



ECOLOGY  
AUSTRALIA

# National Drive Reserve - Flora and Fauna Management Plan



Prepared for: City of Greater Dandenong

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## Summary

### Background

In February 2015 Ecology Australia was commissioned by the City of Greater Dandenong (Council) to review and update the Management Plan for National Drive Reserve, Dandenong South (the Reserve). Ownership of this 21.6 ha reserve was transferred to Council in 2008 as an offset for native vegetation removal associated with the Lyndhurst Industrial Development. Council was then responsible for implementing the approved 10 Year Vegetation Offset Management Plan (OMP) (ABZECO 2008) for the entirety of the liability period (until 2018). This updated management plan incorporates the last of the works specified in the OMP which are to be completed by Council and builds upon those management actions to provide future management direction to restore and revegetate the site. The works recommended in this plan are consistent with the objectives of the OMP and relate primarily to weed control, revegetation, habitat augmentation and hydrological modifications. Council manage the Reserve with a minimalist intervention approach due to the size and value of the Reserve and the resources available. This updated Management Plan takes into account the current Net Gain obligations of the OMP and any new management issues with these limitations in mind.

Consistent with the OMP, the Reserve is divided into four Management Zones (MZs) with similar vegetation types, quality and management activities required. Management Zone 1 comprised exotic lawn with scattered remnant trees, MZ2 included a patch of open Plains Grassy Woodland, MZ3 covered the triangular block of densely treed Plains Grassy Woodland with scattered high quality understorey, and MZ4 included a degraded wetland.

### Values

To inform the preparation of this updated plan, Ecology Australia undertook an extensive data review and comprehensive flora and fauna field surveys across multiple seasons in 2015, and an additional site visit in March 2016.

NaturePrint provides information about the relative modelled biodiversity importance at state level, for all parts of Victoria. National Drive Reserve is modelled as having the highest and second highest possible rating (out of a possible 8 ratings) for its contribution of natural values in Victoria. The model considers native vegetation extent, threatened species distributions and habitat connectivity amongst other values. In context, the retention and appropriate management of native vegetation within the site is important for the threatened species and their habitats occurring within the reserve.

Two Ecological Vegetation Classes were identified onsite (Plains Grassy Woodland and Aquatic Herbland), along with a suite of Scattered Trees, large expanses of mown lawn and a degraded wetland that no longer comprises enough cover of indigenous species to qualify as remnant native vegetation. Two rare or threatened plant species were recorded during the field surveys: Studley Park Gum (*Eucalyptus X studleyensis*) classified as endangered in Victoria; and Yarra Gum (*E. yarraensis*) classified as rare in Victoria. Studley Park Gum was common within the western square block, while Yarra Gum was restricted to only two individuals. Additional Studley Park Gum's may occur in the eastern triangular block among the River Red-gums, although none were confidently identified due to the frequency of back-cross hybrids with River Red-gums (*E. camaldulensis*) and Swamp Gums (*E. ovata* var. *ovata*). Twenty seven regionally significant plant species were also recorded onsite.



Eighty two fauna species have been recorded within the reserve, of which 60 were recorded during the 2015 surveys using various survey techniques. These include, 37 bird species (five exotic), six amphibian species, one reptile species, 15 mammal species (three exotic) and one invertebrate species. Most of the species recorded are considered locally common and frequently recorded in urban, semi-urban environments. The occurrence of two owl species (i.e. Southern Boobook and Barn Owl) and 10 microbat species is notable in the urban context because they are dependent on woodland and forest habitats. The diversity of six frog species is also notable in the urban context. These species have undoubtedly lost habitat with urbanisation. Two threatened species were recorded during the 2015 targeted surveys: Grey-headed Flying Fox *Pteropus poliocephalus* (listed as Vulnerable under Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*, listed as threatened under the Victorian *Flora and Fauna Guarantee (FFG) Act 1988*, and classified as vulnerable in Victoria); and Yellow-bellied Sheath-tailed Bat *Saccolaimus flaviventris* (listed as threatened under the FFG Act). A further three fauna species of national and/or state significance have been previously recorded within or adjacent to the: Australian Painted Snipe *Rostratula australis*; Eastern Great Egret *Ardea modesta*; and Latham's Snipe *Gallinago hardwickii*.

### Updated Management Plan

Management actions are discussed and have been allocated to one or more of the four Management Zones. The primary management actions to be undertaken relate to: site security and access (fencing); weed control; controlled burning; ecological thinning; considerations for drainage modification; revegetation; pest animal control; user related issues; habitat protection and augmentation; and monitoring.

# 1 Introduction

## 1.1 Background

Ecology Australia was commissioned by the City of Greater Dandenong in February 2015 to review and update the 2008 Management Plan (ABZECO 2008) for National Drive Reserve, Dandenong South (henceforth referred to as the Reserve).

In 2008, ownership of this 21.6 ha reserve was transferred to the City of Greater Dandenong as an offset site for permitted vegetation clearance undertaken within the Lyndhurst Industrial Development Plan Stage 1 (LDP1) area on land in the M2 Estate and at 935, 945 and 965 Taylors Road, Lyndhurst (ABZECO 2008). The ownership of the Reserve was transferred in 2008 to the City of Greater Dandenong who responsible for the implementation of the approved 10 Year Vegetation Offset Management Plan (OMP) (ABZECO 2008) for the entirety of the liability period (until 2018).

This updated management plan incorporates the last of the works specified in the OMP which are to be completed by Council by 2018 (i.e. the end of the 10 year OMP period) to achieve a Net Gain under the former Native Vegetation Framework (DNRE 2002a). It also builds upon those management actions to provide future management direction to restore and revegetate the site. These aims for management within the Reserve as set out in the OMP relate to (ABZECO 2008):

- Maintaining and enhancing the biodiversity of the Reserve through active habitat management;
- Controlling threats to the native flora and fauna of the site, including pest plants, animals and destructive human activities; and
- Improving the quantity, quality and viability of indigenous vegetation to achieve the Net Gain offset liability under the former Native Vegetation Framework (DNRE 2002a).

The works recommended in this plan are consistent with the objectives of the OMP and relate primarily to weed control, revegetation, habitat augmentation and hydrological modifications.

Apart from recent works within the Reserve (e.g. infrastructure and hydrological modifications), Council manage the Reserve with a minimalist intervention approach due to the size and value of the Reserve and the resources available. This updated Management Plan takes into account the current Net Gain obligations and any new management issues with these limitations in mind. The scope and objectives of this Management Plan are outlined below.

## 1.2 Objectives and Scope

This Flora and Fauna Management Plan for National Drive Reserve is based on an extensive data review and comprehensive field assessments covering both general flora/fauna assessments and targeted surveys. Contemporary data collected for the site have informed the recommendations for management, along with acknowledgement of existing Net Gain offset obligations under the OMP (ABZECO 2008). The specific objectives of this new Plan are to:

- Document the flora and fauna values of the site based on general and targeted threatened species surveys over multiple seasons as well as review of previous ecological documentation for the site;

- Assess management issues and threats and update the management plan to reflect the contemporary ecological values of the site, the Net Gain obligations and new recommendations for management;
- Address the ecological implications of fire, and detail fire safety issues;
- Consider the proposed hydrological alterations to utilise stormwater runoff to seasonally inundate portions of the site for the benefit of vegetation communities and fauna habitat; and
- Review environmental policy and legislation as it relates to the management of ecological assets within the Reserve.

A review and evaluation of the management activity progress associated with Net Gain obligations under the OMP (ABZECO 2008) has been provided in a separate document (Ecology Australia 2016).

## 2 Study Area

National Drive Reserve is located at 43 - 67 National Drive, Dandenong South, c. 34 km south-east of Melbourne. The c. 21.6 ha Reserve is bounded by the Cranbourne Railway Line to the east, National Drive to the south and west and industrial land to the north (see Figure 1). It comprises two main blocks of land: a square block to the west which includes areas of open woodland, scattered trees and wetlands/drainage lines (see Section 2.1, Management Zones 1, 2 and 4); and a triangular block to the east which comprises a dense stand of eucalypts, mostly River Red-gums (*Eucalyptus camaldulensis*) (see Section 2.1, Management Zone 3).

National Drive Reserve is located within the Gippsland Plain Bioregion and receives an average of 778 mm of rain annually, most of which falls in spring (BOM 2015). The underlying geology is Baxter Sandstone of fluvial origin from the Tertiary period (GeoScience 2015).

The Reserve is zoned as Industrial Zone 1 (IN1Z) in the west of the Reserve and Farming Zone (FZ) in the east under the City of Greater Dandenong Planning Scheme and is also partially covered by an Environmental Significance Overlay (ESO2). The ESO2 covers the triangular woodland section of the Reserve and relates to the preservation and enhancement of the River Red Gum Woodland on-site which is considered to be “highly regionally significant, being the most extensive stand of River Red Gum in the region and which supports a diversity of significant flora and fauna” (Cook, in prep.).

The Reserve has undergone modification from previous land-clearance, cattle grazing, drainage works and recreational usage (4 Wheel Driving and dirt bike riding). Grazing was removed from the eastern triangular block in the 1970’s allowing the eucalypts to recruit en masse (Aquatic Systems Management 2010). The western woodland block (Management Zones 1, 2 and 4) remained under grazing for a longer period and parts of Management Zones 1 and 4 have also been previously disturbed by the Hastings to Dandenong Gas pipeline (Aquatic Management Systems 2010). Despite this modification, the site still supports high biodiversity values and is protected for conservation in perpetuity as an offset site; a Section 173 Agreement also applies to the title of the land on the eastern woodland block.

The artificial waterbodies within the Reserve include two drainage channels and a dam indicative of the site’s former agricultural land usage (Figure 1). The dam is located in Management Zone 1 in the south of the square western block and is connected to the main east west drain which flows diagonally through the triangular woodland (Management Zone 3) to the southern boundary of the Reserve. A second drainage channel, the north south drain, is located along the western boundary of the triangular woodland (Management Zone 3). In an attempt to reintroduce a flooding regime to the site, alterations to these drainage channels have occurred in 2014 to allow stormwater collected from the adjoining factory land and surrounding areas north of the site to flow across the site. These alterations are discussed in more detail in Section 6.6.

The four Management Zones are described below in Section 2.1.

### 2.1 Management Zones

The Reserve is divided into four Management Zones that will require similar management actions. These zones are based on vegetation type, quality and management activities required to protect and enhance the ecological values. While the number of Management Zones remains consistent with that of the previous Offset Management Plan (ABZECCO 2008), the boundaries of the zones have been slightly

modified to ensure that all areas of the Reserve are allocated a zoning and hence management prescriptions. These four management zones are detailed below and illustrated in Figure 1.

**Management Zone 1 – Exotic lawn with remnant trees** scattered individually or in small clusters. This zone is located in the western square block and includes small degraded patches of Plains Grassy Woodland, Scattered Trees and the artificial dam and drain (Aquatic Herbland). Aside from the wetland vegetation, the understorey is almost wholly exotic and is regularly slashed to keep the biomass down.

