet *Pseudophryne semimarmorata* species was recorded within the contract area. Growling Grass Frog and Southern Brown Bandicoot targeted surveys were not conducted during this assessment. These species were targeted during sub-regional assessments and are discussed within those reports. See Draft Sub Regional Surveys for Southern Brown Bandicoot (2010) and the Draft Sub-regional surveys for Growling Grass Frog (Renowden et al. 2010).

Fifty-three national and state significant fauna species recorded or predicted to occur within ten kilometres of the contract area are documented on the Victorian Fauna Database and EPBC Protected Matters Search Tool. Twelve fauna species recorded on AVW and EPBC searches are considered to have a high likelihood of occurrence within the contract area. An additional 11 species are considered to have at least a moderate likelihood of occurrence within the contract area

Large constructed wetlands within the Cardinia Creek riparian corridor offer excellent habitat for a range of species, including many threatened species, in particular a suite of threatened wetland birds and the area is considered to be of 'high regional' habitat significance.

Other areas of native (non-indigenous) and exotic (introduced) vegetation, including areas of regenerating Swamp Scrub and other native vegetation do not meet the DSE threshold for consideration under Victoria's *Native Vegetation Management Framework*. Some of these areas occur within roadsides and drainage-lines within the contract area. Whilst highly modified or immature, some of these areas comprise relatively complex vegetation structures and floristic diversity and are considered habitat for threatened fauna species, such as threatened wetland birds and amphibians (Figure iv).

The constructed wetlands in the centre and along the eastern edge of the contract area support excellent habitat for the regions indigenous fauna (Figure iv). Dams with fringing native vegetation offer high quality habitat for wetland birds and amphibians. Habitat condition may improve as the wetland floristic diversity increases and habitat values develop.

The largest dam at the south-eastern section of the contract area is of particular importance as it supports a number of islands serving as breeding sites for numerous species, including; Little Pied Cormorant *Microcarbo melanoleucos,* Little Black Cormorant *Phalacrocorx sulcirostris* and the state significant Pied Cormorant *Phalacrocorax varius*. The state significant Royal Spoonbill *Platalea regia* was also observed nesting in one of the islands.

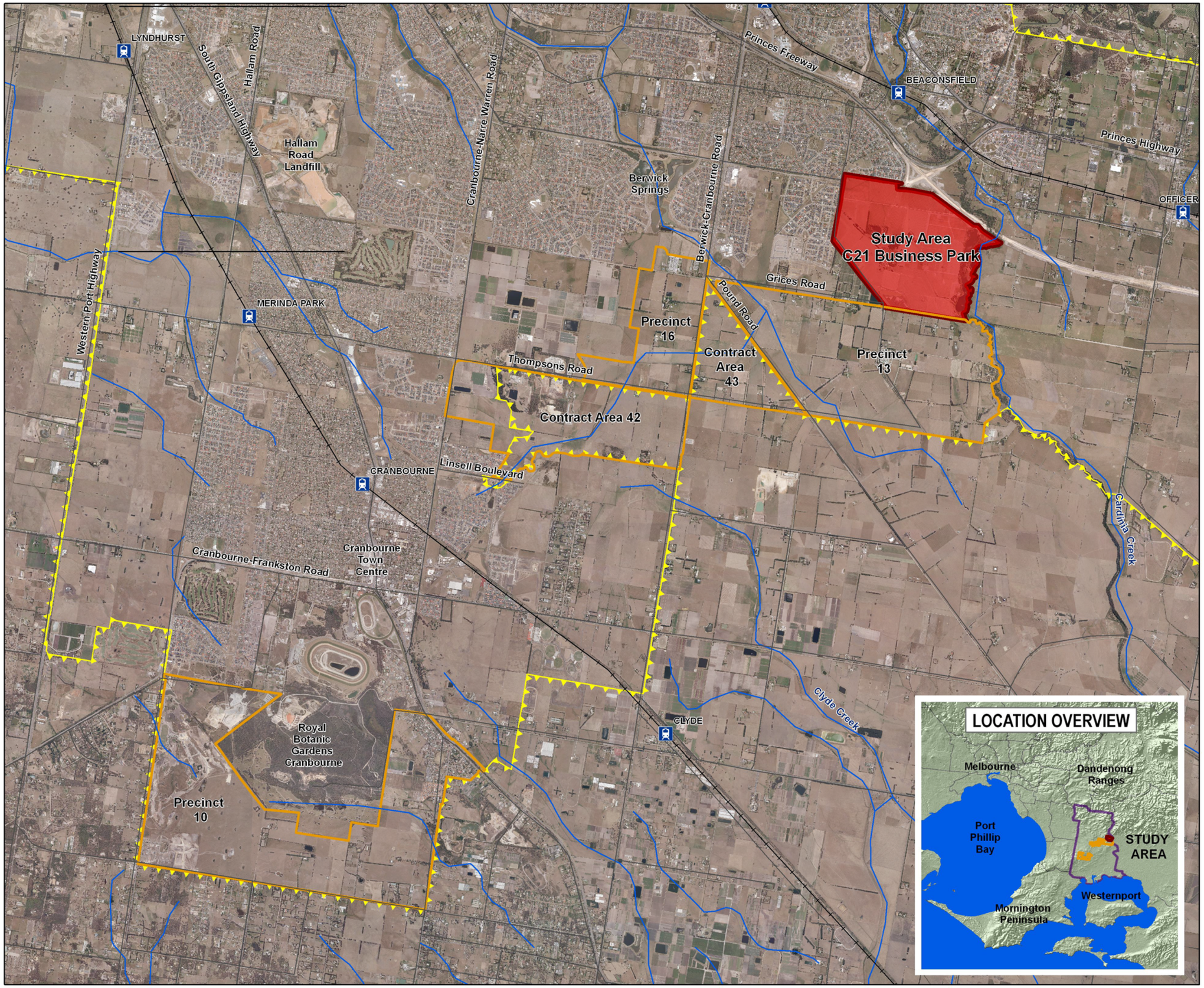
Key Biodiversity Issues and Implications

The area of highest conservation priority within the contract area consists of the remnant Swamp Scrub, woodlands and wetlands within the Cardinia Creek Corridor. Other areas of wetland and drainage-line habitat throughout the precinct also have significant value.

Land-use change within the contract area, such as residential, business or industrial developments have the potential to significantly impact existing native vegetation, ecosystem function, water quality, threatened species habitat and local and regional biodiversity, through the direct removal of native vegetation and habitat. However, approximately two percent of the contract area comprises indigenous vegetation, which provides significant opportunities to avoid native vegetation removal, as required first and foremost by Victoria's *Native Vegetation Management: a Framework for Action*. Indirect impacts, especially altered drainage patterns and changes to water quality have the potential to impact breeding habitat within the Cardinia Creek corridor for a suite of threatened wetland birds. Rezoning and subsequent development of the contract area must proceed with caution to avoid impacting this important regional habitat. Existing and potential fauna habitat should be appropriately buffered from development and public open space to avoid impacts to threatened bird species, such as increased predation and disturbance by feral and domestic animals.

There is potential to improve the habitat values through implementation of rehabilitation and conservation programs, and through improved land and water use practices that promote natural regeneration of the site's wetland and riparian EVCs.

The Cardinia Creek Corridor has been identified by DSE as an area of high native vegetation connectivity within the region and therefore has significant biodiversity value. Potential biolinks within Precinct 11 and neighbouring Precinct areas can play an important role in linking core habitats between Western Port Bay and the foothills of the Great Dividing Range.



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NOTES:
Practical Ecology bears no responsibility for the accuracy and completeness of this information and any decisions or actions taken on the basis of the map. While information appears accurate at publication, nature and circumstances are constantly changing.

VERSION: 02	DATE: 30/09/10

MAP AND SURVEY DETAILS

Mapping by: Staci Timms, 29/04/10
Generated from: Aerial Imagery and GIS base layers supplied by DSE and GAA, additional GIS layers from Geoscience Australia.

For further detail of C21 Business Park, refer to "FIGURE 1: Study Area"

DATUM: GDA 94 VICGRID 94

N

0 0.5 1 1.5 2 2.5
Kilometres

1:50,000 when printed at A3

LEGEND

- Roads
- Watercourse
- Railway Stations
- Railway Lines
- Urban Growth Boundary
- STUDY AREA C21 Business Park
- Other Contract Areas and Precincts
- City of Casey Local Government Area Boundary

FIGURE i
REGIONAL CONTEXT
C21 Business Park
Biodiversity Mapping Project
2009-2011

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VERSION: 02	DATE: 30/09/10

MAP AND SURVEY DETAILS
Mapping by: Staci Timms, 20/04/10
Flora Survey by: Mark Shepherd, Peter Gannon and Jeremy Neal. 29 Oct - 7 Nov 2008 and 28th January 2010
Generated from: Aerial Imagery and GIS base layers supplied by DSE and GAA, additional GIS layers from Geoscience Australia.
For further detail of EVCs and Scattered Trees, refer to Figure 2

DATUM: GDA 94 VICGRID 94

N

0 100 200 300 400
Metres

1:8,000 when printed at A3

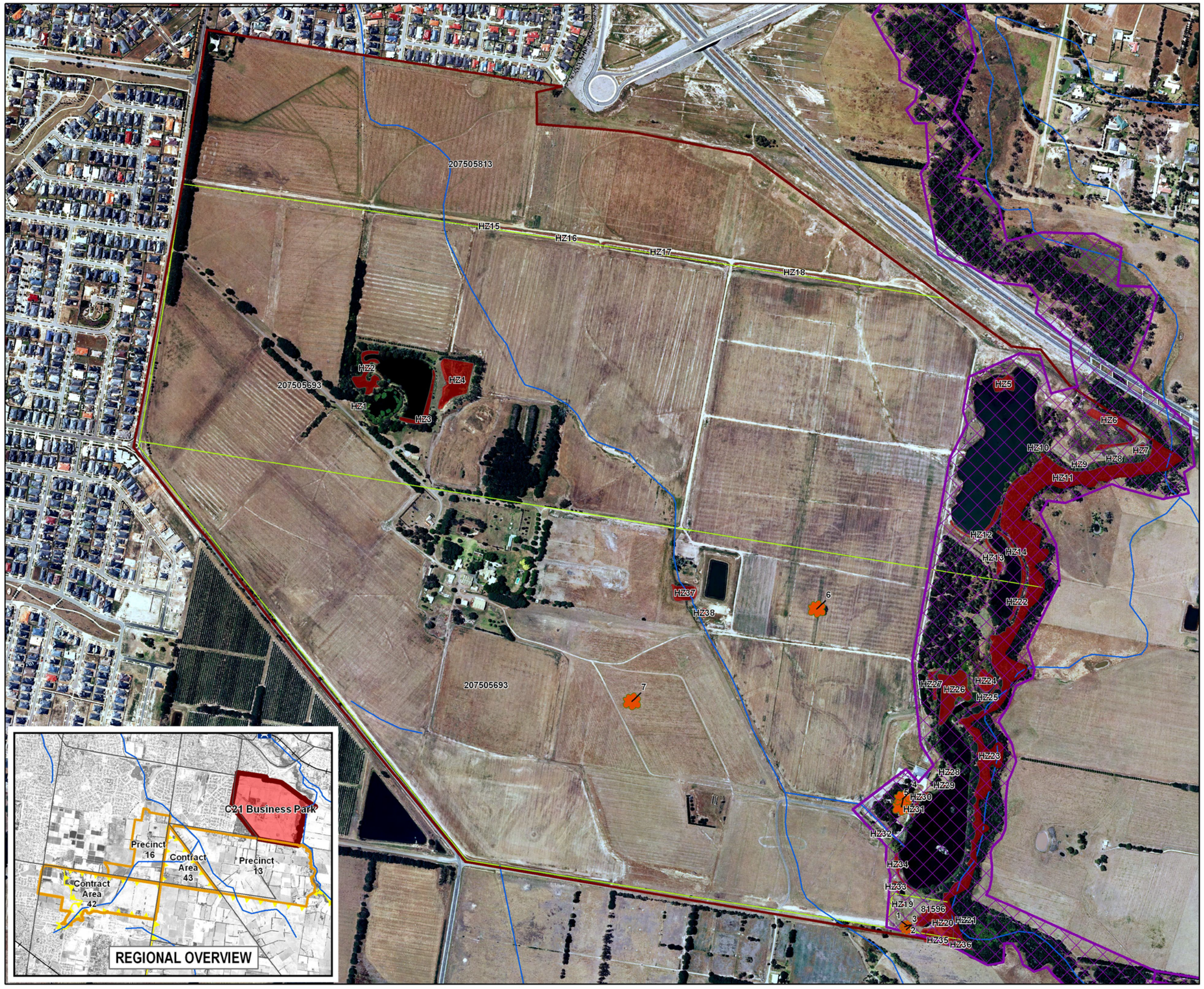
LEGEND

Access was granted for all properties.

- Roads
- Watercourse
- 257423 Property Boundary and PFI
- C21 Business Park Study Area
- Other Precincts and Contract Areas
- 1 Scattered Trees and Identification Number
- Non Native Vegetation and/or Degraded Treeless Vegetation*
- HZ1 Remnant Patch and Identification Number

*Non Native Vegetation and Degraded Treeless Vegetation were mapped as per methodology defined in "Biodiversity Assessment Report: Flora Assessment and Mapping. Precinct Structure Plan area 11, C21 Business Park" and were not differentiated at time of survey.

FIGURE ii
PROPERTY ACCESS AND FLORA SURVEY RESULTS
C21 Business Park
Biodiversity Mapping Project 2009-2011



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MAP AND SURVEY DETAILS
Mapping by: Staci Timms, 20/04/10
Flora Survey by: Mark Shepherd, Peter Gannon and Jeremy Neal
29 Oct-7 Nov 2008 and 28 Jan 2010
Generated from: Aerial Imagery and GIS base layers supplied by DSE and GAA, additional GIS layers from Geoscience Australia.

DATUM: GDA 94 VICGRID 94

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0 100 200 300 400
Metres

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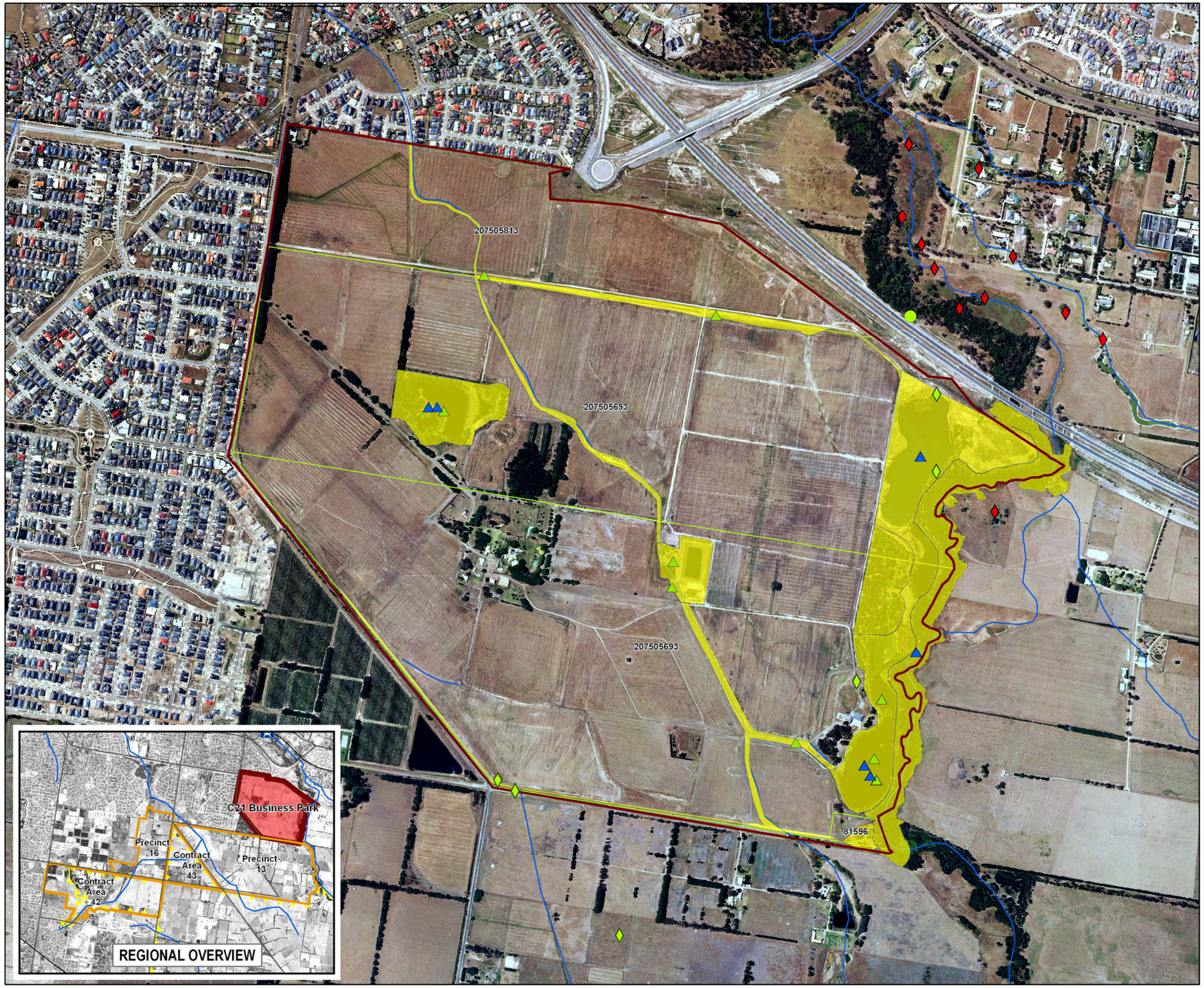
LEGEND

- Roads
- Watercourse
- 257423 Property Boundary and PFI
- C21 Business Park Study Area

Conservation Significance

- High Conservation Significance - Scattered Tree
- Very High Conservation Significance - Remnant Patch
- Biosite #6888: Cardinia Creek - Lower

FIGURE iii
CONSERVATION SIGNIFICANCE OF HABITAT ZONES AND SCATTERED TREES
C21 Business Park
Biodiversity Mapping Project 2009-2011



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VERSION: 02	DATE: 30/09/10

MAP AND SURVEY DETAILS
Mapping by: Staci Timms, 20/04/10
Surveyed by: Mark Shepherd, Gidja Walker, Jeremy Neal, Mal Legg, Jo Henry, Zorza Goodman, Annabelle Stewart, David Nance.
Generated from: Aerial Imagery and GIS base layers supplied by DSE and GAA, additional GIS layers from Geoscience Australia.
For more detailed maps of significant flora and fauna species and fauna habitat, refer to Figures 4, 5 and 7 respectively.

DATUM: GDA 94 VICGRID 94

N

0 100 200 300 400
Metres

1:10,034 when printed at A3

LEGEND

- Roads
- Watercourse
- 257423 Property Boundary and PFI
- C21 Business Park Study Area
- Other Precincts and Contract Areas
- Fauna Habitat

Significant Flora Records
- FIS Database

Significant Fauna Records
- Practical Ecology Survey Results
- AVW Database

Conservation Significance Level
- Regional
- State
- National

FIGURE iv
THREATENED SPECIES RECORDS AND FAUNA HABITAT
C21 Business Park
Biodiversity Mapping Project
2009-2011

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1. INTRODUCTION

This report presents the findings of ecological assessments undertaken in accordance with the contract specifications outlined in GAA *Biodiversity Mapping Project 2009-2011* (DSE 2009a). Also included in this report are the results of habitat hectare analysis and other biodiversity data collected during the Growth Areas Authority (GAA) *Native Vegetation Mapping Project* 2008/2009 in accordance with specifications developed for that contract. This report therefore presents the findings of two separate ecological assessment contracts and is therefore not entirely consistent with biodiversity reports undertaken for other precinct or 'Investigation Areas' that have used the *Biodiversity Mapping Project 2009-2011* specifications exclusively.

The following sections describe project backgrounds for the *Native Vegetation Mapping Project* 2008/2009 and the *Biodiversity Mapping Project 2009-2011*.

1.1 Native Vegetation Mapping Project 2008/2009 project background

The Growth Area Authority (GAA) engaged contractors during 2008 / 2009 to map and assess native vegetation and fauna habitat in designated Precinct Structure Plan areas surrounding Melbourne. The scope and design of this project was developed jointly with the Department of Sustainability and Environment (DSE). The purpose of this mapping and assessment process was to:

- Prepare biodiversity reports as essential background input into precinct structure planning at an early stage in the planning process;
- Inform the preparation of precinct structure plans in areas designated for future urban development (in most cases this will also include preparation of a Native Vegetation Precinct Plan)
- Identify priorities for protection and enhancement of biodiversity including potential reserve areas, biodiversity corridors and areas with potential to provide offsets for vegetation lost as a result of urban development;
- Assist long term planning related to infrastructure including liaison with relevant service authorities to ensure their requirements are met over the next 30-50 years;

This new approach focuses on achieving the objectives of the Victorian Native Vegetation Framework and planning development within the Urban Growth Zone at a regional level. This approach will improve the clarity and flexibility of native vegetation management, reduce the administrative burden on local government, provide greater certainty for urban development and improve biodiversity outcomes.

The mapping and assessment undertaken as part of this project has been undertaken in sufficient detail and of a sufficient standard to be used for the preparation of Native Vegetation Precinct Plans and Precinct Structure Plans.

The contractors assessed and mapped vegetation within existing precinct planning areas inside the Urban Growth Boundary (UGB). Contractors were required to submit a GIS data layer of all site assessments, together with other site information and observations on a monthly basis. The site assessments included:

- The extent of native and non-native vegetation.
- Mapped polygons of sites/zones.
- Confirmation of the native vegetation type (EVC).
- Native vegetation condition assessment (Habitat Hectares site and landscape context score) and other site attributes including land use and dominant weeds.
- The genera, size (small, medium, large and very large) and location of all remnant indigenous scattered trees.
- The number and size (small, medium, large and very large) of trees within vegetation patches that meet DSE's benchmark definition of a canopy species
- The location of all observed rare or threatened plants or observed native flora.
- The location of all observed rare or threatened native fauna or habitat and land use features for fauna.

After consideration of the maps, information and records collected during the Habitat Hectare assessment and existing data, fauna and mapping provided by DSE - GAA in consultation with DSE proposed to further investigate biodiversity values within Precinct 11 by undertaking a general assessment of fauna habitats, general fauna survey, targeted fauna survey and targeted flora survey.

The priority for 2008 / 2009 was to assess areas for the next group of precinct structure plans, including PSP numbers 10, 13, 16, 23, 25, 26, 37, & 40 (total area 6796 hectares).

1.2 Biodiversity Mapping Project 2009-2011 background

Project Purpose

The role of the Growth Areas Authority (GAA) is to plan for the new suburbs on the periphery of metropolitan Melbourne, to improve planning process and achieve better outcomes for new communities.

The GAA has undertaken detailed scale flora and fauna assessment and mapping to determine biodiversity values within Melbourne's growth areas. This is an essential input into the planning process and informs the environmental outcomes that can be achieved from the process. Assessment and mapping of biodiversity values, as part of Melbourne's planning, has never been undertaken on this scale before.

The project provides biodiversity information which is needed to carry out the detailed planning for future urban precincts. Importantly, this information (which includes determination of 'habitat hectares' of native vegetation in each precinct) will enable the application of the *Victorian Native Vegetation Management Framework* principles of 'avoid, minimise and offset' and the achievement of 'net gain' outcomes.

Planning of new precincts in Melbourne must also meet National objectives for the conservation of matters of National Environmental Significance as described by the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999. The biodiversity reports prepared by the GAA are an important tool in Victoria meeting its obligations under Commonwealth legislation and achieving these national environmental objectives.

The purpose of the GAA Biodiversity Assessment and Mapping Project is to:

- Undertake detailed field surveys of native vegetation and targeted flora and fauna species and to assess and map the ecological significance of these.
- Prepare Biodiversity Reports (covering native vegetation and flora and fauna habitat) as essential background input into precinct structure planning at an early stage in the planning process.
- Inform the preparation of precinct structure plans in areas designated for future urban development
- Assist the long term planning of Melbourne's growth areas, including working with infrastructure authorities to ensure their requirements are met over the next 30-50 years;

The project has been undertaken over two consecutive years covering a total of 43,577 hectares, using prescribed survey techniques to map native vegetation, and targeted flora and fauna species. Experienced botanists and zoologists have been contracted by the GAA to undertake field surveys according to standards established by the GAA and the Victorian Department of Sustainability and Environment (DSE).

The total areas surveyed during the first year of the project (2008/2009) was 32,899 hectares of which 6,070 hectares was inside the Urban Growth Boundary; 20,320 hectares was within investigation areas (proposed Urban Growth Boundary); and 6,509 hectares of western grassland areas - resulting in the production and publication of 13 Biodiversity Reports.

The second year of the project (2009/2010) assessed and mapped an additional area of 10,678 hectares of land proposed for future urban development and will result in the preparation of a further 20 Biodiversity Reports.

Biodiversity Reports

These Biodiversity Reports will inform the preparation of precinct structure plans in areas designated for future urban development. In particular, the reports provide data about the quality, type, extent and significance of native vegetation and flora and fauna habitat within each planning precinct. Additionally, the Reports provide data used for preparation of Native Vegetation Precinct Plans and, in some cases, for preparation of Conservation Management Plans.

This process enables the planners and other professionals working on the precinct plan to understand the ecological value of habitat existing within the precinct and to make decisions about the future urban structure and provision of infrastructure within the precinct using the principles contained in *Victoria's Native Vegetation Management Framework* of 'avoid, minimise and offset'.

The State Government's goal for conserving native vegetation in Victoria is 'to achieve a reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain'. The assessment and mapping of Victoria's biodiversity values make a significant contribution to the State Government's goal in the context of planning for Melbourne's growth areas.

Streamlining Initiative

Detailed assessment and mapping of biodiversity prior to precinct planning is an initiative developed by the GAA to improve and streamline the planning process. It is an innovative approach to structure planning practice and improves both planning and environmental outcomes in Victoria by the following:

- The assessments are carried out early in the planning cycle so that they can inform design and decision making.
- The field work is undertaken at the correct time of the year according to ecological standards and according to survey techniques established and agreed by GAA and DSE.
- Multiple field surveys are conducted concurrently by qualified practitioners, which is a more efficient method of collecting the biodiversity data.
- Economies of scale are achieved by contractors covering large land areas (at the precinct scale), reducing the cost and time required.

- The resulting Biodiversity Reports provide all stakeholders with consistent and reliable information about flora, fauna and habitat values within the precinct to enable better decision making and environmental outcomes to be achieved.

- GAA carrying out this work reduces the burden on local governments and land owners and provides greater certainty for urban development and biodiversity outcomes.

As a streamlining initiative, the project follows GAA principles of carrying out the necessary background research competently and early in the process. By the GAA establishing the survey and reporting standards required up front and by doing the research early in the process, it avoids others having to repeat or rectify the research later in the process. Repeat surveys and inadequate quality of surveys has often occurred in the past and the GAA seeks to avoid this occurring in current planning work.

New Standards of Practice

The GAA Biodiversity Mapping and Assessment Project establishes new standards in the integration of biodiversity conservation in the planning of new suburbs in growth areas by:

- Determining up front with the Department of Sustainability and Environment the prescribed survey techniques to be used by contractors working in the field.

- Establishing up front with the Department of Sustainability and Environment which targeted surveys (for which species of flora and fauna) are required in each precinct according to known or likely habitat.

- Agreements between GAA and DSE mean that a more strategic approach has been taken to surveys for specific species – using either an 'assumed' presence model (e.g. Striped Legless Lizard) and a sub-regional survey approach (for Southern Brown Bandicoot, Growling Grass Frog and Golden Sun Moth).

- Use of hand-held GPS field mapping devices and a common approach to map presentation to provide consistent and quality mapping standards to be achieved.

- All contractors, while being experienced and qualified scientists, were required to undergo three days of compulsory training in habitat hectare assessment techniques and a competency check (managed by DSE) and field based quality checks of their work.

The GAA flora and fauna mapping and assessment project was undertaken in close association with the Department of Sustainability and Environment (DSE) which is the regulator for biodiversity protection and conservation in Victoria. This collaborative and proactive approach by the GAA to work with the DSE has added significant value to the quality and reliability of the project outcomes. The data collected by the project and it assessment and mapping adds to the protection, management and restoration of the environment through the precinct planning process.

The Biodiversity Reports prepared for each planning precinct are a key input into the detailed planning for the precinct. They support the preparation of key documents such as:

- The Biodiversity Plan (setting out the key biodiversity issues and implications) included within the Precinct Structure Plan.
- Native Vegetation Precinct Plan (setting out the native vegetation to be retained, removed and offset within the precinct).
- A Conservation Management Plan if required (which sets out the management prescriptions for matters of national environmental significance).

Collaboration by GAA with the Victorian Department of Sustainability and Environment (DSE) throughout the project has enabled the development of a robust methodology and a biodiversity template for the production of reports.

Quality of Professional Work and Final Product

The GAA approach has established appropriate standards at the outset of the project and ensured that the work is done to meet these standards, to avoid re-work and future delays. Measures have been put in place throughout this project to ensure quality standards are met and reflected in the final reports. These can be summarised as follows:

- A project governance structure has been used by the project from start to finish involving both the GAA (undertaking the project) and DSE (the regulator for biodiversity matters under Victorian legislation) in establishing the project scope and standards to be achieved.
- A project scope was prepared and reflected within the Tender specification used by the GAA to ensure that contractors who were selected by the GAA had the experience and skill required to carry out the project and meet the required quality standards.
- Contractors working on the project were required to undertake 3 days of compulsory training and to meet a competency check.
- Contractors were required to submit monthly reports of the data collected to GAA and DSE to enable checking of data and mapping integrity. This quality check provided confidence in the information collected and rectification of any deficiencies prior to acceptance of the results.
- Biodiversity Reports which explain and interpret the data collected in the field were prepared by qualified ecologists and are designed to enable planners, engineers, designers and others to understand the information and use it in practical applications.

Quality assurance of draft reports by another qualified ecological consultant has been used to ensure work is accurate and consistent in meeting project standards. The quality assurance process provides a streamlined approach to checking and amending reports before they are finalised and accepted by GAA and DSE.

1.3 Objectives

Practical Ecology Pty Ltd was commissioned by Growth Areas Authority (GAA) to undertake a habitat hectare, general flora and fauna survey, and targeted flora and fauna survey for four threatened species with Precinct 11 in Clyde North, Victoria. The primary objectives of this study are to establish the presence and distribution of flora, fauna and habitat within the Precinct, and to present the information within the context of relevant legislation and policy.

This report provides information on significant flora and fauna, and habitat values within Precinct 11 by:

- Identifying the contract area's known habitat values and the conservation status therein.
- Documenting significant fauna species that occur or have potential to occur within the contract area.
- Assessing all fieldwork data and information from relevant literature and databases against relevant policy and legislation.

This information will be utilised by GAA to inform:

- The preparation of a Precinct Structure Plan.
- The identification of priorities for protection and enhancement of biodiversity including potential reserve areas, biodiversity corridors and areas with potential to provide offsets for vegetation lost as a result of urban development.
- Long term planning related to infrastructure including liaison with relevant service authorities to ensure their requirements are met over the next 30-50 years.

1.4 Contract area

Precinct Structure Plan (PSP) area 11, *C21 Business Park*, is located within the suburb of Berwick, within the City of Casey in Melbourne's south eastern growth corridor (Figure 1). C21 Business Park, referred to hereafter as *Precinct 11*, is approximately 314 hectares in area and is bounded by the Pakenham Bypass to the north, Soldiers Road to the west, by Cardinia Creek to the east and by Grice Road to the south. The contract area is surrounded predominately by agricultural land to the south, and east and by residential areas to the north-west (Figure 1).

The contract area consists of one privately owned property (consisting of three parcels) and includes adjacent road reserves. The majority of the contract area is currently being used for cropping and grazing stock and features large open paddocks with some indigenous scattered trees. Native vegetation is common in roadsides and adjacent to constructed wetlands and is especially prevalent within the Cardinia Creek riparian corridor, including associated wetlands and farm dams on the Cardinia Creek Flood plain within the contract area (Figures 4A-C).

The majority of Precinct 11 is zoned *Urban Growth Zone*, however one small parcel in the south-east is zoned *Public Park and Recreation Zone*. A section of the contract area adjacent to Cardinia Creek is covered by a *Land Subject to Inundation Overlay* (LSIO) (DPCD 2009b).

Parts of the contract area adjacent to Cardinia Creek are also covered by Biosite #6888 *Cardinia Creek - Lower*, as defined by (DSE 2005a) (Figure 1). Biosite #6888 is a regionally significant Biosite. Biosite #6889 occurs immediately north of the study area and is also a regionally significant Biosite (DSE 2005a),

The contract area falls within the Gippsland Plains Bioregion (DSE 2010a).

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VERSION: 02	DATE: 30/09/10

MAP AND SURVEY DETAILS

Mapping by: Staci Timms, 20/04/10
Generated from: Aerial Imagery and GIS base layers supplied by DSE and GAA, additional GIS layers from Geoscience Australia.

