

**Flora and fauna assessment
of CSIRO land, Highett, Victoria**

March 2004

Jeff Yugovic and Sally Koehler

Report for CSIRO and Bayside City Council

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ABBREVIATIONS

| | |
|-------|--|
| ARCUE | Australian Research Centre for Urban Ecology |
| AVW | Atlas of Victorian Wildlife (DSE) |
| DSE | Department of Sustainability & Environment, Victoria formerly NRE (Department of Natural Resources & Environment) |
| EPBC | <i>Environment Protection and Biodiversity Conservation Act 1999</i> |
| EVC | Ecological vegetation class |
| FFG | <i>Flora and Fauna Guarantee Act 1988 (Vic.)</i> |
| FIS | Flora Information System (DSE) |
| IUCN | International Union for the Conservation of Nature |
| PMST | Protected Matters Search Tool (EPBC Act) |
| sp. | Species (one species) |
| spp. | Species (more than one species) |

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1.0 INTRODUCTION

1.1 Project Background

Biosis Research Pty Ltd was commissioned by CSIRO to undertake a flora and fauna assessment of its land at Highett, Melbourne, Victoria. Bayside City Council, at its 6 October 2003 meeting, also resolved to undertake a native vegetation assessment of the CSIRO site. CSIRO and Bayside City Council subsequently agreed to combine their efforts into a single project.

1.2 Objectives

The objectives of this investigation are to:

- Identify and map all flora and fauna of conservation significance.
- Identify conservation values that require long term protection if CSIRO vacates the site in future.
- Prepare a conservation management plan for CSIRO's occupancy of the site.

1.3 Study Area

The study area (or site) is defined as Commonwealth Government land occupied by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Graham Road, Highett (Figure 1). The land is currently used by the Division of Manufacturing and Infrastructure Technology. Most of the site is occupied by buildings, access roads and lawns. Remnant native vegetation is also present, mainly in the south of the site. The land area is approximately 9.5 hectares.

2.0 METHODS

2.1 Taxonomy

Common and scientific names for plants and terrestrial vertebrate fauna (mammals, birds, reptiles, amphibians) follows the Flora Information System (FIS) 2002 Version and the Atlas of Victorian Wildlife (AVW) of the Department of Sustainability and Environment (DSE).

2.2 Literature and Database Review

Pre-existing information in the FIS and AVW databases was reviewed. A search of the online Protected Matters Search Tool (PMST) for the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* was conducted. Relevant literature sources were also reviewed.

2.3 Field Survey

The composition, structure and condition of the vegetation and fauna habitat were assessed. A list of indigenous flora species was compiled and terrestrial vertebrate fauna observed were documented. The locations of flora were recorded and the stem diameter of the eucalypts were estimated.

Field survey took place on 17 October 2003.

2.4 Limitations

As relatively limited native vegetation and fauna habitat is present within the site, and the site has been subject to previous flora survey, there are no significant limitations on the data available and conclusions made.

The present survey includes only vascular flora (ferns, conifers and flowering plants) and terrestrial vertebrate fauna. Non-vascular flora (e.g. mosses, liverworts), invertebrates and aquatic fauna are not considered.

2.5 Defining Significant Species and Communities

A number of categories and criteria are formally applied to assess the conservation significance of flora and fauna and sites supporting flora and fauna. The definition and application of the criteria are detailed in Appendix 1.

3.0 RESULTS

3.1 Flora

3.1.1 Species

Records from present assessment

A total of 20 indigenous plant species is recorded from the site (Figure 2, Appendix 2). An additional 5 species have been reported (Appendix 2).

It is possible that a dormant soil seed bank containing further indigenous species is present within the soil on the site.

FIS database records

The FIS has records of 614 flora species from within 5 km of the site but none from the site itself. Apart from those already recorded, it is unlikely that many of these species occur on the site, and those that do are likely to be weeds.

3.1.2 Ecological Vegetation Classes

Classification of native vegetation in Victoria follows a typology in which ecological vegetation class (EVC) is the primary level of classification. Each EVC contains one or more floristic communities (Oates and Taranto 2001).

Most of the site supports introduced vegetation composed of planted non-indigenous trees and shrubs over an introduced ground layer.

Remnants of the pre-existing native woodland are present, most noticeably the eucalypt trees. A small range of indigenous understorey species is also present. The native vegetation is highly modified from original condition through loss of sensitive species and their replacement by introduced species.

Grassy Woodland (Modified)

The vegetation is considered here to be a modified form of Grassy Woodland, however the vegetation is similar to another EVC, Plains Grassy Woodland. Some discussion of the relationships of the vegetation is required. Both are endangered in the bioregion (DSE 2003) and have similar planning implications.

The DSE 1:100,000 vegetation map of the pre-1750 distribution of EVCs in the Melbourne area (DSE 2003a) shows the following:

1. Most of the site is mapped as supporting the EVC '719 Grassy Woodland / Damp Sands Herb-rich Woodland Mosaic'. This means that the site

supported either one or both of these EVCs but the mapping does not indicate which EVC was present. The geology map (1:63,360 Ringwood sheet) indicates this vegetation mosaic was correlated with associated with Tertiary Red Bluff Sands consisting of ‘fine to coarse sands, with minor poorly sorted gravels, poorly consolidated’, the ‘red beds’ of Hart (1939).

2. The south-west corner of the site is mapped as supporting ‘892 Heathy Woodland / Sand Heathland Mosaic’. This means that the site supported either one or both of these EVCs but the mapping does not indicate which EVC was present. The geology map (1:63,360 Ringwood sheet) indicates this vegetation mosaic was correlated with Quaternary ‘sand ridges and sand hills’. However the south-west corner of the site is flat and has River Red-gums *Eucalyptus camaldulensis* and a Swamp Gum *Eucalyptus ovata*, indicating that vegetation mosaic EVC 892 was not present. A sand ridge that may have supported this vegetation type is immediately south of the site.

Yellow Box and River Red-gum were associated with ‘flat-topped ridges’ within the red beds (Red Bluff Sands), suggesting slow runoff of water but not involving any swampiness (Hart 1939). The red beds were markedly different in soils and vegetation from the longitudinal Quaternary sand dunes running parallel and in a south-easterly orientation through the sandbelt of Melbourne. These dunes supported Sand Heathland and Heathy Woodland (Oates and Taranto 2001).

River Red-gum *Eucalyptus camaldulensis* is typical of Plains Grassy Woodland (Oates and Taranto 2001). Yellow Box *Eucalyptus melliodora* may occur sporadically within Plains Grassy Woodland in the Gippsland Plain Bioregion, for example at Bundoora (Koehler and Yugovic 2002). At CSIRO Highett, River Red-gum is the most frequent species among the remaining trees, outnumbering Yellow Box 26 to 7. However, it is unknown whether Yellow Box has been selectively cleared in the past or has been less durable under disturbance. Hart (1939) stated that Yellow Box was the ‘chief tree’ at the site he described south of Highett Station corresponding approximately to the CSIRO land.

The small number of persistent species now present on the site occur in both Grassy Woodland and Plains Grassy Woodland and therefore are not useful in discerning between these EVCs. A possible exception is *Austrodanthonia geniculata* which tends to occur more in Grassy Woodland. However they represent only a small proportion of those originally present. The full flora, if it were present, would make classification more straightforward. Hart’s (1939) reference to *Platylobium obtusangulum* and *Acrotriche serrulata* indicate Grassy Woodland as they are diagnostic species (D. Frood, botanical consultant, pers. comm.). This evidence, with Hart’s statement that Yellow Box was the ‘chief tree’, makes Grassy Woodland the more appropriate EVC.

The vegetation may have been transitional, as a broad drainage line runs through the northern part of the site, as indicated by the Special Building Overlay (SBO) in the Bayside Planning scheme. The Special Building Overlay is applied to areas identified by Melbourne Water as being at risk of inundation for a 1 in 100 ARI storm event. The apparent gap in the SBO for the CSIRO property is because the planning controls do not apply on Commonwealth land. The extent of the 1 in 100 year inundation, as modelled by Melbourne Water to today's conditions, can be interpolated across the site (P. Johnstone, Bayside City Council, pers. comm.). This drainage line may have supported River Red-gum within Plains Grassy Woodland. However, the red gums extend well outside this drainage line onto relatively well-drained land.

'Yellow Box Grassy Woodland' is mapped and described as a plant community in the south-eastern Melbourne area by Scott et al. (2002). There are indications that Yellow Box is associated with a distinct floristic community within the Grassy Woodland EVC although the evidence is now fragmentary. While most species recorded by Hart (1939) are members of typical grassy woodland on the Mornington Peninsula, five species are not: Yellow Box, River Red-gum, Lightwood *Acacia implexa*, Narrow-leaf Bitter-pea *Daviesia leptophylla*, Curved Rice-flower *Pimelea curviflora*. Since Hart's list was only a short partial list, there may have been other species that distinguished the vegetation from typical grassy woodland and there may also have been absences of typical species.

The pre-European vegetation map of the Melbourne sandbelt in Scott et al. (2002) and the DSE pre-1750 EVC vegetation map are not consistent. Scott et al. used more detailed information (1 m contours, historical sources, old herbarium specimens etc) and mapped at a much finer scale than DSE's pre-1750 mapping. The mapped Yellow Box Grassy Woodland in Scott et al. (2002) is within the mapped Grassy Woodland of DSE. However, another community mapped by Scott et al. (2002), Red Gum Grassy Woodland, is also within Grassy Woodland on the DSE map. This suggests that the two woodland communities of Scott et al. are discrete units within the Grassy Woodland EVC.