**Management Zone 2 – Open Plains Grassy Woodland** with relatively intact understorey, located in the western block. This zone comprises an open eucalypt canopy over a largely indigenous understorey of grasses with scattered shrubs and other herbaceous species. Grassy weeds are common though infrequently dominate;

**Management Zone 3 – Densely treed Plains Grassy Woodland** with variously intact or exotic understorey. This zone covers the entire eastern triangular block. It contains the most quality variation of all the management zones as the ground layer varies from high to very-low cover of indigenous species. The wet depressions and artificial drains that traverse this Management Zone add additional complexity; and

**Management Zone 4 – Degraded wetland** (former Plains Grassy Wetland) located in the north-east corner of the western square block. In 2008, this area was considered to comprise adequate indigenous vegetation cover to qualify as a remnant patch of Plains Grassy Wetland (ABZECO 2008), though this may have been overstated at the time (City of Greater Dandenong, pers. comm.). Compared to the 2008 survey the weed cover has now increased and indigenous cover decreased to the point that it no longer represents remnant vegetation. This area continues to receive inflows of water that can inundate the depression after high flow events and keep the soils wetter for longer compared to adjoining areas. In some places the ground has been disturbed by the installation of the Hastings-Dandenong gas pipeline and previous four wheel drive activities and slashing machinery when the soils were wet and boggy. This soil disturbance may explain at least some of the increased weed cover and decreased indigenous cover which can be seen in the wheel rutted/disturbed areas. Decreased water inputs during the millennium drought (1996-2010) have likely also contributed to the decline in quality across the wetland.

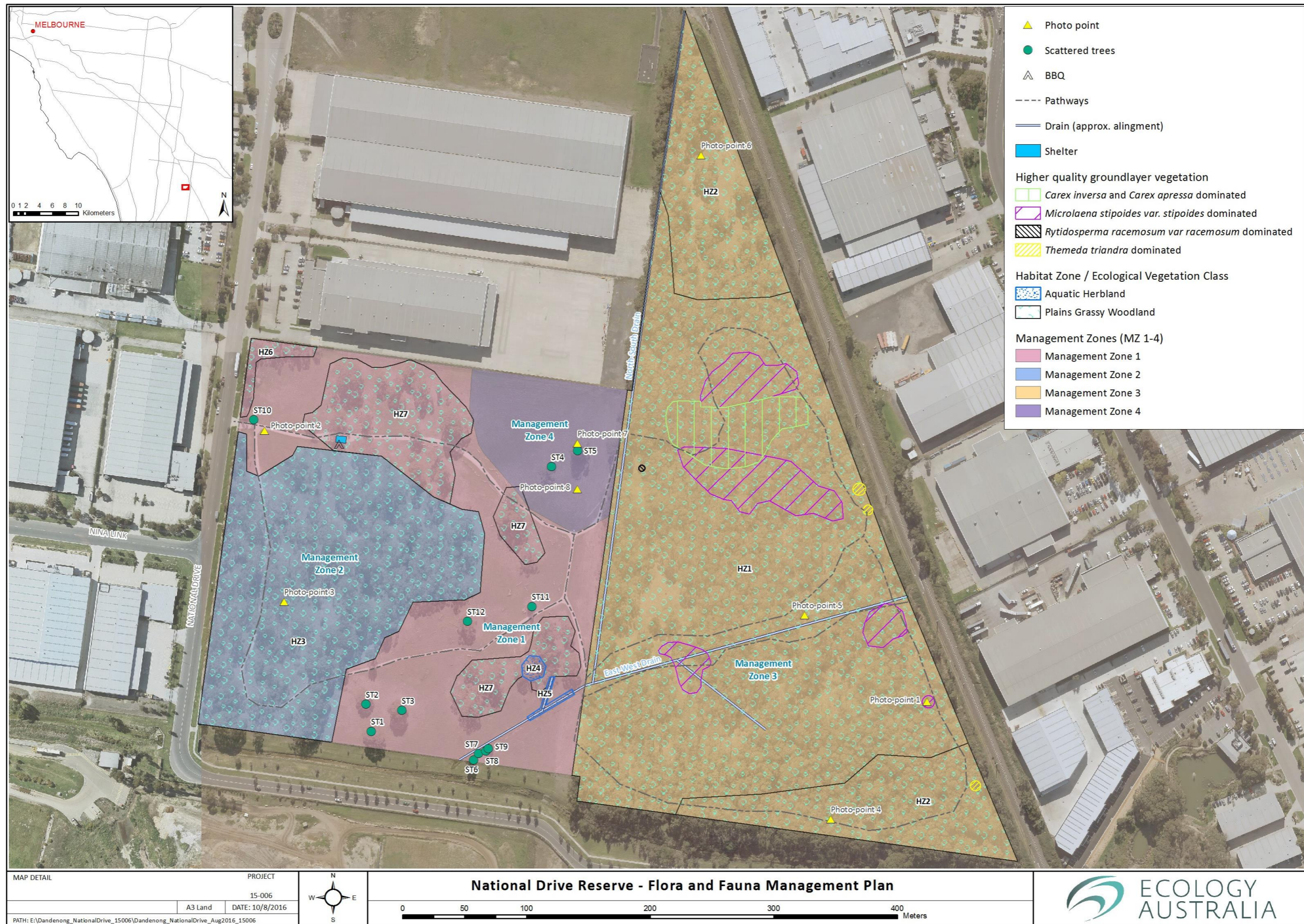


Figure 1 The study area including separation of Management Zones, National Drive Reserve, Dandenong South.

## 3 Methods

To inform the preparation of this new plan, Ecology Australia undertook an extensive data review and comprehensive flora and fauna field surveys across multiple seasons in 2015. The methodologies used to gather contemporary data on the ecological values of the study area are outlined below.

### 3.1 Data and Information Review

A data and information review was undertaken to determine the presence, location and extent of natural values and threats within National Drive Reserve. Data and information reviewed include:

- Flora and fauna records within 5 km of the study area held in the Victorian Biodiversity Atlas<sup>1</sup> (VBA), a state-wide database maintained by the Department of Environment, Land, Water and Planning (DELWP 2015a);
- A search for flora and fauna species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* within a 5 km radius of the study area using the EPBC Protected Matters Search Tool (DoE 2015a);
- DELWP's interactive maps - Ecological Vegetation Class (EVC) mapping/modelling of the area (both extant and pre-1750) (DELWP 2015b);
- Review of relevant GIS and aerial photo data;
- Review of the legislative and policy context of the Reserve including, the existing management obligations under the former Net Gain policy, and various Commonwealth and State Acts, frameworks, guidelines and advisory lists;
- Victoria's Planning Scheme's Online (DTPLI 2015);
- Review of technical reports from the study area including:
  - Frood (2011) National Drive Reserve Dandenong South: Review of Hydrology Report and Associated Ecological Considerations;
  - Australian Ecosystems (2011) – Lyndhurst Woodland nature Reserve: advice on hydrological management;
  - Biosis (2011) – Lyndhurst Woodland Reserve: Review of Hydrology Report;
  - Biosis (2010) – Notes on Lyndhurst Woodland Reserve;
  - Aquatic Systems Management (2010) - National Drive Reserve Hydrological Management Review;

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<sup>1</sup> The VBA is a web-based information system designed to manage biodiversity information in Victoria. The system includes species attribute information, including origin and conservation status, along with more than six million records of species distribution and abundance from systematic surveys and general observations. The VBA replaces several of Victoria's legacy systems, including the Flora Information System, the Atlas of Victorian Wildlife, the Aquatic Fauna Database and the VROTPop system.

- ABZECO (2008) - 10 Year Vegetation Offset Management Plan FOR m2 Estate Council Reserve, National Drive, Lyndhurst;
  - Hill and Costello (2005) – Environmental Management Plan for land south of Abbotts Road, Lyndhurst, Victoria; and
  - Donaldson (1998) – Lyndhurst (Red Gum Swamp) and Rail Reserve: A preliminary assessment.
- Review of various correspondence and documentation including: itemised works records for planting, weed removal and biomass reduction; fauna species lists and hydrological draft concept plan.

### 3.1.1 Liaison

Consultation regarding common and threatened species, ecological communities and management issues within National Drive Reserve was undertaken with Council staff, primarily through the Conservation Programs Coordinator, and various other experts as required. Ecology Australia staff met with City of Greater Dandenong on-site to discuss ecological values and site management on 23 March 2015. A second meeting to review the draft management plan was held at the Council offices in December 2015 which prompted the final site meeting with City of Greater Dandenong on 21 March 2016.

Other experts consulted during the progress of the project include:

- Rob Gration (Principal Environmental Scientist, EcoAerial) - bat call analysis within the Reserve; Damien Cook (Director, Rakali Ecological Consulting) - previous flora and fauna records and Plains Grassy Wetland; and
- Scott Seymour of Aquatic Management Systems – recommendations for hydrological modifications.

Consultation with Council staff and experts helped to frame the context for renewal of the management plan and identify key issues on-site.

## 3.2 Field Assessment

### 3.2.1 Flora

The site was surveyed by two botanists over one day in autumn (5 March 2015) and one day in spring (18 September 2015) to identify and record vascular plant species, plant communities (Ecological Vegetation Classes, EVCs) and identify threats and other management issues. Conducting repeat surveys in differing seasons increases the likelihood of recording seasonal taxa (e.g. annuals and geophytes) and allows for seasonal differences in weed populations to be addressed.

A final site visit was undertaken on 21 March 2016 with City of Greater Dandenong to map higher quality grassy understorey patches within Management Zone 3.



### Vegetation sampling and mapping

An inventory of the vascular flora of the Reserve (indigenous and exotic – naturalised and planted) was compiled. This was conducted per Management Zone, and all species were assigned a population size /abundance category based on the following:

- Rare/localised;
- Scattered/common;
- Widespread - sparse; and
- Widespread - abundant.

Floristic data were entered into the Victorian Biodiversity Atlas (VBA) database (DELWP 2015a), and will be made available to the administrators of this database at Department of Environment, Land Water and Planning (DELWP). The VBA was also used to generate an inventory of plant species recorded in areas of remnant vegetation during the survey.

The location and population size of locally and/or regionally rare plant taxa and weeds of management concern was documented using a hand-held GPS unit. The sites potential to support rare or threatened flora species and ecological communities was also considered.

Patches of remnant vegetation<sup>2</sup> were mapped and assigned to an Ecological Vegetation Class (EVC) with reference to DELWP's EVC modelling (DELWP 2015b) and EVC benchmarks (DELWP 2015c). EVC's were divided into Habitat Zones (HZs) based on differences in native vegetation quality. A Habitat Hectare assessment was completed for each HZ following DELWP's Vegetation Quality Assessment Manual (DSE 2004). Scattered trees (native canopy trees that do not form part of a remnant patch) were also identified and mapped.

It is very difficult to estimate the age of the larger eucalypts that occur across the Reserve without undertaking trunk cores (with an incremental borer) or counting growth rings of felled trees. In addition, conventional growth rings are often very difficult to detect in eucalypts because of the irregularity of their growth. As such, tree trunk diameter at breast height (DBH) was measured in an attempt to age the larger suite of eucalypts onsite.

### Fuel Hazard Assessment

Three Fuel Hazard Assessments were conducted in each of the four Management Zone following DSE's Overall Fuel Hazard Assessment Guide (DSE 2010). To get an average representative assessment for each Management Zone, the three assessments were undertaken in locations that represented the diversity of fuel arrangements. Briefly, the fuel hazard assessment included: location details; estimated canopy height (to top and to base); bark fuel assessments; and estimated cover and height of elevated fuels, near-surface fuels and surface fuels. These were then used to determine an overall fuel hazard.