DATUM: GDA 94 VICGRID 94

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0 200 400 600 800
Metres

1:15,000 when printed at A3

LEGEND

- Roads
- Watercourse
- Urban Growth Boundary
- 257423 Property Boundary and Property PFI
- C21 Business Park Study Area
- Other Precincts and Contract Areas
- Biosites #6888: Cardinia Creek - Lower
- Biosites #6975: Lecky Road, Officer
- Biosites #6889: Cardinia Creek Retarding Basin
- Cardinia Creek Parklands

FIGURE 1
STUDY AREA
C21 Business Park
Biodiversity Mapping Project
2009-2011

2. METHODS

2.1 Terminology

Flora taxonomic nomenclature is consistent with the Flora Information System (FIS) database when accessed through Viridans software (DSE 2009b). Taxonomic nomenclature for scientific names is derived from Walsh and Stajsic (2008).

Fauna taxonomic nomenclature is consistent with Atlas of Victorian Wildlife database, accessed through Viridian software (DSE 2009c).

2.2 Literature and Database Review

Background information on the contract area's bioregion and EVC distribution (pre-1750, and current) and previous threatened flora and fauna data was gathered by literature and database review prior to site surveys. Planning reports and land management documents were also reviewed.

Several GIS mapping layers were provided to Practical Ecology by GAA and DSE and these were incorporated into a GIS. Mapping layers and data sources are detailed below.

2.2.1 GIS data

The following GIS mapping layers supplied to Practical Ecology by DSE for use in this project included:

- cadastre data, identifying individual land parcels, and individual parcel identifiers;
- pre 1750 EVCs;
- extant EVCs;
- Biosite25_region mapping layer; and
- geo-referenced and ortho-rectified aerial photographs of the contract area.

2.2.2 Victorian resources

Flora Information System (FIS) and Atlas of Victoria Wildlife (AVW): The Flora Information System (DSE 2009b) and Atlas of Victoria Wildlife (DSE 2009c) databases were queried to a distance of 10 kilometres from the contract area boundary. The recorded locations of significant flora and fauna taxa were referred to in the field during the surveys and were

used to assist in the determination of likelihood of occurrence. Flora species record sheets were generated using the FIS.

DSE Aquatic Fauna Database. The DSE's database of aquatic fauna was reviewed.

DSE Advisory Lists. DSE's advisory lists of rare and threatened flora and fauna, including invertebrate fauna were reviewed (DSE 2005b; 2007a; 2009d;c;b).

2.2.3 Commonwealth resources

EPBC Act Protected Matters Search Tool. The *Protected Matters Search Tool* (DEWHA 2010a) was queried for a 10 km buffer from the contract area boundary. The search tool provides information on EPBC Act listed species occurring or predicted to occur in the search area: http://www.environment.gov.au/erin/ert/epbc/index.html

EPBC Act Species Profile and Threats Database. EPBC Act listed species profiles were investigated on the DEWHA species profile and threats database (DEWHA 2010b): http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Environmental Reporting Tool (ERT) The ERT was consulted for threatened species, important wetlands and heritage sites within the contract area (DEWHA 2010c): http://www.environment.gov.au/apps/boobook/mapservlet?app=ert

National Recovery Plans National Recovery Plans for EPBC Act listed flora and fauna were reviewed: http://www.environment.gov.au/biodiversity/threatened/recovery.html (DEWHA 2010d).

2.2.4 Consultant's Reports

A review was conducted of ecological reports, including Strategic Impact Assessments/ Surveys made available to us that were relevant to the contract area. This literature assisted the identification of significant sites, species, habitat corridors and other relevant matters.

These reports included:

- Net Gain Assessment, Pakenham Bypass at Cardinia Creek, Officer, Victoria (Costello 2003)
- Flora and Fauna Assessment of the Proposed Pakenham Bypass, Victoria (Costello, Timewell and Organ 2001)
- Biodiversity Enhancement Strategy – City of Casey: Volumes 1 & 2 (McMillan et al. 2003)
- Net Gain Offset Management Plan for the Pakenham Bypass (James, MacDonald and Picone 2008)

- Proposed Revegetation Strategy for the City of Casey (Brett Lane and Associates 2008)
- Draft Sub-regional surveys for Southern Brown Bandicoot *Isoodon obesulus* (Stewart and Shepherd 2010)
- Draft Sub-regional strategy for Southern Brown Bandicoot *Isoodon obesulus* (O'Malley 2010)
- Draft Sub Regional Survey for Growling Grass Frog (Renowden et al. 2010))
- Biodiversity Assessment Report: Cranbourne North (Stage 2) (Shepherd, Henry and Gannon 2010)
- Biodiversity Assessment Report: Clyde North (Shepherd et al. 2009)
- Dwarf galaxias survey of the Cardinia Creek Retarding Basin and selected locations in the Cardinia Creek catchment (McGuckin 2010)

2.2.5 Consultation and data sharing with other consultancy firms

Ecology Australia undertook a sub-regional targeted survey for Growling Grass Frog for Growth Areas Authority within the entire south-east growth corridor, however, this contract area was not prioritised for surveys (Renowden et al. 2010). The contract area was included in the Sub Regional Survey for Southern Brown Bandicoot (Stewart and Shepherd 2010). These reports form part of *Melbourne's Strategic Assessment* to address EPBC listed species on a sub-regional scale. These reports were reviewed and survey results were incorporated into the results and discussion sections of this report.

2.2.6 Consultation with field naturalists

Malcolm Legg assisted with general and targeted fauna surveys, and the identification of *potent*ial habitat for threatened and significant flora and fauna.

Rob Gration provided advice on the use of bat detectors and the survey of micro-bats.

2.2.7 Determination of likelihood of occurrence for threatened species

Threatened flora

Likelihood of occurrence for threatened flora species was determined by habitat analysis and proximity to past records (DSE 2009b). All current and past significant flora records within 10 kilometres of the contract area were displayed on a working map to aid the determination of likelihood of occurrence.

The Flora of Victoria (Foreman and Walsh 1993; Walsh and Entwisle 1994a;c;b) and FIS (DSE 2009b) was reviewed for habitat descriptions and distributions of threatened flora.

Threatened Fauna

Likelihood of occurrence for threatened fauna species was determined by habitat analysis and proximity to past records (DSE 2009c). All current and past significant fauna records within 10 kilometers of the contract area were displayed on a working map to aid the determination of likelihood of occurrence.

Malcolm Legg of Mal's Ecological and Environmental Services provided zoological expertise in potential habitat to target for conservation significant species.

2.3 Field survey techniques

2.3.1 General Flora Survey

General flora survey was undertaken on foot. The majority of survey was undertaken between September 2009 and December 2010.

Particular attention was given to areas of high floristic diversity, including areas of indigenous habitat and drainage-lines. Flora species were recorded on species record sheets generated from the FIS (DSE 2009b).

2.3.2 Habitat hectare assessments

The majority of habitat hectare assessments were undertaken during the 2008/2009 survey season in accordance with specifications developed for the GAA's *Native Vegetation Mapping Project 2008/2009*. Surveys were consistent with DSE's *Vegetation Quality Assessment Manual* (DSE 2004b), *User Guide Habitat Hectares Assessment Sheet for ArcPad 7.1.1 – Version 6* (DSE 2008b) and *GAA Native Vegetation Mapping Project Field Assessment Methodology – Quick Reference Guide* (DSE 2008c). Training was provided by DSE in a three day session at the project's inception. Auditing was undertaken by DSE throughout the fieldwork stage.

Two additional patches of vegetation were subject to habitat hectare assessments, using software and specifications developed for the GAA *Biodiversity Mapping Project 2009-2010* in January 2010. The following description of habitat hectare methods applies to the *Native Vegetation Mapping Project 2008/2009* only.

Flora data was collected in the field using a hand-held Person Digital Assistant (PDA). Habitat hectare and significant species data was recorded in the field on the PDA using *HabitAs*, a GIS software application for ArcPad 7.1.1 developed by DSE for the *Growth Areas Authority Native Vegetation and Mapping project* (DSE 2008b). DSE's software application

enabled the collection of data as outlined in the sections below. The resulting ESRI shapefiles were processed using ArcView V.9 software to re-edit and refine of polygon boundaries, based on hardcopy mapping

GIS data was submitted to GAA and DSE for monthly review throughout the project. Requested edits were completed and data was resubmitted. At the conclusion of the fieldwork, the monthly data was merged to form a single GIS file, which was exported to into excel spreadsheets for presentation in this report.

The site assessments included:

- Mapping the extent of remnant and non-remnant vegetation.
- Mapping polygons of Habitat Zones, as defined below and in accordance with Victoria's Native Vegetation Management Framework (DNRE 2002).
- Determination of Ecological Vegetation Classes (EVC).
- Native vegetation condition assessment (Habitat Hectares site and landscape context score) and assessment of other site attributes including land-use, habitat attributes and high threat environmental weeds.
- The size (small, medium, large and very large) and genera of trees (either as patches or individual trees when scattered in the landscape).
- The location of observed rare or threatened plant species.
- The location of incidentally recorded threatened fauna species.

Vegetation in the contract area was categorised into different categories. These categories and their definitions are consistent with policy and legislation, particularly *Victoria's Native Vegetation Management Framework* (DNRE 2002), and assists in identifying where such policies come into effect.

The following categories were applied.

Remnant Vegetation Patch

- EVCs and Habitat Zones were identified within each patch in accordance with Section 5 of DSE's *Vegetation Quality Assessment Manual Version 1.3* (DSE 2004b).
- For each Habitat Zone the Zone Overview data was recorded using DSE's Site Assessment Checklist. Details on the type of information collected are provided in the GAA Vegetation Mapping User Guide, Section 2 – *Collecting Zone Overview data.*
- Each Habitat Zone was mapped and a Habitat Hectares Assessment using DSE's PDA based 'Habitat Hectares for ArcPad' software was conducted in accordance

with the GAA Vegetation Mapping User Guide, Section 5 – *Completing a Habitat Hectares Assessment.*

- The number of Very Large Old Trees (VLOTS), Large Old Trees (LOTS), Medium Old Trees (MOTS) and Small Trees (STs) were recorded in the Tree Count Tab of DSE's PDA based 'Habitat Hectares for ArcPad' software (refer to Section 5.6.5 of the GAA Vegetation Mapping User Guide for more information).

- The number of small trees cannot be recorded via the Scattered Tree software and was therefore recorded manually and transferred to the Habitas.dbf file (refer to Section 5.6.5 of the GAA Vegetation Mapping User Guide for more information).

- The location of any observed VROT flora was recorded using DSE's PDA based 'tflora_template' shapefile (refer to Section 10 of the GAA Vegetation Mapping User Guide – *Mapping the Location & Number of all Observed Rare or Threatened Flora* for more information).

- The location of any observed VROT fauna was recorded using DSE's PDA based 'tfauna_template' shapefile (refer to Section 11 of the GAA Vegetation Mapping User Guide, Section 11 – *Mapping the Location & Number of all Observed Rare or Threatened Fauna* for more information).

Scattered Trees

- Scattered tree polygons were assigned in the field and an scattered tree EVC was assigned in accordance with Section 5 of DSE's *Vegetation Quality Assessment Manual Version 1.3* (DSE 2004b).

- Scattered tree Zone Overview data was recorded for each scattered tree 'zone' using DSE's Site Assessment Checklist. Details on the type of information collected are provided in the GAA Vegetation Mapping User Guide, Section 2 – *Collecting Zone Overview data.*

- For each Zone map the complete boundary of each Habitat Zone was mapped and a Scattered Trees Assessment was conducted using DSE's PDA based 'Scattered Tree Assessment for ArcPad software in accordance with the GAA Vegetation Mapping User Guide, Section 6 – *Completing a Scattered Tree Assessment.*

- The number of VLOT, LOT, MOT and ST was recorded for each scattered tree zone using DSE's PDA based STLocn_template shapefile in accordance with the GAA Vegetation Mapping User Guide, Section 6 – *Completing a Scattered Tree Assessment*.

- The location of any observed VROT flora was recorded using DSE's PDA based 'tflora_template' shapefile (refer to Section 10 of the GAA Vegetation Mapping User Guide – *Mapping the Location & Number of all Observed Rare or Threatened Flora* for more information).

- The location of any observed VROT fauna was recorded using DSE's PDA based 'tfauna_template' shapefile (refer to Section 11 of the GAA Vegetation Mapping User Guide, Section 11 – *Mapping the Location & Number of all Observed Rare or Threatened Fauna* for more information).

Degraded Treeless Vegetation

- Degraded Treeless Vegetation Overview data was recorded for each site using DSE's Site Assessment Checklist. Details on the type of information collected are provided in the GAA Vegetation Mapping User Guide, Section 2 – Collecting Zone Overview data.

- The complete boundaries of each site was mapped the relevant data was recorded using DSE's PDA based 'Habitat Hectares for ArcPad' software in accordance with the GAA Vegetation Mapping User Guide, Section 9 – Completing a Degraded Treeless Vegetation Assessment.

- The location of any observed VROT flora was recorded using DSE's PDA based 'tflora_template' shapefile (refer to Section 10 of the GAA Vegetation Mapping User Guide – Mapping the Location & Number of all Observed Rare or Threatened Flora for more information).

- The location of any observed VROT fauna was recorded using DSE's PDA based 'tfauna_template' shapefile (refer to Section 11 of the GAA Vegetation Mapping User Guide, Section 11 – Mapping the Location & Number of all Observed Rare or Threatened Fauna for more information).

2.3.3 Targeted flora survey

Targeted Flora Surveys were conducted for four designated targeted flora species outlined in Appendix 6 of the Growth Areas Authority *Biodiversity Mapping Project Request for Tender* document No. D/09/4006:

- Matted Flax-lily
- River Swamp Wallaby-grass
- Maroon Leek-orchid
- Grey Billy buttons

An additional six species were targeted during general flora survey, as per the request for tender documentation:

- Pale Swamp Everlasting
- Veined Spear-grass

- Purple Diuris
- Naked Sun-orchid
- Wine-lipped Spider-orchid
- Frankston Spider-orchid

The appropriate season and conditions were chosen for each of the targeted flora species within appropriate habitat at the contract area.

Appropriate habitat for threatened flora species within the contract area was identified during general flora survey and during reconnaissance visits at the beginning of the survey period. Six broad areas of habitat were identified (Figure 2).

Targeted flora surveys were undertaken in six locations in spring. The six locations were surveyed again in early summer.

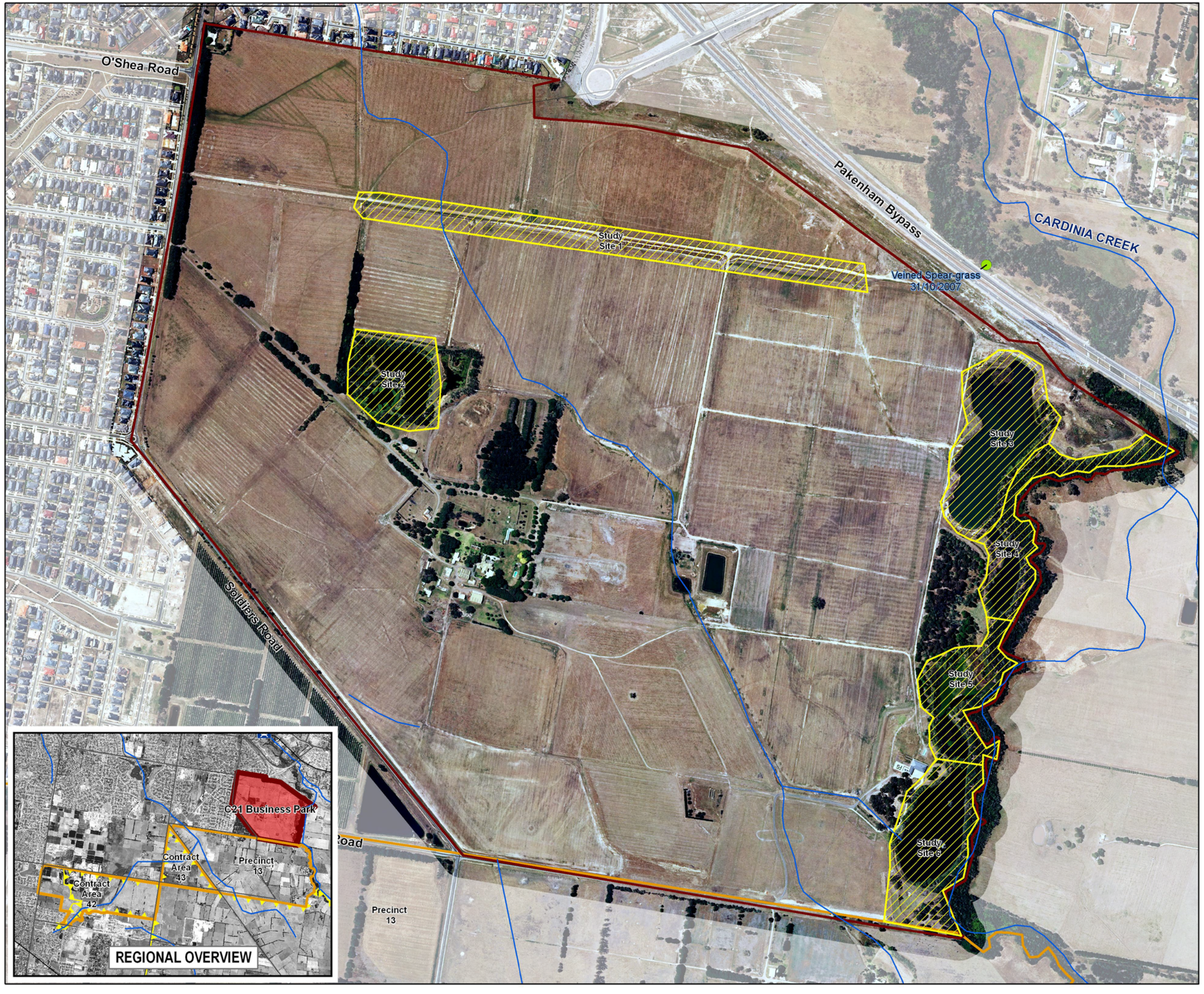
Targeted searches were undertaken in contiguous patches of appropriate habitat within a defined area of 1 to 4 hectares for at least two hours. In most cases, searches for targeted species were also carried out during general flora survey and habitat hectare assessments. In some cases, areas of highest floristic diversity and potential to harbor threatened species were surveyed multiple times.

The structure of targeted flora searches was influenced by landscape features and the habitat dimensions within the study area. Many targeted searches within the study area were undertaken on the margins of wetlands or drainage-lines, within narrow ephemeral zones between the water and adjacent exotic vegetation, so were therefore undertaken as lineal surveys. The structure of targeted surveys within the surrounds of the Cardinia Creek was limited by dense stands of Swamp Paperbark, Tree Violet *Melicytus dentatus*, and large Blackberry infestations. Several sections of the creek were impenetrable due to this obstructing vegetation. Targeted searches were therefore undertaken only within areas of the targeted flora study sites that could be accessed. Line transects were generally not carried out in the study area, due to obstructing vegetation, such as Blackberry or due to obstructing landscape features such as the Cardinia Creek and associated wetlands.

2.3.4 General Fauna Survey

The contract area was surveyed by Malcolm Legg of *Mal's Environmental and Ecological Services* and by Joanne Henry, Annabelle Stewart, David Nance and Zorza Goodman of *Practical Ecology* between September 2009 and April 2010.

General fauna survey was undertaken throughout potential habitat areas within the Precinct. This included diurnal bird surveys, invertebrate surveys, micro-bat surveys and spotlighting (Figure 3). All incidental fauna seen or heard was recorded during targeted surveys.



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VERSION: 02	DATE: 30/09/10

MAP AND SURVEY DETAILS
Mapping by: Staci Timms, 20/04/10
Surveyed by: Jeremy Neal, Gidja Walker and Mark Shepherd.
4 Sept 2009 - 28 Jan 2010
Generated from: Data collected in the field using IPAC PDAs. Aerial Imagery and GIS base layers supplied by DSE and GAA, additional GIS layers from Geoscience Australia.

DATUM: GDA 94 VICGRID 94

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LEGEND

- C21 Business Park Study Area
- Targeted Flora Survey Study Sites
- Blue-billed Duck (1998) — State Significant Species Date of Record

Significant Species Records

- Database Records of Species of State Significance

FIGURE 2
SIGNIFICANT FLORA SPECIES AND SURVEY EFFORT
C21 Business Park
Biodiversity Mapping Project 2009-2011

Bird census was undertaken throughout the Precinct. Incidental records were also compiled for fauna species recorded within this Precinct.

All fauna sampling within the contract area was carried out under Research Permit Numbers 10004805 (Practical Ecology) and 10004056 (Mal's Environmental and Ecological Services).

Spotlighting

Spotlighting was undertaken at least 30 minutes after sunset on foot using 50 watt spotlights. Potential habitat for arboreal mammals, amphibians and nocturnal birds was targeted during the spotlight surveys. These were undertaken over three separate nights for a minimum of two hours each night. All surveys were conducted by either two or three people for OH&S reasons and to increase survey coverage. All fauna seen and heard during spotlight walks were recorded. Figure 3 displays the location of spotlighting surveys undertaken within the contract area.

Invertebrate survey

Areas of potential habitat were identified and two invertebrate pitfall transects were deployed. Transects consisted of ten pitfalls located approximately 20m apart. Pitfall traps were filled with a solution of biodegradable, odourless, chemical free detergent, table salt and water. The detergent serves to break the surface tension of the water while the salt acts as a preservative for short periods. Traps were open for three consecutive nights during warm weather. Invertebrates were collected each day and traps reset.

Active searching was undertaken at each transect site, including log turning, bark removal, pooter (vacuum) collection and the sweeping of areas with a large canvas net. Aquatic invertebrate sampling involved netting and the collection of silt. Other collection of invertebrates took place opportunistically in areas of habitat throughout the precinct. Figure 3 displays the locations of invertebrate pitfalls undertaken within the contract area.

Invertebrates were preserved in an ethanol solution and identified and photographed in a laboratory. Classification of invertebrates was undertaken to Order and in some instances Family level.

Micro-bat surveys

Anabat II and Anabat SD1 were used to detect micro-bat presence within the contract area. The Anabat detectors were used passively and actively during the surveys. Passive survey involved leaving the Anabat out unattended during the evening, and active survey involved carrying the Anabat detector whilst surveying with a spotlight. Both techniques are effective for detecting micro-bat species. Figure 3 displays the locations of Anabat surveys undertaken within the contract area.

Bird surveys

Bird Surveys were undertaken at every habitat type twice between dawn and midday and twice preceding sunset. Wetland birds were surveyed during daylight hours. All birds were identified using sight and call vocalisation. All birds seen and heard during other targeted surveys were recorded. Figure 3 displays the locations of bird surveys undertaken within the contract area.

General and incidental survey

Non-target amphibians, reptiles, birds and mammals were subject to incidental survey during targeted searches undertaken with a particular emphasis placed on threatened species using the following methods:

- Birds, including wetland birds were identified by sight and vocalisation during daytime and spotlight walks. Woodland birds were surveyed between dawn and midday and two hours preceding nightfall.
- Reptiles were identified by sight, during log and rubbish turning and during general inspection of habitat. Where possible, reptiles were captured by hand to assist identification. All reptiles were returned to the point of capture after identification.
- Reptiles and small mammals were also surveyed using the Glossy Grass Skink methods detailed in section 2.3.5 below.
- Mammals were identified by vocalisation, sight and by identifying diggings, scats and footprints.
- Amphibians were identified by vocalisation and sight, including spotlighting and fish trapping (tadpoles were detected using small fish traps and dip netting) within a selection of appropriate amphibian habitat during spotlighting surveys.

A fauna species list for the entire contract area was compiled. This included species recorded in the contract area and those flying over or heard close to the contract area.

2.3.5 Targeted Fauna Survey

Targeted searches were commissioned by GAA for four fauna species listed as threatened under State and Federal legislation (Table 1). Targeted searches for any other threatened species, including Growling Grass Frog and Southern Brown Bandicoot were not commissioned by GAA for this assessment.

Table 1. Threatened Species Targeted for Fauna Survey

FFG	EPBC	DSE (2007a)	Common name	Scientific name
L	VU	v	Dwarf Galaxias	*Galaxiella pusilla*
		n	Glossy Grass Skink	*Pseudemoia rawlinsoni*
		v	Southern Toadlet	*Pseudophryne semimarmorata*
L		v	Swamp Skink	*Egernia coventryi*

Dwarf Galaxias

Dwarf Galaxias *Galaxiella pusilla* were targeted using rectangular bait traps baited with White Bait and glow sticks placed in appropriate habitat, such as near reed beds and sedges. Bait traps were deployed in all potential habitats. Traps were left overnight and checked the following morning. Dip-nets were also used near the banks of waterways in and around reeds and sedges in random searches at each survey location. Dip netting occurred for a minimum of 15 minutes at each location. Trap locations are displayed in Figure 3.

Glossy Grass Skink

Glossy Grass Skink *Pseudemoia rawlinsoni* was surveyed by using 30cm by 30cm pieces of colour-bond tin placed at 10-20 metre intervals within suitable habitat. Habitat included drainage lines, along Cardinia Creek, around wetlands and dams throughout the contract area. The tin sheets were lifted during the morning prior to 11am and reptiles sheltering under the tin for warmth were caught or observed. 300 tin pieces were deployed within the contract area and were checked four times each. Surveys were undertaken in all weather conditions throughout the survey period.

Tin locations are displayed in Figure 3.

Southern Toadlet

Areas of potential Southern Toadlet *Pseudophryne semimarmorata* habitat within the contract area, including roadsides and drainage lines were identified. These sites have been traversed on foot to identify Southern Toadlet calls during wet weather.

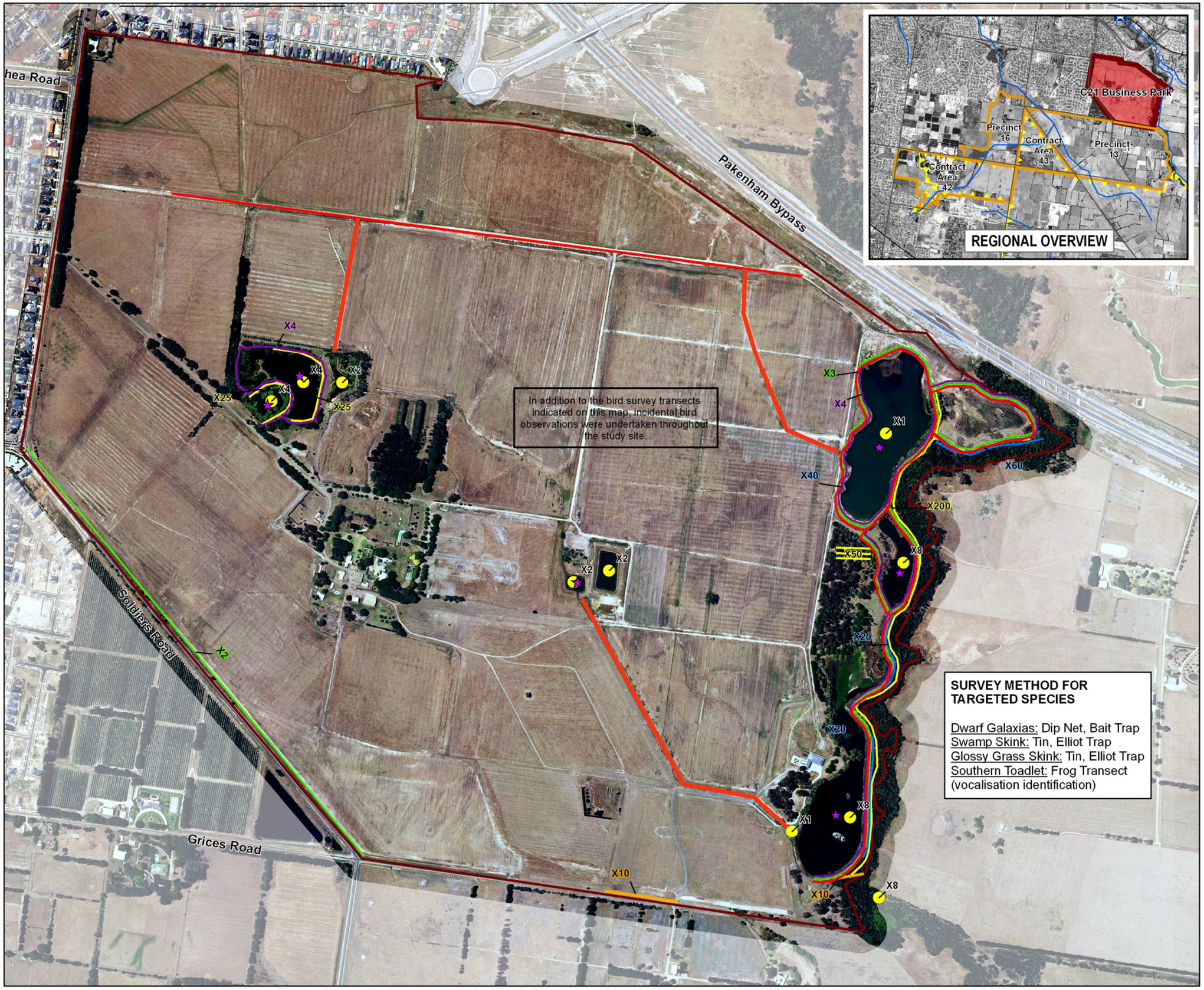
Areas of potential habitat that have been traversed are displayed in Figure 3.

Swamp Skink

Swamp Skink *Egernia coventryi* was surveyed by using 30cm by 30cm pieces of corrugated tin placed at 10-20 metre intervals within suitable habitat. Habitat included drainage lines and around wetlands and dams throughout the precinct. The tin pieces were lifted during the morning prior to 11am and reptiles sheltering under the tin for warmth were caught or observed. 300 tin pieces were deployed and most were checked a total of four times each. Surveys were undertaken in all weather throughout the survey period.

Swamp Skinks were also surveyed using Elliot traps. Traps were baited with a mixture of peanut butter, oats, molasses and sardines and were placed in potential habitat throughout

the contract area. A total of 120 Elliot traps were deployed for four nights, traps were checked each morning. Tin and trap locations are displayed in Figure 3.



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VERSION 02	DATE: 30/09/10

MAP AND SURVEY DETAILS
Surveyed by: Jo Henry, Annabelle Stewart, Mal Legg, Zorza Goodman, Dave Nance. Oct09 - Apr10
Mapping by: Staci Timms, Apr10
Generated from: Data collected in the field using IPAC PDAs. Aerial Imagery and GIS base layers supplied by DSE and GAA, additional GISlayers from Geosciences Australia.

DATUM: GDA 94 VICGRID 94

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Metres

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LEGEND

- C21 Business Park Study Area

Survey Method*

- Dip Net
- Light Trap (X4) Number of traps
- Elliot Traps (X40) Number of traps
- Tin Tiles (X50) Number of tiles
- Inverterbrate Pitfall and netting (X10) Number of pitfall traps
- Spotlight (X3) Number of repetitions
- Anabat (X3) Number of repetitions
- Bird Surveys (X4) Number of repetitions
- Frog Transect

*Survey locations mapped are general only and do not represent exact spatial location of route taken or position of traps.

FIGURE 3
FAUNA SURVEY EFFORT
C21 Business Park
Biodiversity Mapping Project
2009-2011

2.3.6 Limitations

Wetland flora assessments

Wetlands in the form of large dams and retarding basins within the contract area held fluctuating amounts of water during the assessment. An initial reconnaissance and general flora survey in September 2009 at the contract area revealed large areas of DTV (including native plant species) surrounding a large wetland and a dry depression in the north-east of the contract area. When surveys resumed a number of weeks later, these areas had been filled with water extracted from the Cardinia Creek (Photo 1). The water level had risen to cover areas previously occupied by native vegetation, which therefore limited the survey for threatened wetland species such as Wetland Blown-grass *Lachnagrostis filiformis* Var 2 and River Swamp Wallaby-grass *Amphibromus fluitans* that had potential to occur within these areas.

Photo 1. Dead vegetation within inundated area in north-east of contract area

Flora survey timing

Targeted surveys for threatened flora species are ideally extend over a twelve month period or longer, with extensive survey being conducted during the spring flowering-seed set

period. Greater certainty of the presence or absence of threatened flora species would be gained if targeted surveys were undertaken for at least a twelve month period.

Scattered Trees

The number of Very Large Old Trees (VLOTs), Large Old Trees (LOTs), Medium Old Trees (MOTs) and Small Trees (STs) were recorded for each scattered tree zone using DSE's PDA based STLocn shapefile in accordance with the GAA *Vegetation Mapping User Guide*, Size classifications were based on the trunk diameter at breast height (DBH), as measured at 1.3 metres from ground level. Records of actual DBH measurements of individual trees were not kept, in accordance with the project brief and the *User Guide*. The DBH of small trees is however, required to calculate tree recruitment offset requirements for small trees in accordance with the *Port Phillip and Westernport Native Vegetation Plan* (PPWCMA 2006).

Fauna Survey

The optimal time for most fauna sampling is during spring/summer. Different results may have been achieved if surveying was undertaken in different times of the year and over a longer period. An extended survey period would produce more detailed results and a greater certainty of presence or absence of fauna species. Fully comprehensive fauna survey should therefore occur during all seasons over a number of years. This study included four targeted species surveys; Glossy Grass Skink, Swamp Skink, Dwarf Galaxias and Southern Toadlet. However, other threatened species that have the potential to occur within the contract area were not targeted for survey.