An alternative interpretation is that 'Yellow Box Grassy Woodland' is equivalent to DSE's Grassy Woodland and 'Red Gum Grassy Woodland' is equivalent to DSE's Plains Grassy Woodland (a different EVC) although not accurately mapped by DSE and/or Scott et al. This is probably the better interpretation.

Further research into the status of 'Yellow Box Grassy Woodland' in the southern Melbourne area and in the Gippsland Plain Bioregion is recommended. Such research may include comparing a species list from Yellow Box woodland (i.e. from Hart, herbarium specimens and existing remnants) with lists from other sites from the Gippsland Plain recorded in the DSE Flora Information System using statistical similarity measures (N. Williams, ARCUE, pers. comm.).

3.2 Fauna

3.2.1 Species

Records from present assessment

A total of 15 terrestrial vertebrate fauna species was recorded from the site during the present survey (Appendix 3). This includes 10 indigenous species (two mammals, eight birds) and five introduced species (all birds). Michael Harvey (CSIRO, pers. comm.) reported that a night security guard has observed an additional species, the nationally significant Grey-headed Flying-fox. An additional 10 indigenous species have been reported (Appendix 3).

AVW database records

The DSE Atlas of Victorian Wildlife contains recent records of 151 additional terrestrial vertebrate fauna species from the local area: 10 mammals (five native, five introduced), 132 birds (124 native, eight introduced), four reptiles (all native) and five frogs (all native). The site is highly modified and does not contain suitable habitat for most of these species. Some would be expected to use the site, either as residents, or visitors on a regular, uncommon or rare basis.

3.2.2 Habitat

Fauna habitat within the site is highly modified and consists of buildings interspersed with planted non-indigenous native and exotic trees. There are numerous scattered remnant indigenous eucalypts, particularly in the south, some of which contain hollows. Nest boxes have been placed in some trees in the past. The understorey is kept mown and there is no fallen debris. The site is of limited habitat value for most fauna species recorded in the local area.

4.0 CONSERVATION SIGNIFICANCE

From the available information, the CSIRO Highett site has **regional** significance for biodiversity. It makes a substantial contribution to biodiversity in the Melbourne sandbelt area and within the Gippsland Plain Bioregion.

The Gippsland Plain Bioregion extends from Melbourne to Lakes Entrance.

The site is significant for the following reasons:

- Presence of a small remnant of Grassy Woodland, an endangered ecosystem in Australia and in the Gippsland Plain Bioregion, and critically endangered in the Melbourne area, although highly modified by loss of sensitive species and weed invasion. There are indications that Yellow Box is associated with a distinct floristic community within the Grassy Woodland EVC.
- Presence of regionally rare Yellow Box *Eucalyptus melliodora*, and an unusual occurrence of the species in Grassy Woodland in southern Victoria. The trees are of biogeographic significance and provide evidence of natural vegetation patterns in the western part of the bioregion.
- Presence of seven recorded flora species that are rare within the Gippsland Plain Bioregion and therefore of regional significance, including the particularly rare species Sweet Hound's-tongue *Cynoglossum suaveolens*.
- Presence of several large individuals of Yellow Box and River Red-gum. Some of the trees appear to have hollows, suggesting a considerable age for these trees. However, the Council's arborists' view is that the apparent hollows are wounds from damage and bracket fungus that may develop into true hollows in future (P. Johnstone, Bayside City Council, pers. comm.). Old eucalypt trees generally produce more nectar hence the trees may be very important to fauna in the local area due to the absence of other old trees.
- Presence of several native flora and fauna species that are rare within the Highett area and therefore of local significance for biodiversity.

Extremely little native vegetation remains in Highett, another example being highly modified vegetation in the Sir William Fry Reserve next to the railway line (heathland species) (N. Williams, ARCUE, pers. comm.).

It is noted that the vegetation has considerable social value in addition to its scientific or environmental value:

- The site has historical conservation significance as it forms part of the small area south of Highett Station described by Hart (1939) as the last intact remnant of a 'lost vegetation' community in southern Melbourne. Remarkably, some of trees and vegetation survived.
- The site provides a rare connection to the pre-European history of the Highett area.
- In terms of landscape preservation, woodlands dominated by Yellow Box and River Red-gum were once locally extensive in the sandbelt of Melbourne, with the last remaining example at Highett described by Hart (1939).
- Potential of the site as an indigenous garden with demonstration indigenous lawns that require no watering, no fertilising and minimal mowing.
- Potential of the site for research and education in indigenous garden management, natural heritage conservation and ecological sustainability.

The social value of indigenous vegetation can exceed its scientific value, as recently discussed in a planning panel report on a site in nearby Mentone:

In considering the broader community significance of the biodiversity values of such a site, in the Panel's view a balance must be struck between its strictly scientific significance (in terms of species and ecological vegetation class), its location and its context. In strictly scientific terms, its significance is high local to regional. However, the location of the site in an urban context, surrounded by cleared and developed land, but accessible to and appreciable by a large population, provides it in the Panel's view with a greater than strictly scientific significance.

(Kingston Planning Scheme Amendment C25 Chicquita Park: Panel Report, 2004)

The sandbelt (south-east suburbs) of Melbourne has little remaining natural heritage, and is on the verge of losing its native Australian landscape character. As a result, Melbourne is a different city to Sydney for example, which has numerous bushland reserves. At least 100 species of the sandbelt flora are locally extinct (Australian Research Centre for Urban Ecology, Royal Botanic Gardens, data), and most of the surviving species are threatened.

The CSIRO site is unusual in its suburban residential context, in that land use over the past century has isolated but not eliminated its native vegetation. Unlike the surrounding land the southern section has not been systematically cleared, developed or landscaped with exotic vegetation. This endows the site with high conservation significance in the context of the Melbourne urban area.

4.1 Previous Assessments

Hart (1939) described native woodland vegetation in a small area ‘about half a mile directly south of Highett Station’ which corresponds to the CSIRO site. Exactly half a mile south is on the adjacent Telstra land, and on Quaternary sand dune (1:63,360 Ringwood sheet) which is not the correct substrate. It appears that the CSIRO land is within Hart’s site and that the Yellow Box woodland extended slightly east of Graham Road (now housing, with no indigenous trees).

Cook (2003) assessed the flora and vegetation of the CSIRO site, concluding that ‘The area is of great conservation significance, not only because of the age of the trees on the site and their local rarity, but also as an example of an extremely depleted vegetation type’.

4.2 Significant Flora

Significant flora recorded from the site, recorded from the local area (FIS), or predicted to occur in the local area (EPBC Act Search Tool) are discussed below.

No flora species of national or state significance are known from the site. Three flora species of national significance and four flora species of state significance are recorded from within 5 km of the site (DSE Flora Information System). Three flora species listed as threatened under the EPBC Act are predicted to occur, or their habitat is predicted to occur, within 5 km of the site. There is no likelihood of these species occurring within the site (Appendix 2).

Seven of the recorded flora species have regional significance within the Gippsland Plain Bioregion (Table 1).

Table 1. Regionally significant flora

| Common name | Species | Comments |
|-----------------------|---------------------------------|------------------------|
| Lightwood | <i>Acacia implexa</i> | 1 plant |
| Sheep's Burr | <i>Acaena echinata</i> | c. 10 plants |
| Velvet Wallaby-grass | <i>Austrodanthonia pilosa</i> | < 50 plants |
| Sweet Hound's-tongue | <i>Cynoglossum suaveolens</i> | 2 plants |
| Yellow Box | <i>Eucalyptus melliodora</i> | 7 trees, southern area |
| Creeping Mistletoe | <i>Muellerina eucalyptoides</i> | substantial population |
| Grassland Wood-sorrel | <i>Oxalis perennans</i> | 2 plants |

Yellow Box occurs over approximately half of the Gippsland Plain Bioregion, in two areas at either end of the bioregion (DSE Flora Information System): (1) eastern Melbourne, where it is occasional on relatively shallow soils associated with Palaeozoic bedrock and rare on deep sands of the south-eastern sandbelt (including Highett), (2) east of Morwell, including the Sale Plain.

The nearest records of Yellow Box in the DSE Flora Information System are from 9 km to the north-east (Ashburton) and 9 km to the south-east (Braeside Park). However, two trees also occur near Moorabbin railway station, 2 km to the north of the CSIRO site (Scott et al. 2003). There are also Yellow Box in Alma Park, St Kilda (Wills et al. 2003). Yellow Box is a widespread species in south-eastern Australia, with Highett being on the edge of geographic range. It does not occur on the Mornington Peninsula to the south.

Most of the other recorded species have local significance due to severe depletion of native vegetation in the 5 km radius local area (Appendix 2).

The eucalypts are currently under consideration for the Bayside Significant Tree Register (P. Johnstone, Bayside City Council, pers. comm.).

According to the criteria for significance (Appendix 1), a threshold for significance is one per cent of the total extant population of a significant species within a specified geographic area or one per cent of the total extant area of a significant ecological community within a specified geographic area. None of the recorded flora or fauna species have more than one per cent of the total bioregional population within CSIRO Highett. Therefore the site does not attain regional conservation status due to individual flora or fauna species.