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<sup>2</sup> Remnant patch vegetation is defined by DELWP (DEPI 2013) as an area of vegetation where at least 25% of the total perennial understory plant cover is native, or any area with three or more native canopy trees where the canopy foliage cover is at least 20% of the area.

Consideration was also given to: the likely projected behaviour of a fire based on the fuel loads, types and arrangements; and the opportunities and limitations of using fire as a management tool.

### Photo-points

Seven permanently marked photo-points were established within the Reserve. Of these, most are marked with a black star picket with yellow cap, one is marked with an existing wooden surveyor's peg, and two are marked with an obvious piece of infrastructure (bench seat/bubble tap). Photos were taken in areas of representative vegetation and the location coordinates, photo bearing and notes were recorded.

### Hydrology considerations

To evaluate the management issues and threats of the proposed use of stormwater to recreate flooding regimes for the benefit of water reliant EVC's in the Reserve, the following was considered:

- Background information regarding the hydrology regime and proposed modifications were reviewed (as outlined in Section 3.1 above);
- The diversity and cover of indigenous and exotic plant species in potentially affected areas; and
- Other site observations such as topography and likely inundation locations based on water outlet positions.

#### 3.2.2 Fauna

The Reserve was visited by two zoologists on 23 March, 8 April, 5 May and 5, 12, 19 and 21 October 2015. The survey design for fauna aimed to allow the identification of fauna habitats and compile a comprehensive inventory of the fauna occurring on-site over multiple seasons. The following techniques were used:

- Site inspection and habitat assessments;
- Observation surveys and incidental species sightings;
- Diurnal bird surveys;
- Call playback for large forest owls;
- Call playback and spotlighting surveys for frogs;
- Spotlighting surveys to detect arboreal mammals;
- Recording of the ultrasonic/echolocation calls of microchiropteran/insectivorous bat species;
- Active searches for cryptic fauna species such as reptiles; and
- Camera surveys using infrared motion sensing cameras to detect small mammals and other cryptic fauna species.

Detailed methodology for each survey technique is provided below. These methods are in line with the standard fauna surveys techniques approved by DELWP (where applicable). Appendix 1 summarises the fauna survey techniques, timing and total survey effort for each technique.

### Site Inspection and Habitat Assessment

The habitat assessment involved a review of aerial photographs and maps (e.g. species distribution maps), to gain an appreciation of the vegetation cover and to place the study area in a broader landscape context. This was followed by a site inspection on 23 March<sup>3</sup> 2015 to assess the fauna habitat values and the potential to support threatened fauna species. The habitat assessment focused on:

- Size and shape of remnant vegetation patches;
- Connectivity (habitat links or corridors);
- The floristics, structure and age of native vegetation;
- The level of disturbance (e.g. weed invasion);
- Particular attention was given to potential habitat attributes of threatened fauna species and other key features, such as:
  - Hollow-bearing trees suitable for arboreal mammals, large forest Owl's and other bird species;
  - Nectar-producing trees for birds, insects and mammals (e.g. EPBC Act-listed Grey-headed Flying Fox *Pteropus poliocephalus*);
  - Shrub and/or ground layer characteristics;
  - The presence and cover of leaf litter, logs and rocks within terrestrial habitats;
  - The degree of permanency (permanent or ephemeral) of waterbodies on-site; and
  - The presence and abundance of aquatic vegetation, including submergent, floating, emergent and fringing vegetation and the suitability of the aquatic and flooded terrestrial vegetation and other key habitat attributes (e.g. woody debris, leaf litter and rocks surrounding the water) for Flora and Fauna Guarantee (FFG) Act-listed Southern Toadlet *Pseudophryne semimarmorata*.

During these surveys, Ecology Australia staff also mapped fauna habitats, evaluated the likelihood of the site to support rare and/or threatened species and assessed and identified threats and management issues. This initial site assessment was also used to identify sites for targeted survey as outlined below.

### Observation Surveys and Incidental Species Sightings

Observational searches were conducted within the Reserve to detect fauna species and identify management issues within each Management Zone during each of the site visits (i.e. between March and October).

An inventory of vertebrate fauna found in the study area (native and exotic), based on direct observation and indirect evidence (diggings, scats, tracks, nests, burrows, etc.) was compiled.

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<sup>3</sup> Note: all site visits and surveys were used to gather data on the potential habitat suitability for threatened fauna species between March and October 2015.

Observation surveys also involved opportunistic searches for indirect evidence that indicated the presence of fauna, such as nests, dreys, scats, owl pellets and white-wash.

### Diurnal Birds: Random meander

Two diurnal bird surveys were undertaken, one in autumn on 8 April 2015 between the hours of 4pm and 5.30 pm and another in spring on 12 October 2015 between the hours of 6 pm and 7 pm. The random meander method was employed and all bird species were identified by sight or by calls.

### Nocturnal Birds: Call Play-back and Spotlighting Surveys

Two zoologists undertook surveys for nocturnal birds (e.g. owls) using call-playback and spotlighting in autumn on 8 April 2015 between the hours of 9 pm and 9.30 pm and also in spring on 12 October 2015 between the hours of 8.15 pm and 8.45 pm. Call playback for forest owls involved broadcasting the calls (using a digital recording on a MP3 player and a Toa ER77 megaphone) of each species for 2 minutes followed by 2 minutes of listening for each species. This was followed by 20 minutes of spotlighting to look for any owls which may have flown in.

Due to the ability of call play back to draw-in birds from some distance and the small size of the Reserve, only one site was selected for owl survey. The survey was repeated in autumn and spring 2015 (see Figure 2).

All fauna species seen or heard during the call play-back and spotlight surveys were recorded (e.g. owls and arboreal mammals recorded during spotlighting).

### Frog Surveys

Two zoologists undertook two spotlighting and call play back surveys for FFG Act-listed Southern Toadlet *Pseudophryne semimarmorata*<sup>4</sup> in autumn after rains (8 April and 5 May 2015) to coincide with the peak calling period for this species. These surveys were undertaken between the hours of 5.50 pm and 8.15 pm along the east-west and north-south drains and dam. The survey involved a period of quiet listening for the calls of frogs, on arrival at a site (e.g. 5 minutes of call recognition), followed by approximately one minute of call playback (using a digital recording on a MP3 player and a Toa ER77 megaphone) and then active searches using hand-held spotlights. Two call playback sites were selected along the east-west drain and a single call playback site at the dam. Spotlights were used to scan along shallow margins of the dam and depressions within and adjacent to the drain. Woody debris and rocks were turned over during this survey to try and detect sheltering toadlets.

The second spotlighting frog survey in spring (12 October 2015) was undertaken between the hours of 8 pm and 9 pm along the east-west drain, dam and associated drainage line and the Melbourne Water

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<sup>4</sup> The Southern Toadlet is a ground dwelling, terrestrial breeding frog which inhabits moist microhabitats such as under logs, rocks and leaf litter, in moist soaks and depressions within a variety of different habitats (e.g. sclerophyll forests, woodlands, shrublands, heaths and grasslands) (Cogger 2014, Robinson 1998). This species lays its eggs in shallow burrows or nests under logs, leaf litter and other woody ground debris in low-lying areas. Southern Toadlet's are heavily dependent on rainfall; this species calls and breeds in response to rainfall. Burrows where eggs are laid (in low-lying areas) later flood and form an aquatic habitat where tadpoles can develop (Cogger 2014).

drain on the southern boundary, outside of the Reserve (see Figure 2). This general survey for frogs involved a period of quiet listening for the calls of frogs, on arrival at a site (e.g. 5 minutes of call recognition), followed by a period of active searching (e.g. 20 minutes) using hand-held spotlights. Spotlights were used to scan the surface of the water and aquatic vegetation, and riparian vegetation on banks of waterways or around waterbodies.

All frog species seen or heard during both the autumn and spring surveys were recorded.

### Arboreal Mammal Surveys

Spotlighting was employed in Woodland Habitat (Management Zones 2 and 3), primarily to detect arboreal and scansorial mammals but also nocturnal birds (large forest owls). Spotlighting, using hand-held spotlights, was undertaken along four transects (one Zoologist walking each transect) in autumn (8 April 2015) between the hours of 8.30 pm and 10 pm and six transects in spring (12 October 2015) between the hours of 8.50 pm and 10.30 pm (see Figure 2 for transect locations). All species observed during the spotlighting were recorded.

### Active Reptile Searches

Active searches for reptiles were undertaken in the afternoon of 19 October 2015. A subset of sites (four) were identified as areas of most suitable habitat during the general fauna survey (see Figure 2 and searches involved lifting logs, rocks and anthropogenic debris (mostly plastic sheeting and styrofoam) to search for sheltering reptiles (and amphibians). All species observed during these surveys were identified and recorded. Surveys were undertaken once at each of the four sites selected within the Reserve during spring, when reptiles are most active. Ten minutes of searching time was undertaken by two zoologists (20 person minutes) searching simultaneously within a 50 m radius of each survey site (Figure 2).

### Microbat Surveys

Mobile bat detectors [one Anabat II Detector (Titley Electronics, Ballina, NSW) and one SM2 song meter (Wildlife Acoustics Inc., Concord, Massachusetts, USA)] were used to remotely survey and record the calls of microchiropteran/insectivorous bat species.

The mobile bat detectors were deployed for six nights/days in autumn between 23 and 29 March 2015 and two nights/days in spring between 19 and 21 October 2015.

During these two survey periods, the bat detectors were deployed at two sites (see Figure 2) within areas of potentially high bat activity (e.g. adjacent to water and flyways or gaps in the woodland canopy). All microchiropteran bat species recorded were identified by Rob Gratton (Principal Environmental Scientist) from EcoAerial who specialises in bat call analysis.

### Remote-sensing Infrared Cameras

A single remote-sensing infrared camera survey was undertaken in early spring 2015. Cameras were installed on 5 October 2015 and collected two weeks after deployment (e.g. cameras were activated for a period of 14 days/nights in the field before collection) on 19 October 2015. Reconyx Infra-red Cameras were used during the survey (HC500). Reconyx cameras take rapid fire still photos with a Passive Infrared (PIR) motion detector and night time infrared illuminator.

Camera installation focused on those areas with the most suitable habitat (i.e. by directed cameras toward areas supporting a shrubby understorey and woody debris. A total of nine infra-red cameras were used during the survey, with cameras placed between 50 m and 100 m apart (where possible).

At each site, a camera was attached to a tree and/or star-picket and directed at a bait station designed by Ecology Australia and placed c. 1-2 m from the camera. The standard bait formula of rolled oats, honey and peanut butter was used.

Data collected at each camera survey site included: site name and Management Zone number; the camera number and SD card identification; the date of camera installation and removal; and the names of personnel. Images were downloaded from cameras immediately on return from the field and data, including the date the image was taken and the species was recorded. Figure 2 shows the location of cameras during the survey period.