In addition to targeted fauna survey, general fauna survey was also undertaken. Incidental observations were made during all surveys. On the basis of existing information and the new information from this study, it is expected that a reasonable proportion of the species expected to be present within the contract area were detected. While tin trapping, Elliot trapping, AnaBat recording, light trapping, dip netting, frog transects, bird census and spotlighting were undertaken as part of general fauna survey, it is likely that other species would be detected over a longer survey period over different seasons.

While spotlighting is a common and proven survey technique, there are a number of limitations associated with it. While spotlighting took place on warm still nights, bright moonlight may have resulted in some fauna species present within the study site remaining undetected. This is due to increased visibility and hence a higher likelihood of predation leading to spotlight avoidance by fauna, which is a common limitation associated with spotlighting.

Tin and Elliot and light trapping also come with limitations. No fauna trapping technique will result in conclusive survey results as many individuals and some species are can be 'trap shy'. While traps were placed in areas that were considered optimal habitat, individuals may not necessarily come into contact with the trap.

In addition to these limitations, a number of species may not have been observed due to drought and other environmental conditions.

3. RESULTS

3.1 General Flora Survey

3.1.1 Flora species recorded

One hundred and sixty-four flora species were recorded within PSP 11 (Appendices 1 & 2). Seventy-three (45%) of these species were indigenous. The remaining 91 (55%) were either exotic species or native species occurring outside of their natural range.

The majority of flora species recorded within the contract area occur within the Cardinia Creek corridor, which represents the areas of highest biodiversity and conservation significance within the contract area.

3.1.2 Threatened flora species recorded within 10 Kilometres

Thirty-nine threatened flora species were identified in database searches as recorded within 10 kilometres (DSE 2009b) or a predicted to occur using the Protected Matters Search Tool (DEWHA 2010a).

Thirty-seven threatened of these flora species have been recorded within 10 kilometres of the contract area on the FIS (DSE 2009b). Three of these species are considered to have a high likelihood of occurrence, based on nearby records and suitable habitat within the contract area. A further five species are considered to have a medium likelihood of occurrence (Appendix 3).

Five threatened flora species are predicted to occur by DEWHA (2010a). Three of these species have also been recorded within 10 kilometres (DSE 2009b). Two species predicted to occur have been assigned a medium likelihood of occurrence, while the remaining species have a low likelihood (Appendix 3).

A description of habitat requirements for threatened flora species recorded within 10 kilometres and species predicted to occur by DEWHA (2010a) is presented in Appendix 3. Appendix 3 also includes an explanation of likelihood of occurrence for each threatened flora species.

3.1.3 Threatened flora species recorded within the contract area

No threatened flora species were recorded within the contract area during the current assessment.

3.1.4 Best or Remaining 50% habitat for rare or threatened flora species

Best or remaining 50% habitat determinations using threatened flora species for individual habitat zones were influenced by three threatened flora species occurring within 10 kilometres of the contract area that have been assigned a high likelihood of occurrence.

All other threatened species recorded within 10km or predicted to occur by (DEWHA 2010a) were granted a likelihood of occurrence no greater than *medium*, based on an evaluation of habitat suitability within the contract area and proximity to records. It was therefore determined that, based on the moderate likelihood of occurrence rating 'no further consideration is required for those species' when addressing Question D in Table 2 of DSE's *Guide for Assessment of Referred Planning Permit Applications* (DSE 2007b).

Twenty-five habitat zones within the contract area were assigned high conservation significance due to the presence of suitable habitat for Wetland Blown-grass *Lachnagrostis filiformis* Var 2. These habitat zones were considered 'remaining 50% habitat' for Wetland Blown-grass in the bioregion given the relatively low site condition and landscape context scores attained. Wetland Blown-grass *Lachnagrostis filiformis* Var 2 is considered 'poorly known' (k) by DSE (2005b). The conservation status of species is more accurately classified 'Vulnerable', as opposed to 'Rare', since its population decline in the region is attributable to wetland habitat loss rather than it being a naturally restricted species. Wetland Blown-grass is therefore considered 'threatened' rather than 'rare' when determining the conservation significance of habitat zones.

Nine habitat zones within the contract area were assigned medium conservation significance due to the presence of suitable habitat for Veined Spear-grass, a species listed as rare by DSE (2005b). These habitat zones were considered 'remaining 50% habitat' for Veined Spear-grass in the bioregion given the relatively low site condition and landscape context scores attained.

All habitat zones except zones 20 and 35 were assigned medium conservation significance due to the presence of suitable habitat for Floodplain Fireweed, a species listed as rare by DSE (2005b). All habitat zones were considered 'remaining 50% habitat' for Floodplain Fireweed in the bioregion given the relatively low site condition and landscape context scores attained.

All conservation significance ratings attributed to 50% best or remaining flora habitat were vanquished by best 50% fauna habitat ratings which resulted in a very high conservation significance determination for every habitat zone within the contract area (Figure 5).

3.1.5 Vegetation

Approximately eight hectares of the 314 hectare contract area (2%) comprises native vegetation classified as Habitat Zones (Figure 4). Appendices figures 2A, 2B and 2C display Ecological Vegetation Classes and Scattered Trees at a finer scale.

3.1.6 Ecological Vegetation Classes

Six EVCs were identified and mapped within the contract area (Figure 4). Table 2 summarises EVCs recorded within the contract area.

Table 2. Summary of EVCs recorded within the contract area.

EVC Name	EVC Number	EVC cons status	Conservation Significance	Net Gain Multiplier	Area (ha)	Habitat Hectares
Aquatic Herbland	GipP0653	Endangered	Very High	X2	0.260	0.080
Plains Grassy Woodland	GipP0055	Endangered	Very High	X2	0.560	0.246
Swampy Riparian Woodland	GipP0083	Endangered	Very High	X2	0.030	0.007
Swamp Scrub	GipP0053	Endangered	Very High	X2	4.960	1.659
Sedge Wetland	GipP0136	Vulnerable	Very High	X2	1.760	0.706
Tall Marsh	GipP0821	Endangered	Very High	X2	0.710	0.299
				Totals	**8.28**	**3.00**

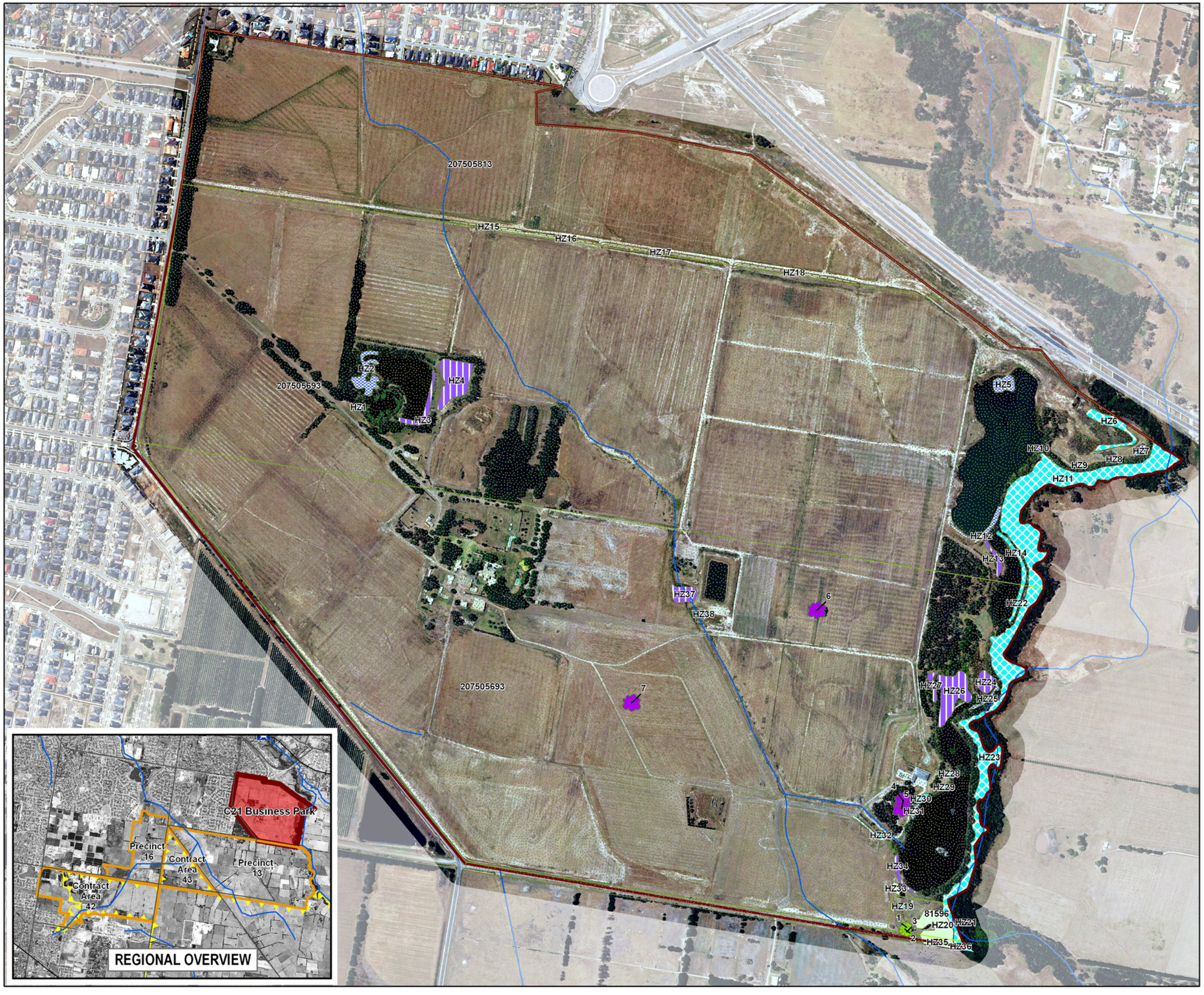
The following EVC descriptions are based on the condition of Habitat Zones found on site, and include more general descriptions referenced from EVC benchmarks available on-line (DSE 2010b) and from Oates and Taranto (2001).

Aquatic Herbland (EVC 653)

Aquatic Herbland is a wetland EVC dominated by aquatic herbs and sedges in slow flowing wetlands such as billabongs. Sedges such as Tall Spike-sedge *Eleocharis sphacelata* tend to dominate the shallower water verges while species such as Water-ribbons *Triglochin procerum* and Water-milfoil *Myriophyllum* spp. and other aquatics such as Floating Pondweed *Potamogeton tricarinatus* and Running Marsh Flower *Villarsia reiformis* dominate the deeper waters and inundated areas (Oates and Taranto 2001).

Aquatic Herbland within the contract area was assigned to a drainage-line comprising colonising native vegetation that intersects the north of the contract area (Figure 4). The

Aquatic Herbland Habitat Zones comprised relatively high floristic diversity and achieved a score of 15 out of a possible 25 for the understorey component during the habitat hectare assessment.



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MAP AND SURVEY DETAILS
Mapping by: Staci Timms, 20/04/10
Flora Survey by: Mark Shepherd, Peter Gannon and Jeremy Neal, 29 Oct-7 Nov 2008 and 28 Jan 2010.
Generated from: Aerial Imagery and GIS base layers supplied by DSE and GAA, additional GIS layers from Geoscience Australia.
For further detail of EVCs and Scattered Trees refer to Figures 4A-4C

DATUM: GDA 94 VICGRID 94

N

0 100 200 300 400
Metres

1:8,000 when printed at A3

LEGEND

- Roads
- Watercourse
- 257423 Property Boundary and PFI
- C21 Business Park Study Area
- Other Precincts and Contract Areas
- Non Native Vegetation*

Scattered Trees
- Small Tree
- Very Large Old Tree

Ecological Vegetation Classes
- EVC 136: Sedge Wetland
- EVC 53: Swamp Scrub
- EVC 55: Plains Grassy Woodland
- EVC 653: Aquatic Herbland
- EVC 821: Tall Marsh
- EVC 83: Swampy Riparian Woodland

*Non Native Vegetation and Degraded Treeless Vegetation were not differentiated at time of survey.

FIGURE 4
ECOLOGICAL VEGETATION CLASSES AND SCATTERED TREES
C21 Business Park
Biodiversity Mapping Project 2009-2011

Aquatic Herbland has an 'Endangered' Conservation Status within the Gippsland Plains bioregion (DSE 2010b).

Plains Grassy Woodland (EVC 55)

Plains Grassy Woodland typically occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. Scattered River Red Gums *Eucalyptus camaldulensis* would have dominated the upper canopy, with an understorey consisting of a few sparse shrubs over a species-rich grassy and herbaceous ground layer (DSE 2010b). This EVC would have once been ecotonal with Plains Grassland within the contract area (DSE 2010b) and is likely to have presented as an open, eucalypt woodland (to 15m tall) dominated by River Red Gums *Eucalyptus camaldulensis*, with a diverse, grassy and herbaceous understorey and a sparse cover of shrubs (DSE 2010b).

Plains Grassy Woodland within the contract area is represented by a two Habitat Zones within the contract area. One of these patches is a relatively large (0.38ha) patch of moderate quality in the south of the contract area. However, both patches are suffering from the impacts of weed invasion and other disturbance as a result of agricultural land use.

This EVC has an 'Endangered' Conservation Status within the Gippsland Plains bioregion (DSE 2010b).

Swampy Riparian Woodland (EVC 83)

Swampy Riparian Woodland was once common along broad drainage lines and on levees near streams and may once have dominated the Cardinia Creek riparian corridor (Oates and Taranto 2001). The EVC is typically dominated by Swamp Gum *Eucalyptus ovata* with the middle and understorey dominated by Swamp Paperbark *Melaleuca ericifolia*, Wooly Tea-tree *Leptospermum lanigerum* and Common Reed *Phragmites australis* (Oates and Taranto 2001).

Swampy Riparian Woodland was recorded as one small Habitat Zone in the south of the contract area, however, this EVC occurs as 1.4 hectare patch within the adjacent VicRoads Pakenham Bypass offset site (James, MacDonald and Picone 2008) and would most likely have been more widely distributed along the Cardinia Creek riparian corridor within the contract area. The EVC has most likely been converted to Swamp Scrub due to clearing of the Swamp Gum canopy (possibly for the production of fence-posts), or lost due to the alteration of the site's surface drainage / hydrology for agricultural land use.

This EVC held a poor representation of indigenous floristic diversity within the contract area and was highly modified, due to the impacts of grazing and changes to hydrology within the contract area.

This EVC has an 'Endangered' Conservation Status within the Gippsland Plains bioregion (DSE 2010b).

Swamp Scrub (EVC 53)

Swamp Scrub is dominated by Swamp Paperbark *Melaleuca ericifolia* or sometimes Woolly Tea-tree *Leptospermum lanigerum* which forms a dense closed canopy. The EVC forms on poorly drained sites or on alluvial deposits along streams. Swamp Paperbark typically out-competes Eucalypt species, although emergent Swamp Gum *Eucalyptus ovata* may occur. Shrubs are usually absent while a herbaceous and grassy understorey may be present depending on light availability (Oates and Taranto 2001).

Swamp Scrub occurs primarily as one continuous patch within low-lying, damp sections of the Cardinia Creek riparian zone, from the most northern to the most southern reaches of the creek within the contract area. Eleven patches of Swamp Scrub were recorded. These patches may be the result of Swamp Scrub replacing Swampy Riparian Woodland within the contract area, due to the possible removal of the Swampy Riparian Woodland Eucalypt canopy.

Swamp Scrub within the contract area displayed relatively high floristic diversity, as reflected by the understorey scores for the patches.

Many other small Swamp Scrub patches within the contract area were showing signs of regeneration and colonisation suggesting that this EVC would naturally colonise damp sites and flood zones if left un-grazed and un-slashed. Small patches with an immature canopy cover were common within the contract area.

This EVC has an 'Endangered' Conservation Status within the Gippsland Plains bioregion (DSE 2010b).

Sedge Wetland (EVC 136)

Sedge Wetland more typically occupies low-lying areas where landforms such as billabongs, lakes, swamps or depressions occur. Vegetation is generally treeless, however shrubs may be present at the fringes and occasionally scattered throughout the EVC. Vegetation is dominated by sedges, rushes and reeds and tends to be low in diversity in central areas with more variety towards the fringes (DSE 2010b).

Within the contract area, this EVC was found fringing dams and was generally the result of natural colonisation and is considered unlikely to be remnant vegetation. Dams that were subject to frequent access by stock or with a fluctuating water level were less likely to have a colonising aquatic margin. On the whole, floristic diversity within this EVC was low, as can be expected of colonising aquatic vegetation in farm dams and constructed wetlands. Extensive patches of Sedge Wetland of up to 0.54 hectares were recorded within the contract area.

This EVC has a 'Vulnerable' Conservation Status within the Gippsland Plains bioregion (DSE 2010b).

Tall Marsh (EVC 821)

Tall Marsh more generally occurs on Quaternary sedimentary geology of mainly estuarine sands, where soils are peaty, silty clays, and average annual rainfall is approximately 600 mm. It requires shallow water (to 1 m deep) and low current-scour, and can only tolerate very low levels of salinity (DSE 2010b).

Tall Marsh was found fringing a number of dams within the contract area and was generally the result of natural colonisation. Within the contract area, this EVC preferred dams with a shallow aquatic margin and a relatively non-fluctuating water level. These sites were generally dominated by Cumbungi *Typha* spp. with Common Reed *Phragmites australis* and Club-sedge *Schoenoplectus* spp often present.

This EVC has an 'Endangered' Conservation Status within the Gippsland Plains bioregion (DSE 2010b).

3.2 Habitat Hectare and Scattered Tree assessments

3.2.1 Habitat Zones

A total of **8.28 hectares** of native vegetation comprising **3.0 habitat hectares** was defined as meeting DSE's (2004b) native vegetation cover thresholds within the contract area.

Vegetation patches within the contract area that constitute Habitat Zones, in accordance with Victoria's *Native Vegetation Management Framework* policy (DNRE 2002), vary between 0.01 and 2.45 hectares and are generally less than 0.3 hectares per patch. Many patches of native vegetation are modified and not contiguous with other native vegetation. This was reflected in the low-moderate habitat hectare assessment scores, which were less than 0.45. The scores are a reflection of the modified agricultural landscape within which the contract area occurs. Low-moderate habitat scores can be attributed to, but not necessarily limited to:

- pugging (due to hard hooves) by livestock, particularly within damper soils in the gullies and around marshy areas;
- soil disturbance, such as gully erosion, tracks through remnants and areas of exposed soil with little to no vegetative cover;
- introduction of grassy weeds, pasture grasses and high nutrient levels;
- cropping of ground storey vegetation in general;
- general absence of regeneration of woody species (due to grazing and rabbits) and subsequently a declining canopy coverage;

- loss of middle and ground-storey vegetation resulting in a depauperate native vegetative understorey cover; and
- removal of canopy eucalypts within riparian corridors, likely for fence-post production and agricultural land use.

Habitat hectare and scattered tree assessments were undertaken within the contract area between 29 October 2008 and 28 January 2010 (Table 3).

Table 3. Habitat hectare and Scattered Tree assessments within the contract area

Month	Survey date
September (2008)	n/a
October (2008)	29/10/2008
	30/10/2008
November (2008)	6/11/2008
	7/11/2008
December (2008)	n/a
January (2010)	28/1/2010

3.2.2 Conservation Significance of habitat zones

All 38 patches of native vegetation recorded within the contract area have been assigned **very high** conservation significance, as per Appendix 3 of Victoria's *Native Vegetation Framework* (DNRE 2002) and in accordance with DSE's *Guide for Assessment of Referred Planning Permit Applications* (DSE 2007b) (Appendix 4; Figure 5).

The very high conservation significance determinations within the contract area are due primarily to the *best 50% habitat for threatened fauna species* determination for all habitat zones. Other factors influencing conservation significance include the endangered conservation status of the majority of EVCs within the contract area. While 'other site attributes' have not influenced the overall conservation significance of any patches, certain patches fall within areas identified as regionally significant Biosite #6888 *Cardinia Creek – Lower* (DSE 2005a) (Figure 4).

3.2.3 Vegetation Quality (habitat hectares)

Vegetation quality in terms of habitat scores varies between 0.17 and 0.52 (Appendix 4). The average habitat score is 0.38 within the contract area.

The relatively low habitat scores are a reflection of the highly modified nature of the agricultural landscape within which the contract area is situated. Landscape scores are ≤10, which is a reflection of a lack of surrounding native vegetation and large conservation

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DATUM: GDA 94 VICGRID 94

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LEGEND

- Roads
- Watercourse
- 257423 Property Boundary and PFI
- C21 Business Park Study Area
- Other Precincts and Contract Areas

Conservation Significance

- High Conservation Significance - Scattered Tree
- Very High Conservation Significance - Remnant Patch
- Biosite #6888: Cardinia Creek - Lower

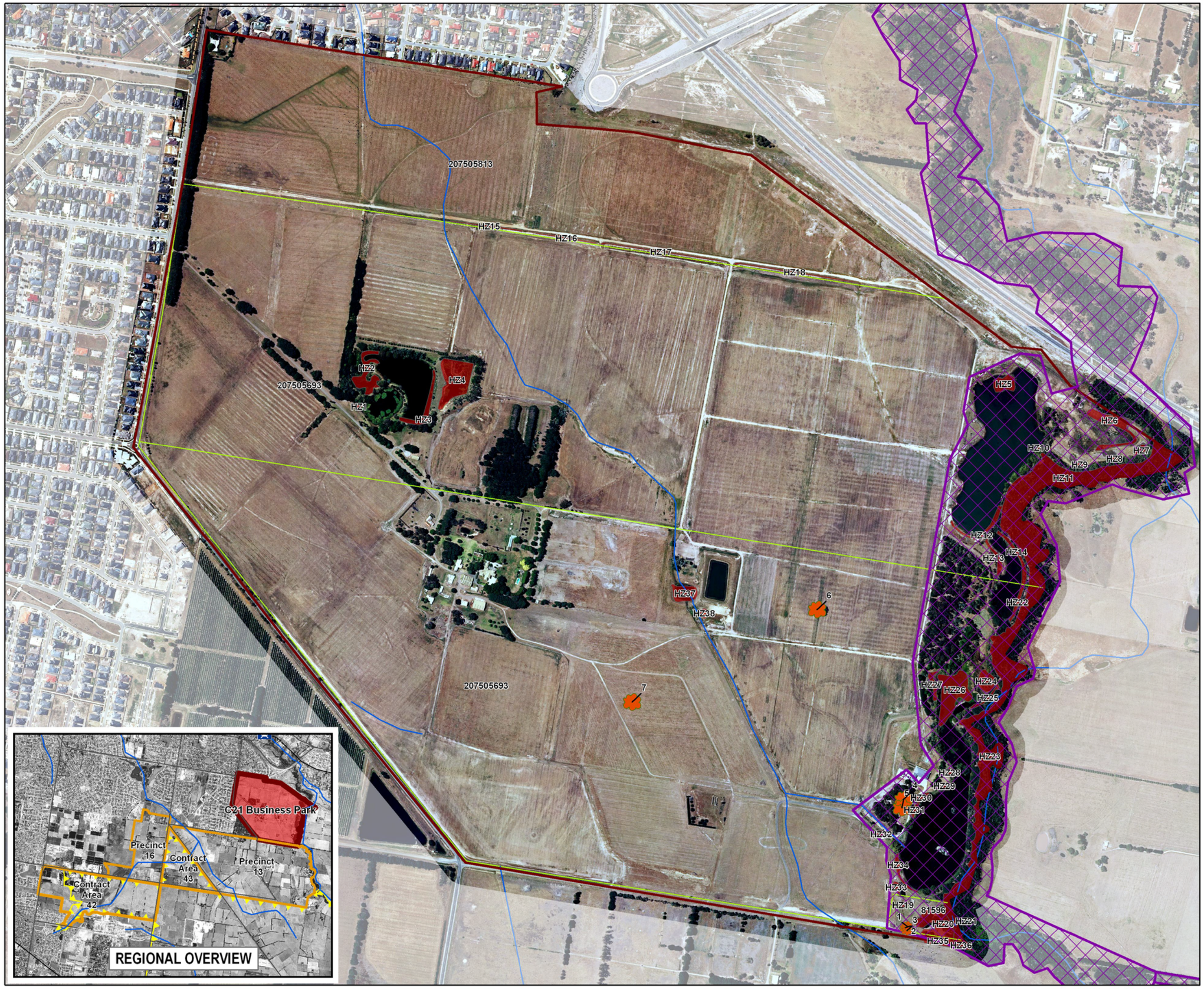


FIGURE 5
CONSERVATION SIGNIFICANCE OF HABITAT ZONES AND SCATTERED TREES
C21 Business Park
Biodiversity Mapping Project 2009-2011

reserves within five kilometres of the contract area boundary. The highest scoring habitat zone within the contract area is a patch of Woodland in the south, which scores 0.43.

Appendix 4 presents all habitat scores recorded within the contract area during the current assessment.

3.2.4 Scattered trees

Seven 'scattered trees', as defined by DSE (2007b), occur within the contract area (Table 4; Figure 4). Scattered trees constitute important habitat for the region's indigenous fauna and in many cases are the only source of tree hollows and canopy nectar in an otherwise highly modified environment.

Table 4. Scattered tree summary

EVC Name	Plains Grassy Woodland	Totals
EVC Number	GipP0055	
EVC Conservation Status	E	
Very Large Old Trees	4	4
Large Old Trees	0	0
Medium Old Trees	0	0
Small Trees	3	3
Totals	**7**	**7**

In general, scattered trees displayed poorer than expected canopy health, most likely due to:

- below average rainfall in recent years;
- higher than expected mistletoe infestations;
- cattle pugging and soil compaction at the base of the trees;
- tree trunk damage due to stock rubbing against trees; and
- general impacts associated with agricultural use of the land such as:
  - removal of supporting ground and middle-storey vegetation;
  - soil cultivation;
  - introduction of fertilizers and nutrients; and
  - changes to the surface and sub-surface hydrology.

All scattered trees found within the contract area belong to the genus *Eucalyptus*. Table 5 below summarises scattered tree size classes and EVCs found within the contract area.

Table 5. Scattered Trees within the contract area

Tree ID	Property PFI	Tree Size	Bioregion	Other attributes	Overall Conservation Significance	Latitude	Longitude	Location Figure 4A-C
1	81596	Small	Gippsland Plains	Medium*	Medium	-38.07920151090	145.37492538900	L12
2	81596	Small	Gippsland Plains	Medium*	Medium	-38.07923311550	145.37487804700	L12
3	81596	Small	Gippsland Plains	Medium*	Medium	-38.07928900490	145.37492053700	L12
4	81599	VLOT	Gippsland Plains	Medium*	Medium	-38.07667182010	145.37481432400	L8
5	81599	VLOT	Gippsland Plains	Medium*	Medium	-38.07683286530	145.37477901500	L8
6	81599	VLOT	Gippsland Plains	Low	Low	-38.07288384960	145.37261015400	I2
7	81599	VLOT	Gippsland Plains	Low	Low	-38.07474379760	145.36794170200	C5

* Scattered tree included within regionally significant Biosite #6888

3.2.5 Conservation Significance of scattered trees

The Conservation Significance of scattered trees is determined by a combination of:

- EVC conservation status (assigned the lowest conservation significance which applies to the original EVC which they belonged);
- if the tree species is or provides habitat for a threatened species; and
- 'other attributes'.

Plains Grassy Woodland EVC was assigned to all scattered trees within the contract area, based on the species (predominately River Red-gum), their location, soil type and pre-1750 EVC and is classified as an 'Endangered' EVC within the Gippsland Bioregion (DSE 2010b).

All scattered trees were considered 'remaining 50%' habitat for several regionally significant species that occur within ten kilometres of the contract area \, as identified on the AVW database (DSE 2009c) or were recorded on site during the current assessment. Some scattered trees have been assigned Medium conservation significance based on the location of these trees within regionally significant Biosite #6888 *Cardinia Creek – Lower* (Table 5) (Figure 5).

3.2.6 Degraded Treeless and Non-Native Vegetation

Degraded Treeless Vegetation (DTV) and Non-native Vegetation (NNV) were not differentiated at the times of the assessment due the habitat hectare assessment being

undertaken using contractual specifications under the 08/09 contract. In the 08/09 contract, DTV was defined as all vegetation that did not meet the cover thresholds for determination as a remnant patch, whereas in 09/10, DTV was determined as areas of native vegetation that occurred below the cover threshold. In addition, the 09/10 contract included the addition of the NNV category, which was defined as areas of vegetation that contained no native vegetation. DTV and NNV have therefore been amalgamated in this report because they were not distinguished at the time of the assessment in 08/09.

Degraded Treeless Vegetation (DTV) and Non-native Vegetation (NNV) dominate the contract area in the form of grazing land (Figure 4). NNV within the contract area typically comprises exotic pasture grasses, such as Rye grasses *Lolium* spp. with occasional introduced crop weeds such as Thistles and other broadleaf weeds. Residential areas (including gardens), windbreaks and other areas vegetated with non-indigenous flora have been included within NNV at the contract area.

An extensive area of planted vegetation consisting of non-indigenous native plants such as eucalypts, Giant Honey-myrtle *Melaleuca armillaris* subsp *armillaris,* and European trees occurs adjacent to the riparian corridor of the Cardinia Creek in the eastern-central section of the contract area (Figure 6). This area was classified as DTV/NNV within the contract area, however, it holds significantly more value as habitat for native fauna compared to the surrounding farmland. Flowering gums within this vegetation, for example, provide food resources for Swift Parrot, which has been recorded within five kilometres of the contract area (DSE 2005b) and is predicted to occur by DEWHA's *Protected Matters Search Tool* (DEWHA 2010a).

3.3 Targeted flora

No threatened flora species were recorded within the contract area during the current assessment (Figure 4).

Targeted surveys for threatened flora were undertaken in six areas of habitat (Figure 2; Table 6). Species nominated by DSE were targeted, in addition to other species that were known to occur within 10 km for which suitable or potential habitat was identified on-site (Appendix 3).

Table 6. Threatened flora survey effort

Month	Study site no.	Assessor	Survey date	Duration of survey (hrs)	Temperate range (°C)^	Species Surveyed*
September	**1**	Gidja Walker, Jeremy Neal, Mark Shepherd	4/9/2009	2	8.0-15.5	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
	3	Gidja Walker, Jeremy Neal, Mark Shepherd	4/9/2009	2	8.0-15.6	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
	4	Gidja Walker, Jeremy Neal, Mark Shepherd	4/9/2009	4	8.0-15.7	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
	5	Gidja Walker, Jeremy Neal	11/9/2009	4	5.4-20.2	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
	6	Gidja Walker, Jeremy Neal	11/9/2009	4	5.4-20.3	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
October						
November	**3**	Gidja Walker, Mark Shepherd	18/11/2009	1	9.5-~	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
	4	Gidja Walker, Mark Shepherd	18/11/2009	1	9.5-~	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
	5	Gidja Walker, Mark Shepherd	18/11/2009	1	9.5-~	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
December	**2**	Mark Shepherd	3/12/2009	2	11.2-30.5	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
January	**6**	Mark Shepherd	27/1/2010	2	14.5-20.8	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
	2	Mark Shepherd	28/1/2010	2	12.4-26.5	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
	4	Mark Shepherd	28/1/2010	2	12.4-26.6	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
	3	Mark Shepherd	28/1/2010	2	12.4-26.7	MFL, RSWG, MLO, GBB, PSE, VSG, PD, NSO, WLSO, FSO
February	**n/a**					

*

MFL	Matted Flax-lily
RSWG	River Swamp Wallaby-grass
MLO	Maroon Leek-orchid
GBB	Grey Billy buttons
PSE	Pale Swamp Everlasting
VSG	Veined Spear-grass
PD	Purple Diuris
NSO	Naked Sun-orchid
WLSO	Wine-lipped Spider-orchid
FSO	Frankston Spider-orchid

^ BOM (2010)

~ Missing Data from BOM (2010)

The six areas of habitat identified for targeted searches within the contract area comprised the following habitat types:

- Ephemeral zones within constructed wetlands adjacent within the Cardinia Creek corridor.
- Swamp Scrub immediately adjacent to Cardinia Creek.
- Plains Grassy Woodland in the south of the study area.
- A constructed drainage-line transecting the contract area from east to west (Figure 2).
- Dams in the west of the contract area.

Locations of threatened flora targeted searches are displayed in Figure 2.