4.2.1 Significant Plant Communities

Grassy Woodland is listed as 'endangered' in the Gippsland Plain Bioregion (DSE 2003a) and is threatened in Victoria generally (Lunt and Bennett 2000).

Less than one per cent of the total extant area of the Grassy Woodland EVC within the Gippsland Plain Bioregion occurs within the site, hence the site does not have regional significance on the basis of this EVC alone. However it has regional significance on the basis of the rare 'Yellow Box Grassy Woodland' which appears to be a floristic community within the Grassy Woodland EVC.

An unusual feature of the woodland is that it is not dominated by the typical and widespread Manna Gum *Eucalyptus viminalis*, Swamp Gum *E. ovata*, Narrow-leaf Peppermint *E. radiata* or Snow Gum *E. pauciflora*. Yellow Box and River Red-gum are highly valued timber species and are more likely to have been removed than the typical species, suggesting their dominance is natural.

Hart (1939) discussed the occurrence of Yellow Box woodland in southern Melbourne, and the last remaining stand at Highett:

The Yellow Box, *Eucalyptus melliodora*, is not recorded in the F.N.C. Census, 1928, for the sandy country of the southern suburbs of Melbourne. There remains, however, a small timbered area at Highett, in which it is the chief tree, and search has revealed scattered examples over a considerable area. . . being in a class of country which soon went under cultivation. . . The timbered patch at Highett, as the last of its kind remaining in these parts, seems worth description. It is about half a mile directly south of Highett station. .

The estimated original extent of 'Yellow Box Grassy Woodland' in the south-eastern Melbourne area is mapped and described by Scott et al. (2002):

Close to the city, a drier community, characterised by Yellow Box, occurred on broad flat ridges and the tops of hills composed of Brighton Sandstones. . . It is likely that this community occurred at South Yarra, in a band between Armadale and Windsor extending south to Gardenvale and east to Glenhuntly, and scattered throughout Brighton and Highett. Remnants of the Yellow Box community containing many of the species characteristic of the community persist in a few small patches along the Sandringham Railway line between Windsor and Gardenvale. A pair of Yellow Box trees still stand near the Moorabbin railway station.

None of the rail line understorey remnants of this community now have Yellow Box present (Wills et al. 2003, R. Scott, Naturelinks, pers. comm.). The vegetation type is extremely rare in south-eastern Melbourne, with CSIRO Highett having the only stand of Yellow Box with any indigenous understorey.

4.3 Significant Fauna

Significant fauna recorded from the site, recorded from the local area (AVW), or predicted to occur in the local area (EPBC Act Protected Matters Search Tool) are discussed below. Criteria for significant species are given in Appendix 1.

Species listed under the migratory and marine provisions of the *Environment Protection and Biodiversity Conservation Act 1999* are dealt with in Section 5.

4.3.1 National significance

Records during present assessment

No fauna species of national significance have been recorded from the site.

AVW database records

Four fauna species of national significance have been recorded in the local area (Appendix 3):

- Grey-headed Flying-fox *Pteropus poliocephalus*. Flying-foxes have been observed in trees in the north of the site by the night security guard (Michael Harvey, CSIRO, pers. comm.). The bats were probably feeding.
- Swift Parrot *Lathamus discolor*. This is a migratory species, breeding in Tasmania during the summer months, then moving to feed on flowering eucalypts in south-eastern mainland Australia during the winter months. Probably the most important habitat for Swift Parrots in south-eastern Australia is the box-ironbark forests, however smaller numbers of individuals are often recorded within winter-flowering eucalypts throughout much of south-eastern Australia, including within planted trees in parks and gardens (Higgins 1999). This species has been recorded on several occasions at the nearby Tea Tree Reserve (AVW). It is therefore likely that Swift Parrots occasionally forage within the eucalypts of the site.
- Superb Parrot *Polytelis swainsonii*. The single 1975 record of this species is likely to be of an aviary escapee. The present range of this species is around southern New South Wales and northern Victoria. At least since European settlement, the natural distribution of this species is unlikely to have included the site. A small number of aviary escapees may persist within the greater Melbourne area (Emison et al. 1987), but do not contribute to the conservation of this species. Aviary escapees may visit on rare occasions.
- Growling Grass Frog *Litora raniformis*. This species has not been recently recorded in the local area and there is no suitable habitat within the site.

EPBC Act Protected Matters Search Tool

Seventeen additional threatened fauna species listed under the EPBC Act are predicted to occur, or their habitat is predicted to occur, within 5 km of the site (Appendix 3). Of these, there is potential habitat for Regent Honeyeater, although the range of this species has severely contracted in recent decades (Garnett and Crowley 2000). Now, at most, it is a vagrant visitor to the local area. There is a very low possibility that, on rare occasions, individuals or small numbers of Regent Honeyeaters may visit flowering trees within the site.

The remaining species are either marine birds or mammals (10 species) or species for which the site does not provide suitable habitat (six species).

4.3.2 State significance

Records during present survey

No state significant fauna species were recorded from the site during the present assessment.

Database records

Ten fauna species of state conservation significance have been previously recorded in the local area (Appendix 3). It is considered unlikely any of these species would occur within the site.

4.3.3 Regional and local significance

Other fauna species recorded from the local area have regional significance, for example, Azure Kingfisher, Nankeen Night Heron and Pacific Gull (lower risk-near threatened, DSE 2003b). It is unlikely any species of regional significance would be regular visitors to the site.

All other indigenous species are considered to be of local conservation significance. Some of these species are likely to be residents or regular visitors.

5.0 LEGISLATION AND GOVERNMENT POLICY

Government legislation and policies affecting the species and environments identified during this assessment are discussed in this section.

5.1 Commonwealth

5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) applies to developments and associated activities that have the potential to significantly impact on matters protected under the Act.

Under the Act, unless exempt, actions require approval from the Environment Minister if they are likely to significantly impact on a ‘matter of national environmental significance’. There are six matters of national significance:

- World Heritage properties;
- Ramsar wetlands of international significance;
- nationally listed threatened species and ecological communities;
- listed migratory species;
- Commonwealth marine areas; and
- nuclear actions (including uranium mining).

Other matters protected by the EPBC Act are Commonwealth lands, listed marine species, whales and other cetaceans, and critical habitats.

Any person proposing to take an action that may, or will, have a significant impact on a matter of national environmental significance must refer the action to the Commonwealth Environment Minister for determination as to whether the action is a ‘controlled action’ or is not approved. If this is the case, the Minister will determine the type of environmental assessment and reporting that is required and make a decision on whether to approve the taking of the action.

Relevant matters of national environmental significance:

Ramsar wetlands of international significance

The site is more than 10 km from the Edithvale-Seaford Wetlands.

Listed threatened species and/or ecological communities

Ecological communities

No listed ecological communities occur within the site.

Listed flora species

Two EPBC listed flora species have been recorded in the local area (FIS). There is no likelihood of these species occurring within the site (Appendix 2).

The PMST predicts the occurrence of, or suitable habitat for, two species not previously recorded from the 5 km search area. There is no likelihood of these species occurring within the site (Appendix 2).

Listed fauna species

Two of the five listed fauna species recorded in the local area (AVW) are likely to use resources within the site: Swift Parrot *Lathamus discolor* and Grey-headed Flying-fox *Pteropus poliocephalus* (Section 4.4, Appendix 3).

Seventeen additional species listed under the EPBC Act are predicted to occur, or their habitat is predicted to occur, within 5 km of the site (PMST). There is no suitable habitat for any of these species within the site (Appendix 3).

Listed migratory species

Species listed under the ‘migratory’ provisions of the EPBC Act are listed in Appendix 3 and summarised below:

- None were recorded within the site during the present assessment.
- 30 species have been recently recorded from the local area (AVW).
- An additional 16 species are predicted to occur, or their habitat is predicted to occur, within 5 km of the site (PMST).

While some of these species could use the site on occasions, and some of them may do so regularly or may be resident, the site does not provide habitat for an ecologically significant proportion of any of these species.

Implications for the site

None. There are no matters of national environmental significance that may or will be significantly impacted by land use within the site.

It is unlikely that any change of land use within the site would require a referral to the Commonwealth Environment Minister under the EPBC Act.

5.2 State

The CSIRO land is owned by the Commonwealth Government and therefore is not subject to State or local government jurisdiction, including the *Planning and Environment Act 1987* and *Flora and Fauna Guarantee Act 1988*.

However, if the site was either sold or used for non-Commonwealth purposes it would become subject to State jurisdiction for planning and environment matters. It is therefore prudent for CSIRO to have regard for the State legislation and policy in considering the future use and management of the site.

5.2.1 Victoria's Biodiversity Strategy

The Commonwealth is not bound by Victoria's Biodiversity Strategy and the Native Vegetation Management Framework, since the Strategy and Framework are implemented through Victoria's planning schemes pursuant to the *Planning and Environment Act 1987*. However, should any clearing be considered in terms of the Framework, the following information would be relevant.

Victoria's Biodiversity Strategy is outlined in *Victoria's Biodiversity – Directions in Management* (NRE 1997) which details the actions to take to ensure biodiversity is managed in a manner both ecologically sound and sustainable. The following goals are intended to ensure that within Victoria:

- *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;*
- *to ensure that within Victoria the ecological processes and the biodiversity dependent on terrestrial, freshwater and marine environments are maintained and, where necessary, restored;*
- *the present diversity of species and ecological communities and their viability is maintained and 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.*

In a practical sense, the goals of the Biodiversity Strategy are addressed by the Native Vegetation Management Framework (below).