### Habitat Suitability Rating

A Habitat Suitability Rating, developed by Ecology Australia, was applied to each fauna species identified by the VBA (DELWP 2015a) and Protected Matters Search Tool (DE 2015) to potentially occur in the study area. This rating is based on:

- The present survey results (presence or absence of the species, with regard to survey effort and ease of detection);
- Habitat assessment, including:
  - Site attributes, such as habitat structure, density of hollow-bearing trees, vegetation composition, level of coarse woody debris, etc.; and
  - Landscape context, such as degree of habitat connectivity [i.e. higher quality sites have contiguous habitat or substantial areas of habitat in close proximity, whereas lower quality sites may be isolated by infrastructure or unsuitable habitat (e.g. through anthropogenic disturbance)].
- Past records of the species, including an assessment of the degree of previous survey effort undertaken at the site as well as the ease of detection of the species in question.

Based on the survey results, habitat assessment and past records, the Habitat Suitability Rating provides a categorised rating for each species from 0 to 1.0 (Table 1).

**Table 1 Habitat Suitability Rating Guidelines**

Habitat Suitability Rating	Habitat Suitability	Guidelines
0-0.2	Very low/ Negligible	No recent or historic records of the species Habitat considered to be largely unsuitable (i.e. few, if any, attributes required for a species life-cycle are present)
0.2-0.5	Low	No recent records and/or records suggest infrequent occurrence of the species Habitat generally suitable, but clearly limited with regard to one or more aspects of a species life-cycle (e.g. small area, isolation, paucity of a critical resource, higher levels of adverse disturbance)
0.5-0.7	Moderate	Recent records of the species (unless region poorly surveyed and/or species highly cryptic) Habitat suitable and life-cycle requirements for a species present to some extent (e.g. area of habitat, moderate or greater connectivity, essential habitat resources present, lower levels of adverse disturbance)
0.7-1.0	High	Multiple historic and recent records of the species indicating regular occurrence or residency (unless area poorly surveyed and/or species highly cryptic) High quality habitat and landscape attributes which meet the life-cycle requirements of a species (e.g. large area of habitat, high connectivity with surrounding habitat, moderate or greater availability of essential habitat resources, lower levels of adverse disturbance)

### Confidence rating

The Confidence rating is used to illustrate the extent of evidence for the assigned Habitat Suitability Rating, whereby:

- High – supported by repeated scientific or empirical evidence;
- Medium – supported by single studies or observations, consensus within scientific community, or empirical evidence from highly relevant study/studies; and
- Low – supported by expert/professional opinion based on logical/plausible associations (i.e. rather than empirical evidence).

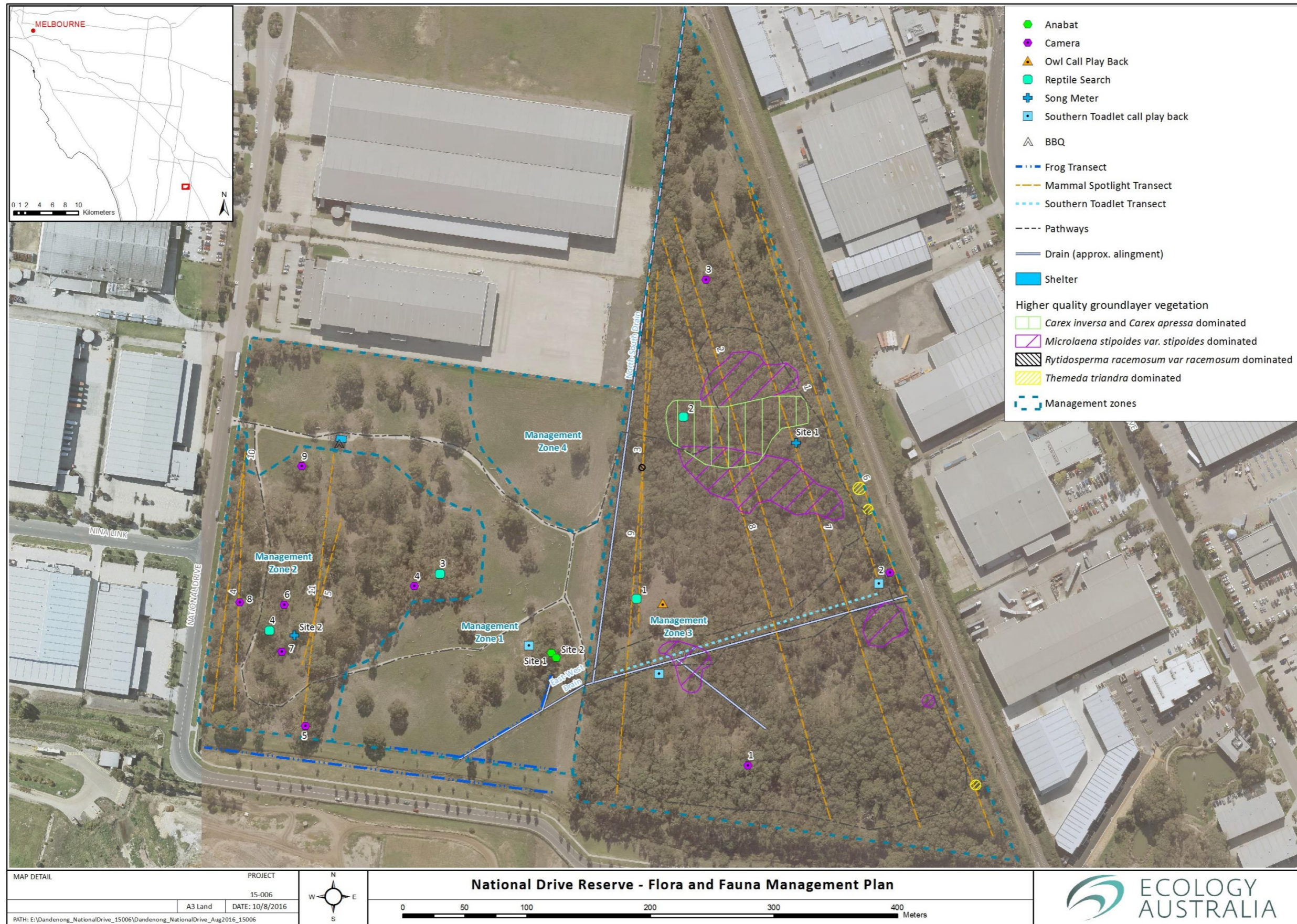


Figure 2 Location of targeted fauna surveys undertaken, National Drive Reserve, Dandenong South.



### 3.3 Limitations

The seasonality of some plant species may provide a limitation to the survey. Although this limitation has been minimised by conducting an autumn and a spring survey, some species may still have been overlooked because they were inconspicuous when the survey was conducted, or have been identified to genus level only due to the absence of fertile material. However, this limitation is unlikely to alter the major findings regarding overall quality and significance of the vegetation.

The endangered Studley Park Gum *Eucalyptus X studleyensis* is a hybrid between River Red Gum *E. camaldulensis* and Swamp Gum *E. ovata* var. *ovata*. All three of these species occurred onsite, including individuals that are likely to be back crosses between the hybrid *E. X studleyensis* and either parent species. As such, identification of some of these individuals was difficult given the variation in physical characteristics, but this limitation only applies to a small number of trees.

While the fauna survey was comprehensive (e.g. implemented over two seasons using a variety of survey techniques), it is likely that not all fauna species occurring within the study area have been detected. This is due to the cryptic nature of some species (e.g. reptiles) or not surveying during the period when nomadic species or those that utilise the Reserve only occasionally are present. However, this limitation is compensated for by the use of the VBA (DELWP 2015a) and Protected Matters Search Tool (DoE 2015a) and by a comprehensive habitat assessment and evaluation of the ability of the Reserve to support threatened species.

### 3.4 Conservation Status

The conservation status of plant and animal species was determined by reference to Victoria's Advisory lists (DSE 2009, 2013, DEPI 2014) and listings under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) and the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Regional significance was determined for plant species based on knowledge of the species distribution, abundance and recent population changes within the greater Melbourne region.

### 3.5 Nomenclature and taxonomy

Plant names in this report follow the online census VicFlora (Royal Botanic Gardens Melbourne 2015) and the Victorian Biodiversity Atlas (VBA) database (DELWP 2015a). For fauna, scientific names and common names follow the Victorian Biodiversity Atlas (DELWP 2015a).

Where an asterisk (\*) precedes a plant or animal name, it signifies non-indigenous taxa – those species which have been introduced to Victoria or Australia. A hash (#) is used to denote Victorian native plants that are not indigenous to the relevant vegetation type.

## 4 Policy and Legislative Context

A summary of the legislation, policy and guidelines relevant to National Drive Reserve in a national, state, regional and local context is provided in Appendix 1. It covers the relevant legislation/policy, the scope of the legislation/policy, when it applies and its relevance to the City of Greater Dandenong's management of the Reserve.

## 5 Ecological Values

### 5.1 Flora Values

A total of 159 indigenous or naturalised vascular plant species was recorded from the study area, of which 86 (54 %) were indigenous and 73 (46 %) were exotic. Appendix 2 documents the flora species recorded within the study areas and their abundance within each Management Zone.

#### 5.1.1 Vegetation Communities

Ecological Vegetation Class (EVC) modelling of the study area (DELWP 2015a) identifies EVC 897 Plains Grassland / Plains Grassy Woodland Mosaic as the dominant vegetation community across the property both historically (pre-1750) and more recently (2005). During the site assessment it was determined that all remnant terrestrial vegetation was referable to EVC 55 Plains Grassy Woodland and this dominated the majority of the Reserve alongside areas of exotic lawn in the western block. The western block also comprised a dam and artificial drainage line containing EVC 653 Aquatic Herbland, and a degraded wetland that no longer qualifies as remnant vegetation (previously identified as Plains Grassy Woodland; Biosis 2005, ABZECO 2008).

These vegetation communities are discussed below. Within each EVC, areas of differing quality (i.e. Habitat Zones) were assessed for their vegetation condition. The results of the Vegetation Quality Assessments are presented in Table 2.

**Table 2 Results of the Vegetation Quality Assessments conducted in each Habitat Zone, National Drive Reserve, Dandenong South.**

**Key:** GP = Gippsland Plain

**EVC = Ecological Vegetation Class: PGW = Plains Grassy Woodland; AH = Aquatic Herbland**

Habitat Zone		HZ1	HZ2	HZ3	HZ4	HZ5	HZ6	HZ7	
Management Zone (MZ)		MZ 3	MZ 3	MZ 2	MZ 1	MZ 1	MZ 1	MZ 1	
Applicable Habitat Zones (HZs)		HZ 7	HZ 5, 6	HZ 10	HZ 8	HZ 1	HZ 9	HZ 2, 3, 4	
Bioregion		GP	GP	GP	GP	GP	GP	GP	
EVC #: Name		55: PGW	55: PGW	55: PGW	653: AH	653: AH	55: PGW	55: PGW	
	Max Score	Score	Score	Score	Score	Score	Score	Score	
Site Condition	Large Old Trees	10	6	10	10	-	-	0	10
	Canopy Cover	5	5	5	5	-	-	5	5
	Understorey	25	15	5	15	15	0	5	5
	Lack of Weeds	15	7	0	4	7	10	7	0
	Recruitment	10	6	3	10	0	0	1	1
	Organic Matter	5	3	3	3	5	4	2	2
	Logs	5	4	2	5	-	-	2	5
	<i>Total Site Score</i>	75	46	28	52	27	14	22	28
	<i>EVC standardiser</i>	<i>e.g.</i> <i>75/55</i>	75	75	75	55	55	75	75
	<i>Adjusted Site Score</i>		46	28	52	37	19	22	28
Landscape value	25	6	6	4	4	4	4	4	
<b>Habitat Score (%)</b>	<b>100</b>	<b>52</b>	<b>34</b>	<b>56</b>	<b>41</b>	<b>23</b>	<b>26</b>	<b>32</b>	

### EVC 55 Plains Grassy Woodland

The DELWP (2015b) describes EVC 55 Plains Grassy Woodland as “an open, eucalypt woodland to 15 m tall occurring on a number of geologies and soil types. [It] occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer.” This EVC is considered endangered by DELWP (2015b); this vegetation does not form part of a threatened ecological community as listed under the FFG or EPBC Acts.