3.4 Fauna Survey Results

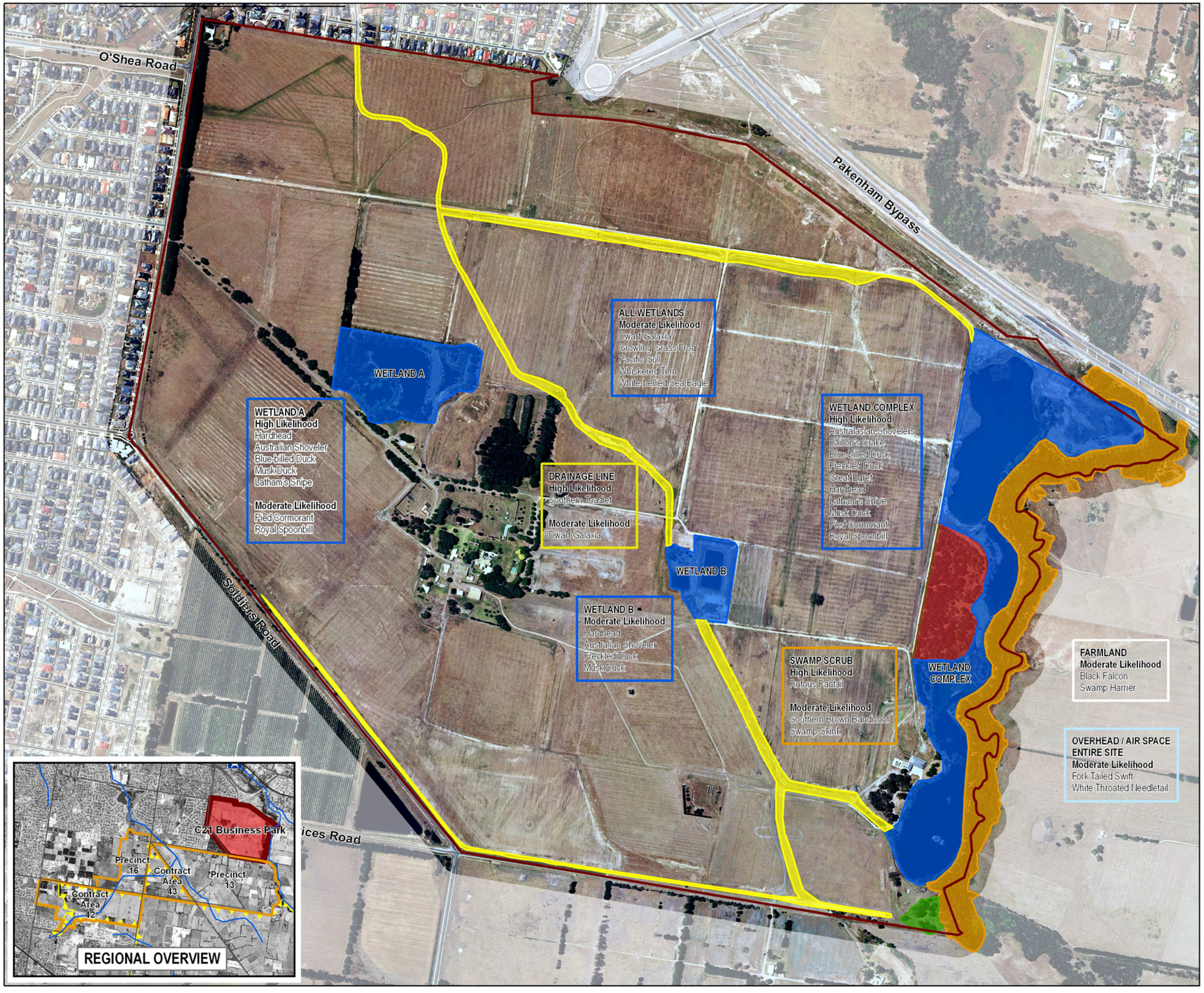
3.4.1 Fauna habitats

A large proportion of the contract area has been highly modified by farming practices resulting in open paddocks supporting planted crops and exotic pasture. However, a number of man-made wetlands and fragments of remnant vegetation along Cardinia Creek provide significant habitat for migratory waders and water birds, fish, mammals and reptiles. Native and exotic vegetation that occurs along the Cardinia Creek corridor, adjacent to wetlands and in roadside vegetation along Soldiers Road, provides potential habitat for threatened fauna within the contract area (Figure 6).

The determination of areas classified as having high faunal habitat values is based on all or any of the following factors:

- The area is a representative or remnant vegetation community.
- The area constitutes a wildlife corridor.
- The area contains important breeding sites.
- The area has high floristic and/or structural diversity.

The contract area has been divided up into six habitat types. An evaluation of each of the habitat types is described below.



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NOTES:
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VERSION: 02	DATE: 30/09/10

MAP AND SURVEY DETAILS
Surveyed by: Jo Henry, Annabelle Stewart, Mal Legg, Zorza Goodman, Dave Nance. Oct09 - Apr10
Mapping by: Staci Timms, Apr10
Generated from: Data collected in the field using IPAC PDAs. Aerial Imagery and GIS base layers supplied by DSE and GAA, additional GISlayers from Geosciences Australia.

DATUM: GDA 94 VICGRID 94

N

0 100 200 300 400
Metres

1:8,000 when printed at A3

LEGEND

C21 Business Park Study Area

Habitat Type

- Drainage Line
- Non-Indigenous Eucalypt Woodland
- Remnant Woodland
- Swamp Scrub
- Wetland

FIGURE 6
FAUNA HABITAT
C21 Business Park
Biodiversity Mapping Project
2009-2011

Wetlands (including surrounding vegetation)

The constructed wetlands in the centre and along the eastern edge of the contract area support excellent habitat for the region's indigenous fauna. Dams with fringing native vegetation offer high quality habitat for wetland birds and amphibians (Hero, Littlejohn and Marantelli 1991; Pizzey and Knight 2007). Habitat condition may improve as the wetland floristic diversity increases and habitat values develop. Ecological Vegetation Classes supported around and within the wetlands include Swamp Scrub (EVC 53), Tall Marsh (EVC 821), Sedge Wetland (EVC 136) and Aquatic Herbland (EVC 653).

The largest dam at the south-eastern section of the contract area is of particular importance as it supports a number of islands that are breeding sites for numerous species, including: Little Pied Cormorant *Microcarbo melanoleucos,* Little Black Cormorant *Phalacrocorx sulcirostris* and the state significant Pied Cormorant *Phalacrocorax varius*. The state significant Royal Spoonbill *Platalea regia* was also observed nesting on one island and the critically endangered Intermediate Egret *Ardea intermedia* was observed foraging on the wetlands edges. One island comprises a canopy of introduced trees such as Poplar *Populus* spp. and Willow *Salix* spp. with a shrubby layer of Swamp Paperbark. Another island supports Swamp Paperbark and standing dead Eucalypts. A number of species were recorded nesting in both islands.

A number of threatened and near threatened birds and one amphibian were recorded within the contract area during this survey. See table 6 below.

Table 7. Threatened Fauna species recorded in Precinct 11

Common Name	Scientific Name	Conservation Status			Recorded
		EPBC	FFG	DSE	
Birds					
Australasian Shoveller	*Anas rhynchotis*	Migratory		Vulnerable	09/10 mapping
Australian White Ibis	*Threskionis molucca*	Marine			09/10 mapping
Baillon's Crake	*Poszana pusilla palustris*		Listed	Vulnerable	09/10 mapping
Blue-billed Duck	*Oxyura australis*	Migratory	Listed	Endangered	09/10 mapping
Clamorous Reed Warbler	*Acroceohalus stentoreus*	Migratory (Bonn)*			09/10 mapping
Eastern Great Egret	*Ardea modesta*	Migratory (JAMBA, CAMBA)* Marine	Listed	Vulnerable	09/10 mapping
Freckled Duck	*Stictonetta naevosa*		Listed	Endangered	Previous survey
Hardhead	*Aythya australis*	Migratory		Vulnerable	09/10 mapping
Intermediate Egret	*Ardea intermedia*		Listed	Critically Endangered	09/10 mapping
Latham's Snipe	*Gallinago hardwickii*	Migratory (Bonn, JAMBA, CAMBA, ROKAMBA)*		Near Threatened	09/10 mapping
Musk Duck	*Biziura lobata*.	Marine		Vulnerable	09/10 mapping

Pied Cormorant	*Phalacrocorax varius*		Near Threatened	09/10 mapping
Royal Spoonbill	*Platalea regia*	Migratory	Vulnerable	09/10 mapping
Straw Necked Ibis	*Threskionis spinicollis*	Migratory		09/10 mapping
Amphibian				
Southern Toadlet	*Pseudophryne semimarmorata*		Vulnerable	09/10 mapping

*Bonn – Bonn Convention on the Conservation of Migratory Species of Wild Animals

JAMBA – Japan-Australia Migratory Bird Agreement

CAMBA – China-Australia Migratory Bird Agreement

ROKAMBA- Republic of Korea-Australia Migratory Bird Agreement

Previous surveys (DSE 2009c) have also recorded the threatened Freckled Duck *Stictonetta naevosa,* which was not recorded during the present study, within the Precinct. Wetlands within PSP Area 11 provide significant habitat for threatened bird species and are a ***high priority for conservation***.

The group of wetlands and fringing vegetation provides potential habitat and a permanent water source for amphibians, mammals, reptiles and insects. Additional species seen utilising dams and associated drainage-lines included the Short-finned Eel *Anguilla australis*, Common Galaxias *Galaxias maculatus,* Common Long-necked Tortoise *Chelodina longicollis* and six frog species including Southern Bull Frog *Limnodynastes dumereli,* Striped Marsh Frog *Linmodynastes peronii*, Spotted Marsh Frog *Limnodynastes tasmaniensis*, Southern Brown Tree Frog *Litoria ewingii*, Whistling Tree Frog *Litoria verreauxii* and Common Froglet *Crinia signifera*.

Plate 2. One of the islands in the wetlands close to Cardinia creek clearly showing a number of wetland birds roosting and nesting (photo taken by J. Henry)

Plates 3 & 4. Islands in the wetland close to Cardinia creek showing nesting birds. (photos by J. Henry)

Plate 5. Wetland along main driveway, closest to Soldiers Road (photo by J. Henry)

Cardinia Creek and associated drainage-lines

Cardinia Creek and its associated drainage-lines potentially provide significant habitat for threatened vertebrate and invertebrate species. The majority of vegetation along Cardinia Creek in PSP Area 11 consists of Swamp Scrub with an overstorey of Swamp Paperbark and scattered Eucalypts, with a dense thick understorey of exotic weeds such as Blackberry, Gorse and Broom and/or Canary Grass. The EVCs along Cardinia Creek include Swamp Scrub, Swampy Riparian Woodland and Tall Marsh.

Vegetation along Cardinia Creek also provides potential habitat for threatened species including Glossy Grass Skink, Swamp Skink and Southern Brown Bandicoot *Isoodon obesulus obesulus*. Other native fauna recorded utilising surrounding vegetation include Sugar Glider *Petaurus breviceps*, Common Ringtail Possum *Pseudocheirus peregrinus*, Common Brushtail Possums *Trichosurus vulpecula*, Weasel Skink *Saproscincus mustelinus,* Garden Skink *Lamphropholis guichenoti* and Delicate Skink *Lampropholis delicata*. Remnant vegetation along Cardinia Creek and associated drainage-lines also acts as a potential habitat corridor, allowing dispersal of the gene pool and preventing inbreeding and bottlenecks. Drainage lines may also serve as migratory routes for the threatened Dwarf Galaxias during times of flood.

There appears to be a high presence of rabbits, feral cats, introduced rodents and foxes throughout this habitat, based on the survey results and the amount of fresh scats observed.

Photo 6. Swamp scrub habitat within Cardinia Creek corridor

Drainage-lines

Drainage-lines throughout the property provide habitat to a number of amphibians. Southern Toadlet was recorded during this assessment in a number of drainage-lines within the contract area. Drainage lines also provide important resources for other fauna such as invertebrates, birds and small mammals.

Introduced species including foxes, rabbits and black rats were recorded during the study. These species are likely to utilise drainage lines and may threaten populations of native species occurring within drainage lines through predation pressure and competition for resources such as food and habitat.

Drainage-lines are also important for their role in habitat connectivity throughout the region.

Roadside Vegetation

Roadside vegetation offers potential habitat for Swamp Skink, Glossy Grass Skink and Southern Toadlet, in addition to a suite of other reptiles, amphibians, mammals, invertebrates and birds.

Roadsides in the contract area are dominated by exotic grasses with occasional trees and drainage-lines. These areas may support reptiles and ground-dwelling mammals and are potentially important dispersal routes for fauna. .

Exotic trees dominate some sections of roadside. Whilst this vegetation is of limited habitat value to many native fauna, it is possible these trees may provide nesting and roosting sites for birds.

Roadsides are also important for their role in habitat connectivity throughout the region.

Woodlands

Remnant woodlands are highly restricted within the contract area and are only found in small patches along Cardinia Creek and surrounding constructed dams. Some of the trees within woodlands at the contract area have hollows suitable for hollow-dependent fauna such as arboreal mammals, bats and birds. There are some logs present from fallen branches and trees, which provide habitat for skinks, invertebrates and small mammals.

Several hectares of non-indigenous, native and exotic plantation vegetation exists as an 'arboretum' like woodland to the east of the Cardinia Creek corridor. The arboretum is likely to be the result of revegetation efforts in the early 1980s, and while it consists of non-indigenous and exotic species offers a considerable range of habitat values to regional fauna.

A section of the fence-line along Soldiers Rd is lined with planted trees and shrubs, including non-indigenous Eucalypts, **Cypress* spp, **Pinus* spp and European trees. While these areas do not hold the floristic diversity of remnant woodlands, they provide limited food, habitat connectivity and shelter resources for fauna, including woodland birds and arboreal mammals (Bennett, Kimber and Ryan 2000).

Woodlands in the contract area provide potential habitat for a number of locally and regionally significant birds and mammals.

Farmland and exotic vegetation

Areas of farmland and exotic vegetation serve a less important role as habitat for most native species. However, Eastern Great Egret was observed in close proximity to the contract area in such habitats. This species was recorded in seasonally wet open fields, near drainage lines and in wetlands in the north of Cranbourne North Stage 2 PSP area 16

(Shepherd, Henry and Gannon 2010). A number of the more generalist bird species and raptors were recorded throughout farmland within the contract area. Open farmland areas and open areas with fringing vegetation are important hunting grounds for raptors such as Brown Falcon *Falco subniger,* Brown Goshawk *Accipiter fasciatus*, Black-shouldered Kite *Elanus axillaris*, Whistling Kite *Haliastur sphenurus* and Nankeen Kestrel *Falco cenchroides* (Pizzey and Knight 2007).

Plate 7. Crop-land on the corner of Soldiers and Grices Road (photo M. Legg)

3.4.2 Fauna Species

Fauna species recorded

A total of 100 fauna species were recorded within the contract area (excluding invertebrates). Ninety-two of these were native and 13 were exotic. Of the native species recorded, there were: eight amphibian species, five reptile species, 63 bird species, three fish species, and eight mammal species. A list of all native species recorded within the contract area is provided in Appendix 7. Of the exotic species recorded there were 8 birds, one fish and four mammals. A list of exotic fauna recorded within the contract area is provided in Appendix 8.

Fifty-six invertebrate species, totalling 856 individuals were identified during invertebrate surveys within the contract area, (Appendix 9). Many invertebrates could not be identified

beyond Order, however most have been recorded photographically and are displayed in Appendix 9.

Database records and previous surveys

A total of 294 fauna species are documented on DSE's VFD (DSE 2009c) from within 10 km of the contract area boundary. Fifty-three national and state significant fauna species recorded or predicted to occur within ten kilometres of the contract area are documented on the VFD (DSE 2009c) and the EPBC Protected Matters Search Tool (DEWHA 2010a)(Appendix 10).

In determining the 'likelihood of occurrence' and utilisation of the study site by national or state significant fauna, the following factors were considered:

- The conservation status of the species and its distribution.
- Previous recordings of species in the local area.
- The quality, distribution and availability of suitable habitat for individual species.
- The generally fragmented and highly modified nature of fauna habitat surrounding the contract area.

Based on the review criteria detailed above, 12 species recorded on the VFD and EPBC databases are considered to have a high likelihood of occurrence within the contract area. A further 11 species are considered to have at least a moderate likelihood of occurrence within the contract area (Appendix 10). The habitat requirements for significant species detected on the VFD and EPBC databases are detailed in Appendix 10.

Threatened fauna species

Fourteen fauna species listed as threatened and/or migratory and/or marine under state and federal policy and legislation were recorded within the contract area during the current assessment (Figure 7). Ten of these species are wetland birds and one is an amphibian. The listed species recorded are as follows:

- The Intermediate Egret is listed as Critically Endangered in Victoria and listed under the *Flora and Fauna Guarantee Act 1988* (DSE 2007a).
- The Blue-billed Duck is listed as Endangered in Victoria (DSE 2007a) and listed under the *Flora and Fauna Guarantee Act 1988* (FFG Act) and listed as migratory under the EPBC Act 1999(DEWHA 2010b).
- Baillon's Crake and Eastern Great Egret are both listed as Vulnerable in Victoria (DSE 2007a) and are listed as threatened under the FFG Act 1988. The Eastern Great Egret is also listed as a migratory species under the EPBC Act 1999 (DEWHA 2010b).
- The Australasian Shoveler, Hardhead, Musk Duck and Royal Spoonbill are listed as Vulnerable in Victoria (DSE 2007a) and migratory and/marine under the EPBC Act 1999 (DEWHA 2010b).

- The Latham's Snipe and Pied Cormorant are listed as near threatened in Victoria (DSE 2007a); the Latham's Snipe is also listed as a migratory species under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999).

- One species of amphibian, the Southern Toadlet, occurred within the precinct and is listed as Vulnerable in Victoria (DSE 2007a).

Three other species were recorded during the current assessment and are listed as migratory and/or marine under the EPBC Act 1999. These were Australian White Ibis, Straw-necked Ibis and Clamorous Reed Warbler (DEWHA 2010b).

One additional threatened species; Freckled Duck was recorded within the contract area during a previous assessment (DSE 2009b) and was not recorded during the current survey.

Threatened Fauna Species likely to occur in the precinct

Dwarf Galaxias have been recorded in both Cardinia Creek and the Cardinia Creek floodplain (McGuckin 2010). The records that are closest to the precinct include:

- A wetland on eastern side of Cardinia Creek in Officer South Precinct

- A number of wetlands on eastern side of Cardinia Creek in Officer precinct

- Retarding basin directly to the north of the precinct (less than 100 metres to the north) (McGuckin 2010).

It is therefore considered highly likely that this species would use the waterway for dispersal and as habitat. It is also likely that the species will disperse along the drainage lines and into the wetlands in times of flood.

The Growling Grass Frog Sub-regional Survey (Renowden et al. 2010) has identified Cardinia Creek as an important dispersal corridor in the region for Growling Grass Frog.

The GAA Sub-Regional Fauna Survey Southern Brown Bandicoot (Stewart and Shepherd 2010) found that the '… most optimal SBB habitat within the contract area was identified along Cardinia Creek within PSP Areas 5 and 11…' . Although '… no Southern Brown Bandicoots were detected in these areas…management actions aimed at feral animal control and rehabilitation of vegetation could potentially result in SBBs colonising the area'. Cardinia Creek was also 'found to represent important habitat links between PSP Areas and Investigation areas. The vegetation along waterways also has the potential to supply habitat links between population clusters outside of the contract area.'

Best or Remaining 50% habitat for rare and threatened fauna species

Habitat zones have been assessed for determination of 'best or remaining 50% habitat' (DSE 2007b) for all threatened fauna species that were detected through database searches and recorded during the current assessment. The wetlands and creek line represents high quality habitat and habitat connectivity for a number of threatened species. The open water

within wetlands themselves are not classified as habitat zones and therefore can't be assigned best or remaining 50% habitat, however the wetlands in their entirety are regarded as optimal habitat for a number of threatened wetland bird species, including all the threatened bird species recorded on site.

The decision making process for determination of best or remaining 50% habitat for each habitat zone was undertaken in accordance with DSE's *Guide for Assessment of Referred Planning Permit Applications* (DSE 2007b). The decisions are detailed in a separate spreadsheet too large to be included in Appendices and have been provided to GAA and DSE in electronic format.

3.5 Targeted fauna

One targeted threatened fauna species listed as Vulnerable within Victoria (DSE 2007a) was recorded within the contract area; Southern Toadlet. Southern Toadlet was recorded in two drainage lines within PSP 11 (Figure 7). No other targeted fauna species were recorded within the contract area during the current assessment.

Table 8. Threatened fauna survey effort

Month	Survey date	Property Address	Survey Type	Common Name	Scientific Name	Mean Temperature range (°C)^
October						
November	12/11/2009	100 Soldiers Rd	Tin	Swamp Skink	*Egernia coventryi*	16.2–28.0
	12/11/2009	100 Soldiers Rd	Tin	Glossy Grass Skink	*Pseudemoia rawlinsoni*	16.2–28.0
	18/11/2009	100 Soldiers Rd	Tin	Swamp Skink	*Egernia coventryi*	9.5–21.8
	18/11/2009	100 Soldiers Rd	Tin	Glossy Grass Skink	*Pseudemoia rawlinsoni*	9.5–21.8
December	9/12/2009	100 Soldiers Rd	Tin	Swamp Skink	*Egernia coventryi*	8.1–24.0
	9/12/2009	100 Soldiers Rd	Tin	Glossy Grass Skink	*Pseudemoia rawlinsoni*	8.1–24.0
	07/12/2009–11/12/2009	100 Soldiers Rd	Elliott trap	Swamp Skink	*Egernia coventryi*	10.7–20.6
	07/12/2009–11/12/2009	100 Soldiers Rd	Elliott trap	Glossy Grass Skink	*Pseudemoia rawlinsoni*	10.7–20.6
	10/12/2009	100 Soldiers Rd	Tin	Swamp Skink	*Egernia coventryi*	11.5–23.6
	10/12/2009	100 Soldiers Rd	Tin	Glossy Grass Skink	*Pseudemoia rawlinsoni*	11.5–23.6
	12/12/2009	100 Soldiers Rd	Bait Traps	Dwarf Galaxias	*Galaxiella pusilla*	12–21.5
	12/12/2009	100 Soldiers Rd	Dip net	Dwarf Galaxias	*Galaxiella pusilla*	12–21.5
	11/12/2009–14/12/2009	100 Soldiers Rd	Elliott trap	Swamp Skink	*Egernia coventryi*	11.5–19.9
	11/12/2009–14/12/2009	100 Soldiers Rd	Elliott trap	Glossy Grass Skink	*Pseudemoia rawlinsoni*	11.5–19.9
	15/12/2009	100 Soldiers Rd	Bait Traps	Dwarf Galaxias	*Galaxiella pusilla*	8.5–27.1
	15/12/2009	100 Soldiers Rd	Dip net	Dwarf Galaxias	*Galaxiella pusilla*	8.5–27.1
	19/12/2009	100 Soldiers Rd	Tin	Swamp Skink	*Egernia coventryi*	13.4–19.1
	19/12/2009	100 Soldiers Rd	Tin	Glossy Grass Skink	*Pseudemoia rawlinsoni*	13.4–19.1
	20/12/2009	100 Soldiers Rd	Bait Traps	Dwarf Galaxias	*Galaxiella pusilla*	10.3–21.1
	20/12/2009	100 Soldiers Rd	Dip net	Dwarf Galaxias	*Galaxiella pusilla*	10.3–21.1
January	4/01/2010	100 Soldiers Rd	Bait Traps	Dwarf Galaxias	*Galaxiella pusilla*	8.9–25.0
	4/01/2010	100 Soldiers Rd	Dip net	Dwarf Galaxias	*Galaxiella pusilla*	8.9–25.0
	30/01/2010	100 Soldiers Rd	Bait Traps	Dwarf Galaxias	*Galaxiella pusilla*	11.1–32.5
	30/01/2010	100 Soldiers Rd	Dip net	Dwarf Galaxias	*Galaxiella pusilla*	11.1–32.5
February	4/02/2010	100 Soldiers Rd	Bait Traps	Dwarf Galaxias	*Galaxiella pusilla*	20.2–29.1
	4/02/2010	100 Soldiers Rd	Dip net	Dwarf Galaxias	*Galaxiella pusilla*	20.2–29.1
March	25/03/2010	100 Soldiers Rd	Vocalisation ID	Southern Toadlet	*Psuedophryne semimarmorata*	12–29.9
April	1/04/2010	100 Soldiers Rd	Vocalisation ID	Southern Toadlet	*Psuedophryne semimarmorata*	*–22.9
	19/04/2010	100 Soldiers Rd	Vocalisation ID	Southern Toadlet	*Psuedophryne semimarmorata*	12–26.5

* missing data

^ Data from BOM (2010)

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DATUM: GDA 94 VICGRID 94

N

0 100 200 300 400
Metres

1:8,220 when printed at A3

LEGEND

No Significant Flora Records occur within the Study Area

- C21 Business Park Study Area
- Other Precincts and Contract Areas
- Dwarf Galaxias (1998) — National Significant Species Date of Record
- Hardhead (1998) — State Significant Species Date of Record
- Blue-billed Duck (1998) — Regionally Significant Species Date of Record

Significant Species Records

- Database Records of Species of State Significance
- Database Records of Species of National Significance
- Survey* Records of Species of National Significance

* McGuckin 2010 Dwarf Galaxias survey

FIGURE 7
SIGNIFICANT FLORA AND FAUNA SPECIES RECORDS
C21 Business Park
Biodiversity Mapping Project 2009-2011

4. RELEVANT POLICY AND LEGISLATION

The following section outlines the implications of legislation, treaties, plans, or policies, for habitat hectare, and flora and fauna values found on site.

4.1 Commonwealth Policy and Legislation

4.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Act 1999* (EPBC Act 1999) applies to sites where proposed developments or projects may have a *significant impact* on *matters of National Environmental Significance* (NES). Numerous threatened species and communities listed under the EPBC Act have been recorded, or have the potential to occur in the Casey-Cardinia Growth Area, within which the contract area is situated. The development of the Casey-Cardinia growth area has the potential to have a significant impact on matters of NES, including impacts on threatened fauna species (DSE 2009e).

Under the EPBC Act 1999, a proponent must refer proposed actions that may require approval, to the Commonwealth Environment Minister. The Minister then decides which assessment and reporting option is applied. The Minister may approve a 'controlled action' allowing the development to proceed provided conditions are applied to mitigate significant impacts protected by this act.

Under Section 146(1) of the EPBC Act, an agreement between a state/territory government and the federal government can be made, whereby, the state or territory may administer the assessment and (if appropriate) approval of actions that may impact on matters of national environmental significance (NES). This mechanism is designed to avoid duplication of assessments and approvals when a project requires consideration under both state and federal biodiversity legislation. The Department of Sustainability and Environment (DSE) has made such as agreement with DEWHA to assess the impacts of the Casey-Cardinia Growth Corridor relevant to the EPBC Act 1999. As part of this agreement, Strategic Impact Assessments (SIA) have been undertaken within the contract area and includes surrounding areas.

Strategic Impact Assessments have been undertaken for two EPBC listed species; the Growling Grass Frog and the Southern Brown Bandicoot. Potential habitat for both of these species was identified within the contract area, are included and addressed in the Casey-Cardinia Growth Area SIA (DSE 2009e). Neither of these species was targeted during this biodiversity assessment.

The SIA notes that:

> *Extending the urban area to the south-east will further compromise ecological processes persisting in those areas. In the south-east, some road reserves and minor drainage lines are known to afford narrow avenues of connected habitat for the Southern Brown-bandicoot, albeit tenuous ones (Practical Ecology 2009). This connectivity within the south-east will more than likely be removed as a result of urban development. The mitigation emphasis will be on*

> *maintaining and restoring connectivity at a sub-regional level, focusing on larger areas of habitat and major strategic linkages. The challenge for monitoring will be finding practical ways to assess the degree of ecological function remaining in this part of the landscape, and identifying how urban development and the mitigation strategies influence the net result.*

Source: (DSE 2009e).

The SIA states that habitat corridors and indirect impacts to SBB are likely to be the greatest impacts.

The SIA lists mitigation objectives, including:

- Exclude major areas of suitable habitat from development.
- Retain, upgrade and connect existing habitats within proposed precincts and outside the Urban Growth Boundary, including the important population at the Royal Botanic Gardens Cranbourne.
- Secure and manage retained habitat and linkages to conserve Southern Brown Bandicoot.
- Monitor retained and new habitat and adjust management accordingly.
- Carefully plan and construct urban development within precincts to minimise impacts on species (such as employing road design and other techniques that facilitate road crossings, and restricting cat, dog and human access in particular areas).

The Growling Grass Frog has not been detected within the contract area, however potential habitat has been identified on site. The sub-regional strategy for this species identified this habitat and also identified the Cardinia Creek as a major corridor for this species (Renowden et al. 2010). The SIA states that all habitat and potential habitat must be retained and/or created in order to promote connectivity for this species throughout the landscape. The SIA sets out guidelines in with respect to this species, this document should be referred to throughout the development process.

Dwarf Galaxias have also been identified as having habitat within the contract area (McGuckin 2010). This species has been recorded within close proximity to the contract area (McGuckin 2010) and have also been identified as having a high likelihood of occurrence on site. The guidelines identified within the National Recovery Plan for this species must be followed (see section 4.1.3).

The SIA also outlines the objectives of a Sub-regional Strategy and Conservation Management Plan for each PSP area.

Fourteen other EPBC listed fauna species which were recorded on site or have the potential to occur have not been addressed in the SIA: These are listed in the table below.

Table 9. Fauna species listed as migratory and/or marine under the EPBC Act 1999

Common Name	Scientific Name	Conservation Status		
		EPBC	FFG	DSE
Australasian Shoveller	*Anas rhynchotis*	Migratory		Vulnerable
Australian White Ibis	*Threskionis molucca*	Marine		
Baillon's Crake	*Poszana pusilla palustris*		Listed	Vulnerable
Blue-billed Duck	*Oxyura australis*	Migratory	Listed	Endangered
Clamorous Reed Warbler	*Acroceohalus stentoreus*	Migratory (Bonn)*		
Eastern Great Egret	*Ardea modesta*	Migratory (JAMBA, CAMBA)* Marine	Listed	Vulnerable
Freckled Duck	*Stictonetta naevosa*		Listed	Endangered
Hardhead	*Aythya australis*	Migratory		Vulnerable
Intermediate Egret	*Ardea intermedia*		Listed	Critically Endangered
Latham's Snipe	*Gallinago hardwickii*	Migratory (Bonn, JAMBA, CAMBA, ROKAMBA)*		Near Threatened
Musk Duck	*Biziura lobata*.	Marine		Vulnerable
Pied Cormorant	*Phalacrocorax varius*			Near Threatened
Royal Spoonbill	*Platalea regia*	Migratory		Vulnerable
Straw Necked Ibis	*Threskionis spinicollis*	Migratory		

These species are wetland bird species and will most likely need to be addressed in a referral to DEWHA. Under the EPBC Act, the proponent must refer proposed actions that may require approval, to the Commonwealth Environment Minister. The Minister then decides which assessment and reporting option is applied. The Minister may approve a 'controlled action' allowing the development to proceed provided conditions are applied to mitigate significant impacts protected by this act.

Other EPBC listed threatened fauna species with at least a moderate likelihood of occurrence that are not addressed in the SIA, may also need to be addressed in a referral to DEWHA. These species include:

- Fork-tailed Swift
- Rufous Fantail
- White-bellied Sea-Eagle

No EPBC listed flora species were recorded within the contract area. Two EPBC listed flora species are considered to have at least a moderate likelihood of occurrence within the contract area:

- River Swamp Wallaby-grass *Amphibromus fluitans*
- Matted Flax-lily *Dianella amoena*

These flora species may also need to be addressed in a referral to DEWHA.

4.1.2 RAMSAR – The Convention on Wetlands of International Importance 1971

There are no RAMSAR wetlands within the contract area, however Cardinia Creek flows into Westernport Bay Ramsar Site The RAMSAR *Handbook 16: Managing Wetlands* suggest that all wetlands require a dynamic management plan that sets out key objectives (Ramsar Convention Secretariat 2007). A risk assessment can also be carried out and wetlands should have ongoing monitoring to identify and manage hazards. In PSP Area 11, creek line, wetland and riparian vegetation are integrally linked and all have a high conservation value. Large and dramatic changes such as those that will come with urban development will most likely impact water regimes and water quality. Furthermore, The Westernport Bay Ramsar site is located less than 20 kilometres south of the contract area, so hydrological changes within PSP Area 11 also have the potential to impact this RAMSAR site. Creek-line, wetlands and riparian vegetation are key biodiversity areas within the contract area and should have management plans that include ongoing monitoring to identify changes and associated hazards.

4.1.3 Recovery Plans

Recovery plans address research priorities and management strategies to halt decline and conserve threatened species listed under the EPBC Act. Recovery plans aim to provide a framework by which relevant stakeholders can optimise the long-term survival of threatened species and ecosystems in-situ. A number of Recovery Plans may be relevant to threatened species that have been recorded within PSP 11 or have the potential to occur within the contract area.

The relevant Recovery Plans and basic objectives are listed below.