5.2.2 Native Vegetation Management Framework

The Native Vegetation Management Framework (NRE 2002) is State Government policy for the protection, enhancement and revegetation of native vegetation in Victoria. The primary goal of the Framework is:

A reversal, across the whole landscape, of the long-term decline in the extent and quality of native vegetation, leading to a Net Gain (NRE 2002).

Net Gain includes a three step approach to protection and clearance decisions at the on-ground level (NRE 2002):

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

The Framework emphasises avoidance and then minimisation of impacts on native vegetation. Where clearing is unavoidable and permitted, certain ‘offset’ (actions undertaken to achieve commensurate gains) are required (NRE 2002). The Department of Sustainability and Environment (DSE) regards the three-step approach as critical in achieving Net Gain within any development project.

Losses and offsets are quantified in terms of:

1. Habitat hectares (a unit of habitat combining quality and quantity), for each ecological vegetation class (EVC).
2. Indigenous large and medium ‘old’ canopy trees (eucalypts).

Offsets can be achieved by improvements in the quality or extent of native vegetation in a selected ‘offset area’. The conservation significance of vegetation to be removed is also taken into account when offsets are determined.

Guidelines for the implementation of Net Gain and measurement of vegetation quality (habitat scoring) are currently under preparation by DSE. Information on habitat scoring and habitat hectares is given in Parkes et al. (2003).

Under the Native Vegetation Management Framework (NRE 2002, p. 25), habitat hectares are calculated where the understorey is at least 10% of the benchmark for the particular EVC. This is the threshold for a ‘patch’ in Net Gain terminology. Trees over mainly introduced understoreys (less than 10% of the benchmark for the particular EVC) are not offset using habitat hectares; rather they are offset using tree protection and/or recruitment (NRE 2002).

Very little if any of the vegetation on the CSIRO land has 10% or more of the benchmark understorey cover for Grassy Woodland as determined by DSE. The quantity of habitat hectares is negligible (less than 0.01 hab ha).

The eucalypt canopy trees, however, are addressed by the Native Vegetation Management Framework (Net Gain) policy. From preliminary assessment, there are 24 large old trees and 9 medium old trees as defined by the DSE benchmark for Grassy Woodland. Under the policy, any clearing of these trees should be avoided and then minimised. Should any clearance of trees be both unavoidable and permitted, there are two tree offset requirement options (DSE in prep.):

1. Protect and recruit. Involves protection of prescribed numbers of old trees and numbers of trees to be recruited (planted or regenerated). In this case, a minimum of 57 trees are to be protected and 285 trees are to be recruited. This involves protecting more trees than are present on the site, that is, locating some of the offset away from the site, elsewhere in the bioregion.
2. Recruit only. Involves prescribed numbers of recruitment trees (planted or regenerated). Since there is no protection component, recruitment numbers are considerably higher than for the previous option. In this case, a minimum of 2850 trees are to be recruited. This would require a substantial area.

These tree offsets would be difficult to locate in the local (5 km radius) area. There are not 57 indigenous trees in the local area to protect, hence this is not a practicable option unless trees are located further away. It is doubtful whether 2850 trees could be recruited in the local area. General dissemination of plants from nurseries is unlikely to be acceptable to DSE unless the seedlings were followed up and establishment of the recruited trees confirmed. This difficulty in obtaining offsets may mean that clearance of the existing trees would not be permitted under the Native Vegetation Management Framework policy.

5.3 Local

The CSIRO land is owned by the Commonwealth Government and therefore is not subject to State or local government jurisdiction, including the provisions of the Bayside Planning Scheme.

A change in tenure or use away from Commonwealth purposes would bring the site under State jurisdiction which would include application of local planning controls through the Bayside Planning Scheme under the provisions of the *Planning and Environment Act 1987*.

6.0 MANAGEMENT PLAN

This management plan is based on ‘CSIRO’s occupancy of the site’ (see *Objectives*). It does not assume a highly intensive level of management that may be applied in a conservation reserve, but assumes a level of ongoing management that maintains or improves natural values consistent with CSIRO’s occupancy.

Accordingly, the objectives of conservation management are to:

- Protect all indigenous flora and fauna species as far as practicable.
- Facilitate regeneration of all indigenous flora species as far as practicable.

The actions below are concerned primarily with maintenance of the vegetation of the site. They also serve to maintain fauna habitat as far as practicable.

6.1 Protection

Some existing plant populations require continued protection from physical damage or disturbance and are also subject to weed invasion.

The small fenced area in the south of the site with several significant plant species including Sweet Hound's-tongue *Cynoglossum suaveolens* requires continued protection from disturbance. This area has the highest concentration of indigenous understorey species. Hand weeding of the area is recommended in spring to prevent smothering of plants and their seedlings from weeds. Herbicide should be avoided. This would take 2–4 person days per year. The work should be undertaken only when supervised by a person skilled in plant identification and weed control. Professional bushland regenerators are recommended.

Actions

1. Generally protect existing indigenous plants from physical damage.
2. Prevent soil compaction under the dripline of the remnant eucalypts, and consider control of competing introduced vegetation and mulching but not where indigenous ground layer species would be affected.
3. Undertake weed management of the fenced area to protect existing plants.

Tree Health

The most important management issue is tree decline. Seven trees are in serious decline and urgently need tree guards (6 River Red-gum, 1 Yellow Box). The tree decline problem is extremely serious and is likely to spread. Possum grazing is a major cause of tree decline in southern Melbourne and on the Mornington Peninsula (Yugovic, pers. obs.). Observations within the site indicate that possums are the cause. Scats of both Common Brushtail Possum and Common Ringtail Possum were seen below partially defoliated trees. Through repeated defoliation the affected trees are likely to die and, as a consequence, the remaining trees will be subject to increased pressure.

Tree guards are a means of preventing possum access to trees. The cost of installing a tree guard is considerably less than the cost of removing a dead tree which may become a safety hazard and liability if left standing. Guards consist of clear plastic sheeting, one metre wide. Self tapper screws are recommended to avoid any damage to the wood (nails are not acceptable). Protected trees usually undergo dramatic and complete recovery, with full crown health attained in six to twelve months. In our experience, the guards need to be installed skillfully and professionally, as poorly installed guards may not work.

The protected tree must be at least one metre from other vegetation and from buildings to prevent possums reaching the tree. This may entail pruning of adjacent trees or even the tree being protected. To ensure isolation it may be necessary to install guards on all trees in a stand. Once the first trees are guarded, possum pressure on other trees may increase such that eventually all of the trees may require guarding.

The trees should have an arboricultural management strategy in place to maximise the health and longevity of the individual trees. This would ensure that tree guards and other actions, such as pruning, are planned for and undertaken in an integrated program to further protect the trees in their modified environment.

Actions

4. Install tree guards on trees indicated in Figure 3.
5. Monitor other trees and install tree guards as appropriate.
6. Inspect guards annually for build-up of organic material under guard and for growth of the tree. Where necessary, remove guard temporarily to clean trunk or increase guard size. No action is likely to be required in most years.
7. Prepare an arboricultural management strategy to maintain the trees.

6.2 Regeneration

If the indigenous flora is to be maintained, it should be capable of natural regeneration, that is, the recruitment of new plants to populations. The objective is to create viable reproductive populations of all indigenous species.

Generally, the priority is on perennial species that have short life spans, as these are generally the first to disappear if there is no recruitment, for example Sweet Hound's-tongue *Cynoglossum suaveolens*. Long-lived species such as the eucalypts do not require recruitment in the near to medium term, as they can live for centuries. However the number of Yellow Box trees is low and seedling recruitment is required to increase the population to a more viable size.

There is considerable potential for natural regeneration from the existing plants, especially the Yellow Box and River Red-gum. Generally, eucalypt seed is dispersed about 1–3 tree height equivalents downwind from the crown of the parent tree (NRE 1999). According to Cremer et al. (1990), most seed falls within a distance of 1.5 times the height of the parent tree, though isolated trees can have a higher proportion of seed beyond this limit than do trees in a forest. Lawrence et al. (1998) found that direction of prevailing winds did not adequately explain their results, and suggested that habitat factors such as differences in shading or topsoil moisture, may offer a better explanation. Seedlings can be expected all around parent trees, to a distance of approximately 1.5–2.0 tree heights. Few if any saplings are likely to establish under the crowns of trees, the regeneration forming a ring (annulus) around the parent tree.

A dormant seed bank containing further indigenous species may be present within the soil on the site. Several species, particularly those with hard-coated seed such peas and acacias, may remain viable in the soil for several decades. This soil seed bank may be germinated by means such as physical soil disturbance or fire. There are opportunities for research into soil seed banks.

If recruitment facilitated by management does not occur, then propagation and reinforcement planting may be considered for the (short-lived) herbaceous species. Re-introduction of site-extinct species is not a high priority in terms of 'CSIRO's occupancy of the site' as the site is not a conservation reserve.

Actions

8. Manage all indigenous species for regeneration.
Refer to Appendix 2 for management requirements for each species.
9. Establish tree recruitment zones around existing eucalypts where space is available for this purpose, to a distance of 1.5 to 2.0 tree height equivalents.

10. Undertake backup seed and propagule collection from the rare species to ensure that genetic material is not lost under current management.