Within the study area, four zones of quality were identified for this EVC: Habitat Zones 1 and 2 in the triangular block to the east (Management Zone 3) and Habitat Zone 3 and 6 in the western block (Management Zones 1 and 2).

Habitat Zone 1 comprised the highest quality vegetation and covered the majority of the Management Zone 3. It was dominated by a dense canopy of River Red-gum *Eucalyptus camaldulensis* and Swamp Gum *E. ovata* var. *ovata* with a predominantly indigenous ground layer. Shrubs and understorey trees such as Blackwood *Acacia melanoxylon*, Hedge Wattle *A. paradoxa*, and Drooping Cassinia *Cassinia arcuata* were scattered sparsely over an indigenous grassy understorey. Common ground layer species included Weeping Grass *Microlaena stipoides* var. *stipoides*, Wallaby Grasses *Rytidosperma* spp., Kangaroo Grass *Themeda triandra* and Common Tussock-grass *Poa labillardierei* var. *labillardierei*. A suite of regionally typical wetland species were common in natural depressions and artificial drainage lines, and included Rushes *Juncus* spp., Common Spike Sedge *Eleocharis acuta*, Tall Sedge *Carex appressa* and Common Reed *Phragmites australis*.

Habitat Zone 2 was located along some of the boundaries of Management Zone 3 and showed evidence of edge effects such as increased weed invasion. It formed a similar canopy and understorey structure to Habitat Zone 1, but the ground layer comprised few indigenous species and a higher abundance of weeds such as \*Panic Veldt-grass *Ehrharta erecta* var. *erecta*, \*Annual Veldt-grass *E. longiflora*, \*Cocksfoot *Dactylis glomerata* and \*Toowoomba Canary-grass *Phalaris aquatica*.

Habitat Zone 3 was located in the slightly more elevated Management Zone 2 and comprised a drier version of Plains Grassy Woodland than Habitat Zones 1 and 2. The canopy comprised River Red-gum, Swamp Gum, Studley Park Gum *Eucalyptus X studleyensis* and Yarra Gum *E. yarraensis*. Shrubby species were more common including patches of Burgan *Kunzea ericoides* spp. agg. and Prickly Tea-tree *Leptospermum continentale*, with scattered Hedge Wattle among others. The ground layer was variously dominated by Weeping Grass, \*Panic Veldt-grass, \*Paspalum *Paspalum dilatatum*, \*Brown-top Bent *Agrostis capillaris* and \*Sweet Vernal-grass *Anthoxanthum odoratum*. Plantings have been undertaken within areas of this Habitat Zone, particularly as a buffer along the western boundary fence. These plantings largely comprise indigenous species such as Hedge Wattle, Common Tussock-grass, Tall Sedge and Spiny-headed Mat-rush.

Habitat Zone 6 comprised buffer plantings of indigenous species such as River Red-gum, Manna Gum *Eucalyptus viminalis* subsp. *viminalis*, Blackwood, Prickly Moses *Acacia verticillata* subsp. *verticillata* and Rushes. Disturbance-tolerant and colonising weed species were common including \*Kikuyu *Cenchrus clandestinum*, \*Couch *Cynodon dactylon* var. *dactylon*, \*Veldt-grasses and \*Flatweed *Hypochaeris radicata*.

Eleven Scattered Trees that would have once form part of Plains Grassy Woodland vegetation were recorded, varying in size from small immature trees (>3 m tall), to very large remnant trees that likely

predate European Settlement. They included River Red-gum, Swamp Gum and Studley Park Gum, and were surrounded by predominately exotic grasses that are regularly slashed forming a lawn.

### EVC 653 Aquatic Herbland

Aquatic Herbland was restricted to the dam (Habitat Zone 4) and an artificial drainage line (Habitat Zone 5) near the southern boundary of the square western block.

The aquatic and semi-aquatic wetland vegetation of the artificial dam was primarily restricted to the perimeter of the water body, and comprised Slender Knotweed *Persicaria decipiens*, \*Lesser Reed-mace *Typha latifolia*, \*Water Couch *Paspalum distichum* and Common Spike-sedge, with Thin Duckweed *Landoltia punctata* on the surface of the water and adjoining mud where the waterline had receded. Around the outskirt of the wetland, many young River Red-gums had recruited likely from the adjoining very large mature trees that overhang the dam. At the time of the assessments, the water was very dark with tannins.

The dam is connected to an artificial drain to the south. The drain was dominated by indigenous wetland vegetation, predominantly Common Spike-sedge and Upright Water-milfoil *Myriophyllum crispatum*. The drain lacked a mature canopy but several young River Red-gum had regenerated along it. Weeds were common including \*Water Couch, \*Paspalum, \*Brown-top Bent and \*Gorse *Ulex europaeus*.

### Exotic lawn

The slashed areas dominated by exotic grasses occurred between the Habitat Zones and Scattered Trees. Dominant species included \*Paspalum, \*Brown-top Bent, \*Panic Veldt-grass, \*Flatweed and \*Ox-tongue *Helminthotheca echioides*. \*Blackberry *Rubus fruticosus* spp. agg. and \*Gorse were also common, growing low to the ground due to repeated slashing.

### Degraded wetland

The wetland area that has previously been identified as Plains Grassy Wetland by Biosis (2005; the north-east corner of the western block) no longer qualifies as remnant vegetation as the cover of perennial weeds is over 75%. During the 2015 assessments, this area is dominated \*Paspalum, \*Couch, \*Brown-top Bent and other exotic weeds, with a consistent but sparse covering of Common Spike-sedge. Populations of Prickfoot *Eryngium vesiculosum* were also present through this degraded wetland depression.

During wetter years/season's Common Spike-sedge *Eleocharis acuta*, Common Swamp Wallaby-grass *Amphibromus nervosus*, Australian Sweet-grass *Glyceria australis*, Poison Lobelia *Lobelia pratioides* and large patches of Prickfoot *Eryngium vesiculosum* are more common than observed during the field assessment (Conservation Programs Coordinator, pers. comm.).

Heavy rains during spring 2016 flooded this wetland. Photographs from this period are provided in Plate 1 as supplied by the City of Greater Dandenong.



**Plate 1** The flooded degraded wetland after substantial spring rains (taken after completion of the field assessments), 25 October 2016. Photo credit: Simonette Charles, City of Greater Dandenong.



These photographs depict the degraded wetland in conditions not observed during the field surveys that were undertaken during drier periods. These photographs have been provided for future reference of the wetland during flood. They illustrate the wetland comprising a higher cover of indigenous species, particularly Common Spike-sedge, along with other indigenous species and exotic grasses such as Paspalum and Sweet Vernal Grass.



### 5.1.2 BioSites

A BioSite is “a physical area of land or water containing biological assets with particular attributes, such as the presence of rare or threatened flora, fauna or habitat required for their survival, and/or rare or threatened vegetation communities” (DSE 2005). DELWP have mapped the location of BioSites within the Port Phillip and Western Port Regions although the BioSites register is no longer used or contributed to and detailed information is now difficult to obtain.

A Site of Biodiversity Significance, or BioSite, of State Significance covers part of the Reserve, namely the densely treed triangle and the degraded wetland. This is BioSite 4694: Lyndhurst Red Gum Swamp (Abbots Road Woodland) which lists an endangered vegetation community (likely Plains Grassy Woodland) and significant flora (species unknown) as the reason for the status. Further information is not available as DELWP no longer provide the reports for BioSites.

### 5.1.3 Strategic Natural Values: NaturePrint

NaturePrint (DELWP 2015b) provides information about the relative modelled biodiversity importance at state level, for all parts of Victoria. It models the entire state on a scale of eight categories that range from “high contribution to natural values” to “low contribution to natural values”.

National Drive Reserve is patchily modelled as having the highest and second highest possible rating for its contribution of natural values in Victoria. The model considers native vegetation extent, threatened species distributions and habitat connectivity amongst other values. In context, the retention and appropriate management of native vegetation within the site is important for the threatened species and their habitats occurring within the reserve.

### 5.1.4 Estimated age-class of very large eucalypts

Historically, the site has been partially cleared, with only some of the original eucalypts left standing. Since the original clearing many decades ago, multiple recruitment events have resulted in a variety of eucalypt age classes within the stand. The largest eucalypts have trunk diameters exceeding 140 cm at breast height (up to c. 180 cm), though the bulk of sizable eucalypts are in the vicinity of c. 90 – 120 cm diameter at breast height (DBH) (Figure 3).

It is difficult to infer the age of trees from size classes (trunk diameter at breast height, DBH) – i.e. assuming that the biggest must be the oldest – because trees develop at different rates dependant on a range of factors, not the least of which is competition with other plants (especially other trees). Trees isolated by clearing in pasture for example (such as the scattered trees in the square western block of the Reserve) are likely to have grown more rapidly than trees contained by competition (such as the trees in the triangular eastern block in the Reserve).

When comparing the number of trees onsite that fall into different size categories, there is a gap in DBH measurements between 127 cm and 143 cm (Figure 4). This gap separates the majority of eucalypts from the eight largest trees (measuring 140-180 cm DBH) that are believed to be old-growth and pre-European in age (i.e. >200 years old). Some of the other larger trees may also be pre-European in age, however this cannot be convincingly determined. To be more specific estimating tree age is very difficult and fraught with inaccuracies unless the trees are felled to count growth rings or trunk cores extracted with an incremental borer – both methods of which can also present complications and are obviously damaging or detrimental to the ongoing survival of the trees.