The National Recovery Plan for the Dwarf Galaxias *Galaxiella pusilla* (Saddlier, Jackson and Hammer 2010)

Management actions to ensure the National Recovery Plan for the Dwarf Galaxias objectives are met are as follows:

- *No direct loss of habitat through wetland drainage on either public or private land.*
- *No physical alteration to Dwarf Galaxias habitat as a consequence of incidental works on land adjoining Dwarf Galaxias habitat.*
- *Applications for water abstraction or dam construction do not compromise flow regimes for Dwarf Galaxias.*
- *Habitat and adjoining riparian habitat are fenced off to stock access.*
- *Off-stream watering points are provided for stock.*
- *No further damage to riparian vegetation.*

- *Damaged or depleted riparian vegetation is protected and (if necessary) supplemented by active revegetation works.*
- *Plans to clear vegetation lying adjacent to Dwarf Galaxias habitat will not impact upon water quality (no increase in sedimentation/nutrient levels/pesticides/herbicides etc).*
- *Plans to revegetate with plantation timber/crops will not impact upon overall water yield (and subsequently flow regime of Dwarf Galaxias habitat).*
- *Proposals to translocate aquatic species into Dwarf Galaxias habitat are subject to relevant risk management processes according to relevant national and State guidelines.*

Source: (Saddlier, Jackson and Hammer 2010)

Dwarf Galaxias was not recorded within the contract area, however there are records for this species within close proximity to the contract area. Therefore, the Recovery Plan should be reviewed and the above guidelines should be incorporated into the precinct structure planning of the contract area.

A National Recovery Plan is currently being prepared for the Southern Brown Bandicoot *Isoodon obesulus* which may impact the ongoing management of the Cardinia Creek riparian corridor. A National Recovery Plan is in preparation for the Growling Grass Frog *Litoria raniformis* which may have recommendations for the management of the wetlands within the contract area (DEWHA 2010b).

4.1.4 Conservation Advices

Conservation advices provide information to various stakeholders on implementing on-ground actions for identifying threats to communities or species of concern and on developing management plans to control those threats.

There are 12 conservation advices for the Port Phillip and Westernport Area. These include:

- Alpine *Sphagnum* Bogs and Associated Fens
- *Amphibromus fluitans* (River Swamp Wallaby Grass)
- Gippsland Red Gum (*Eucalyptus tereticornis subsp. mediana*) Grassy Woodland and Associated Native Grassland
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of Southern-eastern Australia
- Natural Temperate Grassland of the Victorian Volcanic Plain
- *Neophema chrysogaster* (Orange Bellied Parrot)

- *Prasophyllum colemaniae* (Swamp Fireweed, Smooth-fruited Groundsel)
- *Thalassarche chrysostoma* (Grey-headed Albatross)
- *Thalassarche melanophris* (Black-browed Albatross)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Source (DEWHA 2010b)

4.1.5 Threat Abatement Plans

Threat abatement plans are created to address key threatening processes outlined for threatened species under the EPBC Act. Threat abatement plans aim to provide a national framework by which coordinated and integrated management of key threatening processes are undertaken.

Threat Abatement Plans that may be implemented within the contract area are:

- THREAT ABATEMENT PLAN for competition and land degradation by rabbits 2008
- THREAT ABATEMENT PLAN For Dieback caused by the root-rot fungus *Phytophthora cinnamomi*
- THREAT ABATEMENT PLAN infection of amphibians with chytrid fungus resulting in chytridiomycosis
- THREAT ABATEMENT PLAN for predation by the European red fox 2008
- THREAT ABATEMENT PLAN for predation by feral cats 2008

Source (DEWHA 2010b)

These threat abatement plans set out objectives for each threat management and provide actions on how to achieve set objectives.

4.2 State policy and legislation

4.2.1 Planning and Environment Act 1987

The purpose of the *Planning and Environment Act 1987* is to establish a framework for planning the use, development and protection of land in Victoria in the present and long-term interests of all Victorians.

Under the Act a Planning Permit is required for development within Victoria which may have significant effects on the environment, or which the responsible authority considers the

environment may have on the use or development. The objectives of planning and the planning framework include (among others):

- To provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity.
- To establish a system of planning schemes based on municipal districts to be the principal way of setting out objectives, policies and controls for the use, development and protection of land.
- To ensure that the effects on the environment are considered and provide for explicit consideration of social and economic effects when decisions are made about the use and development of land.
- To facilitate development which achieves the objectives of planning in Victoria and planning objectives set up in planning schemes.

Clause 52.17 of the Planning Scheme is the principle action of the Planning and Environment Act within the Scheme relating to native vegetation impacts, that requires a permit to remove, destroy or lop native vegetation, unless:

- The application is exempt under the Table of Exemptions 52.17-6 within the Clause.
- A Native Vegetation Precinct Plan applies.

4.2.2 Flora and Fauna Guarantee Act 1988

The *Flora and Fauna Guarantee Act 1988* (FFG Act) was legislated to ensure the continued survival of all Victorian species of flora and fauna and all Victorian communities of plants and animals. A key component of the FFG Act is to ensure the sustainable use of flora and fauna resources whether they are threatened or not.

The FFG Act lists:

- threatened species of flora and fauna;
- threatened communities of flora and fauna;
- protected flora; and
- potentially threatening processes.

There were no threatened flora species listed under the FFG Act recorded during this survey within the contract area. There are also no listed threatened communities known to occur within the contract area.

Two flora species listed as threatened under the FFG Act is considered to have a moderate likelihood of occurrence within the contract area:

- Purple Diuris *Diuris punctata* var. *punctata*
- Matted Flax-lily *Dianella amoena*

Two FFG listed fauna species were recorded within the contract area, two FFG listed fauna species are assessed as having a high likelihood of occurrence and an additional three fauna species are assessed as having a moderate likelihood of occurrence within the contract area.

The two FFG listed fauna species recorded within the contract area include:

- Blue Billed Duck *Oxyura australis*
- Ballion's Crake *Porzana pusilla*

The FFG listed fauna species thought to have a high likelihood of occurrence are:

- Dwarf Galaxias *Galaxiella pusilla*
- Freckled Duck *Stictonetta naevosa*

The FFG listed fauna species thought to have a moderate likelihood of occurrence are:

- Growling Grass Frog *Litoria raniformis*
- Swamp Skink *Egernia coventryi*
- White-bellied Sea Eagle *Haliaeetus leucogaster*

Protected Flora are species classified as protected to regulate exploitation including removal from the wild for cultivation and the cut-flower industry. Among others the list includes all members of the Asteraceae (daisies) family, all members of Epacridaceae (heaths), all members of Orchidaceae (orchids) and all Acacias (excluding Silver Wattle, Early Black Wattle, Lightwood, Blackwood and Hedge Wattles). A number of species found throughout the contract area are listed under the FFG Act 1988 as Protected Flora.

On public land, a permit is required if proposed works may kill, injure or disturb listed protected flora species.

4.2.3 Environmental Effects Act 1978

The Environmental Effects Acts 1978 only relates to public works deemed so by Order of the Minister and stated in the Government Gazette. If this is the case then the Act states that:

> "*Before commencing any public works to which this Act applies, the proponent must cause an Environment Effects Statement to be prepared and submit it to the Minister for the Minister's assessment of the environmental effects of the works.* [and] *A copy of the statement shall be submitted to the relevant Minister by the proponent.* [and] *A statement under this Act shall be prepared and submitted at the expense of the proponent of the works.*"

Source: (VLPD 2010)

4.2.4 Environment Protection Act 1970: State Environmental Protection Policy (Waters of Victoria) 2003

State Environment Protection Policies (SEPPs) express, in law, the Victorian community's expectations, needs and priorities for protecting and sustainably using the environment, and the social and economic values that depend on it. Made under the *Environment Protection Act 1970*, SEPPs are a means of setting agreed outcomes against which we can measure progress and coordinate environment protection throughout Victoria.

The SEPP Waters of Victoria then sets the framework for government agencies, businesses and the community to work together, to protect and rehabilitate Victoria's surface water environments. The Waters of Victoria SEPP details the uses and values of our water environments (beneficial uses), sets measurements and indicators so we know how well they are being protected (environmental quality objectives) and outlines what needs to be done to protect them (attainment program).

The result is a 'blueprint' for achieving agreed environmental outcomes and strategic directions for protecting Victoria's water. More detailed management frameworks and tools are provided through statewide strategies (e.g. the Victorian River Health Strategy) and more detailed actions are provided in regional plans developed by catchment, coastal and water management bodies.

The *Environment Protection Act 1970* also adopts as a principle tenet the Precautionary Principle where, in the threat of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

4.2.5 Catchment and Land Protection Act 1994

The *Catchment and Land Protection Act 1994* (VLPD 2007) contains provisions relating to the integrated management and protection of catchments, encourages community participation in the management of land and water resources, and sets up a system of controls for the management of noxious weeds and pest animals. This Act also provides a legislative framework for the integrated and coordinated management of private and public land at a catchment level which:

- Focuses on long-term land productivity while also conserving the environment.
- Ensures that the quality of the State's land and water resources and their associated plant and animal life are maintained and enhanced.
- Establishes processes that can be used to assess the condition of the State's land and water resources and the effectiveness of land protection measures.
- Establish processes to encourage and support participation of land holders, resource managers and other members of the community in catchment management and land protection.

- Establishes and supports the operation of the Victorian Catchment Management Council and the Catchment Management Authorities.

- To provide for the control of noxious weeds and pest animals.

The study site supports a number of weeds that are declared noxious under the CaLP Act (Appendix 2). Plants occurring on this list are known, or have the potential to, result in detrimental environmental or economic impact.

Under the CaLP Act declared noxious weeds are categorised into four groups depending on their known and potential impact and specific circumstances for each region. These categories include:

- State Prohibited Weeds (S) are either currently absent in Victoria or are restricted enough to be eradicated. The Victorian Government is responsible for their control.

- Regionally Prohibited Weeds (P) in the Port Phillip Catchment Management Authority area are not necessarily widespread, but have the potential to become widespread. It is expected that weeds that meet this criteria can be eradicated from the region. For weeds considered to be Regionally Prohibited it is the responsibility of the land owner to control these weeds on their land but not on adjacent roadside reserves.

- Regionally Controlled Weeds (C) are usually widespread but it is important to prevent further spread. It is the responsibility of the landowner to control these weeds on their property and on adjacent roadside reserves.

- Restricted occur in other states and are considered to be a serious threat to primary production, Crown land, the environment and/or community health if they were traded in Victoria. No weeds are currently listed as Restricted Weeds.

The contract area supports regionally controlled noxious weeds listed by DPI (2010) (Appendix 2). The control of these weeds on private land and adjacent roadsides is the responsibility of the landholder. The landholder must take all reasonable measures to prevent their spread and control these weed species (DPI 2010).

4.2.6 Victoria's Native Vegetation Management Framework: A Framework for Action

A principle tenet of Victoria's *Native Vegetation Management Framework* is the objective of retention and management of native vegetation (DNRE 2002). According to the DNRE (2002) the goal of native vegetation management in Victoria is to achieve:

> *A reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain.*

Four individual actions to achieve the above goal are outlined in the DNRE's (2002) Framework. These are:

- active improvement of the quality of existing vegetation;
- avoidance or minimisation of further permanent losses through clearing;
- strategic increase in the cover of native vegetation through biodiverse revegetation; and
- the flexibility that is required to support landholders as they move towards more sustainable land use.

To achieve the most strategic outcome for native vegetation across Victoria the *Native Vegetation Management Framework* embraces a system of classification determining both the land protection and conservation significance of any given site. The Net Gain methodology is intended to provide a systematic approach that ensures the conservation of the majority of remnant vegetation across Victoria. DNRE (2002) has established a three step approach to use when applying the Net Gain process. These steps are:

- To avoid adverse impacts, particularly through vegetation clearance.
- If impacts cannot be avoided, to minimise impacts through appropriate consideration in planning processes and expert input to project design or management.
- Identify appropriate offset options.

The outcome of the Net Gain process is intended to ensure that the most significant vegetation incurs no losses (exceptions may apply) and less significant vegetation is adequately managed through commensurate offsets based on the level of significance. During the planning process, it must be ensured that every effort has been made to avoid clearing remnant vegetation at the outset and, if clearance is unavoidable, impacts have been minimised. Preference must also be given to the avoidance of damage or loss of the most significant vegetation and reduce the amount of overall vegetation cleared.

The Precinct development is in the early phases of structure planning that will determine future land use. The Native Vegetation Framework requires that the avoidance of native vegetation is a priority. When vegetation cannot be avoided, vegetation loss and other detrimental impacts must be minimised.

Relatively little of this site's remnant vegetation remains within the contract area. This presents an opportunity, through appropriate (re)zoning, to protect what little remains and avoid future impacts to native vegetation through the integration of a precinct reserve system within the Planning Scheme.

Figure 4 displays the location of native vegetation, including scattered trees within the contract area. Section 5.1 discusses the Net Gain three step process and opportunities to avoid and minimise native vegetation loss during the rezoning and design stages.

4.2.7 Port Phillip and Westernport CMA Native Vegetation Plan

Victoria's *Native Vegetation Management Framework* states that regional vegetation plans will provide regional guidelines for responsible authorities in determining permit applications to remove, destroy or lop native vegetation. The *Port Phillip and Westernport Native Vegetation Plan* (PPWCMA 2006) is to be used as a reference document for the conservation status of native vegetation communities in the region. The *Native Vegetation Plan* represents the minimum requirement for offsets and describes the:

- overall policy response to clearing applications.
- requirements for offsetting the loss of remnant but relatively intact areas of native vegetation.
- requirements for offsetting the loss of scattered, individual trees of various ages, sizes and growth rates.
- requirements for offsetting the loss of scattered trees smaller than medium old trees and slow-growing tree species.
- requirements for offsetting grass trees and tree ferns.
- requirements for offsetting harvesting of timber from naturally established native forest on private land.

The *Native Vegetation Plan* applies where *parcels of land greater than 4ha with less than 8 scattered trees per hectare* or where *parcels of land less then 4ha with any number of scattered old trees per hectare* (DNRE 2002). This applies to very large, large and medium old trees and any trees less than medium trees.

Appendix 3.4 of the *Native Vegetation Plan* states that "where protection and recruitment is not required by Victoria's *Native Vegetation Management Framework* and there is no practical way to achieve protection, a *recruitment only offset* may be applied" (PPWCMA 2006). However, it is part of DSE Port Phillip Region's focus to require the *protection and recruitment* prescription in most planning applications (PPWCMA 2006). Table 3.4C of the *Native Vegetation Plan* sets out the offset requirements for the loss of trees of various ages and sizes.

4.2.8 Wildlife Act 1975 and associated regulations

The purpose of the *Wildlife Act 1975* is to establish procedures in order to promote the protection and conservation of wildlife, prevent wildlife from becoming extinct, and to prohibit and regulate the conduct of persons engaged in activities concerning or related to wildlife. The Act requires people engaged in wildlife research (such as fauna surveys, salvage or translocation activities) to obtain a permit in order to ensure that these activities are undertaken with appropriate conservation and protection measures.

Furthermore, the Act requires that a permit is obtained for the management of wildlife where:

- Wildlife is damaging any building, vineyard, orchard, crop, tree, pasture, habitat or other property.
- For the purposes of the management, conservation, protection or control of wildlife or for the purposes of education about wildlife, research into wildlife or scientific or other study of wildlife.
- For aboriginal cultural purposes.
- For the purposes of enabling the care, treatment or rehabilitation of sick, injured or orphaned wildlife.
- For the purposes of ensuring the health or safety of any person or class of persons.
- To support a recognised wildlife management plan.
- To make provision for the custody, care and management of wildlife, held under another authorisation or a license which has been suspended, during the period of that suspension.

Under the *Wildlife Act 1975* land can also be designated as State Game Reserves, State Game Refuges, State Faunal Reserves, Game Management Stations, or other classifications as specified, for the preservation and conservation of wildlife. A plan of management is to be developed as soon as practicable for each reserve once gazetted.

4.2.9 Wildlife Regulations 2002

The objectives of the *Wildlife Regulations 2002* are:

- To make further provision in relation to the licensing system established by section 22 of the Wildlife Act 1975.
- To prescribe fees, offences, royalties and various other matters for the purposes of the Wildlife Act 1975.
- To provide for exemptions from certain provisions of the Wildlife Act 1975.

Under *Wildlife Regulations 2002* a person, unless licensed, permitted or authorised to do so under the Act:

- Must not willfully damage, disturb or destroy any wildlife habitat.
- Must not use a bait, lure, poison, decoy, or live animal to attract wildlife for the purpose of taking that wildlife.
- Must not use a firearm from an aircraft, motor vehicle, boat, or any other vehicle to take wildlife.

- Must not use an artificial light, electronic device, or recorded sound to hunt or take wildlife.

- Must not use a gun, bow or other weapon, trap, or any other equipment or substance for the purpose of taking wildlife.

Authorisation to conduct wildlife research or wildlife management can be obtained under the Act, and is subject to any conditions, limitations or restrictions placed on that authorisation. Proponents must allow inspection by an authorised officer, at any reasonable time, for the purpose of monitoring compliance with this Act.

4.2.10 Water Act 1989

The *Water Act 1989* provides the framework for allocating surface water and groundwater throughout Victoria. The Act allows authorities and individuals, via various entitlement mechanisms, to use water for commercial or irrigation purposes. Some licenses enable withdrawals of water directly from streams, others from groundwater. The *Water Act 1989* also defines water that is set aside for the environment under the Environmental Water Reserve.

The purpose of the Act is to integrated management of all elements of the terrestrial phase of the water cycle. This includes promotion of orderly, equitable and efficient water use, greater community involvement, integration of surface and subsurface flow management, to promote conservation and environmental enhancement and provide for the protection of catchment conditions.

4.2.11 Port Phillip and Western Port Regional Catchment Strategy

A primary function of the Port Phillip and Westernport Catchment Management Authority is to prepare a catchment management strategy for its region and coordinate and monitor its implementation. The *Port Phillip and Western Port Regional Catchment Strategy* describes the natural assets of the region, how natural assets are related, and provides a management framework for their conservation and sustainable use. The *Regional Catchment Strategy* focuses on four main groups of catchment assets – water resources (sustainable water use and healthy waterways), land (appropriate land management and sustainable productivity), biodiversity (healthy, diverse and enduring ecosystems) and the people of the region (community participation working to achieve sustainability).

The *Regional Catchment Strategy* is an important planning and working document for all organisations and people involved in natural resource management in the region, including government agencies and councils, water authorities and Landcare and community groups. It provides a framework for effort, an investment guide, a means of integrating policy, and an action plan for catchment works. It allocates tasks and defines roles for many stakeholders in the delivery of environmental programs across the region. It is also a regional investment guide, informing the allocation of Victorian and Australian Government investment in natural resource management in the region.

4.2.12 Port Phillip and Western Port Regional River Health Strategy

The *Port Phillip and Westernport Regional River Health Strategy* was developed by Melbourne Water in consultation with the Port Phillip and Westernport Catchment Management Authority, their local community and key stakeholders. The *River Health Strategy* provides a five year blueprint for the stakeholders to work together to improve our rivers and creeks. It identifies waterway values (catchment based), threats to waterway values, and actions to address these threats. The Strategy identifies river health related objectives, activities and targets for rivers located within the Maribyrnong, Werribee, Bunyip and Yarra river basins.

The *Port Phillip and Westernport Regional River Health Strategy* also covers drainages within the Westernport, Werribee and Maribyrnong catchments which, until now, had no designated regional management authority. Under the new arrangements, Melbourne Water is now the regional drainage, waterways and floodplain manager for the entire region, and is responsible for river health, management and maintenance of regional drains as well as identifying and maintaining areas subject to flooding. This arrangement will also provide more consistent and coordinated delivery of waterway health and improvement programs.

4.2.13 Victoria's Biodiversity Strategy

Victoria's Biodiversity Strategy set out guidelines for achieving broad biodiversity objectives as set out below:

- *there is a reversal, across the entire landscape, of the long-term decline in the extent and quality of native vegetation, leading to a net gain with the first target being no net loss by the year 2001.*
- *the ecological processes and the biodiversity dependent upon terrestrial, freshwater and marine environments are maintained and, where necessary, restored.*
- *the present diversity of species and ecological communities and their viability is maintained or improved across each bioregion.*
- *there is no further preventable decline in the viability of any rare species or of any rare ecological community.*
- *there is an increase in the viability of threatened species and in the extent and quality of threatened ecological communities.*

Victoria's Biodiversity Strategy is achieved through adherence to the Acts and policy guidelines aforementioned.

4.3 Local policy and legislation

4.3.1 Local Government Planning Schemes

Local Government Planning Schemes set out policies and provisions for the use, development and protection of land for municipalities in Victoria. These are legal documents prepared by the local council or the Minister for Planning, and approved by the Minister.

The development of the Planning Schemes is based on a comprehensive set of planning provisions for Victoria outlined in the Victorian Planning Provisions (VPPs). VPPs were introduced as part of a planning reform process in 1996 to simplify and standardise the planning process.

Provision 52.17 of the VPP outlines objectives for the protection and conservation of native vegetation. The purpose of 52.17 is to protect and conserve native vegetation, to reduce the impact of land and water degradation and provide habitat for plants and animals, to avoid, minimise or Offset vegetation loss, and to manage vegetation near buildings to reduce the threat to life and property from wildfire.

Before deciding on an application, in addition to the decision guidelines in Clause 65, the responsible authority must consider, as appropriate:

- Victoria's Native Vegetation Management – A Framework for Action (DNRE 2002).
- Whether the proposed development can be located and designed to avoid the removal of native vegetation.
- Whether the proposed development is located and designed to minimise the removal of native vegetation.
- The need to offset the loss of native vegetation having regard to the conservation significance of the vegetation.
- The conservation and enhancement of the area.
- The preservation of and impact on the natural environment or landscape values.
- Any relevant approved Regional Vegetation Plan.
- Whether the proposed development is in accordance with any property vegetation plan that applies to the site.
- The cumulative impact of native vegetation removal on biodiversity conservation and management.

Exemptions apply in certain circumstances, as outlined in Clause 52.17-6, Table of Exemptions.

Almost the entire Precinct is covered by an Urban Growth Zone, a very small section of Public Park and Recreation Zone is present in the south western corner of the contract area. A small part of the contract area along Cardinia Creek and surrounding the wetlands is covered by a Land Subject to Inundation Overlay.

4.3.2 Local Planning Policies/Strategies

The City of Casey has published at least two strategy statements relevant to biodiversity conservation in the Casey municipality which aim to identify biodiversity assets and outline conservation measures:

- *City of Casey Biodiversity Strategy*. Report prepared for the City of Casey by Ecology Australia, Fairfield, Victoria (McMillan et al. 2003).
- *Casey Revegetation Strategy*. Report for the City of Casey by Brett Lane and Associates, North Carlton, Victoria (Brett Lane and Associates 2008).

5. KEY BIODIVERSITY ISSUES AND IMPLICATIONS

The area of highest conservation priority within the contract area consists of the remnant Swamp Scrub, woodlands and wetlands within the Cardinia Creek Corridor. Other areas of wetland and drainage-line habitat throughout the precinct also have significant value.

Land-use change within the contract area, such as residential, business or industrial developments have the potential to significantly impact existing native vegetation, ecosystem function, water quality, threatened species habitat and local and regional biodiversity, primarily through the direct removal of native vegetation and habitat. However, approximately two percent of the contract area comprises indigenous vegetation. This relatively small proportion of the contract area should be retained for conservation and rehabilitation, as required first and foremost by Victoria's *Native Vegetation Management: a Framework for Action* (DNRE 2002). Furthermore, most areas of existing or potential habitat for threatened species coincide with native vegetation patches within the contract area.

The Cardinia Creek Corridor has been identified by DSE (2008a) as an area of high native vegetation connectivity within the region and therefore has significant biodiversity value. Potential biolinks within Precinct 11 and the neighbouring Precinct 13, *Clyde North,* can play an important role in linking core habitats between Western Port Bay and the foothills of the Great Dividing Range. Cardinia Creek flows into the Westernport Bay Ramsar site, which is located less than 20 kilometres south of the contract area, so hydrological changes within PSP Area 11 also have the potential to impact this RAMSAR site. Creek-line, wetlands and riparian vegetation are key biodiversity areas within the contract area and should have management plans that include ongoing monitoring to identify changes and associated hazards. Furthermore, a *Land Subject to Inundation Overlay* (LSIO) occupies 4.7 hectares of the contract area in the Cardinia Creek riparian zone (DPCD 2009a). This area coincides with native vegetation patches for the most part and represents potential habitat for wetland birds during times of flood.

5.1 Opportunities to reduce potential impacts

The following impact minimisation options should be considered for the PSP area:

- The avoidance and therefore retention of native vegetation through careful placement of roads, infrastructure, building lots and open space during the design phase.
- The retention of wetlands including areas of open water and other wetland habitat detailed in section 5.1.3. These should not be used as storm water retention ponds.
- The avoidance of existing roadside vegetation through the purchase of adjacent cleared private land when planning for road duplication.
- The retention of scattered trees within the contract area.
- The staged removal of drainage-line habitat at the construction phase when unavoidable habitat losses are incurred.

- The salvage and re-location of Southern Toadlet during breeding season prior to the construction phase if unavoidable drainage-line habitat losses are incurred.

- The adoption of conservation aims in the rezoning and PSP planning process.

There is potential within the Precinct Structure Planning process to provide for the best possible ecological outcomes during and after the rezoning and subsequent development of the contract area. The sections below elaborate on some of these options. More information and advice is available upon request through consultation with the authors of this report. A *Biodiversity Plan* and a *Conservation Management Plan* will need to be prepared in order to address implementation provisions required for conservation management. A Conservation Management Plan will detail design, staging, mitigation and implementation of the precinct development to protect, enhance, and mitigate impacts on species, communities and habitats, as per DSE's Precinct Structure Planning Kit (DSE 2010c).

5.1.1 Creation of habitat within constructed wetlands

Drainage-lines and farm dams within the contract area currently support threatened species, and hold greater floristic diversity and habitat value compared to surrounding grazing land. Drainage-line modification may need to be undertaken to provide for increased stormwater run-off as a result of possible development of the contract area. Unavoidable loss of aquatic habitat may result after existing drainage-lines are widened and deepened to create wetlands and retarding basins. In order to mitigate this potential habitat loss, it may be appropriate to consider staging the removal of habitat and/or creating constructed wetlands adjacent to drainage-lines and allowing the drainage-lines to remain in place.

If newly constructed wetlands are to be created, significant opportunities exist for the creation of aquatic habitat. Constructed wetlands could be planted with a variety of indigenous aquatic and semi-aquatic vegetation, such as sedges, rushes and herbs, to create habitat for a wide range of flora and fauna including amphibians, reptiles and birds. An appropriately qualified ecologist should be engaged to create a plant species schedule for revegetation which is appropriate to soil type, hydrology, and other site conditions. Appropriate management should be undertaken to maintain the planting, and control weeds, especially in the formative years.

Many wetland birds, including threatened and migratory species were observed nesting on islands within wetlands during the current assessment. Islands could be considered for incorporation into the constructed wetland design within PSP 11 in order to provide additional predator-free roosting and breeding habitat for threatened species. Islands create a higher ephemeral zone to open water ratio, by increasing the lineal shore-line distance which provides additional shore-line habitat. Islands can buffer winds and reduce wave action, thereby improving water quality by reducing erosion of revegetated banks. Constructed islands can also play a role in fluid dynamics by reducing and dispersing input flows, thereby allowing sediments to settle. Revegetation may be difficult to establish and maintain on islands due to the impacts of high density bird populations. Artificial nest-boxes, perches and erected hollow trunks and logs could therefore be considered for introduction to allow vegetation to establish and persist on constructed islands.

5.1.2 Domestic animals and feral predators

The development of the contract area may also result in the need for designated passive recreation areas. Wetland habitats and associated passive recreation areas, including public open space, should be designed to exclude domestic pets, especially cats and dogs, which have the potential to become predators of native birds and bird's eggs, and disrupt their breeding, foraging and nesting patterns.

Significant numbers of foxes have been recorded within the contract area and may increase in numbers after development due to the increase in available food and shelter resources. Fox and cat control within the contract area should be undertaken as a regionally coordinated program in order to protect and enhance biodiversity values, including habitat values for threatened wetland birds.

5.1.3 Protection and enhancement of existing biodiversity assets

It is estimated that only 7% of former native vegetation remains within the City of Casey, of which a significant proportion has been highly modified (McMillan et al. 2003). Native vegetation within Investigation PSP 11 is therefore an especially important biodiversity asset given the little native vegetation that remains within the region. The majority of this native vegetation occurs within the Cardinia Creek Corridor (Section 3.2). Other areas of wetland and drainage-line habitat throughout the precinct also have significant value.

The management of retained vegetation and habitat should aim to control threatening processes currently underway with the contract area, including:

- weed invasion;
- lack of habitat connectivity;
- inappropriate fire regimes; and
- feral animal predation on native fauna.

A detailed ecological management plan prepared by an appropriately qualified ecologist, prescribing management for a >10 year period, is needed to guide appropriate ecological restoration works within the contract area. The following paragraphs summarise the primary threatening processes occurring within the contract area and make suggestions for remedial actions.

Woody weed control

Many woody weed species occur at significant densities within the contract area, including:

- Willows *Salix* spp,
- Sweet Pittosporum *Pittosporum undulatum*, and

- Blackberry *Rubus fruticosus* spp. agg.

Most woody weeds could be easily controlled using the 'cut and paint' method. However, Blackberry dominates the understory in the damp areas near the Cardinia Creek and would be difficult to eliminate due to the large infested area. Strategic control of Blackberry on the infestation's margins and within areas of highest vegetation quality would allow native species to re-establish.

Ecological burns

A schedule for ecological burns undertaken in a mosaic pattern and at varied intervals should be considered for the remnant woodland in the south of the contract area in order to promote and enhance floristic diversity. This should be followed up with weed control.

Rehabilitation and conservation

There is potential to improve the habitat values through implementation of rehabilitation and conservation programs, and through improved land and water use practices that promote natural regeneration of the site's wetlands and riparian EVCs. Several hectares of non-indigenous, plantation vegetation were recorded east of the Cardinia Creek corridor. This site is likely the result of revegetation efforts in the early 1980s. While the site does not qualify as a Habitat Zone, it offers a considerable range of habitat values to regional fauna. This area represents an opportunity for ecological enhancement through introduction of indigenous understorey through supplementary planting using appropriate species.

5.1.4 Buffer zones and habitat links

While the majority of native vegetation within the contract area occurs within the Cardinia Creek corridor, several other smaller areas of native vegetation and habitat occur within the contract area, such as:

- Large farm dams in the central sectors; and
- Drainage-lines throughout the contract area.

These remnants constitute habitat for a range of indigenous fauna including regional and state significant species. There is potential to increase the viability of existing habitat within the contract area by linking the above mentioned habitat with 'core habitat' in the Cardinia Creek corridor, through the creation of revegetated habitat links. Habitat links could be incorporated with the potential network of constructed wetlands described in section 5.1.1.

Habitat links should also be designed with the aim of linking habitat beyond the contract area in the foothills of the Great Dividing Range and Western Port Bay. A recent study commissioned by DSE explores existing and potential habitat connectivity and associated issues in the south-eastern region of Melbourne (McCaffrey and Henry 2010) and should be referred to when designing habitat links within and beyond the contract area.

A reserve system design for the PSP area should consider to the following principles:

- The retention and conservation of all areas of remnant vegetation patches.
- The retention of all areas of habitat for threatened fauna species (including areas dominated by exotic or non-indigenous flora).
- The establishment of habitat links between remnant vegetation and habitat.
- The rehabilitation of existing highly modified habitat to link areas of existing higher quality habitat within the contract area.
- The establishment of habitat links which integrate habitat within the contract area to habitat within neighbouring precincts and beyond.

Areas of non-indigenous vegetation defined as public open space within the potential PSP area should also be incorporated into buffer zones to protect and enhance areas of fauna habitat. There is also potential to utilise roads and footpaths wherever possible to separate reserves from developable areas.

6. CONCLUSION

Native vegetation and fauna habitat within the C21 Business Park is confined primarily to the Cardinia Creek riparian corridor and adjacent wetlands in the east of the contract area. Much of this habitat consists of Swamp Scrub of relatively high quality. This corridor is identified as regionally significant Biosite #6888 *Cardinia Creek – Lower* (DSE 2005a) and is contiguous with riparian habitat in the *Clyde North* PSP Area and PSP Area 5. The Cardinia Creek Corridor represents an area of native vegetation connectivity, as defined by DSE (DSE 2008a) and links habitat in the foothills of the Great Dividing Range in the north with internationally significant Westernport Ramsar wetlands to the south. An intact woodland remnant occurs within the south of the contract area, adjacent to the riparian corridor.

The remainder of the contract area is dominated by pasture used for grazing livestock and has limited value as habitat, with the exception of drainage-lines, farm dams and marshy areas of pasture that may be utilised by fauna species, including wetland birds (Pizzey and Knight 2007).

One hundred and sixty-four flora species were recorded within the contract area (Appendices 1 & 2). Seventy-three (45%) of these species were indigenous. No threatened flora species were recorded during the current assessment. Thirty-nine threatened flora species have been recorded within 10 kilometres of the contract area (DSE 2009b) or are predicted to occur by DEWHA (2010a). Eight of these species are considered to have at least a moderate likelihood of occurrence, based on nearby records and suitable habitat within the contract area.

A total of **8.28 hectares** of native vegetation comprising **2.40 habitat hectares** was defined as meeting DSE's (2004a) native vegetation cover thresholds within the contract area. Six EVCs were recorded within the contract area. Swamp Scrub occupies the largest proportion of native vegetation within the contract area and occurs as a large remnant patch immediately adjacent to the Cardinia Creek.