7.0 FUTURE DIRECTIONS

This section discusses the ‘conservation values that require long term protection if CSIRO vacates the site in future’.

Bayside City Council has communicated the following to Biosis Research:

The report should help to facilitate a smooth transition from its current use by CSIRO to any future development and use of the land by ensuring that the ecological values are properly considered and protected.

It would be useful if the specific areas to be protected/excluded from future development (if any) were identified and mapped out. This should also include a description of the key characteristics to be protected/managed to achieve ecological outcomes. It could also include suggestions for the collection, stockpiling and distribution of topsoil at selected parts of the site if that could help regeneration from the seedbank of the site.

Such information would inform the establishment of any planning controls that may be required for the site if it comes under State jurisdiction. In addition, this would allow potential developers of the site to develop proposals that respond to the particular characteristics of the site. Having a clear, agreed, framework in place prior to the commencement of any future development processes would help to make sure that the best outcomes are achieved for the site for all concerned.

The amount of native vegetation that is retained by any future development of the site is not entirely a scientific issue, rather it is more of a social/planning issue that relates to the value attached to natural heritage by the community and by Council. Where there is disagreement between stakeholders, this issue may be resolved through the planning process, whereby all issues are taken into consideration. There may also be planning constraints in relation to the Native Vegetation Management Framework policy (see *Legislation and Policy*).

From an ecological perspective, all of the native vegetation should be retained within public open space. In our experience, placing trees within private lots in urban areas is not a viable means of protecting tree populations in the long term. Building envelopes provide a temporary but ultimately ineffective means of preserving trees. This is due to lack of maintenance of the trees, gradual removal of the trees due to perceived and actual risks to life and property, and lack of recruitment due to lawn and garden maintenance practices. Public open space is required if remnant native vegetation is to be protected in the longer term.

The question of long-term viability or sustainability is relevant to the future of modified remnants of native vegetation such as CSIRO Highett. ‘Viability’ we understand to mean the capacity to support the existing flora and fauna in the long term, in this case 20 indigenous flora species and 20 indigenous fauna species. This is largely a function of future management inputs, there being no serious technical difficulty in achieving this aim with the possible exception of the two species with only one plant in the population at present. These inputs are not necessarily expensive. Future management regimes are difficult to predict, but if the vegetation were to be protected on public land, management is likely to be sympathetic if not beneficial to the existing species. Such management is likely to be a partnership between Council and the community. Survival of the existing flora and fauna is not assured under the present management regime.

Any public open space should include open areas, well outside the tree canopies and recruitment zones, for passive recreation access and for infrastructure development such as paths and picnic tables. It is not appropriate to construct infrastructure under the canopies of large eucalypts, especially River Red-gums.

It is important that land put aside for public open space (POS) is in addition to land put aside for conservation purposes as the desire of residents in new housing estates for a park to kick the footy, walk dogs etc. is inconsistent with a regenerating grassy woodland. This is a problem in areas where grassland has been put into POS easements and the developer has met POS planning requirements with this (N. Williams, ARCUE, pers. comm.).

Public open space should also be bounded by streets and not by back fences, in order to minimise degrading influences (edge effects) on native vegetation such as mowing, unauthorised planting, watering, garden waste dumping and weed invasion. This would also make the woodland a more visible conservation asset, not secluded or obscured behind houses for the benefit of a few households.

The precise boundary of any public open space is a matter for detailed and informed negotiation between the relevant parties, the southern area being the focus of attention. Any such reserve should have, in addition to the above design elements (internal open areas, boundary formed by a sealed road), a rationalised boundary based on straight lines where possible. This may involve leaving one or more isolated trees outside a reserve, and/or including the southern section of the current footprint of buildings and paved areas within a reserve.

The sympathetic removal of buildings from a future reserve if CSIRO ceases occupancy should be considered. The buildings between the trees would need to be removed carefully and this land once rehabilitated could be suitable for public open space. Just because there is building there now does not mean that it cannot be used for public open space or for conservation purposes in future.

Once the boundaries of any public open space are determined it would then be appropriate to discuss in detail the stockpiling and treatment of soils and other technical matters. As previously stated, the management plan is based on 'CSIRO's occupancy of the site' and does not assume a highly intensive level of management that may be applied in a conservation reserve.

In order to achieve ecological sustainability with regard to the land, it is recommended that the land not be sold until a conservation reserve based on the ecological design criteria discussed in this report is established.

APPENDICES

APPENDIX 1

Significance Assessment

The common language meaning of significance is ‘importance; consequence’ (Macquarie Dictionary). While the general meaning of this is clear, in natural resource assessment and management this meaning needs to be defined in scientific terms.

A1.1 Significant Species and Communities

Species and community conservation significance is defined as follows:

A taxon or community is significant at a particular geographic level (national, state, regional, local) when it is considered to be rare or threatened at that level.

A taxon is an officially recognised species, subspecies or variety of a species. The significance of a taxon or community is a function of its rarity within a specified geographic context: nation, state, region, local area. In each context a taxon or community has a conservation status: not rare, rare, vulnerable, endangered, extinct. ‘Threatened’ is a combination of the ‘vulnerable’ and ‘endangered’ categories.

The significance of the taxon or community is the largest geographic context in which it is at least rare. For example, if a species is uncommon in a state and rare within a region of that state, it has regional significance within that region.

Species listed as ‘poorly known’ are not considered rare or threatened at present and are assigned an intermediate rating. For example, a species listed as poorly known in a state list has potential state significance and is assigned ‘regional/state’ significance.

A1.2 Sites

Site conservation significance is defined as follows:

A site is significant at a particular geographic level (national, state, regional, local) when it is considered to make a substantial contribution to biodiversity at that level.

As a guideline, one per cent of the total extant population of a significant species within a specified geographic area or of the total extant area of a significant ecological community within a specified geographic area is a threshold for ‘substantial contribution’. Comprehensive data are not always available for such assessments and interpretation of available data and information is usually required.

In some cases a site may be small when viewed in isolation but it forms an integral and functional part of a larger site of significance. If there is no ecological reason to divide the larger site, then the rating that applies to the larger site applies to the smaller site.

Sites with a particularly high level of local or regional significance are assigned ‘high local’ or ‘high regional’ significance, respectively. These terms are not applied to state and national levels of significance or to species and communities.

To determine whether a site makes a ‘substantial contribution’ to biological conservation, it is assessed against the following criteria:

- Size – overall size of site or habitats/vegetation communities within the site.
- Significant species and populations – number of significant species or populations known or likely to occur on the site.
- Significant habitat or vegetation communities – presence and extensiveness of significant habitats and vegetation communities on the site.
- Ecological integrity – degree of intactness, level of past disturbance (such as weed invasion) and overall condition of vegetation communities on the site.
- Richness and diversity – quantity of species, vegetation communities and habitats.
- Connectivity – Quality and quantity of linkages between site and adjacent areas of native vegetation/habitat (wildlife corridor value).
- Viability – level of existing and/or future disturbances, degree of existing and/or future fragmentation.
- Distribution – proximity of the site to known distribution limits for significant species, populations, habitats and/or vegetation communities.
- Level of conservation – representation of site attributes in conservation reserves.

As a guideline, *one per cent* of the total extant population of a significant species within a specified geographic area or of the total extant area of a significant ecological community within a specified geographic area is a threshold for ‘substantial contribution’. Comprehensive data are seldom available and interpretation of limited available data and information is usually required.

A1.3 Scale: Geographic Context

Significance is determined within specified geographic contexts:

- Australia
- State Victoria
- Region Gippsland Plain (DSE Flora Information System)
- Local area Highett area (within 5 km of the site)

A1.4 Conservation Status: Degree of Threat

Official government lists define species and communities that are rare or threatened (and thus significant) at *national* and/or *state* levels. Most of these lists appear as schedules under legislation and are followed unless further evidence is available.

Species and communities that are rare or threatened at *regional* and *local* levels are determined from the available literature, data and information, and consultation with relevant individuals where relevant reports and government listings are not available.

National Significance

Species

Species of national significance are either:

- Flora or fauna listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent under the *Environment Protection and Biodiversity Conservation Act 1999*.

- Flora listed as rare in Australia in *Rare or Threatened Australian Plants* (Briggs and Leigh 1996).
- Fauna listed as extinct, endangered, vulnerable or rare in Australia in an Action Plan published by Environment Australia.

Communities

Ecological communities of national significance are either:

- Listed as critically endangered, endangered or vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*.
- Considered to be rare or threatened in Australia by Biosis Research using IUCN criteria where applicable (IUCN 2000).

Ecological communities include flora and/or fauna communities.

State Significance

Species

Species of state significance in Victoria are either:

- Flora or fauna listed as threatened under the *Flora and Fauna Guarantee Act 1988*.
- Flora listed as extinct, endangered, vulnerable or rare in Victoria in the DSE Flora Information System 2002 Version.
- Flora listed as poorly known in Australia in *Rare or Threatened Australian Plants* (Briggs and Leigh 1996).
- Listed as extinct, critically endangered, endangered or vulnerable in *Threatened Vertebrate Fauna in Victoria – 2003* (DSE 2003b).

Communities

Ecological communities of state significance in Victoria are either:

- Listed as threatened under the *Flora and Fauna Guarantee Act 1988*.
- Considered to be rare or threatened in Victoria by Biosis Research using IUCN criteria where applicable (IUCN 2000).