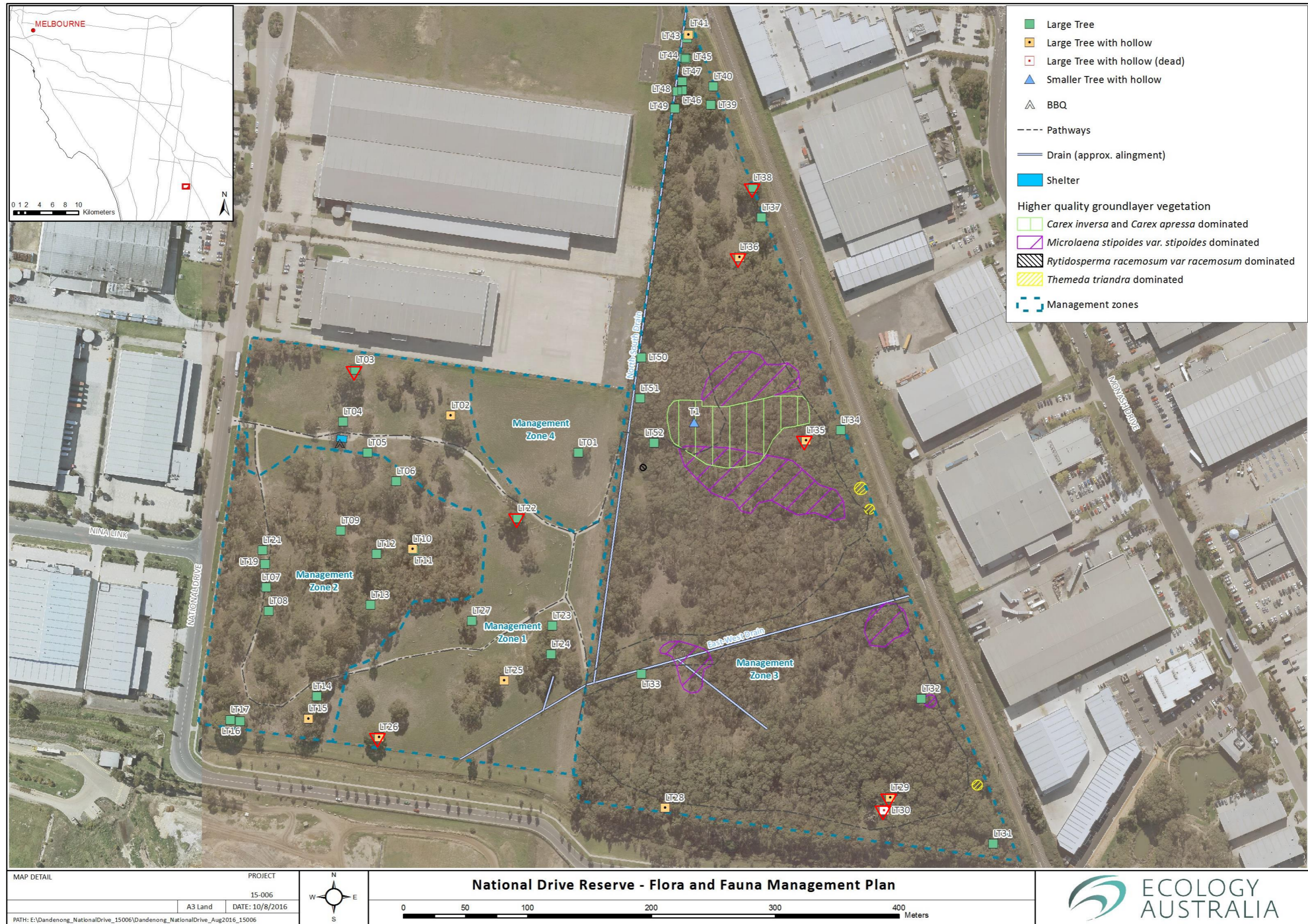
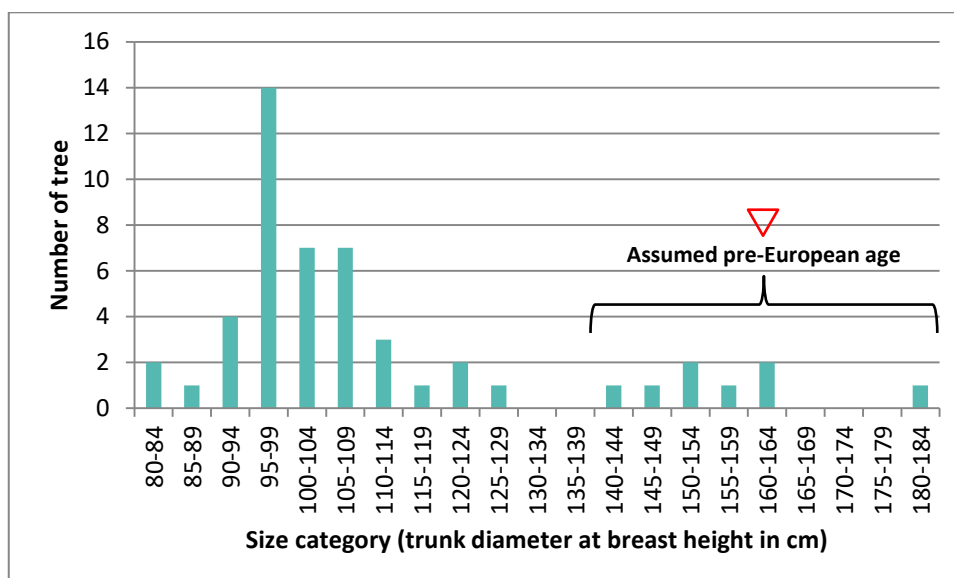


Figure 3 The suite of larger trees within the study area, including those with hollows, and those that area thought to be pre-European settlement in age (▽), National Drive Reserve, Dandenong South.





**Figure 4** Trunk diameter at breast height (DBH) of the larger eucalypts within the site, National Drive Reserve, Dandenong South. Total 50 trees with DBH over 80 cm (see Figure 3 for map, ▽ indicates assumed pre-European trees).

### 5.1.5 Victorian rare or threatened (VROT) plant species

Two rare or threatened plant species were recorded during the field surveys:

- Studley Park Gum *Eucalyptus X studleyensis* – classified as endangered in Victoria (DEPI 2014)
- Yarra Gum *Eucalyptus yarraensis* – classified as rare in Victoria (DEPI 2014)

Studley Park Gum was common within the western square block, while Yarra Gum was restricted to only two individuals. Additional Studley Park Gum's may occur in the eastern triangular block among the River Red-gums, although none were confidently identified.

Fifteen rare or threatened plant species have been recorded (DELWP 2015a) or have may potential habitat (DoE 2015a) within 5 km of the site, of which seven are EPBC Act listed and eight are FFG Act listed. A likelihood of occurrence has been assigned to each of these species based on:

- Date(s) and number of past records;
- General condition and land use history of the study area, i.e. level of modification;
- Comparisons of site factors (climate, soils, topography) between the study area and sites known to support populations of each threatened species; and
- Whether there is a reasonable expectation that the species would have been recorded during the field survey.

Of these 15 rare or threatened plant species identified as occurring or potential habitat occurring within 5 km of the site, two were recorded, and three other species are considered to have a moderate likelihood of occurrence: River Swamp Wallaby-grass (*Amphibromus fluitans*), Grey Billy-buttons (*Craspedia canens*) and Purple Blown-grass (*Lachnagrostis punicea* subsp. *filifolia*) (Table 3). Grey Billy-buttons was last seen just outside the study area in the rail reserve in 2010/2011 (City of Greater Dandenong, pers. comm.). Suitable habitat is present onsite for the two grass species which occur in wet environments such as swamps and marshes.

**Table 3 Rare or threatened species recorded or potential habitat occurring within 5 km of the study area (DELWP 2015a, DoE 2015a), National Drive, Dandenong South.**

**Key:** EPBC = Environment Protection and Biodiversity Conservation Act 1999: E = listed as endangered; V = listed as vulnerable

FFG = Flora and Fauna Guarantee Act 1988: L = listed as threatened; X = not eligible for listing.

VROT = Victorian Rare or threatened species as classified by DELWP (DEPI 2014): e = endangered; v = vulnerable; r = rare; k = poorly known but thought to be rare or threatened.

▲ Species not recorded onsite or within 5 km of the study area (DELWP 2015a). Identified as having potential habitat within 5 km by the EPBC Protected Matters Search Tool (DoE 2015)

Δ = Species not previously recorded within 5 km of the study area (DELWP 2015a), but was recorded onsite.

EPBC	FFG	VROT		Scientific Name	Common Name	Likelihood of occurrence
V	X		▲	<i>Amphibromus fluitans</i>	River Swamp Wallaby-grass	Moderate
E	L	e	▲	<i>Caladenia orientalis</i>	Eastern Spider Orchid	Negligible
		v		<i>Coronidium gunnianum</i>	Pale Swamp Everlasting	Low
	L	e		<i>Craspedia canens</i>	Grey Billy-buttons	Moderate
E	L	e	▲	<i>Dianella amoena</i>	Matted Flax-lily	Low
		k		<i>Eleocharis macbarronii</i>	Grey Spike-sedge	Low
		e		<i>Eucalyptus X studleyensis</i>	Studley Park Gum	<b>Recorded</b>
	X	r	Δ	<i>Eucalyptus yarraensis</i>	Yarra Gum	<b>Recorded</b>
V	L	v	▲	<i>Glycine latrobeana</i>	Clover Glycine	Low
	L	r		<i>Lachnagrostis punicea</i> subsp. <i>filifolia</i>	Purple Blown-grass	Moderate
		v		<i>Microseris scapigera</i> s.s.	Plains Yam-daisy	Low
		k		<i>Poa labillardierei</i> var. (Volcanic Plains)	Basalt Tussock-grass	Low
E	L	e	▲	<i>Prasophyllum frenchii</i>	Maroon Leek-orchid	Negligible
E	L	e	▲	<i>Thelymitra epipactoides</i>	Metallic Sun-orchid	Negligible
V	L	v		<i>Xerochrysum palustre</i>	Swamp Everlasting	Negligible

### 5.1.6 Occurrence of VROT and regionally significant flora species

The occurrence of the 27 Victorian rare or threatened (VROT) and regionally significant flora species was documented during the field surveys and mapped for most species. Distribution information is provided in Table 4 below for all regionally significant and VROT species and their occurrences are mapped in Figure 5. The occurrence of two additional significant species known to have occurred just outside the study area in the rail reserve (last seen in 2010/2011), was also noted: Grey Billy-buttons *Craspedia canens* and Grass Triggerplant *Stylidium graminifolium*.