Ninety indigenous vertebrate fauna species were recorded within the contract area, comprising eight amphibians, five reptiles, 65 birds, 3 fish and 9 mammals. It should be noted that surveys were not conducted for Growling Grass Frog and Southern Brown Bandicoot during this assessment. Eleven fauna species listed as rare, threatened or migratory species under state and federal legislation were recorded within the contract area during the current assessment, including ten wetland birds and one amphibian:

- The Intermediate Egret is listed as critically endangered in Victoria and listed under the FFG Act.
- The Blue-billed Duck is listed as endangered in Victoria (DSE 2009d) and listed under the FFG Act.
- Baillon's Crake and Eastern Great Egret are both listed as Vulnerable in Victoria (DSE 2009d) and are listed as threatened under the FFG Act.
- The Australasian Shoveler, Hardhead, Musk Duck and Royal Spoonbill are listed as vulnerable in Victoria (DSE 2009d).

- The Latham's Snipe and Pied Cormorant are listed as near threatened in Victoria (DSE 2009d); the Latham's Snipe is also listed as a migratory species under the *EPBC Act* .

- One amphibian, Southern Toadlet, was recorded within the precinct and is listed as vulnerable in Victoria (DSE 2009d).

Fifty-three fauna species of state or national significance have been recorded within five kilometres of the contract area or are predicted to occur by DEWHA (2010a) (Appendix 10), including many threatened wetland birds. Twelve species recorded on AVW and EPBC searches are considered to have a high likelihood of occurrence within the contract area. A further 11 species are considered to have at least a moderate likelihood of occurrence within the contract area (Appendix 10).

Large constructed wetlands and dams with vegetated aquatic margins within the Cardinia Creek riparian corridor and in the centre of the contract area offer excellent habitat for a range of threatened species, including a suite of threatened wetland birds. These wetlands have been assessed as being of high regional habitat significance (Costello, Timewell and Organ 2001). At least five threatened birds have been recorded within this wetland during *previous surveys*, which include:

- Hardhead

- Australasian Shoveler

- Blue-billed Duck

- Freckled Duck

- Musk Duck

Source: (DSE 2007a).

Fauna habitat also includes several hectares of planted vegetation adjacent to the riparian corridor consisting of non-indigenous native plants such as eucalypts, Giant Honey-myrtle *Melaleuca armillaris* subsp. *armillaris* and introduced European trees (Figure 6). This area was classified as DTV during the current assessment, however, it holds significantly more value as habitat for native fauna compared to surrounding farmland within the contract area. Flowering Eucalypts within this area, for example, provide food resources for Swift Parrot *Lathamus discolor*, which has been recorded within five kilometres of the contract area (DSE 2009c).

There are other areas of native (non-indigenous) and exotic (introduced) vegetation, including areas of regenerating Swamp Scrub and other native vegetation that does not meet the DNRE (2002) threshold for consideration under Victoria's *Native Vegetation Management Framework*. Some of these areas occur within roadsides and drainage-lines within the contract area. Whilst highly modified or immature, some of these areas comprise relatively complex vegetation structures and floristic diversity and are considered habitat for threatened fauna species, such as threatened wetland birds and amphibians. Non-indigenous planted Eucalypts and other established tree species occur along fence-lines and roadsides, in addition to established trees

within extensive gardens surrounding the residence. All areas of non-indigenous trees and plantings are important for habitat connectivity within the contract area.

Large trees containing hollows and canopy habitat are present as scattered indigenous trees and as planted exotic and non-indigenous eucalypts along fence-lines and roadsides. Established trees, especially eucalypts should be retained for their value as habitat for threatened woodland birds. All other areas of habitat, both indigenous and non-indigenous, including roadsides, wetlands, drainage-lines and areas of woodland should also be considered for retention.

It is estimated that only 7% of former native vegetation remains within the City of Casey, of which a significant proportion has been highly modified (McMillan et al. 2003). Patterns of vegetation clearance within the contract area are consistent with those undertaken historically throughout the City of Casey, whereby, the majority of the contract area has been cleared for agriculture, and remaining native vegetation has been modified to varying degrees. All remnant vegetation and all remaining habitat, both indigenous and non-indigenous, is therefore significant as a local source of biodiversity and should be prioritised for retention and on-going ecological management as part of the *C21 Business Park* rezoning and any future development.

Roadsides within the City of Casey are often the only remaining indigenous habitat within an area and are therefore important as habitat corridors for fauna throughout the municipality (Brett Lane and Associates 2008). Native vegetation distribution within the contract area is consistent with general patterns of vegetation distribution within the City of Casey, in that roadsides comprise greater biodiversity compared to surrounding agricultural land. All roadsides, regardless of native vegetative cover, are important habitat within the contract area, given the potential occurrence of threatened species, including Southern Toadlet and Glossy Grass Skink in these areas.

Careful consideration should be given to wetlands and drainage lines within the contract area and the potential for the development to alter hydrology. Wetlands and wetland vegetation within the contract area are considered to be of 'high regional' significance (Costello 2003) and are critically important habitat, including breeding habitat, for threatened wetland birds and amphibians within the region. Any rezoning and subsequent precinct design should therefore avoid impacts to wetland areas due to the location of the majority of native vegetation within low-lying areas and the known and predicted occurrence of a suite of state and nationally threatened fauna species.

A reserve system, combining biolinks, public open space, buffer zones, revegetation areas and existing habitat managed for conservation, should be incorporated into the rezoning process. The Cardinia Creek riparian corridor has been identified by DSE (2008a) as an area of native vegetation connectivity and acts as a habitat link between core areas of habitat between the foothills of the Great Dividing Range and Westernport Bay. Priority should therefore be given to:

- the retention and conservation of all areas of remnant EVC habitat;
- the retention of all areas of habitat for threatened fauna species (including areas dominated by exotic or non-indigenous flora);
- the establishment of habitat corridors between remnant vegetation;

- the rehabilitation of highly modified habitat linking remnant vegetation; and
- the establishment of habitat corridors which integrate this contract area with habitat values within neighbouring precincts and beyond.

Areas of non-indigenous vegetation defined as public open space within the Precinct development should also be incorporated into buffer zones to protect and enhance areas of fauna habitat. There is also potential to utilise roads and footpaths wherever possible to separate reserves from development areas.

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Appendix 1. Indigenous Flora Species Recorded Within the Contract area

Life Form	Scientific Name	Common Name	EPBC	FFG	VROTS	Regional
Trees	**Mimosaceae**					
	Acacia mearnsii	Black Wattle		P		
	Myrtaceae					
	Eucalyptus camaldulensis	River Red-gum				
	Eucalyptus ovata subsp *ovata*	Swamp-gum				
	Eucalyptus radiata	Narrow-leaf peppermint				
	Santalaceae					
	Exocarpos cupressiformis	Cherry Ballart				
Shrubs	**Asteraceae**					
	Cassinia arcuata	Drooping Cassinia		P		
	Ozothamnus ferrugineus	Tree Everlasting		P		
	Senecio glomeratus	Annual Fireweed		P		
	Senecio minimus	Shrubby Fireweed		P		Reg
	Goodeniaceae					
	Goodenia ovata	Hop Goodenia				
	Malvaceae					
	Gynatrix pulchella s.l.	Hemp Bush				Reg
	Mimosaceae					
	Acacia verticillata	Prickly Moses		P		Reg
	Myrtaceae					
	Melaleuca ericifolia	Swamp Paperbark				
	Pittosporaceae					
	Bursaria spinosa	Sweet Bursaria				Reg
	Rhamnaceae					
	Pomaderris prunifolia var. prunifolia	Prunus Pomaderris				Reg
	Pomaderris racemosa	Cluster Pomaderris				Reg
	Rubiaceae					
	Coprosma quadrifida	Prickly Currant-bush				
	Violaceae					
	Melicytus dentatus s.l.	Tree Violet				Reg
Herbs	**Alismataceae**					
	Alisma plantago-aquatica	Water Plantain				Reg
	Amaranthaceae					
	Alternanthera denticulata s.l.	Lesser Joyweed				Reg
	Apiaceae					
	Centella cordifolia	Centella				
	Hydrocotyle spp.	Pennywort				
	Asteraceae					
	Cotula australis	Common Cotula		P		
	Euchiton spp.	Cudweed		P		
	Senecio quadridentatus	Cotton Fireweed		P		Reg
	Clusiaceae					
	Hypericum japonicum	Matted St John's Wort				Reg

Life Form	Scientific Name	Common Name	EPBC	FFG	VROTS	Regional
	Convolvulaceae					
	Dichondra repens	Kidney-weed				
	Crassulaceae					
	Crassula decumbens var. decumbens	Spreading Crassula				
	Crassula helmsii	Swamp Crassula				
	Geraniaceae					
	Geranium sp. 5	Naked Crane's-bill				Reg
	Pelargonium spp.	Stork's Bill				
	Hydrocharitaceae					
	Vallisneria americana var. americana	Eel Grass				Reg
	Lamiaceae					
	Lycopus australis	Australian Gipsywort				Reg
	Lemnaceae					
	Lemna disperma	Common Duckweed				
	Lythraceae					
	Lythrum hyssopifolia	Small Loosestrife				
	Onagraceae					
	Epilobium billardierianum	Variable Willow-herb				
	Epilobium hirtigerum	Hairy Willow-herb				
	Oxalidaceae					
	Oxalis spp.	Wood Sorrel				
	Polygonaceae					
	Persicaria decipiens	Slender Knotweed				
	Polygonum plebeium	Small Knotweed				Reg
	Ranunculaceae					
	Ranunculus spp.	Buttercup				
	Rosaceae					
	Acaena novae-zelandiae	Bidgee-widgee				
Graminoids (grass-like plants)	**Cyperaceae**					
	Carex appressa	Tall Sedge				
	Carex fascicularis	Tassel Sedge				Reg
	Carex spp.	Sedge				
	Cyperus gunnii subsp. gunnii	Flecked Flat-sedge				Reg
	Eleocharis acuta	Common Spike-sedge				
	Eleocharis sphacelata	Tall Spike-sedge				
	Isolepis fluitans	Floating Club-sedge				
	Isolepis inundata	Swamp Club-sedge				
	Isolepis spp.	Club Sedge				
	Lepidosperma elatius	Tall Sword-sedge				Reg
	Juncaceae					
	Juncus amabilis	Hollow Rush				
	Juncus bufonius	Toad Rush				
	Juncus caespiticius	Grassy Rush				
	Juncus holoschoenus	Joint-leaf Rush				
	Juncus pallidus	Pale Rush				
	Juncus procerus	Tall Rush				
	Juncus spp.	Rush				
	Juncus usitatus	Billabong Rush				
	Poaceae					

Life Form	Scientific Name	Common Name	EPBC	FFG	VROTS	Regional
	Austrodanthonia spp.	Wallaby Grass				
	Austrostipa spp.	Spear Grass				
	Glyceria australis	Australian Sweet-grass				Reg
	Lachnagrostis filiformis var. 1	Common Blown-grass				
	Microlaena stipoides var. stipoides	Weeping Grass				
	Phragmites australis	Common Reed				
	Poa labillardierei	Common Tussock-grass				
	Typhaceae					
	Typha domingensis	Narrow-leaf Cumbungi				
	Typha orientalis	Broad-leaf Cumbungi				
	Typha spp.	Bulrush				
	Xanthorrhoeaceae					
	Lomandra longifolia	Spiny-headed Mat-rush				
Scramblers/ Climbers	**Lauraceae**					
	Cassytha pubescens s.s.	Downy Dodder-laurel				
Ferns	**Azollaceae**					
	Azolla filiculoides	Pacific Azolla		P		

Appendix 2. Exotic flora species within the contract area

Life Form	Origin	Scientific Name	Common Name	CaLP Act listing
NON-INDIGENOUS NATIVE SPECIES				
Trees		**Mimosaceae**		
	#	*Acacia decurrens*	Early Black-wattle	
		Myrtaceae		
	#	*Corymbia maculata*	Spotted Gum	
	#	*Eucalyptus leucoxylon subsp. megalocarpa*	Large-fruit Yellow-gum	
	#	*Melaleuca armillaris subsp. armillaris*	Giant Honey-myrtle	
		Pittosporaceae		
	#	*Pittosporum undulatum*	Sweet Pittosporum	
Shrubs		**Mimosaceae**		
	#	*Acacia baileyana*	Cootamundra Wattle	
	#	*Acacia longifolia subsp. longifolia*	Sallow Wattle	
	*	*Acacia spp. (naturalised)*	Wattle (naturalised)	
EXOTIC SPECIES				
Trees		**Cupressaceae**		
	*	*Cupressus spp.*	Cypress	
		Fagaceae		
	*	*Quercus spp.*	Oak	
		Pinaceae		
	*	*Pinus radiata*	Radiata Pine	
		Salicaceae		
	*	*Populus alba*	White Poplar	
	*	*Salix spp.*	Willow	R
		Ulmaceae		
	*	*Ulmus spp.*	Elm	
Shrubs		**Rosaceae**		
	*	*Cotoneaster franchetii*	Grey Cotoneaster	
	*	*Crataegus monogyna*	Hawthorn	C
	*	*Malus spp.*	Apple	
	*	*Prunus spp.*	Prunus	
	*	*Rosa spp.*	Rose	
		Solanaceae		
	*	*Solanum pseudocapsicum*	Madeira Winter-cherry	
Herbs		**Asteraceae**		
	*	*Arctotheca calendula*	Cape Weed	
	*	*Aster subulatus*	Aster-weed	
	*	*Cirsium vulgare*	Spear Thistle	C
	*	*Conyza spp.*	Fleabane	
	*	*Helminthotheca echioides*	Ox-tongue	
	*	*Hypochoeris radicata*	Flatweed	

Life Form	Origin	Scientific Name	Common Name	CaLP Act listing
	*	*Lactuca serriola*	Prickly Lettuce	
	*	*Leontodon taraxacoides subsp. taraxacoides*	Hairy Hawkbit	
	*	*Sonchus asper s.l.*	Rough Sow-thistle	
	*	*Sonchus oleraceus*	Common Sow-thistle	
		Brassicaceae		
	*	*Cardamine hirsuta s.l.*	Common Bitter-cress	
	*	*Lepidium africanum*	Common Peppercress	
	*	*Raphanus raphanistrum*	Wild Radish	
	*	*Rorippa palustris*	Marsh Yellow-cress	
		Caryophyllaceae		
	*	*Cerastium glomeratum s.l.*	Common Mouse-ear Chickweed	
	*	*Stellaria media*	Chickweed	
		Chenopodiaceae		
	*	*Chenopodium murale*	Sowbane	
		Fabaceae		
	*	*Medicago polymorpha*	Burr Medic	
	*	*Trifolium repens var. repens*	White Clover	
	*	*Trifolium spp.*	Clover	
		Fumariaceae		
	*	*Fumaria muralis subsp. muralis*	Wall Fumitory	
	*	*Fumaria spp.*	Fumitory	
		Gentianaceae		
	*	*Centaurium erythraea*	Common Centaury	
		Geraniaceae		
	*	*Geranium dissectum*	Cut-leaf Crane's-bill	
		Haloragaceae		
	*	*Myriophyllum aquaticum*	Parrot's Feather	
		Malvaceae		
	*	*Malva parviflora*	Small-flower Mallow	
		Nymphaeaceae		
	*	*Nymphaea spp.*	Waterlily	
		Oxalidaceae		
	*	*Oxalis pes-caprae*	Soursob	R
		Onagraceae		
	*	*Ludwigia peploides subsp montevidensis*	Water primrose	
		Polygonaceae		
	*	*Acetosella vulgaris*	Sheep Sorrel	
	*	*Polygonum aviculare s.l.*	Prostrate Knotweed	
	*	*Rumex conglomeratus*	Clustered Dock	
	*	*Rumex crispus*	Curled Dock	
		Primulaceae		
	*	*Anagallis arvensis*	Pimpernel	
		Ranunculaceae		
	*	*Ranunculus repens*	Creeping Buttercup	
		Rubiaceae		
	*	*Galium aparine*	Cleavers	
		Solanaceae		
	*	*Solanum americanum*	Glossy Nightshade	
		Urticaceae		
	*	*Urtica urens*	Small Nettle	

Life Form	Origin	Scientific Name	Common Name	CaLP Act listing
		Veronicaceae		
	*	*Callitriche stagnalis*	Common Water-starwort	
	*	*Plantago major*	Greater Plantain	
	*	*Veronica arvensis*	Wall Speedwell	
Graminoids (grass like plants)		**Alliaceae**		
	*	*Agapanthus praecox subsp. orientalis*	Agapanthus	
		Amaryllidaceae		
	*	*Narcissus spp.*	Narcissus	
		Cyperaceae		
	*	*Cyperus eragrostis*	Drain Flat-sedge	
		Iridaceae		
	*	*Gladiolus spp.*	Gladiolus	
	*	*Romulea rosea*	Onion Grass	
		Juncaceae		
	*	*Juncus articulatus*	Jointed Rush	
		Poaceae		
	*	*Agrostis capillaris var. capillaris*	Brown-top Bent	
	*	*Anthoxanthum odoratum*	Sweet Vernal-grass	
	*	*Bromus catharticus*	Prairie Grass	
	*	*Bromus hordeaceus subsp. hordeaceus*	Soft Brome	
	*	*Cortaderia selloana*	Pampas Grass	
	*	*Cortaderia spp.*	Pampas Grass	
	*	*Cynodon dactylon var. dactylon*	Couch	
	*	*Dactylis glomerata*	Cocksfoot	
	*	*Ehrharta erecta var. erecta*	Panic Veldt-grass	
	*	*Ehrharta longiflora*	Annual Veldt-grass	
	*	*Glyceria maxima*	Reed Sweet-grass	
	*	*Holcus lanatus*	Yorkshire Fog	
	*	*Hordeum spp.*	Barley Grass	
	*	*Lolium perenne*	Perennial Rye-grass	
	*	*Lolium spp.*	Rye Grass	
	*	*Paspalum dilatatum*	Paspalum	
	*	*Paspalum distichum*	Water Couch	
	*	*Phalaris aquatica*	Toowoomba Canary-grass	
	*	*Poa annua*	Annual Meadow-grass	
	*	*Sporobolus africanus*	Rat-tail Grass	
	*	*Vulpia spp.*	Fescue	
Scramblers/ Climbers		**Commelinaceae**		
	*	*Tradescantia fluminensis*	Wandering Jew	
		Rosaceae		
	*	*Rubus fruticosus spp. agg.*	Blackberry	C
Ferns		**Asparagaceae**		
	*	*Asparagus asparagoides*	Bridal Creeper	R

Appendix 3 Threatened flora species within 10km

Flora species recorded within a ten kilometres from the contract area boundary on DSE's *Flora Information System* (DSE 2009b). Relevant species listed on EPBC Protected Matters Search Tool (DEWHA 2010a) also included.

Likelihood of Occurrence:

Low: Few aspects of habitat requirements are met on site.
Moderate: Some aspects of habitat requirements are met on site.
High: Optimal habitat present.

Conservation Status Codes (EPBC and FFG Acts):

EN – Endangered under the National EPBC Act (very high risk of extinction in the wild)

VU – Vulnerable under the National EPBC Act (high risk of extinction in the wild)

f–Listed as threatened under the Flora and Fauna Guarantee Act

Victorian Conservation Status Codes (DSE 2005b):

e – Endangered (at risk of becoming extinct);
v – Vulnerable (at risk of becoming endangered);
r –Rare (rare but not considered otherwise threatened);
k –poorly known (accurate distribution information is inadequate to allocate to one of the conservation status categories);

Life Form	Scientific Name	Family Name	Common Name	Conservation Status			Database	Other Sources	Current Survey	Total No. of Documented Records	Likelihood of Occurrence	Likelihood Reasoning	Habitat description
				FFG	EPBC	DSE							
Shrub	Acacia leprosa (Dandenong Range variant)	Mimosaceae	Dandenong Range Cinnamon Wattle			r	FIS			11	Low	No suitable habitat within the contract area. Nearest records in foothills of Great Divide.	Moist, well drained soils of damp and valley sclerophyll forests (Gray and Knight 2001).
Graminoid	*Amphibromus fluitans*	Poaceae	River Swamp Wallaby-grass		VU		EPBC/FIS			3	Moderate	Nearest record from Lynbrook and close to RBGC. All records on the former south-Gippsland railway. Potential habitat within wetland and drainage-line habitats within the contract area.	Mostly confined to the north-central Victorian reach of the Murray River and is uncommon in southern Victoria. Occurs in natural and constructed wetlands such as farm dams, lagoons and swamp margins (DEWHA 2010b; Walsh and Entwisle 1994b).
Graminoid	*Austrostipa rudis subsp. australis*	Poaceae	Veined Spear-grass			r	FIS			7	High	Has been recorded adjacent to the contract area in Pakenham bypass offset site along Cardinia Creek by James et al. (James, MacDonald and Picone 2008) as part of a Net Gain and Offset Management Plan for Vicroads.	Dry open forest, grassy low open forest on sandy soils. Uncommon with scattered populations across southern Victoria (Walsh and Entwisle 1994b).
Graminoid	*Burnettia cuneata*	Orchidaceae	Lizard Orchid			r	FIS			1	Low	One record at Guys Hill (Foothills of the Great Dividing Range) ~10km away. No suitable habitat within the contract area (No M. squarrosa)	Usually found in acidic, low-nutrient soils which are frequently waterlogged and dominated by Melaleuca squarrosa (DSE 2009b).
Graminoid	*Caladenia aurantiaca*	Orchidaceae	Orange-tip Finger-orchid			r	FIS			1	Low	1 record from 1971. Other most recent rec 1999 from RBGC. Low-moderate likelihood of occurrence within 1520 Thompsons Road.	Southern Victoria, east of Melbourne in open forests, heathlands and heathy woodlands (Walsh and Entwisle 1994b).
Graminoid	*Caladenia orientalis*	Orchidaceae	Eastern Spider-orchid	f	EN	e	EPBC			0	Low	Nearest record in South Gippsland	Populations limited to a small area of coastal far western Victoria and Southern Gippsland. Found in coastal heathlands and heathy woodlands on sandy soils (Walsh and Entwisle 1994b).
Graminoid	*Caladenia oenochila*	Orchidaceae	Wine-lipped Spider-orchid			v	FIS			3	Low	Unlikely - record from 1939 - north of bypass	Uncommon populations across southern Victoria. Occurs in Foothill and heathy Forests in low hill areas (Jeanes and Backhouse 2006).

Life Form	Scientific Name	Family Name	Common Name	Conservation Status			Database	Other Sources	Current Survey	Total No. of Documented Records	Likelihood of Occurrence	Likelihood Reasoning	Habitat description
				FFG	EPBC	DSE							
Herb	*Cardamine paucijuga s.s.*	Brassicaceae	Annual Bitter-cress			v	FIS			1	Low	1 record from 1998 north of RBGC. Unlikely to occur due to lack of high quality habitats within the contract area.	Scattered populations, primarily in southern Victoria including Portland, Grampians and Wilsons Promontory (Walsh and Entwisle 1996). Occurs in riparian and swamp scrub in rich soil in dry or moist conditions (Gray and Knight 2001).
Herb	*Cardamine tenuifolia*	Brassicaceae	Slender Bitter-cress			k	FIS			1	Moderate	One record north of the Pakenham bypass adjacent to Cardinia Creek	Swamp margins, plains grassland, valley sclerophyll forest in populations scattered across southern Victoria (Walsh and Entwisle 1996).
Graminoid	*Carex alsophila*	Cyperaceae	Forest Sedge			r	FIS			1	Low	1 record in foothills of the Great Divide. No suitable habitat within the contract area.	Endemic in Victoria where occurring in mountain gullies and swamps between Alexandra and Erica, but locally rather common (Walsh and Entwisle 1994b).
Graminoid	*Carex chlorantha*	Cyperaceae	Green-top Sedge			k	FIS			1	Low	1 record from 1903. Lack of suitable habitat within the contract area.	Scattered in cooler, mostly southern parts of the state from near sea-level (Orbost) to the alps (e.g. Buckety Plain). Usually in open sites of permanently moist to wet, rather fertile soils. Rather uncommon (Walsh and Entwisle 1994b).
Graminoid	*Corybas aconitiflorus*	Orchidaceae	Spurred Helmet-orchid			r	FIS			1	Low	North of Beaconsfield Nature Conservation Reserve along Cardinia Creek.	Localized and uncommon colonies in the south-east of Victoria. Preferring sheltered, damp positions in shrubby vegetation (Walsh and Entwisle 1994b).
Herb	*Craspedia canens*	Asteraceae	Grey Billy-buttons	f		e	FIS			4	Low	Unlikely - records from intact wetland north of Cranbourne in 1993.	Few populations in south-east Victoria between Cranbourne and Traralgon. Grasslands, often around margins of swamps (Walsh and Entwisle 1999).
Herb	*Desmodium varians*	Fabaceae	Slender Tick-trefoil			k	FIS			3	Low	Records in foothills of the Great Divide. No suitable habitat within the contract area.	An uncommon species mostly from inland parts of Eastern Victoria where found mainly in woodland and open-forest (Walsh and Entwisle 1996).
Graminoid	*Dianella amoena*	Hemerocallidaceae	Matted Flax-lily	f	EN	e	FIS/EPBC			10	Moderate	All records east of Cardinia Creek but could be in contract area as undetected plants	Confined to southern Victoria in vegetation types such as lowland grasslands, grassy woodlands and grassy wetlands. The species can tolerate well drained to seasonally wet soils (DEWHA 2010b).
Graminoid	*Diuris punctata var. punctata*	Orchidaceae	Purple Diuris	f		v	FIS			15	Moderate	Records from early 1980's, but may still be present in Plains Grassy Woodland remnants.	Distributed widely across lowland areas of Victoria. Occurs in grassy and heathy vegetation types such as lowland native grasslands, grassy woodlands, heathy woodlands and open heath-lands, usually on fertile, loamy soils. The species can tolerate periodic inundation (Earl and Barlow 2004).
Graminoid	*Eleocharis macbarronii*	Cyperaceae	Grey Spike-sedge			k	FIS			2	Low	Last records from Mid-90s in Lyndhurst. Unlikely.	Infrequent populations in areas of western and northern Victoria. Found in heavy soils in waterlogged areas around wetlands and drainage lines (Walsh and Entwisle 1994b).
Graminoid	*Entolasia stricta*	Poaceae	Upright Panic			k	FIS			1	Low	Recorded close to Botanic Drv in RBGC but unlikely due to lack of suitable habitat	Sandy soils in grassy low open forests. Distribution uncertain however recorded east of Bairnsdale and near Frankston and Stradbroke (Walsh and Entwisle 1994b).
Tree	*Eucalyptus fulgens*	Myrtaceae	Green Scentbark			r	FIS			14	Moderate	All recs from southern highlands fall bioregion, occasional plants on the plains. Several records nearby.	Open forest areas, tolerating damp conditions. Found in areas east of Healesville and Woori Yallock to the Latrobe Valley (Walsh and Entwisle 1996).

Life Form	Scientific Name	Family Name	Common Name	Conservation Status			Database	Other Sources	Current Survey	Total No. of Documented Records	Likelihood of Occurrence	Likelihood Reasoning	Habitat description
				FFG	EPBC	DSE							
Tree	*Eucalyptus X studleyensis*	Myrtaceae	Studley Park Gum			e	FIS			1	Low	Few scattered remnant trees within the contract area.	A naturally occurring hybrid (E. ovata × E. camaldulensis) found in Studley Park/Yarra Bend and along the Yarra Valley (Gray and Knight 2001).
Herb	*Geranium solanderi var. solanderi s.s.*	Geraniaceae	Austral Crane's-bill			v	FIS			1	Medium	Unlikely - Lack of suitable habitat within the contract area.	An uncommon species of damp to dryish, usually sheltered sites in grassy woodlands. Often along drainage line or in seepage areas (Walsh and Entwisle 1999).
Climber/Scrambler	*Glycine latrobeana*	Fabaceae	Clover Glycine	f	VU	v	FIS/EPBC			1	Low	Unlikely - Lack of suitable habitat within the contract area.	Widespread, infrequent populations in southern Victoria (Walsh and Entwisle 1996). Plains Grassland and Woodlands in moist well drained soils (Gray and Knight 2001).
Herb	*Helichrysum aff. rutidolepis (Lowland Swamps)*	Asteraceae	Pale Swamp Everlasting			v	FIS			5	Low	Unlikely - no suitable habitat. Records from intact wetland at Lynbrook and former south-Gippsland Railway	Moist well drained sites in open grassy forest or woodland. Frequent, widespread populations across much of Victoria, excluding the north-west (Walsh and Entwisle 1999).
Graminoid	*Lachnagrostis filiformis var. 2*	Poaceae	Wetland Blown-grass			k	FIS			3	High	Could occur within wetlands and drainage-lines within the contract area. Numerous L. filiformis Var1 plants occur within the contract area. Var 2 can occur along-side.	Grows on the edges of wetlands
Graminoid	*Lachnagrostis punicea subsp. filifolia*	Poaceae	Purple Blown-grass	f		r	FIS			7	Low	Unlikely - records from intact wetland at Lynbrook and from former South-Gippsland Railway	Scattered populations across the Victorian Volcanic plains in wet depressions, marshes and slightly saline swamps.
Herb	*Leionema bilobum*	Rutaceae	Notched Leionema			r	FIS			1	Low	Unlikely. 1 record from foothills of the Great Divide. Lack of suitable habitat within the contract area.	Wet and damp forests
Herb	*Microseris sp. 1*	Asteraceae	Plains Yam-daisy			v	FIS			3	Low	Unlikely - no suitable habitat. Records from remnant near Lynbrook and former South-Gippsland Railway.	Rare in Plains Grassland and Woodlands in damp depressions in the Basalt soils of Victorias Western Plains (Walsh and Entwisle 1999).
Shrub	*Olearia asterotricha*	Asteraceae	Rough Daisy-bush			r	FIS			1	Low	1 record near Fountain Gate from 1914. No suitable habitat within the contract area.	Occurs in moist forest and swampy heathland in a few disjunct areas of southern Victoria (e.g. Portland area, Grampians, Emerald, Gembrook and Tonimbuk). Generally uncommon (Walsh and Entwisle 1999).
Herb	*Potamogeton perfoliatus s.l.*	Potamogetonaceae	Perfoliate Pondweed			k	FIS			1	Moderate	Possible as it has been recorded in 2005 north of contract area in Cardinia Creek. It is a wetland plant which could disperse easily through water.	Flowing or still, fresh or brackish, creeks and rivers. On Sandy, stony or muddy substrates (Walsh and Entwisle 1994b).
Graminoid	*Prasophyllum frenchii*	Orchidaceae	Maroon Leek-orchid	f	EN	e	FIS/EPBC			15	Low	Recent records (within the last 20 years) >5km away in Clyde railway	Infrequent, widespread populations in south western Victoria. Grasslands, heathlands and grassy woodlands on moist well drained soils, including roadsides or rail reserves (Jeanes and Backhouse 2006).
Graminoid	*Prasophyllum pyriforme s.s.*	Orchidaceae/	Silurian Leek-orchid			e	FIS			1	Low	Last record from 1932. Lack of suitable habitat within the contract area.	Few known populations, occurring to the north-east of Melbourne in dry open forest with shrubby understory (Jeanes and Backhouse 2006).
Graminoid	*Pterostylis grandiflora*	Orchidaceae	Cobra Greenhood			r	FIS			4	Low	Last record from 1940. Lack of suitable habitat within the contract area.	Few widely distributed populations in Eastern Victoria. Moist shady slopes in heath and grassy open forests (Jeanes and Backhouse 2006).