Regional Significance

Species

Species of regional significance are:

- Flora recorded from less than 5% of documented sites (quadrats/defined area lists) from the Gippsland Plain Bioregion in the DSE Flora Information System unless there is reason to believe they are undersampled in the available data.
- Fauna listed as data deficient or lower risk – near threatened in *Threatened Vertebrate Fauna in Victoria – 2003* (DSE 2003b).
- Fauna considered to be rare or threatened at the bioregional level by Biosis Research using IUCN criteria where applicable (IUCN 2000).

Communities

Ecological communities of regional significance in Victoria are:

- Listed as an endangered, vulnerable or depleted ecological vegetation class (EVC) within a particular bioregion in a Draft Native Vegetation Plan.
- Considered to be a rare EVC or floristic community at the bioregional level by Biosis Research using IUCN criteria where applicable (IUCN 2000).

Local Significance

Species

Species of local significance are:

- Flora or fauna considered to be rare or threatened at the local level by Biosis Research using IUCN criteria where applicable (IUCN 2000).

Communities

Ecological communities of local significance are:

- Considered to be rare or threatened at the local level by Biosis Research using IUCN criteria where applicable (IUCN 2000).

No Significance

Species and ecological communities are not significant when they are considered not to be rare or threatened at any geographic level by Biosis Research using IUCN criteria where applicable (IUCN 2000). Species that are not indigenous to a given site are not significant. Plantings are generally not significant.

A1.5 Habitat Assessment

Floristic and structural features of the vegetation form a habitat type, which provides a set of resources to support a community of fauna species. Habitat types correspond broadly to vegetation communities. Lines drawn around these habitats do not represent rigid boundaries, as many species move between habitats or utilise more than one habitat according to changing conditions or seasons.

The value of a habitat will assist in the final determination of significance. This is determined by a number of features, including:

- Habitat status
- Size/connectivity
- Condition
- Significant species
- Other features

Three categories are used to evaluate habitat value:

High: Ground flora containing a high number of indigenous species; vegetation community structure, ground, log and litter layer intact and undisturbed; a high level of breeding, nesting, feeding and roosting resources available; a high richness and diversity of native fauna species.

Moderate: Ground flora containing a moderate number of indigenous species; vegetation community structure, ground log and litter layer moderately intact and undisturbed; a moderate level of breeding, nesting, feeding and roosting resources available; a moderate richness and diversity of native fauna species.

Low: Ground flora containing a low number of indigenous species, vegetation community structure, ground log and litter layer disturbed and modified; a low level of breeding, nesting, feeding and roosting resources available; a low richness and diversity of native fauna species.

Other habitat features, such as its value as a habitat corridor, or the presence of remnant communities, or unusual ecology or community structure, may also be used to assess habitat quality.

APPENDIX 2

Flora Results

A2.1 Flora species recorded from the site

Table A2.1. Flora recorded from the site

Significance/status of species:

| | |
|-----|--|
| N | national |
| S | state |
| R | regional; recorded from less than 5% of documented sites in bioregion |
| Lr | local; recorded from less than 5% of documented sites in bioregion but considered more common than present records indicate |
| L | local |
| FFG | FFG protected flora |
| 1 | Record from Cook (2003) |

| | Scientific name | Common name | Management requirements |
|----|-----------------------------------|----------------------|---|
| R | <i>Acacia implexa</i> | Lightwood | Protect single plant, obtain seed, propagate and plant |
| L | <i>Acacia mearnsi</i> FFG | Black Wattle | Apply fire to or remove mowing to facilitate regeneration |
| R | <i>Acaena echinata</i> | Sheep's Burr | Protect plants, facilitate seedling recruitment, hand weed site |
| Lr | <i>Austrodanthonia geniculata</i> | Kneed Wallaby-grass | Allow seed set and release before mowing. |
| R | <i>Austrodanthonia pilosa</i> | Velvet Wallaby-grass | Allow seed set and release before mowing. |
| L | <i>Austrodanthonia racemosa</i> | Stiped Wallaby-grass | Allow seed set and release before mowing. |
| | <i>Cotula australis</i> FFG | Common Cotula | No special management, survives under current management |
| | <i>Crassula decumbens</i> | Spreading Crassula | No special management, survives under current management |
| | <i>Crassula sieberiana</i> | Sieber Crassula | Allow seed set and release before mowing. |
| R | <i>Cynoglossum suaveolens</i> | Sweet Hound's-tongue | Protect plants, facilitate seedling recruitment, hand weed site |
| L | <i>Dichondra repens</i> | Kidney-weed | No special management, survives under current management |
| L | <i>Eucalyptus camaldulensis</i> | River Red-gum | Install tree guards, facilitate natural regeneration |
| R | <i>Eucalyptus melliodora</i> | Yellow Box | Install tree guards, facilitate natural regeneration |

| | Scientific name | Common name | Management requirements |
|---|-------------------------------------|-----------------------|---|
| L | <i>Eucalyptus ovata</i> | Swamp Gum | No special management, possibly planted |
| L | <i>Kennedia prostrata</i> | Running Postman | Protect single plant, obtain seed, propagate and plant |
| L | <i>Lomandra filiformis</i> | Wattle Mat-rush | Protect plants, facilitate seedling recruitment, hand weed site |
| L | <i>Microlaena stipoides</i> | Weeping Grass | Allow seed set and release before mowing. |
| R | <i>Muellerina eucalyptoides</i> | Creeping Mistletoe | Parasitic on eucalypts, protect trees from possums |
| R | <i>Oxalis perennans</i> | Grassland Wood-sorrel | Protect plants, facilitate seedling recruitment, hand weed site |
| L | <i>Schoenus apogon</i> ¹ | Common Bog-sedge | Allow seed set and release before mowing. |

Additional species reported by M. Norris or J. Stewart (not seen during this survey):

| | | | |
|---|-----------------------------|-----------------|---|
| L | <i>Bursaria spinosa</i> | Sweet Bursaria | Locate and protect plants, facilitate seedling recruitment |
| L | <i>Melaleuca ericifolia</i> | Swamp Paperbark | Locate and protect plant, facilitate vegetative spread, apply water |
| L | <i>Microtis</i> sp. FFG | Onion-orchid | Locate and protect plants, facilitate seedling recruitment |
| L | <i>Pterostylis</i> sp. FFG | Greenhood | Locate and protect plants, facilitate colony growth |
| L | <i>Thelymitra</i> sp. FFG | Sun-orchid | Locate and protect plants, facilitate seedling recruitment |

Note: A large Manna Gum *Eucalyptus viminalis* occurs in the north of the site (Figure 2). The tree is relatively smooth-barked, indicating that it is a planted, non-local provenance of the species.

A2.2 Significant flora species

Table A2.2. Flora of national or state significance recorded from within 5 km of the site

Source: DSE Flora Information System 2002 Version

Australian status:

| | |
|------|---|
| E | Listed under EPBC Act as endangered |
| V | Listed under EPBC Act as vulnerable |
| R | Listed as rare Australia in Briggs & Leigh (1996) |
| EPBC | Listed as endangered or vulnerable under EPBC Act (Cwlth) |

Victorian status (DSE Flora Information System (2002 Version):

| | |
|-----|---|
| e | Endangered |
| v | Vulnerable |
| r | Rare |
| e | Extinct |
| FFG | Listed as threatened under <i>Flora and Fauna Guarantee Act 1988</i> (Vic.) |

| Scientific name | Common name | Aust. status | Vic. status | Likelihood of occurrence |
|---|-------------------------|--------------|-------------|--------------------------|
| National significance: | | | | |
| <i>Arachnorchis robinsonii</i> | Frankston Spider-orchid | E/EPBC | e/FFG | Nil |
| <i>Thelymitra epipactoides</i> | Metallic Sun-orchid | E/EPBC | e/FFG | Nil |
| <i>Burnettia cuneata</i> | Lizard Orchid | R | r | Nil |
| State significance: | | | | |
| <i>Salsola tragus</i> ssp. <i>pontica</i> | Coast Saltwort | | r | Nil |
| <i>Pterostylis pedoglossa</i> | Prawn Greenhood | | v | Nil |
| <i>Pterostylis</i> X <i>toveyana</i> | Mentone Greenhood | | v | Nil |
| <i>Diuris</i> X <i>palachila</i> | Broad-lip Diuris | | r | Nil |

Table A2.2b. Flora of national significance predicted, or their habitat is predicted, to occur within 5 km of the site

Source: DEH EPBC Act Protected Matters Search Tool

| Scientific name | Common name | Status | Likelihood of occurrence |
|--------------------------------|---------------------|------------|--------------------------|
| <i>Prasophyllum frenchii</i> | Maroon Leek-orchid | Endangered | Nil |
| <i>Thelymitra epipactoides</i> | Metallic Sun-orchid | Endangered | Nil |
| <i>Glycine latrobeana</i> | Purple Clover | Vulnerable | Nil |

APPENDIX 3

Fauna Results

A3.1 Fauna species recorded from the site

Table A3.1. Fauna recorded from the site

Key:

* introduced species

pers. comm.