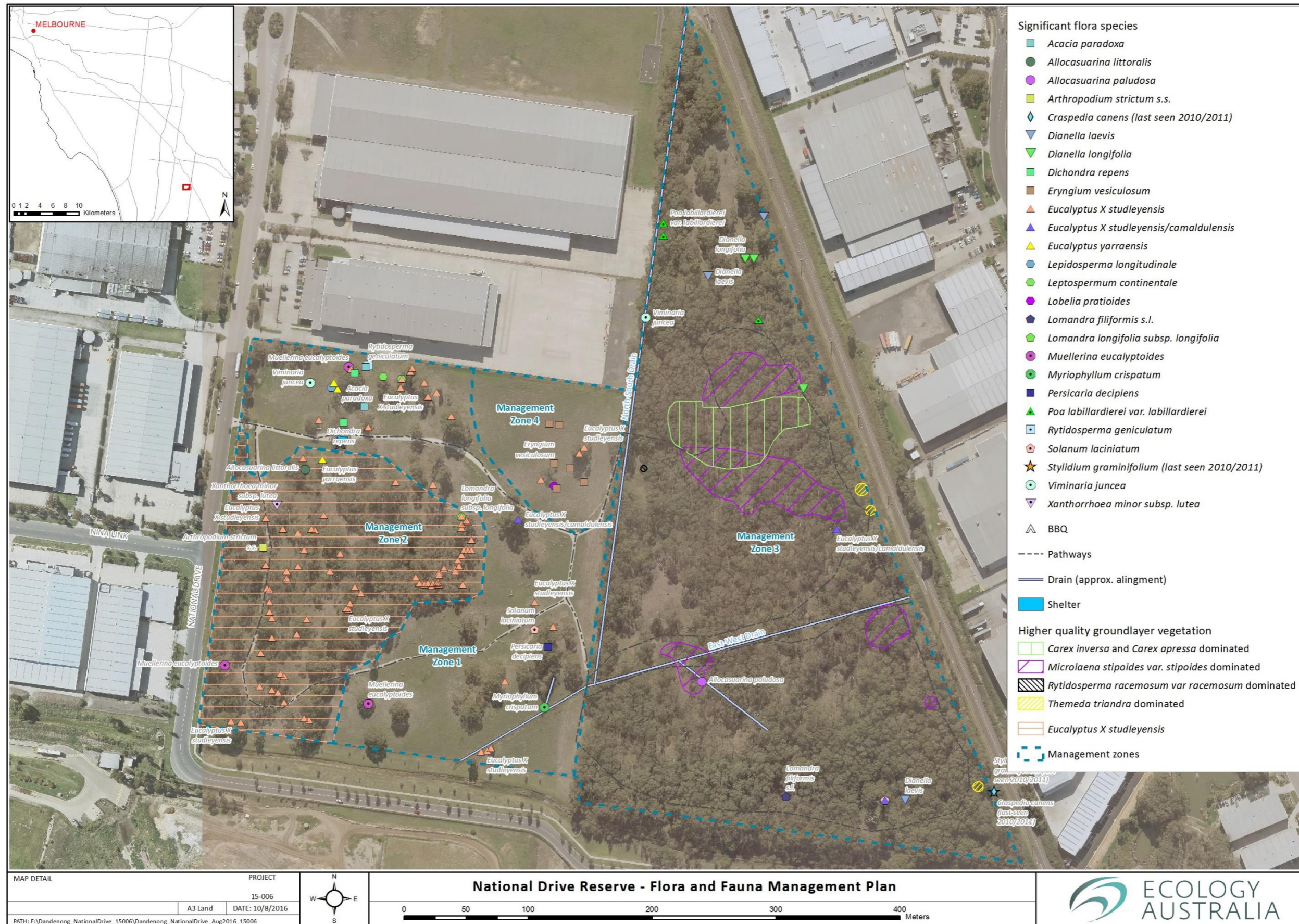


Figure 5 The distribution of significant flora species within the study area, National Drive Reserve, Dandenong South.

**Table 4 Victorian rare or threatened (VROT) and regionally significant flora species recorded within the study area, National Drive Reserve, Dandenong South.**

**Key:** EPBC = Environment Protection and Biodiversity Conservation Act 1999: **E** = listed as endangered; **V** = listed as vulnerable  
 FFG = Flora and Fauna Guarantee Act 1988: **L** = listed as threatened; **X** = not eligible for listing.  
 VROT = Victorian Rare or threatened species as classified by DELWP (DEPI 2014): **e** = endangered; **v** = vulnerable; **r** = rare; **k** = poorly known but thought to be rare or threatened.  
 RegS = Regionally Significant: **RS** = considered to be a Regionally Significant record in the greater Melbourne region.

EPBC	FFG	VROT	RegS	Taxon name	Common name	Distribution notes
			RS	<i>Allocasuarina littoralis</i>	Black Sheoak	One large tree in MZ2
			RS	<i>Allocasuarina paludosa</i>	Scrub Sheoak	One plant in MZ3
			RS	<i>Alternanthera denticulata s.s.</i>	Lesser Joyweed	Several plants in MZ3 mostly associated with artificial drainage lines and wetland depressions, not mapped
			RS	<i>Arthropodium strictum s.s.</i>	Chocolate Lily	Two plants in MZ2
			RS	<i>Bossiaea prostrata</i>	Creeping Bossiaea	Several plants scattered in MZ2, locations not mapped
	L	e		<i>Craspedia canens</i>	Grey Billy-buttons	No observed in current surveys. Last seen in rail reserve in 2010/2011 (Conservation Programs Coordinator, pers. comm.)
			RS	<i>Dianella admixta</i>	Black-anther Flax-lily	Small number of plants in MZ2, locations not mapped
			RS	<i>Dianella laevis</i>	Smooth Flax-lily	Two plants in MZ3, three plants in MZ2
			RS	<i>Dichondra repens</i>	Kidney-weed	Sparsely scattered in MZ1 and MZ3, two populations mapped
			RS	<i>Eryngium vesiculosum</i>	Prickfoot	Multiple clumps scattered through MZ4, occasional plants observed in MZ3
		e		<i>Eucalyptus X studleyensis</i>	Studley Park Gum	Widespread and abundant in MZ2, scattered through MZ1, one tree in MZ4 and assumed to present in MZ3 although no plants were confidently identified (potential backcross hybrids present)
		r		<i>Eucalyptus yarraensis</i>	Yarra Gum	Three trees in MZ1 and the northern part of MZ2
			RS	<i>Geranium gardneri</i>	Rough Crane's-bill	Small number of plants in MZ3, not mapped
			RS	<i>Hemarthria uncinata var. uncinata</i>	Mat Grass	Scattered patches in MZ2, not mapped
			RS	<i>Lepidosperma longitudinale</i>	Pithy Sword-sedge	One plant observed in MZ2
			RS	<i>Lobelia pratioides</i>	Poison Lobelia	c. 3 m <sup>2</sup> observed across a c. 10 m x 10 m area in MZ4
			RS	<i>Lomandra filiformis subsp. filiformis</i>	Wattle Mat-rush	Many plants scattered through MZ3, not mapped

EPBC	FFG	VROT	RegS	Taxon name	Common name	Distribution notes
			RS	<i>Lomandra filiformis</i> (rhizomatous green)	Wattle Mat-rush	Several plants in MZ2, not mapped
			RS	<i>Lomandra filiformis</i> (glaucous, tufted)	Wattle Mat-rush	Several plants in MZ2, not mapped
			RS	<i>Lomandra longifolia</i> subsp. <i>longifolia</i>	Spiny-headed Mat-rush	Several plants in MZ2 and MZ3, not mapped
			RS	<i>Muellerina eucalyptoides</i>	Creeping Mistletoe	Three plants in MZ2
			RS	<i>Myriophyllum crispatum</i>	Upright Water-milfoil	Many plants located in the artificial dam and drainage line in MZ1
			RS	<i>Persicaria decipiens</i>	Slender Knotweed	Many plants located in the artificial dam in MZ1
			RS	<i>Poa labillardierei</i> var. <i>labillardierei</i>	Common Tussock-grass	Commonly scattered throughout MZ1-4, particularly the areas of remnant vegetation. Not mapped.
			RS	<i>Solanum laciniatum</i>	Large Kangaroo Apple	Scattered sparsely though Management Zones 2 and 3
			RS	<i>Stylidium graminifolium</i>	Grass Triggerplant	Not observed in current surveys. Last seen in rail reserve in 2010/2011 (Conservation Programs Coordinator, pers. comm.)
			RS	<i>Tricoryne elatior</i>	Yellow Rush-lily	Scattered through MZ2, not mapped
			RS	<i>Viminaria juncea</i>	Golden Spray	Two plants, one in MZ1 and one in MZ3
			RS	<i>Xanthorrhoea minor</i> subsp. <i>lutea</i>	Small Grass-tree	Two plant located in MZ2

## 5.2 Fauna Values

### 5.2.1 Fauna Records

A total of 82 fauna species have been recorded within the Reserve (i.e. including the current 2015 assessment records and/or historic records from previous surveys - see Appendix 3). The broad habitat requirements for each species are provided within Appendix 3.

Of the 82 fauna species, 60 species were recorded during the 2015 surveys using various techniques. These include, 37 bird species (five exotic), six amphibian species, one reptile species, 15 mammal species (three exotic) and one invertebrate species<sup>5</sup> (see Appendix 3). Most of the species recorded during the current assessment are considered to be locally common and frequently recorded in urban, semi-urban environments. The occurrence of two owl species (i.e. Southern Boobook and Barn Owl) and 10 microbat species is notable in the urban context because they are dependent on woodland and forest habitats. The diversity of six frog species is also notable in the urban context. These species have undoubtedly lost habitat with urbanisation. Two threatened species were recorded during the 2015 targeted surveys, including:

- Grey-headed Flying Fox *Pteropus poliocephalus* [listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act), and classified as Vulnerable in Victoria (DSE 2013)]; and
- Yellow-bellied Sheath-tailed Bat *Saccolaimus flaviventris* (listed as threatened under the FFG Act).

A further three fauna species of national and/or state significance have been previously recorded within or adjacent to the Reserve (see Appendix 3), including:

- Australian Painted Snipe *Rostratula australis* [Listed as Vulnerable under the EPBC Act, listed as threatened under the FFG Act and classified as Critically Endangered in Victoria (DSE 2013)] recorded adjacent to the Reserve in 1989 (DELWP 2015a; Australian Ecosystems 2011);
- Eastern Great Egret *Ardea modesta* [(Listed as threatened under the FFG Act and classified as vulnerable in Victoria (DSE 2013)] (Australian Ecosystems 2011); and
- Latham's Snipe *Gallinago hardwickii* [Classified as Near Threatened in Victoria (DSE 2013) and listed under the Marine and Migratory provisions of the EPBC Act] recorded within the Reserve in 1998 (Donaldson 1998).

The habitat suitability for each threatened species recorded within 5 km of the Reserve is outlined within Appendix 4. Only those species with a moderate or higher Habitat Suitability Rating are discussed below in Section 5.2.10.

Results of targeted surveys during 2015 are discussed below, under the various survey techniques used for detection.

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<sup>5</sup> The surveys were not intended to target invertebrates.

### 5.2.2 Nocturnal Birds: Call play back and spotlighting for large forest owls

The two targeted surveys for large forest owls using call-playback and spotlighting in autumn and spring 2015 resulted in two species of owl (either observed or heard) recorded on-site, including (see Figure 2 and Appendix 4):

- Boobook Owl *Ninox novaeseelandiae* sighted during spotlighting surveys along the eastern boundary of the Reserve within a small River Red Gum on 8 April 2015; and
- Barn Owl *Tyto javanica* was heard calling in response to the call play back on 8 April 2015 within the eastern woodland block.

No threatened owl species were recorded during the assessment. The Habitat Suitability Rating for threatened owl species is discussed below.

#### Owl Habitat Assessment

A habitat assessment was undertaken with the aim to evaluate the suitability for large threatened forest owls. The woodland habitat within the Reserve supports at least 44 hollows in 18 trees (some trees supported five or more hollows of varying size - see Figure 2). Of the 44 hollows, two were categorised as very large (>40 cm), and of these, only one is considered to have some potential for use by large forest owls (LT34 Live large old tree, *E. camaldulensis*) (the other is located in the buttress of the tree and too low for owl nesting) (see Figure 2). It is unknown whether the depth of this hollow within LT34 is suitable for owl nesting (i.e. (depths of greater than 100 cm generally required for large owls)). No signs or evidence of occupation were observed at this hollow and no roosting sites (i.e. no white-wash or pellets) were found anywhere across the Reserve.