Life Form	Scientific Name	Family Name	Common Name	Conservation Status			Database	Other Sources	Current Survey	Total No. of Documented Records	Likelihood of Occurrence	Likelihood Reasoning	Habitat description
				FFG	EPBC	DSE							
Graminoid	*Pterostylis sp. aff. parviflora (Southern Victoria)*	Orchidaceae	Red-tip Greenhood			r	FIS			1	Low	Unlikely. 1 record from foothills of the Great Divide. Lack of suitable habitat within the contract area.	In well drained loams of valley sclerophyll forests, sclerophyll woodland and swamp scrub (Gray and Knight 2001).
Graminoid	*Pterostylis X ingens*	Orchidaceae	Sharp Greenhood			r	FIS			1	Low	Last record from 1940's. Lack of suitable habitat and lack of parent plants.	Infrequent, widespread colonies across Victoria. Occurring in areas of moist open forest (Walsh and Entwisle 1994b).
Herb	*Senecio campylocarpus*	Asteraceae	Floodplain Fireweed			r	FIS			1	High	Recorded within 1520 Thompsons Rd (Area 42). Areas of modified habitat exist within the contract area. Likely overlooked due to recent taxonomic revision.	Occurs in drainage-lines or waterlogged areas, often in modified habitats such as within 1520 Thompsons Road in Investigation Area 42 (Doug Frood pers comm).
Shrub	*Tetratheca stenocarpa*	Elaeocarpaceae	Long Pink-bells			r	FIS			1	Low	Last record in 1935	Tall open forest areas with populations limited to the Healesville area, the Pyrete Ranges and French Island (Walsh and Entwisle 1999).
Graminoid	*Thelymitra circumsepta*	Orchidaceae	Naked Sun-orchid			v	FIS			1	Low	1999 was the last record on FIS, there is a stable pop at RBGC. Unlikely to occur due to very specific habitat requirements.	Found around the margins of swamps, along sub-alpine streams and sphagnum bogs. Often in disturbed areas and exposed positions in woodlands, open forests and wet heathlands (Jeanes and Backhouse 2006).
Graminoid	*Thelymitra epipactoides*	Orchidaceae	Metallic Sun-orchid	f	EN		EPBC			0	Low	Nearest record near Dandenong in 1980, nearest recent record in West Gippsland	Uncommon small colonies in areas of southern Victoria, particularly near the coast (Walsh and Entwisle 1999). Greatly reduced populations due to decline in suitable habitat. Grows in coastal heathlands, grasslands and woodlands and in swampy depressions (Jeanes and Backhouse 2006).
Herb	*Xerochrysum palustre*	Asteraceae	Swamp Everlasting	f	VU	v	FIS/EPBC			2	Low	Nearest record in Lyndhurst.	Occurs in swamps usually found on basalt derived soils

Appendix 4. Habitat hectare results

Habita Zone ID			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
PFI			207505676	207505676	207505676	207505676	207505676	207505676	207505676	207505676	207505676	207505676	207505676	207505676	207505676	207505676	20750581	20750581	207505810	207505810	81596
Site ID			1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	1
Habitat Zone			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
EVC Name (Initials)			TM	TM	SW	SW	TM	SS	TM	TM	TM	SW	SS	TM	SW	SS	AH	AH	AH	AH	SS
EVC Number			GipP0821	GipP0821	GipP0136	GipP0136	GipP0821	GipP0053	GipP0821	GipP0821	GipP0821	GipP0136	GipP0053	GipP0821	GipP0136	GipP0053	GipP0653	GipP0653	GipP0653	GipP0653	GipP0053
Total Area of Habitat Zone (ha)		(#.#)	0.02	0.26	0.15	0.54	0.14	0.28	0.04	0.01	0.01	0.01	2.45	0.12	0.08	0.11	0.05	0.04	0.08	0.09	0.01
		Max Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Canopy Cover	5	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	4
	Lack of Weeds	15	9	9	9	9	9	9	9	9	9	9	0	9	9	6	6	6	6	6	0
	Understorey	25	20	20	5	15	5	5	5	10	15	15	15	15	15	5	5	5	5	5	5
	Recruitment	10	0	0	3	3	0	0	0	0	0	1	3	0	6	3	6	6	6	6	0
	Organic Matter	5	5	5	5	0	5	5	5	5	5	5	3	5	5	5	5	5	5	5	3
	Logs	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Score	75	46	46	30	37	26	24	26	33	39	41	30	39	48	24	30	30	30	30	15
Landscape Score		25	2	2	2	2	4	5	5	5	7	4	4	4	4	4	1	1	1	1	2
Habitat Score#		100	48	48	32	39	30	29	31	38	46	45	34	43	52	28	31	31	31	31	17
Habitat Score as above = #/100		0.##	0.48	0.48	0.32	0.39	0.30	0.29	0.31	0.38	0.46	0.45	0.34	0.43	0.52	0.28	0.31	0.31	0.31	0.31	0.17
Habitat Hectares		(#.#)	0.01	0.13	0.05	0.21	0.04	0.08	0.01	0.00	0.00	0.00	0.83	0.05	0.04	0.03	0.02	0.01	0.02	0.03	0.00
Bioregion			GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP
EVC Conservation Status			E	E	V	V	E	E	E	E	E	V	E	E	V	E	E	E	E	E	E
Conservation Significance	Conservation Status x Habitat Score		Very High	Very High	High	High	High	High	High	High	Very High	High	High	Very High	Very High	High	High	High	High	High	High
	Threatened Species Rating (flora)		High	High	High	High	Medium	Medium	Medium	Medium	High	High	Medium	High	High	High	High	High	High	High	Medium
	Threatened Species Rating (fauna)		Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High
	Other Site Attribute Rating						Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium					Medium
	Overall Conservation Significance (highest rating)		Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High
Other Site Atribute Ratings	Which biosite, if any, does the site cover?		6888	6888	6888			6888	6888			6888	6888	6888	6888	6888					6888

Habita Zone ID			20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
PFI			81596	81596	81599	81599	81599	81599	81599	81599	81599	81599	81599	81599	81599	81599	81599	R539084	R539084	81599	81599
Site ID			3	4	4	5	6	6	7	8	9	10	11	11	12	13	14	2	2	16	17
Habitat Zone			A	A	A	A	A	B	A	A	A	A	A	B	A	A	A	A	B	A	A
EVC Name (Initials)			PGW	SS	SS	SS	SW	TM	SW	SW	SS	SS	SS	TM	SRW	PGW	SW	PGW	SS	SW	TM
EVC Number			GipP0055	GipP0053	GipP0053	GipP0053	GipP0136	GipP0821	GipP0136	GipP0136	GipP0053	GipP0053	GipP0053	GipP0821	GipP0083	GipP0055	GipP0136	GipP0055	GipP0053	GipP0136	GipP0821
Total Area of Habitat Zone (ha)		(#.#)	0.38	0.12	0.07	1.79	0.14	0.05	0.51	0.07	0.02	0.01	0.04	0.03	0.03	0.04	0.08	0.14	0.06	0.18	0.03
		Max Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	10	0	0	0	0	0	0	0	0	0	0	0	0	9	0	10	0	0	0
	Canopy Cover	5	5	3	0	3	0	0	0	0	1	1	1	0	4	4	0	5	3	0	0
	Lack of Weeds	15	9	0	6	0	6	9	15	9	9	6	6	11	6	0	6	9	0	7	15
	Understorey	25	15	15	5	15	15	15	5	15	15	15	15	15	5	5	15	15	15	15	15
	Recruitment	10	0	3	3	3	6	0	3	6	1	1	1	0	0	0	6	0	3	6	0
	Organic Matter	5	3	3	5	3	5	5	0	5	3	3	3	5	5	3	5	3	3	3	3
	Logs	5	2	0	0	0	0	0	0	0	0	0	0	0	0	5	0	2	0	0	0
	Total Score	75	**44**	**30**	**24**	**30**	**44**	**39**	**31**	**48**	**36**	**33**	**33**	**42**	**20**	**26**	**44**	**44**	**30**	**42**	**45**
Landscape Score		25	2	4	4	4	6	5	4	4	4	2	4	1	2	2	4	2	4	2	2
Habitat Score#		100	46	34	28	34	50	44	35	52	40	35	37	43	22	28	48	46	34	44	47
Habitat Score as above = #/100		0.##	0.46	0.34	0.28	0.34	0.50	0.44	0.35	0.52	0.40	0.35	0.37	0.43	0.22	0.28	0.48	0.43	0.30	0.44	0.47
Habitat Hectares		(#.#)	**0.17**	**0.04**	**0.02**	**0.61**	**0.07**	**0.02**	**0.18**	**0.04**	**0.01**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.04**	**0.06**	**0.02**	**0.08**	**0.01**
Bioregion			GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP	GipP
EVC Conservation Status			E	E	E	E	V	E	V	V	E	E	E	E	E	E	V	E	E	V	E
Conservation Significance	Conservation Status x Habitat Score		Very High	High	High	High	High	Very High	High	Very High	Very High	High	High	Very High	High	High	High	Very High	High	High	Very High
	Threatened Species Rating (flora)		Medium	Medium	High	Medium	High	High	High	High	Medium	Medium	Medium	High	Medium	Medium	High	Medium	Medium	High	High
	Threatened Species Rating (fauna)		Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High
	Other Site Attribute Rating		Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium				
	Overall Conservation Significance (highest rating)		**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**
Other Site Atribute Rating	Which biosite, if any, does the site cover?		6888	6888	6888	6888	6888	6888	6888	6888	6888	6888	6888	6888	6888		6888			6888	

APPENDIX 5. Reasoning for best or remaining 50% habitat definitions: Flora

Scientific Name	Family Name	Common Name	FFG	EPBC	DSE (2005a)	Database	NumSite (AVW only)	Recorded in present study?	Best or remaining 50% of habitat	A. Is the species, or has the species been recorded as 'resident' on site? *Yes - Got to B. No - Go to D.*	B. Is it possible to discriminate between the importance of different populations of the species? For example, can numbers be reasonably estimated and is there available knowledge on what are typical populations sizes? *Yes - Go to C. No - Go to E.*	C. Does the site contain a populations that is above average size or importance for the bioregion? *Yes - Best 50% of habitat. No - remaining 50% of habitat*	D. Does the habitat on site clearly meet one or more of the habitat requirements of the species? Is it resonable to expect that the species is present or would make significant use of the site in the medium term (eg within te next 10 years)? *Yes to both - go to F. No to either - no further consideration for that species*	E. Has some form of habitat modelling been undertaken for the species in the bioregion? *Yes - use this information to determine Best 50% of habitat or Remaining 50% of habitat. No - Go to F.*	F. Does the site represent above-average condition and landscape context for the relevant EVC or habitat type in the region? *Yes - Best 50% of habitat. No - remaining 50% of habitat.*
Austrostipa rudis subsp. australis	Poaceae	Veined Spear-grass			r	FIS	7	No	Remaining	No - go to D			Yes - Hzs 6,11,14, 20-23, 35, 36.		No -remaining 50%
Lachnagrostis filiformis var. 2	Poaceae	Wetland Blown-grass			k	FIS	3	No	Remaining	No - go to D			Yes - HZs 1-4, 9,10,12-18, 22, 24-28, 31, 34, 37, 38.		No -remaining 50%
Senecio campylocarpus	Asteraceae	Floodplain Fireweed			r	FIS	1	No	Remaining	No - go to D			Yes - all HZs except 20 and 35.		No -remaining 50%

Appendix 6. Methodology for defining faunal significance

This section outlines the assessment methods or criteria used to determine the significance of species, plant communities, fauna habitats and sites. Criteria are consistent with government policies, legislation and publications.

Table Key						
Last rec.	Year fauna taxa was last recorded.					
No. recs	Number of sites in which the species is recorded in					
EPBC	Species listed as threatened in Australia under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC)					
		EX	Extinct			
		CR	Critically Endangered			
		EN	Endangered			
		VU	Vulnerable			
		CD	Conservation Dependent			
		mar.	Marine			
		m	Migratory			
Mig.	Birds listed under bilateral migratory bird agreements listed below:					
		J	JAMBA (Japan-Australia Migratory Bird Agreement 1974)			
		C	CAMBA (China-Australia Migratory Bird Agreement 1986)			
		R	ROKAMBA (Republic of Korea-Australia Migratory Bird Agreement 2006)			
		CMS	Convention on Migratory Species. Birds listed under the Agreement on the Conservation of Albatrosses and Petrels (ACAP) 2006			
		Bonn	Convention on the conservation of migratory species of wild animals (Bonn Convention)			
Vic. cons. status	Conservation status under DSE's *Advisory List Of Threatened Vertebrate Fauna in Victoria 2007 (DSE 2007a).*					
		ex	Extinct			
		r	Regionally Extinct			
		w	Extinct in the Wild			
		c	Critically Endangered			
		e	Endangered			
		v	Vulnerable			
		n	Near Threatened			
		d	Data Deficient			
		*	introduced species. Not listed in the advisory list above.			
FFG	Status under the Flora and Fauna Guarantee Act 1988 (FFG)					
		L	species listed as threatened			
		N	species nominated for listing as threatened but has not yet completed the listing process			
		I	Invalid or ineligible listing			
Sig.	Biological Significance					
	This is a rating of the contribution that biological assets of a site or species make towards the conservation of Australia's native biodiversity.					
		N	National	Species listed under the *Environment Protection and Biodiversity Conservation Act 1999* as extinct, extinct in the wild, critically endangered, endangered or vulnerable.		
		S1	State	Species listed as Threatened under Schedule 2 of Victoria's *Flora and Fauna Guarantee Act 1988*		

				Species listed as extinct, critically endangered, endangered, vulnerable in Victoria *Advisory List of Threatened Vertebrate Fauna in Victoria* – (DSE 2007a).		
		R1	Regional	Regional according to Table 4. *Rare and restricted species in the greater Gippsland Plains* in Radford and Bennett (2005) – birds only.		
		R2	Regional	Regional according to Malcolm Legg (pers. comm.). Region is defined as the Mornington Peninsula and surrounding Western Port area.		
		R3	Regional	Species listed as data deficient or near threatened in Victoria *Advisory List of Threatened Vertebrate Fauna in Victoria – 2007* (DSE 2007a).		
				Birds listed under migratory bird agreements		
				Species not listed in the above categories that have a limited range in a bioregion		
		L	Local	Local. All other native species are considered at least local significance due to the level of habitat depletion in the City of Casey.		
Common Name	According to Atlas of Victorian Wildlife					
Scientific Name	According to Atlas of Victorian Wildlife					

International Significance	Migratory species protected under international treaties (JAMBA, CAMBA, ROKAMBA and Bonn) or listed on the IUCN Red Data List 2006 as threatened
National Significance	Species listed under the *Environment Protection and Biodiversity Conservation Act 1999* as extinct, extinct in the wild, critically endangered, endangered or vulnerable.
State Significance	Species listed as Threatened under Schedule 2 of Victoria's *Flora and Fauna Guarantee Act 1988*
	Species listed as extinct, critically endangered, endangered, vulnerable in Victoria *Advisory List of Threatened Vertebrate Fauna in Victoria* (DSE 2007a).
Regional Significance	Species listed as data deficient or near threatened in Victoria *Advisory List of Threatened Vertebrate Fauna in Victoria* – (DSE 2007a).
	Species not listed in the above categories that have a limited range in a bioregion
Local Significance	Species considered rare, threatened or uncommon within the local area (5km radius from the contract area) by the authors with consideration given to previous studies. Many native species are considered to be locally significant within urban areas due to typically high levels of habitat alteration.

Appendix 7. Indigenous vertebrate fauna records: general & targeted surveys

PSP Area 11 contract area assessment period: September 2009 to April 2010. Fauna taxa recorded incidentally and during targeted searches for threatened searches from within the contract area during this survey by Malcolm Legg of Mal's Ecological and Environmental Services and Joanne Henry, Annabelle Stewart and David Nance of Practical Ecology.

		Conservation Status					
Scientific Name	Common Name	EPBC	FFG	DSE (2007c)	Regional	Type of record	Comments
AMPHIBIANS							
Crinia signifera	Common Froglet				L	General observations/Incidental/Spotlighting	
Uperoleia laevigata	Smooth Toadlet				L	General observations	
Litoria ewingii	Southern Brown Tree Frog				L	Spotlighting	
Limnodynastes dumerilii	Southern Bullfrog				L	General observations/Incidental/Spotlighting	
Pseudophryne semimarmorata	Southern Toadlet			v	L	General observations (heard)	
Limnodynastes tasmaniensis	Spotted Marsh Frog				L	General observations/Incidental/Spotlighting	
Limnodynastes peroni	Striped Marsh Frog				L	General observations/Spotlighting	
Litoria verreauxii	Verreaux's Tree Frog				L	Spotlighting	
REPTILES							
Chelodina longicollis	Common Long-necked Tortoise				R2	General observations/Spotlighting	A number of eggs found near a burrow.
Lampropholis delicata	Delicate Skink				R2	Tin census	Found near wetland and Cardinia Creek.
Lampropholis guichenoti	Garden Skink				L	General observations/Tin census	Found in grass.
Austrelaps superbus	Lowland Copperhead				L	General observations	
Saproscincus mustelinus	Weasel Skink				R2	General observations/Tin census	Found near wetland and Cardinia Creek. Also in grass.
BIRDS							
Tachybaptus novaehollandiae	Australasian Grebe				L	General observations/Timed bird census	
Anthus novaeseelandiae	Australasian Pipit				L	General observations	Found in pastured habitat.
Anas rhynchotis	Australasian Shoveler			v		General observations	
Gymnorhina tibicen	Australian Magpie				L	General observations/Timed bird census	
Corvus coronoides	Australian Raven				L	General observations	

Scientific Name	Common Name	Conservation Status EPBC	FFG	DSE (2007c)	Regional	Type of record	Comments
Tadorna tadornoides	Australian Shelduck				L	General observations	
Threskiornis molucca	Australian White Ibis				L	Timed bird census	
Chenonetta jubata	Australian Wood Duck				L	General observations/Timed bird census	
Porzana pusilla	Baillon's Crake	mar	L	v		General observations	
Cygnus atratus	Black Swan				L	General observations/Timed bird census	Found breeding and with young.
Elseyorinis melanops	Black-fronted Dotterel				R2	General observations/Timed bird census	Found in wetland.
Elanus axillaris	Black-shouldered Kite				L	General observations/Timed bird census	
Oxyura australis	Blue-billed Duck		L	e		General observations/Timed bird census	
Falco berigora	Brown Falcon				L	General observations (heard)	
Accipiter fasciatus	Brown Goshawk				L	General observations	
Acanthiza pusilla	Brown Thornbill				L	Timed bird census	
Anas castanea	Chestnut Teal				L	General observations/Timed bird census	
Acrocephalus stentoreus	Clamorous Reed Warbler	m, mar, Bonn			R2	General observations/Timed bird census	
Ocyphaps lophotes	Crested Pigeon				R1	General observations	
Anhinga novaehollandiae	Darter				L	Timed bird census	
Gallinula tenebrosa	Dusky Moorhen				L	General observations/Timed bird census	
Fulica atra	Eurasian Coot				L	General observations/Timed bird census	Found nesting in wetland.
Eolophus roseicapillus	Galah				L	General observations/Timed bird census	
Cisticola exilis	Golden-headed Cisticola				L	General observations	
Pachycephala pectoralis	Golden Whistler				L	General observations	
Ardea modesta	Eastern Great Egret	m, mar, C, J	L			General observation	Edge of wetland near Cardinia creek
Phalacrocorax carbo	Great Cormorant				L	Timed bird census	
Rhipidura fuliginosa	Grey Fantail				L	General observations/Timed bird census	
Colluricincla harmonica	Grey Shrike Thrush				L	General observations/Timed bird census	
Aythya australis	Hardhead			v		General observations/Timed bird census	
Poliocephalus poliocephalus	Hoary-headed Grebe				L	General observations/Timed bird census	
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo				L	General observations	Found along Cardinia Creek.
Ardea intermedia	Intermediate Egret	mar	L	ce		General observation	Seen in willow at wetlands near Cardinia creek

Scientific Name	Common Name	Conservation Status EPBC	FFG	DSE (2007c)	Regional	Type of record	Comments
		m, mar, Bonn,					
Gallinago hardwickii	Latham's Snipe	C, J, R		n	R2	General observations	
Dacelo novaehollandiae	Laughing Kookaburra				L	Timed bird census	
Phalacrocorax sulcirostris	Little Black Cormorant				L	General observations/Timed bird census	Found nesting in wetland.
Cacatua sanguinea	Little Corella				L	General observations	
Megalurus gramineus	Little Grassbird				L	Timed bird census	
Phalacrocorax melanoleucos	Little Pied Cormorant				L	General observations/Timed bird census/Incidental	Found nesting in wetland.
Corvus mellori	Little Raven				L	General observations/Timed bird census	
Grallina cyanoleura	Magpie-lark				L	General observations/Timed bird census	
Vanellus miles	Masked Lapwing				L	General observations/Incidental	
Biziura lobata	Musk Duck			v		Timed bird census	
Phylidonyris novaehollandiae	New Holland Honeyeater				L	Timed bird census	
Anas superciliosa	Pacific Black Duck				L	General observations/Timed bird census	
Cuculus pallidus	Pallid Cuckoo				L	General observations	Found along Cardinia Creek.
Phalacrocorax varius	Pied Cormorant			n		General observations/Incidental	Found nesting in wetland.
Malacorhynchus membranaceus	Pink-eared Duck				L	Timed bird census	
Porphyrio porphyrio	Purple Swamphen				L	General observations/Timed bird census	
Anthochaera carunculata	Red Wattlebird				L	General observations/Timed bird census	
Neochmia temporalis	Red-browed Finch				L	General observations/Timed bird census	
Platalea regia	Royal Spoonbill			v		General observations/Timed bird census	Found nesting in wetland.
Pachycephala rufiventris	Rufous Whistler				L	Timed bird census	
Zosterops lateralis	Silvereye				L	General observations/Timed bird census	
Threskiornis spinicollis	Straw-necked Ibis				L	General observations/Timed bird census	
Malurus cyaneus	Superb Fairy-wren				L	General observations/Timed bird census	
Hirundo neoxena	Welcome Swallow				L	Timed bird census	
Sericornis frontalis	White-browed Scrubwren				L	Timed bird census	
Egretta novaehollandiae	White-faced Heron				L	General observations/Timed bird census	
Epthianura albifrons	White-fronted Chat				R2	General observations	Found near the wetland.

Scientific Name	Common Name	Conservation Status EPBC	FFG	DSE (2007c)	Regional	Type of record	Comments
Lichenostomus penicillatus	White-plumed Honeyeater				L	General observations	
Lalage sueurii	White-winged Triller				R1,R2	General observations	Found along Cardinia Creek.
Rhipidura leucophrys	Willy Wagtail				L	General observations/Timed bird census	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill				R2	General observations	Found along Cardinia Creek and in pastured habitat.
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo				L	General observations	
INVERTEBRATES							
For complete list of Invertebrates see Appendix 8							
	Fluke Snail					Baited fish trap	
FISH							
Galaxias maculatus	Common Galaxias				L	Baited fish trap/Dip net	Found throughout the wetland.
Anguilla australis	Short-finned Eel				L	Baited fish trap/Spotlighting	
Nannoperca australis	Southern Pigmy Perch				L	Baited fish trap	
MAMMALS							
Trichosurus vulpecula	Common Brushtail Possum				L	Spotlighting	
Pseudocheirus peregrinus	Common Ringtail Possum				L	Spotlighting	
Vespadelus vulturnus	Little Forest Bat				L	Bat detector	
Vespadelus darlingtoni	Large Forest Bat				L	Bat detector	
Mormopterus sp4	Southern Freetail bat				R2	Bat detector	
Petaurus breviceps	Sugar Glider				R2	Spotlighting	Found in large old Eucalypt.
Rattus lutreolus ssp. Lutreolus	Swamp Rat				R2	Elliott trap	
Nyctophilus sp.	Long-eared Bat					Bat detector	
Vespadelus sp.	Forest Bat sp.				L	Bat detector	
Vespadelus vulturnus or Chalinolobus morio	Unidentified Bat					Bat detector	
Tadarida australis	White-striped Freetail Bat				L	Bat detector/Spotlighting	

Appendix 8. Exotic vertebrate fauna species recorded: general and targeted surveys

PSP Area 11 contract area assessment period: September 2009 to April 2010. Fauna taxa recorded incidentally and during targeted searches for threatened searches from within the contract area during this survey by Malcolm Legg of Mal's Ecological and Environmental Services and Joanne Henry, Annabelle Stewart and David Nance of Practical Ecology.

Scientific Name	Common Name	Status	Type of record	Comments
BIRDS				
**Turdus merula*	Common Blackbird		Timed bird census	
**Acridotheres tristis*	Common Myna		General observations/Timed bird census	
**Sturnus vulgaris*	Common Starling		General observations/Timed bird census	
**Carduelis carduelis*	European Goldfinch		General observations/Timed bird census	
**Alauda arvensis*	European Skylark		General observations/Timed bird census	
**Passer domesticus*	House Sparrow		General observations	
**Pavo cristatus*	Indian Peafowl		General observations	
**Streptopelia chinensis*	Spotted Turtle-Dove		General observations/Timed bird census	Seen around wetlands close to main driveway
INVERTEBRATES				
**Pieris rapae*	Cabbage White Butterfly		General observations	
FISH				
**Gambusia holbrooki*	Eastern Gambusia		Baited fish trap/Dip net	Found in fish traps.
MAMMALS				
**Rattus rattus*	Black rat		Elliott trap	
**Oryctolagus cunniculus*	European Rabbit		General observations/Incidental/Spotlighting	
**Mus musculus*	House Mouse		Elliott trap	
**Vulpes vulpes*	Red Fox		Incidental signs	Numerus scats in entire area

Appendix 9. Invertebrate species recorded: general and targeted surveys

Invertebrate species recorded during the current assessment, surveys carried out between November 2009 and January 2010. Field work and identification undertaken by Zorza Goodman.

CLASS	ORDER	COMMON NAME	FAMILY or SPECIES	Number of Individuals
Arachnida	Araneae	Spider 2	Oxyopidae	1
Arachnida	Araneae	Spider 12	Unknownn	3
Arachnida	Araneae	Spider 13	Lycosidae	25
Arachnida	Araneae	Spider 15	Unknownn	4
Arachnida	Araneae	Spider 30	Aranenae	1
Insecta	Coleoptera	Beetle 1	Unknown	4
Insecta	Coleoptera	Beetle 2	Unknown	1
Insecta	Coleoptera	Beetle 8	Unknown	1
Insecta	Coleoptera	Beetle 19	Unknown	1
Insecta	Coleoptera	Beetle 28	Unknown	4
Insecta	Coleoptera	Beetle 29	Unknown	3
Insecta	Diptera	Mosquito 1	Unknown	3
Insecta	Diptera	Mosquito 3	Unknown	2
Insecta	Diptera	Mosquito 5	Unknown	1
Insecta	Diptera	Fly 1	Unknown	3
Insecta	Diptera	Fly 2	Unknown	3
Insecta	Diptera	Fly 3	Unknown	1
Insecta	Diptera	Fly 4	Unknown	2
Insecta	Diptera	Fly 5	Unknown	1
Insecta	Diptera	Fly 6	Unknown	1
Insecta	Diptera	Fly 7	Unknown	12
Insecta	Diptera	Fly 9	Unknown	9
Insecta	Diptera	Fly 22	Unknown	1
Insecta	Diptera	Fly 31	Unknown	1
Insecta	Diptera	Fly 32	Unknown	1
Insecta	Diptera	Fly 34	Unknown	9
Insecta	Diptera	Fly 35	Unknown	2
Insecta	Hemiptera	Sheildbug 1	Unknown	4
Insecta	Hemiptera	Bug 1	Unknown	15
Insecta	Hemiptera	Bug 4	Unknown	3

CLASS	ORDER	COMMON NAME	FAMILY or SPECIES	Number of Individuals
Insecta	Hemiptera	Bug 7	Unknown	12
Insecta	Hymenoptera	Ant 1	Unknown	2
Insecta	Hymenoptera	Ant 2	Unknown	1
Insecta	Hymenoptera	Wasp 1	Unknown	1
Insecta	Hymenoptera	Wasp 11	Unknown	1
Insecta	Hymenoptera	Wasp 26	Unknown	1
Insecta	Hymenoptera	Bee 1	Unknown	1
Insecta	Hymenoptera	Bee 2	Unknown	2
Insecta	Hymenoptera	Bee 3	Unknown	2
Insecta	Lepidoptera	Moth 1	Unknown	2
Insecta	Lepidoptera	Butterfly 2	Pieridae	307
Insecta	Lepidoptera	Butterfly 4	Lycaenidae	41
Insecta	Lepidoptera	Catterpiller 1	Unknown	3
Insecta	Lepidoptera	Catterpiller 4	Unknown	13
Insecta	Odonata	Dragonfly 1	Unknown	11
Insecta	Odonata	Dragonfly 2	Unknown	6
Insecta	Odonata	Dragonfly 4	Unknown	47
Insecta	Orthoptera	Grasshopper 2	Unknown	112
Arachnida	Superorder Parasitiformes	Mite 1	Unknown	1
Gastropoda	Stylommatophora	Snail 2	Unknown	5
Gastropoda	Stylommatophora	Snail 3	Unknown	58
Diplopoda	Unknown	Millipede 1	Unknown	2
Diplopoda	Unknown	Millipede 2	Unknown	3
Crustacea	Unknown	Fresh Water Shrimp 1	Unknown	98
Diplopoda	Unknown	Larvae 1	Unknown	1
Entognatha	Unknowns	Unknowns	Unknown	1
			TOTAL	856

Appendix 10. Threatened fauna species recorded and/or predicted to occur within a radius of 10km of the contract area

Threatened fauna species recorded during the current assessment and those detected within ten kilometres of the contract area boundary on DSE's Victorian Fauna Database (VFD) (DSE 2009c) Species listed on EPBC Protected Matters Search Tool also included, except for Listed Marine Species (not relevant). A likelihood of occurrence is given to each species based on year of last record, number of records and habitat requirements.

Scientific Name	Family Name	Common Name	Conservation Status				Database	Other Sources	Current Survey	Habitat Notes	No. of Records (AVW)	Likelihood of Occurrence	Likelihood Reasoning
			FFG	EPBC	DSE (2007c)	Regional Significance							
Anas rhynchotis	Anatidae	Australasian Shoveler			v		AVW		Present	The Australasian Shoveler occurs mainly on large well vegetated wetlands and lakes, occasionally including areas with saline waters. Populations are found in higher numbers on permanent, well-vegetated freshwater swamps with areas of open water. This species nest in grass nests on the ground, usually in dense cover and near water (Marchant and Higgins 1990; Pizzey and Knight 2007).	11	High	Breeding pairs seen onsite. Known to occur every year during breeding season.
Prototroctes maraena	Retropinnidae	Australian Grayling	L	VU	v		EPBC/AVW			This species only spends part of its life in freshwater streams, Australian Graylings migrate between freshwater streams and the ocean. Streams where this species occur tend to be clear with gravel bottoms and a variety of instream habitat such as pools and riffles. The upstream migration of this species has been effectively terminated in some rivers by dams (Allen, Midgley and Allen 2002; DPI 2006).	2	High	Was last recorded in 1985. Habitat present within Cardinia Creek (Marr et al. 2010)
Porzana pusilla	Rallidae	Baillon's Crake	L		v		AVW		Present	This species returns to northern Victoria in spring, but few details on migration. It inhabits freshwater wetlands and floodwaters usually containing floating plants or tall emergent vegetation. The Baillon's Crake feeds in shallow water, mud and emergent aquatic plants. It has been found to nest in clumps or tussocks of vegetation surrounded by water (Marchant and Higgins 1990; Pizzey and Knight 2007).	2	high	Last recorded in 2003 on AVW, however seen on site during study.
Ninox connivens	Strigidae	Barking Owl	L		e		AVW			Occur in dry woodlands, wooded farmlands and dry forests in the 500-800mm annual rainfall zone and extend into semi-arid areas in River Red Gum forests along the Murray River. Hollow dependent species (Higgins 1999; Pizzey and Knight 2007).	1	low	Last recorded within 10km in 1999, however preferred habitat not present.
Falco subniger	Falconidae	Black Falcon			v	R1	AVW			The Black Falcon has a stronghold in inland Australia. Most Victorian records come from the lowlands and only occasionally from the foothills. It occurs mainly over croplands, grasslands and wooded farmlands. To catch flushed prey, they sweep low over croplands and grasslands and are often attracted by smoke from grassfires and late-summer burning off. This species nests in trees in old stick-nests of other birds (Marchant and Higgins 1993; Pizzey and Knight 2007).	1	Moderate	Was last recorded in 1999, habitat is present within precinct.
Monarcha melanopsis	Dicruridae	Black-faced Monarch		m			EPBC			Black-faced Monarch is a summer migrant to the south-east coastal areas. It is found mainly in rainforest, often in wet sclerophyll forests, and occasionally in mangroves. Sometimes in dry sclerophyll forests or woodlands, especially if they are open and near rainforests (Higgins, Peter and Cowling 2006; Pizzey and Knight 2007).		Low	It hasn't been recorded in AVW and habitat is not present
Oxyura australis	Anatidae	Blue-billed Duck	L		e		AVW		Present	This species inhabits deep, permanent, well-vegetated swamps, but at times (especially in winter) may occur in large numbers on large open wetlands. The Blue-billed Duck catches food while diving or occasionally by feeding from the water surface. Their nests are built on trampled swamp vegetation around the base of established stands of reeds/rushes, often over water or on small islands (Marchant and Higgins 1990; Pizzey and Knight 2007).	10	High	A large number of breeding pairs present in the wetlands near Cardinia Creek.
Coturnix ypsilophora	Phasianidae	Brown Quail			n	R3	AVW			The Brown Quail is widespread in Victoria, however suitable habitats are quite localised. Occupies mainly well watered areas. It has been reported from grass and sedge flats, often adjacent to rivers and swamps. Along major rivers in northern Victoria they occur in grassy River Red Gum forests and in eastern Victoria they inhabit wet woodlands and forests containing grasses, sword-sedges and gahnias. It has also been observed in bracken, lucerne pastures, and potato crops. It feeds and nests on the ground (Marchant and Higgins 1993).	1	Low	Last seen in 1976. Not likely to be present.