| Common name | Scientific name |
|-------------------------|---------------------------------|
| Mammals | |
| Common Brushtail Possum | <i>Trichosurus vulpecula</i> |
| Common Ringtail Possum | <i>Pseudocheirus peregrinus</i> |
| Grey-headed Flying-fox# | <i>Pteropus poliocephalus</i> |
| Birds | |
| Masked Lapwing | <i>Vanellus miles</i> |
| Rainbow Lorikeet | <i>Trichoglossus haematodus</i> |
| Galah | <i>Cacatua roseicapilla</i> |
| Eastern Rosella | <i>Platycercus eximius</i> |
| Noisy Miner | <i>Manorina melanocephala</i> |
| Little Wattlebird | <i>Anthochaera chrysoptera</i> |
| Red Wattlebird | <i>Anthochaera carunculata</i> |
| Australian Magpie | <i>Gymnorhina tibicen</i> |
| Spotted Turtle-Dove* | <i>Streptopelia chinensis</i> |
| Common Blackbird* | <i>Turdus merula</i> |
| House Sparrow* | <i>Passer domesticus</i> |
| Common Myna* | <i>Acridotheres tristis</i> |
| Common Starling* | <i>Sturnus vulgaris</i> |

Additional species reported by M. Norris (not seen during this survey):

Key:

- * introduced species
- # M. Norris
- ## pers. comm. to MN
- ^ presumed escaped cage bird
- ~ bred on site

| Common name | Scientific name |
|--------------------------|-----------------------------------|
| Birds | |
| Pacific Black Duck##~ | <i>Anas superciliosa</i> |
| Collared Sparrowhawk# | <i>Accipiter cirrhocephalus</i> |
| Crested Pigeon# | <i>Ocyphaps lophotes</i> |
| Musk Lorikeet# | <i>Glossopsitta concinna</i> |
| Little Lorikeet# | <i>Glossopsitta pusilla</i> |
| White-plumed Honeyeater# | <i>Lichenostomus penicillatus</i> |
| Magpie-lark## | <i>Grallina cyanoleuca</i> |
| Grey Butcherbird# | <i>Cracticus torquatus</i> |
| Mistletoebird# | <i>Dicaeum hirundinaceum</i> |
| Welcome Swallow##~ | <i>Hirundo neoxena</i> |
| Cockatiel#^~ | <i>Nymphicus hollandicus</i> |
| Budgerigar##^ | <i>Melopsittacus undulatus</i> |
| Rock Dove*## | <i>Columba livia</i> |

A3.2 Significant fauna species

Table A3.2a. Fauna of national or state significance recorded within 5 km of the site

Source: DSE Atlas of Victorian Wildlife

Status of species:

CEn critically endangered

End endangered

Vul vulnerable

NT near threatened

DD data deficient (insufficient known)

L listed under FFG Act

Sources used to derive species status:

EPBC *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)

DSE Advisory List of Threatened Vertebrate Fauna in Victoria (DSE 2003b)

FFG *Flora and Fauna Guarantee Act 1988* (Vic.)

Action Plans: Maxwell et al. (1996) for marsupials and monotremes, Duncan et al. (1999) for bats,

Lee (1995) for rodents, Garnett and Crowley (2000) for birds, Cogger et al. (1993) for reptiles,

Tyler (1997) for amphibians, Wager and Jackson (1993) for fish.

| Common Name | Scientific Name | Date of last record | EPBC Act | DSE 2003b | FFG Act | Action Plan | Likelihood of occurrence in site |
|-------------------------------|----------------------------------|---------------------|----------|-----------|---------|-------------|---|
| National significance: | | | | | | | |
| Swift Parrot | <i>Lathamus discolor</i> | 2000 | End | End | L | End | Likely. Suitable foraging habitat. |
| Superb Parrot | <i>Polytelis swainsonii</i> | 1975 | Vul | End | L | Vul | Possible. Aviary escapee. |
| Grey-headed Flying-fox | <i>Pteropus poliocephalus</i> | 1997 | Vul | Vul | | | Observed within site, suitable foraging and roosting habitat. |
| Humpback Whale | <i>Megaptera novaeangliae</i> | 1980 | Vul | Vul | L | Vul | Nil. No marine habitat. |
| Growing Grass Frog | <i>Litoria raniformis</i> | 1770 | Vul | End | L | Vul | Nil. No wetland habitat. |
| State significance: | | | | | | | |
| Lewin's Rail | <i>Rallus pectoralis</i> | 1982 | | Vul | L | NT | Nil. No wetland habitat. |
| Cape Petrel (southern) | <i>Daption capense capense</i> | 1985 | | | | Vul | Nil. No marine habitat. |
| Royal Spoonbill | <i>Platalea regia</i> | 1975 | | Vul | | | Nil. No wetland habitat. |
| Great Egret | <i>Ardea alba</i> | 2001 | | Vul | L | | Nil. No wetland habitat. |
| Australasian Shoveler | <i>Anas rhynchotis</i> | 2001 | | Vul | | | Nil. No wetland habitat. |
| Hardhead | <i>Aythya australis</i> | 2001 | | Vul | | | Nil. No wetland habitat. |
| Blue-billed Duck | <i>Oxyura australis</i> | 2001 | | End | L | | Nil. No wetland habitat. |
| Grey Goshawk | <i>Accipiter novaehollandiae</i> | 1919 | | Vul | | | Unlikely. |
| White-bellied Sea-Eagle | <i>Haliaeetus leucogaster</i> | 1984 | | Vul | L | | Unlikely. |
| Grey-crowned Babbler | <i>Pomatostomus temporalis</i> | 1985 | | End | L | NT | Unlikely. |

Table A3.2b. Additional fauna of national significance predicted, or their habitat is predicted, to occur within 5 km of the site**Source: DEH EPBC Act Protected Matters Search Tool**

| Common Name | Scientific Name | Status | Likelihood of occurrence |
|--|---|------------|--------------------------------------|
| Birds | | | |
| Southern Royal Albatross | <i>Diomedea epomophora</i> | Vulnerable | Nil. No marine habitat. |
| Gibson's Albatross | <i>Diomedea gibsoni</i> | Vulnerable | Nil. No marine habitat. |
| Northern Royal Albatross | <i>Diomedea sanfordi</i> | Endangered | Nil. No marine habitat. |
| Southern Giant-Petrel | <i>Macronectes giganteus</i> | Endangered | Nil. No marine habitat. |
| Northern Giant-Petrel | <i>Macronectes halli</i> | Vulnerable | Nil. No marine habitat. |
| Australian Painted Snipe | <i>Rostratula australis</i> | Vulnerable | Nil. No suitable habitat. |
| Buller's Albatross | <i>Thalassarche bulleri</i> | Vulnerable | Nil. No marine habitat. |
| Shy Albatross | <i>Thalassarche cauta</i> | Vulnerable | Nil. No marine habitat. |
| Campbell Albatross | <i>Thalassarche impavida</i> | Vulnerable | Nil. No marine habitat. |
| Salvin's Albatross | <i>Thalassarche salvini</i> | Vulnerable | Nil. No marine habitat. |
| Regent Honeyeater | <i>Xanthomyza phrygia</i> | Endangered | Unlikely. Marginal foraging habitat. |
| Fishes | | | |
| Dwarf Galaxias | <i>Galaxiella pusilla</i> * | Vulnerable | Nil. No suitable habitat. |
| Australian Grayling | <i>Prototroctes maraena</i> | Vulnerable | Nil. No suitable habitat. |
| Mammals | | | |
| Spot-tailed Quoll (south-east mainland and Tasmanian subspecies) | <i>Dasyurus maculatus maculatus (s. lat.)</i> | Vulnerable | Nil. No suitable habitat. |
| Southern Right Whale | <i>Eubalaena australis</i> * | Endangered | Nil. No marine habitat. |
| Southern Brown Bandicoot | <i>Isoodon obesulus obesulus</i> | Endangered | Nil. No suitable habitat. |
| Reptiles | | | |
| Striped Legless Lizard | <i>Delma impar</i> * | Vulnerable | Nil. No suitable habitat. |

A3.3. Migratory and marine species

Table A3.3a. Migratory and marine fauna species recorded within 5km of the site

Source: DSE Atlas of Victorian Wildlife

Notes to table:

Mi listed under the migratory provisions of the EPBC Act

Ma listed under the marine provisions of the EPBC Act

Note: species in bold were recorded in the site during the present assessment.