Scientific Name	Family Name	Common Name	Conservation Status				Database	Other Sources	Current Survey	Habitat Notes	No. of Records (AVW)	Likelihood of Occurrence	Likelihood Reasoning
			FFG	EPBC	DSE (2007c)	Regional Significance							
Climacteris picumnus victoriae	Climacteridae	Brown Treecreeper (south-eastern ssp.)			n	R3	AVW			Occurs in eucalypt woodlands, particularly open woodland lacking a dense understorey. It is sedentary and nests in tree hollows within permanent territories, breeding in pairs or communally in small groups. Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (Higgins, Peter and Steele 2001).	1	Low	Last recorded within 10km radius of areas in 2000. Preferred habitat not present.
Ardea ibis	Ardeidae	Cattle Egret		m			EPBC			Cattle Egret is a migratory species. Cattle Egret occurs in many types of wetlands; from tidal flats in estuaries and bays to the margins of inland lakes, swamps and rivers . They also use farm dams, mangroves, flooded areas, and artificial wetlands created by irrigation. Cattle Egret are often seen foraging away from water in crops and pasture, they build stick-nests in trees, usually surrounded by water or dense treed cover, or occasionally in reed-beds. The species nests colonially, often with other waterbirds. Egrets are threatened due to restricted nesting sites (Marchant and Higgins 1990; Pizzey and Knight 2007).		Low	Has not been recorded in the local area.
Galaxiella pusilla	Galaxiidae	Dwarf Galaxias	L	VU	v		EPBC/AVW			Occurs in vegetated margins of slow-flowing coastal creek backwaters, drains and swamps, often with dense aquatic macrophytes. Ephemeral sites require seasonal flooding and linkages to other more permanent populations for population replenishment; therefore wetland connectivity may be critical to survival. Rare in Victoria, however more abundant in the south-east of the state in Mornington Pennisula & Western Port areas (Allen, Midgley and Allen 2002; Saddlier, Jackson and Hammer 2010; Victoria 2006).	10	High	Recently recorded in 2010 adjacent to the precinct. 9 records within close proximity of the precinct. Known to occur in Cardinia Creek and adjacent floodplain.
Numenius madagascariensis	Scolopacidae	Eastern Curlew		m	n	R3	AVW			This species is a summer migrant to Victoria, from Siberian breeding grounds. Small numbers will over winter in coastal areas. During summer they occur regularly on tidal mudflats in Corner Inlet, Western Port and Port Phillip Bay. Small numbers occur elsewhere on coastal mudflats and, rarely, birds appear on muddy edges of inland saline lakes. They feed by probing in mudlfats, in rock pools and among seagrass and roost on spits, islets or in saltmarshes (Higgins and Davies 1996; Pizzey and Knight 2007).	2	Low	Last recorded in 1909.
Ardea modesta	Ardeidae	Eastern Great Egret	L	m	v		AVW		Present	Eastern Great Egret is widespread in Australia and has been observed in a wide range of wetland habitats including swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs (DEWHA 2010b).	3	High	Was seen on site during this study
Apus pacificus	Apodidae	Fork-tailed Swift		m		R1	EPBC			The Fork-tailed Swift is a migratory species occurring throughout Australia. This insectivorous species is almost entirely aerial. Occur over inland plains, often over cliffs or beaches, also over settled areas. Feed aerially, and probably also roost aerially, although rarely seen to land (Higgins 1999; Pizzey and Knight 2007).		Moderate	Could potentially fly over area as it is almost always aerial
Stictonetta naevosa	Anatidae	Freckled Duck	L		e		AVW			This species can occur on fresh water swamps, creeks, ponds, dams, reservoirs, sewage ponds and other ephemeral wetlands. It needs a thick cover of vegetation such as bulrush, lignum or tea-tree for nesting, which always occurs over water and usually with easy access from the water amongst shelter. This species is a specialist filter feeder, limiting foraging to aquatic habitats (Marchant and Higgins 1990).	1	High	Potential habitat is present on site
Plegadis falcinellus	Threskiornithidae	Glossy Ibis		m	n	R3	AVW			This species is a partial summer migrants to Victoria from northern Australia. They inhabit vegetated or muddy margins of freshwater wetlands and nearby grasslands and pastures. They forage in shallow water or mud on the margins of wetlands and occasionally from low vegetation and nest colonially, usually with other ibises. They build stick-nests in trees and shrubs low over water, in reed beds or on islands (Marchant and Higgins 1990; Pizzey and Knight 2007).	1	Low	Last recorded in 1976. Generally found further north than contract area.

Scientific Name	Family Name	Common Name	Conservation Status				Database	Other Sources	Current Survey	Habitat Notes	No. of Records (AVW)	Likelihood of Occurrence	Likelihood Reasoning
			FFG	EPBC	DSE (2007c)	Regional Significance							
Synemon plana	Castniidae	Golden Sun Moth	L	CR	c	N, S, R2	EPBC/AVW			It is generally found in temperate grasslands and open grassy woodlands where the ground layer is dominated by native Wallaby Grass. Optimal habitat is dominated by wallaby grasses *Austrodanthonia* spp. with an open tussock structure (O'Dwyer and Attiwill 2000). It has also been recorded in grasslands dominated by Kangaroo Grass *Themeda triandra* and exotic dominated grasslands (i.e. Chilean Needlegrass).	1	Low	No habitat present on site
Pteropus poliocephalus	Pteropodidae	Grey-headed Flying-fox	L	VU	v		EPBC/AVW			The Grey-headed Flying-fox occurs in various forest habitats in close proximity to plentiful supplies of nectar producing flowers and fleshy fruit. Large camps can be found roosting in the branches of tall trees in a range of vegetation, including rainforest patches, *Melaleuca* stands, mangroves, riparian woodland and modified vegetation in urban areas (Richards 1983).	1	Low	Not generally seen this far south, preferred habitat not present. Was last recorded within 10kms in 2003.
Pomatostomus temporalis	Pomatostomidae	Grey-crowned Babbler	L		e		AVW			This species inhabit dry forests and open woodlands, roadside trees, and wooded farmlands and can be associated with river floodplains. The Grey-crowned babbler feed in leaf and branch litter, bark and branch crevices and from foliage of shrubs and trees. They live in groups and build a series of large domed nests in shrubs or small trees (Higgins and Peter 2002; Pizzey and Knight 2007).	1	Low	Last record in 1988 within 10kms of contract area. Preferred habitat not present within contract area.
Litoria raniformis	Hylidae	Growling Grass Frog	L	V	e		EPBC/AVW			The species often inhabitant water bodies with a diverse assemblage of aquatic vegetation, including emergents such as sedges, submergent species such as curly pondweed, floating species such as water ribbon and filamentous algae . The aquatic vegetation provides sites for male frogs to call from, sites for eggs to be deposited and for relatively safe development, food and shelter for tadpoles. Dense submergent vegetation is especially important to protect eggs and tadpoles from predation (Anstis 2007; Hamer and Organ 2006; Heard, Robertson and Moysey 2004).	102	Moderate	Was recorded south of contract area during summer (2009/2010). Wetlands have potential habitat.
Aythya australis	Anatidae	Hardhead			v		AVW		Present	Hardheads inhabit deep to shallow wetlands with open water and fringing emergent vegetation (Pizzey and Knight 2007). The species feeds by diving in deep water and occasionally by dabbling just under the water surface (Rogers 1990). Nests are built in thick vegetation (e.g. reeds, lignum, cumbungi), usually over water (Halse et al. 2005; Rogers 1990). These birds are most common in the wetland systems of inland Australia (Halse et al. 2005). Birds do visit Victoria from these areas in spring and summer, returning as the northern wetlands is replenished by rain (Halse et al. 2005). However, some birds are present in Victoria all year round depending on the suitability of the wetland (Pizzey and Knight 2007).	16	High	Was recorded during present study.
Lichenostomus melanops cassidix	Meliphagidae	Helmeted Honeyeater	L	E	c		EPBC/AVW			Inhabits open eucalypt forest or woodland, Subspecies *cassidix* confined to Yellingbo area of Yarra Ranges. Nest in colonies along creeks and nests built in low shrubs (Higgins, Peter and Steele 2001).	1	Low	Last recorded in 1915.
Ardea intermedia	Ardeidae	Intermediate Egret	L		c		AVW		Present	The Intermediate Egret occurs in the shallows of mainly grassy inland wetlands, flooded pastures or grasslands. They only occasionally visit coastal wetlands and are generally rare in Victoria. They are sometimes seen foraging in pastures with grazing cattle. This species builds platform nests which are built in trees in riverine forest, swamp woodland and mangroves (Pizzey and Knight 2007).	1	High	Recorded during study
Acrodipsas brisbanensis	Lycaenidae	Large Ant Blue	L		e		AVW			The caterpillar of this species appears to spend its entire life within an ant nest and is suspected of being carnivorous, eating the ants. Adult butterflies tend to fly high near the tops of trees (Braby 2004). They are mostly found around coastal areas.	1	Low	Last recorded in 1941.
Gallinago hardwickii	Scolopacidae	Latham's Snipe		m	n	R3	EPBC/AVW		Present	Latham's Snipe is a migratory species. The species migrates to Victoria from breeding grounds in Japan. In Victoria this species is widely distributed in a range of habits including heavily vegetated freshwater swamps, and pools or ditches in heaths or subalpine herblands (Pizzey and Knight 2007). Also occurs in small ephemeral wetlands such as wet depressions after floods recede. Generally roosts in thick vegetation during the day, sometimes under shrubs away from wetlands, and will feed in swamps at night. They are occasionally seen feeding during the day. This species feeds by probing in soft mud and rarely moves far from concealing vegetation (Higgins and Davies 1996).	15	High	Seen during this study.

Scientific Name	Family Name	Common Name	Conservation Status				Database	Other Sources	Current Survey	Habitat Notes	No. of Records (AVW)	Likelihood of Occurrence	Likelihood Reasoning
			FFG	EPBC	DSE (2007c)	Regional Significance							
Potorous tridactylus tridactylus	Potoroidae	Long-nosed Potoroo (SE mainland)	L	VU	e		EPBC			The Long-nosed Potoroo is most commonly found in heathy coastal vegetation, dry and wet sclerophyll forests with a dense understorey with a sandy loamy soil. Their habitat tends to have some open areas with a grassy understorey for foraging. Preferred habitat has an understorey that may feature grass-trees, sedges, ferns or heath, or low shrubs of tea-trees or melaleucas (Johnston 2008).		Low	
Anseranas semipalmata	Anseranatidae	Magpie Goose	L		n	R3	AVW			Most of the populations of this species have been re-introduced. They breed colonially and build platform nests over water, usually among tall rushes or reedbeds. The Magpie Goose feeds by digging in mud or by up-ending in shallow water, they have also been see grazing and digging well away from water (Marchant and Higgins 1990).	1	Low	1987
Biziura lobata	Anatidae	Musk Duck			v		AVW		Present	Usually seen in small numbers on the deep waters of well vegetated fresh to saline lakes, swamps and occasionally shallow inlets and bays. Nests formed in low vegetation in areas sheltered by surrounding vegetation (Marchant and Higgins 1990; Pizzey and Knight 2007).	2	High	Was recorded during present study.
Pseudomys novaehollandiae	Muridae	New Holland Mouse	L		v		AVW			The New Holland Mouse is found in dry heath and open forest where understorey is low growing and leaf-litter is sparse They are nocturnal, gregarious, and shelter in burrow systems up to several metres long (Kemper and Wilson 2008).	1	Low	Last recorded within 10km of area in 1976.
Neophema chrysogaster	Psittacidae	Orange-bellied Parrot	L	CR/m	c		EPBC			Breed in south-west Tasmania and are winter migrants to Victoria where they are usually present from late March to early November, inhabiting coastal habitats such as bays and estuaries in saltmarshes, herbland or low shrublands (Higgins 1999). Much of their winter habitat has been altered and saltmarshes in low low rainfall areas have been developed for uses such as salt extraction. Illegal trapping has also reduced numbers.		Low	Never been recorded within 10km of area and habitat not present.
Larus pacificus pacificus	Laridae	Pacific Gull			n	R3	AVW			The Pacific Gull is one of the largest gulls within the Australian and New Zealand territories, confined to the coast where flocks occur on intertidal mudflats and nearby rubbish tips in Port Phillip Bay, Western Port and Corner Inlet, with smaller numbers elsewhere on estuaries, along beaches and on other intertidal habitats (Higgins and Davies 1996). This species breeds mainly on islands in Bass Strait and off Tasmania. Smaller numbers breed on islands off Wilsons Promontory. Their nests are built on the ground on the tops of steep-sided islands (Higgins and Davies 1996).	20	Moderate	Last recorded within 10 km of area in 2006. However not likely to be core habitat.
Grantiella picta	Meliphagidae	Painted Honeyeater	L		v		AVW			The Painted Honeyeater is a summer migrant to Victoria. They are generally found to inhabit box-ironbark, Broad-leaved Peppermint and Red Stringybark forests and box-buloke woodlands in the northern foothills of the great Divide. May also occur in Red Ironbark and Red Box forests in southern Victoria. They are occasionally found along the Murray River valley to Hattah-Kulkyne National Park where they inhabit Black Box woodlands. This species is usually found in open stands of old eucalypts that are infested with mistletoes (Higgins, Peter and Steele 2001).	1	Low	Last recorded in 1981 within 10km of contract area. Not generally seen in this part of Victoria.
Rostratula australis	Rostratulidae	Australian Painted Snipe	L	V/m	cr		EPBC/AVW			Listed as vulnerable under the EPBC Act. This species is migratory. They usually occur in the lowlands on shallow freshwater swamps with emergent vegetation, and flooded saltmarshes. They do not form flocks but loose groups are sometimes seen, either alone or with Latham's Snipe. Painted Snipe forage on mud among dense swamp vegetation. Their nests are depressions or well made nest of twigs and reeds surrounded by shallow water and dense vegetation (Marchant and Higgins 1993; Pizzey and Knight 2007).		Low	Not been recorded within 10km of contract area. Preferred habitat not present within contract area.
Phalacrocorax varius	Phalacrocoracidae	Pied Cormorant			n	R3	AVW		Present	This species is most often found along the coast, however are known to use inland wetlands including billabongs, deep and open swamps and rivers (large freshwater and saline wetlands). They nest in colonies, building platforms nests in mangroves or other trees (Marchant and Higgins 1990; Pizzey and Knight 2007).	2	High	Was recorded during present study, was paired and breeding.

Scientific Name	Family Name	Common Name	Conservation Status				Database	Other Sources	Current Survey	Habitat Notes	No. of Records (AVW)	Likelihood of Occurrence	Likelihood Reasoning
			FFG	EPBC	DSE (2007c)	Regional Significance							
Ninox strenua	Strigidae	Powerful Owl	L		v	R1	AVW			The Powerful Owl is widespread in foothill and coastal forests where they tend to favour gullies with peppermint and manna gum forests. They are occasionally seen in wetter mountain forests, drier box-ironbark forests, open woodlands, and softwood plantations. This species requires very large hollows for breeding (Higgins 1999).	4	Low	Last recorded in 2003 within 10kms of contract area. Preferred habitat not present within the contract area.
Merops ornatus	Meropidae	Rainbow Bee-eater		m			EPBC			The Rainbow Bee-eater is a migratory species. It occurs in many types of habitat including woodland, shrubland, semi-cleared land and farmland, however it mainly occurs where eucalyptus species are dominant (Higgins 1999). It is almost entirely insectivorous and mostly occurs near to permanent water (Higgins 1999).		Low	Has not been recorded in the local area.
Anthochaera phrygia	Meliphagidae	Regent Honeyeater	L	EN/m	c		EPBC			Occurs mainly in box-ironbark forests and woodlands north of the Great Divide. This species is highly nomadic as their movements are determined by the flowering of eucalypts (Higgins 1999; Pizzey and Knight 2007).		Low	Has not been recorded in the local area.
Gadopsis marmoratus	Gadopsidae	River Blackfish			d	R3	EPBC/AVW			Predominantly in clear slow flowing waterways where abundant fallen branches and snags occur, reaching to tidal, brackish areas. Throughout their lifespan the River Blackfish remain in small (20-30) areas and is susceptible to over-fishing (Allen, Midgley and Allen 2002).	1	Low	last record within 10kms of contract area was in 1985. This record was in creeks north of the contract area in the ranges.
Platalea regia	Threskiornithidae	Royal Spoonbill			v		AVW		Present	The Royal Spoonbill inhabits the shallow parts of fresh and saline wetlands; these birds are gregarious in small flocks. They are mostly common on intertidal mudflats in coastal bays. Their stick-nests are built in reeds, shrubs or trees, singly or in loose colonies and are often seen with other species (Rogers 1990).	5	High	Was recorded during this study. Was paired and breeding.
Rhipidura rufifrons	Dicruridae	Rufous Fantail		m		R2	EPBC			The Rufous Fantail is migratory and can be found in a variety of habitats including swampy woodland, rainforest, mangrove, dense wet forests. It is generally found where there is dense shade and thick understorey shrubs and bushes and is often seen close to the ground. It can be found in less dense habitats during migration and has been seen in many urban sites (Higgins, Peter and Cowling 2006).		High	Although not recorded previously, potential habitat exists within the contract area.
Myiagra cyanoleuca	Dicruridae	Satin Flycatcher		m		R2	EPBC			The Satin Flycatcher is a migrant to southern parts of Victoria during the spring/summer months. It is generally found in many habitat types including wet sclerophyll forest and woodland, particularly along watercourses (Higgins, Peter and Cowling 2006).		Low	No previous record near contract area. Preferred habitat not present within contract area.
Pseudomys fumeus	Muridae	Smoky Mouse	L	EN	cr		EPBC			The Smoky Mouse occurs mainly in dry sclerophyll forest on ridges with heath and tussock-grass understorey, and within coastal heath and subalpine heath. It shelters communally in a nest on the surface of the ground. Its preferred habitat is dense heath, and its diet consists of fungi, seeds and flowers. It has a patchy distribution and may have a successional pattern of occurrence relating to time since fire (Menkhorst and Knight 2001; Van Dyck and Strahan 2008).		Low	This species has not been recorded previously within 10kms of contract area. Preferred habitat not present.
Isoodon obesulus obesulus	Peramelidae	Southern Brown Bandicoot	L	E	n	R3	EPBC/AVW			The Southern Brown Bandicoot is both active during the day and night. It is found in forest, heath and shrub communities. It shelters in a nest of vegetation beneath dense cover and eats fungi, tubers and arthropods (Menkhorst and Knight 2001; Van Dyck and Strahan 2008).	23	Moderate	Last seen in 2005 within 10kms of contract area. Potential habitat present in and adjacent contract area (Stewart and Shepherd 2010).
Tyto tenebricosa	Tytonidae	Sooty Owl	L		v		AVW			Inhabits mainly old growth forests in large areas of continuous forest. They are absent or rare in some areas where the habitat seems suitable such as Otway Ranges, Wilsons Promontory and Strzelecki Ranges. This may be because the forests are too small or fragmented. They catch prey from branches of trees and shrubs or from the ground. They nest and roost in large holes in eucalypts; occasionally they also roost on low tree branches or the tops of tree-ferns. These owls are sedentary and territorial (Marchant and Higgins 1990).	1	Low	Last recorded in 1992 within 10kms of contract area. Habitat not present on site.

Scientific Name	Family Name	Common Name	Conservation Status				Database	Other Sources	Current Survey	Habitat Notes	No. of Records (AVW)	Likelihood of Occurrence	Likelihood Reasoning
			FFG	EPBC	DSE (2007c)	Regional Significance							
Pseudophryne semimarmorata	Myobatrachidae	Southern Toadlet			v		AVW		Present	The Southern Toadlet can be found in dry forest, woodland, shrubland, grassland and heaths. It shelters under leaf litter and other debris in moist soaks and depressions. Their eggs are spawned in shallow burrows under organic litter in low areas close to water (Hero, Littlejohn and Marantelli 1991).	84	High	Was recorded during this study.
Dasyurus maculatus maculatus (SE mainland population)	Dasyuridae	Spot-tailed Quoll	L	EN	e		EPBC			The Spot-tailed Quoll is a carnivorous marsupial and found in many different treed habitats including rainforest, wet and dry sclerophyll forest and woodland. In parts of Tasmania it is also found in coastal heath and scrub (Belcher, Burnett and Jones 2008; Menkhorst and Knight 2001; Van Dyck and Strahan 2008).		Low	Not found within this part of Victoria anymore. Habitat not present
Circus assimilis	Accipitridae	Spotted Harrier			n	R2,R3	AVW			This species occurs in open grasslands, open shrublands, saltbush, open woodlands, crops and similar low vegetation that allows hunting. Their stick nests are built in low trees (Pizzey and Knight 2007).	2	Moderate	This species was last record within 10km of contract area in 2004. One record is very close to the contract area. Potential hunting sites are present.
Egernia coventryi	Scincidae	Swamp Skink	L		v		AVW			The Swamp Skink can be found in cool temperate, low-lying wetlands including swamp margins, tea-tree thickets and tidal salt-marshes. This species is secretive, and often found in dense low vegetation. It shelters in burrows (Wilson and Lowe 2003).	11	Moderate	Last recorded within 10kms of contract area in 1996. Potential habitat present on site.
Polytelis swainsonii	Psittacidae	Superb Parrot	L	VU	e		EPBC/AVW			This species is generally only found in the Upper Murray Valley, mainly in the riverine forests and woodlands of the Barmah Forest in Victoria. All other sightings have been made along or within 10 km of the Murray, Ovens and Goulburn Rivers. Their nests are located in hollows of very large riparian trees in River Red Gum forests. They feed mainly in Black Box, Grey Box, Yellow Box woodlands and sometimes in open woodland. They forage in their nesting forests and may also forage on the ground, in eucalypts and in mistletoes (Higgins 1999; Pizzey and Knight 2007).	1	Low	Not been recorded within 10kms of contract area previously.
Lathamus discolor	Psittacidae	Swift Parrot	L	E	e	R1	EPBC/AVW			The Swift Parrot is a winter migrant to Victoria which arrive from their breeding areas in Tasmania; however, small numbers of non-breeding birds may remain here during summer. They are nomadic and follow the flowering trees and psyllid infestations. They are often seen in box-ironbark forests and can be seen in urban parks. They occur sporadically elsewhere in forests and woodlands but are rarely seen in treeless areas, rainforests or wet forests (Higgins 1999; Pizzey and Knight 2007).	1	Low	Last recorded in 1989. Preferred habitat not present in contract area.
Chlidonias hybridus	Laridae	Whiskered Tern			n	R2,R3	AVW			This is mainly a summer migrant to Victoria, although some remain here over winter. They inhabit shallow freshwater swamps and fresh or brackish lakes, favouring areas with emergent vegetation. The Whiskered Tern builds nests on the water in colonies among flooded or emergent vegetation (Pizzey and Knight 2007).	2	Moderate	Last recorded in 2004 within 10kms of contract area. Potential habitat present.
Haliaeetus leucogaster	Accipitridae	White-bellied Sea-Eagle	L	m	v		EPBC/AVW			The White-bellied Sea-eagle mainly occurs along the coast, but may travel along some inland rivers and lakes (Pizzey and Knight 2007).	6	Moderate	Last recorded in 1997 within 10kms of study area. However, anecdotal evidence suggests this species hunts within wetlands onsite occasionally.
Hirundapus caudacutus	Apodidae	White-throated Needletail		m			EPBC			White Throated Needletail is a migratory species. It is almost entirely aerial and occurs over many types of habitat (Pizzey and Knight 2007).		Moderate	Potential habitat is present on site

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NOTES:
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VERSION: 02	DATE: 30/09/10

MAP AND SURVEY DETAILS
Mapping by: Staci Timms, 20/04/10
Flora Survey by: Mark Shepherd, Peter Gannon and Jeremy Neal
29 Oct-7 Nov 2008 and 28 Jan 2010
Generated from: Aerial Imagery and GIS base layers supplied by DSE and GAA, additional GIS layers from Geoscience Australia.

DATUM: GDA 94 VICGRID 94

N

0 50 100 150 200
Metres

1:4,000 when printed at A3

LEGEND

- Roads
- Watercourse
- 257423 Property Boundary and PFI
- C21 Business Park Study Area
- Non Native Vegetation and/or Degraded Treeless Vegetation*

Scattered Trees

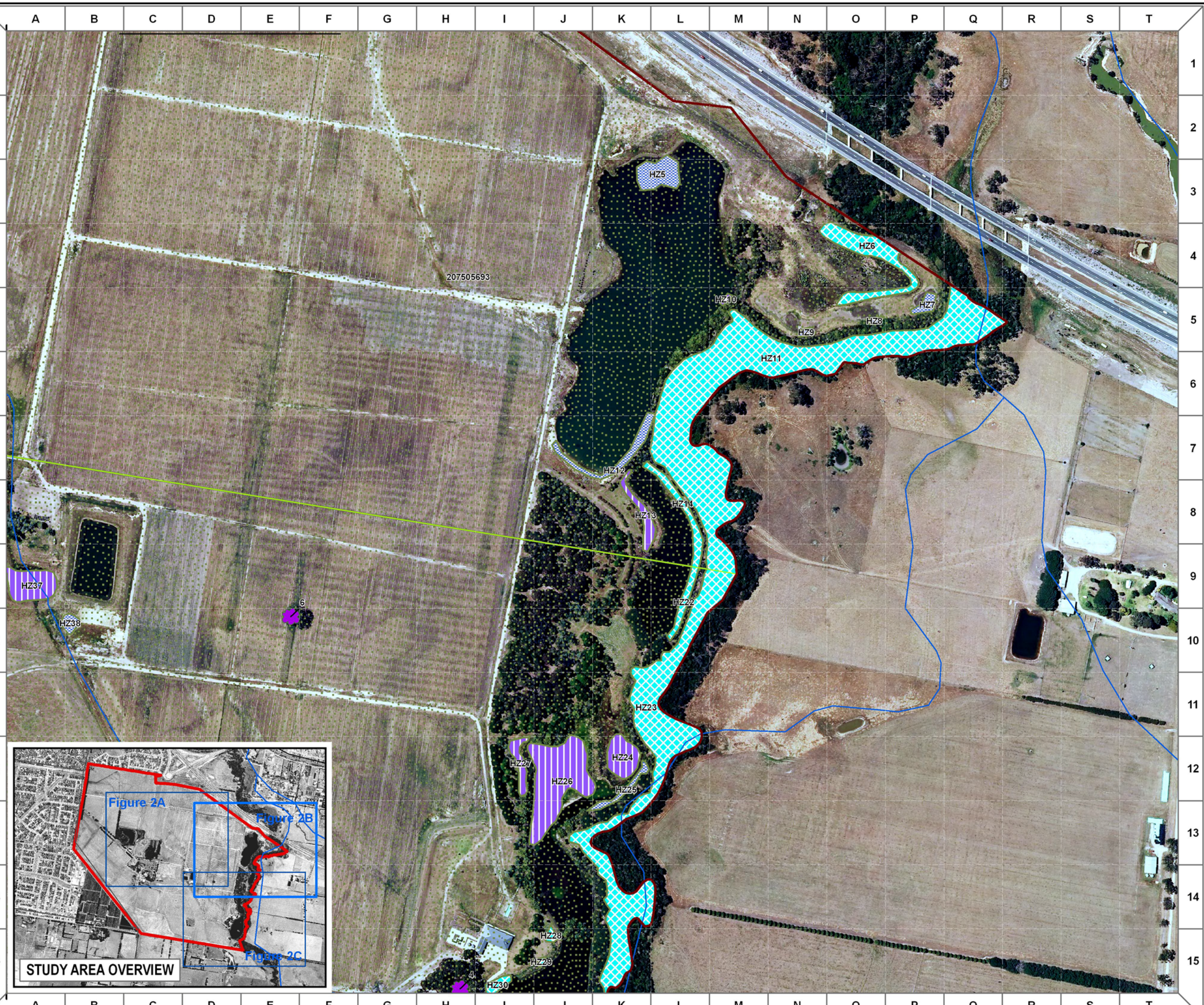
- Small Tree
- Very Large Old Tree

Ecological Vegetation Classes

- EVC 136: Sedge Wetland
- EVC 53: Swamp Scrub
- EVC 55: Plains Grassy Woodland
- EVC 653: Aquatic Herbland
- EVC 821: Tall Marsh
- EVC 83: Swampy Riparian Woodland

*Non Native Vegetation and Degraded Treeless Vegetation were not differentiated at time of survey (refer to methods section of this report).

FIGURE 4A
ECOLOGICAL VEGETATION CLASSES AND SCATTERED TREES
C21 Business Park
Biodiversity Mapping Project
2009-2011



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LEGEND

- Roads
- Watercourse
- 257423 Property Boundary and PFI
- C21 Business Park Study Area
- Non Native Vegetation and/or Degraded Treeless Vegetation*

Scattered Trees

- Small Tree
- Very Large Old Tree

Ecological Vegetation Classes

- EVC 136: Sedge Wetland
- EVC 53: Swamp Scrub
- EVC 55: Plains Grassy Woodland
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- EVC 821: Tall Marsh
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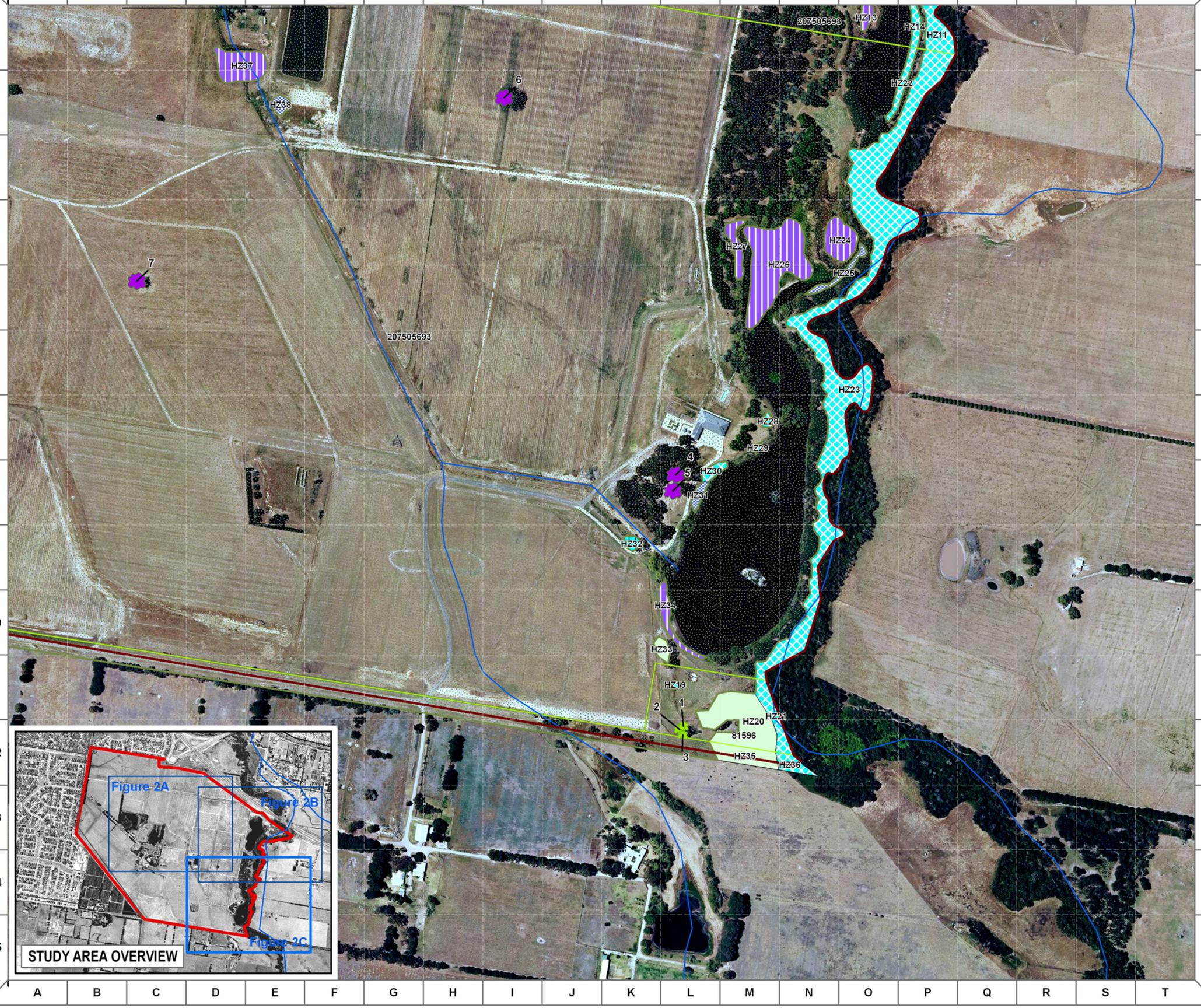
FIGURE 4B
ECOLOGICAL VEGETATION CLASSES AND SCATTERED TREES
C21 Business Park
Biodiversity Mapping Project
2009-2011



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DATUM: GDA 94 VICGRID 94

N

0 50 100 150 200
Metres

1:4,000 when printed at A3

LEGEND

- Roads
- Watercourse
- 257423 Property Boundary and PFI
- C21 Business Park Study Area
- Non Native Vegetation and/or Degraded Treeless Vegetation*

Scattered Trees

- Small Tree
- Very Large Old Tree

Ecological Vegetation Classes

- EVC 136: Sedge Wetland
- EVC 53: Swamp Scrub
- EVC 55: Plains Grassy Woodland
- EVC 653: Aquatic Herbland
- EVC 821: Tall Marsh
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FIGURE 4C
ECOLOGICAL VEGETATION CLASSES AND SCATTERED TREES
C21 Business Park
Biodiversity Mapping Project 2009-2011