| Common Name | Scientific Name | Migratory | Marine |
|-------------------------|----------------------------------|-----------|--------|
| Birds | | | |
| Little Penguin | <i>Eudyptula minor</i> | | Ma |
| Stubble Quail | <i>Coturnix pectoralis</i> | | Ma |
| Purple Swamphen | <i>Porphyrio porphyrio</i> | | Ma |
| Short-tailed Shearwater | <i>Puffinus tenuirostris</i> | Mi | Ma |
| Cape Petrel (southern) | <i>Daption capense capense</i> | | Ma |
| Australasian Gannet | <i>Morus serrator</i> | | Ma |
| Australian Pelican | <i>Pelecanus conspicillatus</i> | | Ma |
| Crested Tern | <i>Sterna bergii</i> | | Ma |
| Silver Gull | <i>Larus novaehollandiae</i> | | Ma |
| Pacific Gull | <i>Larus pacificus</i> | | Ma |
| Masked Lapwing | <i>Vanellus miles</i> | Mi | |
| Banded Lapwing | <i>Vanellus tricolor</i> | Mi | |
| Black-fronted Dotterel | <i>Euseyornis melanops</i> | Mi | |
| Latham's Snipe | <i>Gallinago hardwickii</i> | Mi | Ma |
| Australian White Ibis | <i>Threskiornis molucca</i> | | Ma |
| Straw-necked Ibis | <i>Threskiornis spinicollis</i> | | Ma |
| Great Egret | <i>Ardea alba</i> | Mi | Ma |
| Nankeen Night Heron | <i>Nycticorax caledonicus</i> | | Ma |
| Australian Wood Duck | <i>Chenonetta jubata</i> | Mi | |
| Black Swan | <i>Cygnus atratus</i> | Mi | |
| Pacific Black Duck | <i>Anas superciliosa</i> | Mi | |
| Chestnut Teal | <i>Anas castanea</i> | Mi | |
| Grey Teal | <i>Anas gracilis</i> | Mi | |
| Australasian Shoveler | <i>Anas rhynchos</i> | Mi | |
| Hardhead | <i>Aythya australis</i> | Mi | |
| Blue-billed Duck | <i>Oxyura australis</i> | Mi | |
| Swamp Harrier | <i>Circus approximans</i> | Mi | Ma |
| Grey Goshawk | <i>Accipiter novaehollandiae</i> | Mi | |
| Brown Goshawk | <i>Accipiter fasciatus</i> | Mi | Ma |
| Collared Sparrowhawk | <i>Accipiter cirrhocephalus</i> | Mi | |

| Common Name | Scientific Name | Migratory | Marine |
|---------------------------|----------------------------------|-----------|--------|
| White-bellied Sea-Eagle | <i>Haliaeetus leucogaster</i> | Mi | Ma |
| Whistling Kite | <i>Haliastur sphenurus</i> | Mi | Ma |
| Black-shouldered Kite | <i>Elanus axillaris</i> | Mi | |
| Australian Hobby | <i>Falco longipennis</i> | Mi | |
| Peregrine Falcon | <i>Falco peregrinus</i> | Mi | |
| Brown Falcon | <i>Falco berigora</i> | Mi | |
| Nankeen Kestrel | <i>Falco cenchroides</i> | Mi | Ma |
| Southern Boobook | <i>Ninox novaeseelandiae</i> | | Ma |
| Swift Parrot | <i>Lathamus discolor</i> | | Ma |
| Sacred Kingfisher | <i>Todiramphus sanctus</i> | | Ma |
| White-throated Needletail | <i>Hirundapus caudacutus</i> | Mi | Ma |
| Fork-tailed Swift | <i>Apus pacificus</i> | | Ma |
| Pallid Cuckoo | <i>Cuculus pallidus</i> | | Ma |
| Fan-tailed Cuckoo | <i>Cacomantis flabelliformis</i> | | Ma |
| Horsfield's Bronze-Cuckoo | <i>Chrysococcyx basalus</i> | | Ma |
| Shining Bronze-Cuckoo | <i>Chrysococcyx lucidus</i> | | Ma |
| Welcome Swallow | <i>Hirundo neoxena</i> | | Ma |
| Rufous Fantail | <i>Rhipidura rufifrons</i> | | Ma |
| Satin Flycatcher | <i>Myiagra cyanoleuca</i> | Mi | Ma |
| Flame Robin | <i>Petroica phoenicea</i> | | Ma |
| Magpie-lark | <i>Grallina cyanoleuca</i> | | Ma |
| Black-faced Cuckoo-shrike | <i>Coracina novaehollandiae</i> | | Ma |
| Clamorous Reed Warbler | <i>Acrocephalus stentoreus</i> | | Ma |
| Silvereye | <i>Zosterops lateralis</i> | | Ma |
| Richard's Pipit | <i>Anthus novaeseelandiae</i> | | Ma |
| Bassian Thrush | <i>Zoothera lunulata</i> | Mi | |
| Little Raven | <i>Corvus mellori</i> | | Ma |
| Cattle Egret | <i>Ardea ibis</i> | Mi | Ma |
| Mammals | | | |
| Australian Fur Seal | <i>Arctocephalus pusillus</i> | | Ma |
| New Zealand Fur Seal | <i>Arctocephalus forsteri</i> | | Ma |
| Crabeater Seal | <i>Lobodon carcinophagus</i> | | Ma |
| Humpback Whale | <i>Megaptera novaeangliae</i> | Mi | Cet |
| Bottlenose Dolphin | <i>Tursiops truncatus</i> | | Cet |
| Common Dolphin | <i>Delphinus delphis</i> | | Cet |

Table A3.3b. Migratory and marine fauna species predicted to occur within 5km of the site

Source: EPBC Act Protected Matters Search Tool

Migratory species

| Common name | Scientific name | Status |
|---------------------------------|---------------------------------|-----------------------------------|
| Terrestrial Species | | |
| Birds | | |
| White-bellied Sea-Eagle | <i>Haliaeetus leucogaster</i> * | Migratory |
| White-throated Needletail | <i>Hirundapus caudacutus</i> | Migratory |
| Black-faced Monarch | <i>Monarcha melanopsis</i> | Migratory |
| Satin Flycatcher | <i>Myiagra cyanoleuca</i> | Migratory |
| Rufous Fantail | <i>Rhipidura rufifrons</i> | Migratory |
| Regent Honeyeater | <i>Xanthomyza phrygia</i> | Migratory |
| Wetland Species | | |
| Birds | | |
| Latham's Snipe, Japanese Snipe | <i>Gallinago hardwickii</i> | Migratory |
| Migratory Marine Species | | |
| Birds | | |
| Southern Royal Albatross | <i>Diomedea epomophora</i> | Migratory |
| Gibson's Albatross | <i>Diomedea gibsoni</i> | Migratory |
| Northern Royal Albatross | <i>Diomedea sanfordi</i> | Migratory |
| Southern Giant-Petrel | <i>Macronectes giganteus</i> | Migratory |
| Northern Giant-Petrel | <i>Macronectes halli</i> | Migratory |
| Buller's Albatross | <i>Thalassarche bulleri</i> | Migratory |
| Shy Albatross | <i>Thalassarche cauta</i> | Migratory |
| Campbell Albatross | <i>Thalassarche impavida</i> | Migratory |
| Salvin's Albatross | <i>Thalassarche salvini</i> | Migratory |
| Mammals | | |
| Bryde's Whale | <i>Balaenoptera edeni</i> * | Migratory |
| Pygmy Right Whale | <i>Caperea marginata</i> * | Migratory |
| Southern Right Whale | <i>Eubalaena australis</i> * | Migratory |
| Humpback Whale | <i>Megaptera novaeangliae</i> * | Migratory |
| Killer Whale | <i>Orcinus orca</i> * | Migratory |
| Spotted Bottlenose Dolphin | <i>Tursiops aduncus</i> | Migratory (Arafura/ Timor Sea) |

Listed Marine Species

| Common Name | Scientific Name | Status |
|-----------------------------------|-----------------------------------|------------------------------|
| Birds | | |
| Southern Royal Albatross | <i>Diomedea epomophora</i> | Listed |
| Gibson's Albatross | <i>Diomedea gibsoni</i> | Listed |
| Northern Royal Albatross | <i>Diomedea sanfordi</i> | Listed |
| Latham's Snipe, Japanese Snipe | <i>Gallinago hardwickii</i> | Listed - overfly marine area |
| White-bellied Sea-Eagle | <i>Haliaeetus leucogaster</i> * | Listed |
| White-throated Needletail | <i>Hirundapus caudacutus</i> | Listed - overfly marine area |
| Swift Parrot | <i>Lathamus discolor</i> | Listed - overfly marine area |
| Southern Giant-Petrel | <i>Macronectes giganteus</i> | Listed |
| Northern Giant-Petrel | <i>Macronectes halli</i> | Listed |
| Black-faced Monarch | <i>Monarcha melanopsis</i> | Listed - overfly marine area |
| Satin Flycatcher | <i>Myiagra cyanoleuca</i> | Listed - overfly marine area |
| Rufous Fantail | <i>Rhipidura rufifrons</i> | Listed - overfly marine area |
| Buller's Albatross | <i>Thalassarche bulleri</i> | Listed |
| Shy Albatross | <i>Thalassarche cauta</i> | Listed |
| Campbell Albatross | <i>Thalassarche impavida</i> | Listed |
| Salvin's Albatross | <i>Thalassarche salvini</i> | Listed |
| Mammals | | |
| Fur-seal | <i>Arctocephalus pusillus</i> * | Listed |
| Whales and Other Cetaceans | | |
| Bryde's Whale | <i>Balaenoptera edeni</i> * | Cetacean |
| Pygmy Right Whale | <i>Caperea marginata</i> * | Cetacean |
| Common Dolphin | <i>Delphinus delphis</i> * | Cetacean |
| Southern Right Whale | <i>Eubalaena australis</i> * | Cetacean |
| Risso's Dolphin | <i>Grampus griseus</i> * | Cetacean |
| Dusky Dolphin | <i>Lagenorhynchus obscurus</i> * | Cetacean |
| Humpback Whale | <i>Megaptera novaeangliae</i> * | Cetacean |
| Killer Whale | <i>Orcinus orca</i> * | Cetacean |
| Spotted Bottlenose Dolphin | <i>Tursiops aduncus</i> | Cetacean |
| Bottlenose Dolphin | <i>Tursiops truncatus</i> s. str. | Cetacean |

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FIGURES

1 Location of study area, CSIRO Highett

2 Ecological features, CSIRO Highett

3 Recommended tree guards, CSIRO Highett