The remaining 42 hollows fall within the small, medium and large size classes and are suitable for arboreal mammals such as the Common Brushtail Possum *Trichosurus vulpecula* and potentially the Boobook Owl or other hollow dependant fauna (microbats, rosella's, etc.). Common Brushtail Possums are a common prey item for large forest owls (e.g. Powerful Owl *Ninox strenua*) and were abundant across the site. Common Ringtail Possums *Pseudocheirus peregrinus*, another potential prey species that do not require tree hollows (but will nest in dreys within the tall, dense shrubs) were recorded infrequently) (see Section 5.2.4 below for further discussion). Multiple \*European Honeybee *Apis mellifera* nests were observed in tree hollows, utilising valuable hollow space and excluding native species.

Despite the availability of a single potentially suitable nesting hollow and abundance of prey, the FFG Act-listed Powerful Owl, Barking Owl *Ninox connivens connivens* and Masked Owl *Tyto novaehollandiae novaehollandiae* are considered to have a Low Habitat Suitability Rating (Low HSR) due to the lack of evidence of their presence (i.e. no white-wash, pellets and no response during call play back surveys) throughout the multiple site assessments and absence of records within 5 km of the Reserve (DELWP 2015a).

#### Other fauna species recorded during the targeted owl surveys

One threatened fauna species (EPBC-Act listed-Grey-headed Flying Fox) and two arboreal mammals (Common Brushtail Possum and the Common Ring-tail Possum) were recorded during the spotlighting component of this targeted survey.

Microchiropteran bats (unknown species) were also observed flying through the canopy during spotlighting.

The EPBC Act-listed Grey-headed Flying Fox is discussed in Section 5.2.10 below.

### 5.2.3 Nocturnal Frog Surveys – Call play back and spotlighting

The three nocturnal targeted frog surveys resulted in a total of six common frog species recorded within the dam and immediate surrounds (drainage line and surrounding terrestrial habitat). These species include (see Figure 2 and Appendix 4):

- Striped Marsh Frog *Limnodynastes peronii*;
- Spotted Marsh Frog *Limnodynastes tasmaniensis*;
- Common Froglet *Crinia signifera*;
- Southern Brown Tree Frog *Litoria ewingii*;
- Pobblebonk *Limnodynastes dumerilii*; and
- Whistling Tree Frog *Litoria verreauxi*.

Common Froglet was also recorded calling from the two drains outside the Reserve to the east and south. Tadpoles and egg masses of *Limnodynastes* spp. were present in dam. The exotic and predatory Eastern Gambusia \**Gambusia holbrooki* was not recorded within the dam during any of the site assessments. Habitat values within waterbodies are outlined within Section 5.2.8.

The Southern Toadlet was not recorded in the Reserve during the autumn targeted surveys. There are no recent records of this species within the DRA (within the last 20 years). There is one historic record from 1989, located c. 450 m to the north-west of the Reserve within an area that is now covered by the industrial estate.

While the Reserve supports suitable habitat for the Southern Toadlet (predominantly in low lying areas, drainage lines and at the edges of the dam) and we acknowledge that the species is notoriously difficult to detect (even in areas where they are known to occur due to secretive nature and calling in response to rain during autumn can be unreliable), given the absence of recent records within 5 km of the Reserve, this species is considered to have a Low Habitat Suitability Rating (Low HSR) and is not discussed further.

### 5.2.4 Arboreal Mammal Surveys: Spotlighting

Two common mammal species were recorded during the spotlighting transects (see Figure 2 for transect locations), including:

- Common Brushtail Possum and Common Ringtail Possum: A total of 35 Common Brushtail Possums were recorded during transect surveys in spring. Recommendations for monitoring the abundance of this species within the Reserve are provided in Section 6.10.

Three additional species were recorded during the transect surveys including:

- Two bird species recorded roosting in River Red Gum within the eastern woodland block of Management Zone 3:
  - A single White-faced Heron *Egretta novaehollandiae*; and



- Four individual Straw-necked Ibis *Threskiornis spinicollis*.
- One exotic predator: European Fox \**Vulpes vulpes*.

### 5.2.5 Active Reptile Searches

The four active searches resulted in only three separate fleeting observations of a small unidentified skink at reptile survey site 2 (see Figure 2). It is likely that this skink is the common Garden Skink *Lampropholis guichenoti*, observed during the general site and habitat assessment within the Reserve. No other reptile species were recorded during any of the site visits. City of Greater Dandenong staff regularly observe Lowland Copperheads *Austrelaps superbis* onsite (Conservation Programs Coordinator, pers. comm.).

### 5.2.6 Microbat Surveys: Mobile bat detectors

Table 5 below identifies the microbat species / genus recorded during the surveys (See Figure 2 and also Appendix 4 for survey period and techniques used for detection and broad habitat requirements for each of the bat species). A total of nine species were recorded in the Reserve (two species recorded in autumn and an additional seven species recorded in spring. One threatened species was recorded on-site: FFG Act-listed Yellow-bellied Sheathtail Bat. This species is discussed in Section 5.2.10 below.

**Table 5 Microbat species recorded during the autumn and spring survey periods**

Scientific Name	Common Name	Survey Period Detected	Status
<i>Tadarida australis</i>	White-striped Freetail Bat	Autumn and spring	
<i>Saccolaimus flaviventis</i>	Yellow-bellied Sheathtail Bat	Spring	FFG Act listed
<i>Mormopterus planiceps</i>	Southern Freetail bat	Spring	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	Spring	
<i>Chlainolobus gouldi</i>	Gould's Wattled Bat	Autumn and spring	
<i>Vespadelus darlingtoni</i>	Large Forest Bat	Autumn and spring	
<i>Falsistrellus tasmaniensis</i>	Eastern Falsistrellus	Spring	
<i>Vespadelus vulturnus</i>	Little Forest Bat	Spring	
<i>Nyctophilus</i> sp	Long-eared Bat	Spring	
<i>Vespadelus darlingtoni</i> / <i>V. regulus</i> / <i>V. vulturnus</i>	Forest Bat Sp.	Autumn and spring	

### 5.2.7 Remote Sensing Infrared Camera surveys

Table 6 summarises fauna species recorded at each camera location (i.e. 1 to 9) over the survey period: the 5 to 19 October 2015 (see Figure 2 for camera location). A total of seven common fauna species were recorded during the camera survey. These comprised two mammal species (one introduced) and five bird species (one introduced). No threatened fauna species were recorded. No large exotic predators (e.g. Fox *\*Vulpes vulpes* and the Feral Cat *\*Felis catus*) were recorded during the camera survey, despite the known occurrence of at least one Fox within the study area (see records on Figure 7).

Plates 2 to 5 below show a variety of common and exotic fauna species photographed during the camera surveys.

**Table 6 Fauna species recorded during the camera survey (5 till 19 October 2015)**

Common Name	C1 (IR1)	C2 (IR2)	C3 (IR3)	C4 (IR4)	C5 (IR10)	C6 (IR19)	C7 (IR22)	C8 (IR25)	C9 (IR27)
Brush-tail Possum	X	X				X	X	X	X
*Black Rat					X				
Australian Magpie	X	X				X			
Little Raven		X							
White-plumed Honeyeater					X				
Australian Magpie-lark						X			
*Starling								X	



Plate 2 Common Brushtail Possum – Camera 6 (IR19), 7 October 2015.



Plate 3 Two White-plumed Honeyeaters – Camera 5 (IR10), 18 October 2015.



Plate 4 Australian Magpie – Camera 1 (IR1), 16 October 2015.



Plate 5 \*Black Rat – Camera 5 (IR10), 17 October 2015.

### 5.2.8 Fauna Habitats

Table 7 below summarises the general habitat values present within the Reserve. Specific habitat requirements for those threatened fauna species recorded during the survey are outlined within Section 5.2.10 and Appendix 4. Three fauna habitats are recognised in the Reserve, comprising:

- Woodland;
- Waterbodies; and
- Exotic lawn with scattered trees.

The key habitat attributes associated within each fauna habitat type are outlined below.

**Table 7 Fauna habitat types identified in National Drive Reserve and their key habitat attributes**

Fauna Habitat	Key Attributes	Potential / known key species
Woodland (Plains Grassy Woodland): Management Zones 2 and 3	<p>The woodland in Management Zone 3 supports mostly canopy trees (<i>E. camaldulensis</i>). Management Zone 2 provides more diverse habitat values for fauna with a higher cover of native shrubs and predominantly native grassy understorey. Very few large understorey trees are present within the Reserve: a couple of large <i>Acacia melanoxydon</i> Blackwood and <i>A. mearnsii</i> Black Wattle spread between Management Zone 2 and 3.</p> <p>Woodland in both Management Zones 2 and 3, provide habitat for a variety of locally common birds (e.g. Galah <i>Eolophus roseicapilla</i> and Eastern Rosella <i>Platycercus eximius</i>) and mammals (e.g. Common Ringtail Possum <i>Pseudocheirus peregrinus</i> and Common Brushtail Possum <i>Trichosurus vulpecula</i> and microchiropteran bat species). The eucalypts in particular provide a valuable foraging resource for a variety of native fauna species that would utilise nectar (e.g. Rainbow Lorikeet <i>Trichoglossus moluccanus</i>, Musk Lorikeet <i>Glossopsitta concinna</i> and Red Wattlebird <i>Anthochaera carunculata</i>) and also provide additional resources for insectivorous birds that forage under strips of bark to locate bark-dwelling arthropods.</p> <p>While there is a large number of small stemmed eucalypts, some very large old trees and stags support hollows of varying size (small &lt;10 cm to very large &gt; 40 cm) that provide nesting and roosting sites for fauna species such as microchiropteran bat species, parrot's, Possum's, Kookaburra's, and owls such as the Boobook Owl observed during spotlighting surveys. Common Brushtail Possums</p>	<p>EPBC Act listed - Grey-headed Flying-Fox;</p> <p>FFG Act listed- Yellow-bellied Sheathtail Bat;</p> <p>Non-threatened Boobook and Barn Owls; and</p> <p>High diversity of microchiropteran bats.</p>

Fauna Habitat	Key Attributes	Potential / known key species
	<p>appear to be highly abundant within the Reserve.</p> <p>Large numbers (dozens) of the EPBC Act-listed Grey-headed Flying Fox were observed flying overhead during the October spotlighting surveys and are likely to forage when eucalypts and other trees are in flower/fruit.</p> <p>FFG Act-listed Yellow-bellied Sheathtail Bat recorded using the mobile bat detectors is likely to utilise the woodland habitat for foraging, flying high above the canopy to catch insects. Small to medium sized hollows would be utilised for roosting and breeding by this species.</p> <p>There is a moderate cover of woody debris (including the placement of some large logs) and leaf litter within woodland habitats that provide shelter and foraging habitat for common reptiles, frogs and birds.</p> <p>The Reserve supports the only substantial woodland remnant within local area. The rail reserve and drainage lines provide some (but poor) connectivity to other fauna habitats within the surrounding region.</p>	
<p>Waterbodies: Management Zones 1, 3 and 4.</p>	<p>Waterbodies in the Reserve comprise of: artificial drainage lines, dam and natural ephemeral wetland depressions. Two additional drainage lines are located outside the Reserve on the eastern and southern boundaries.</p> <p>These waterbodies are likely to support a range of common water dependant fauna species, including aquatic invertebrates, amphibians and wetland birds.</p> <p>The artificial dam supports a small open pool with emergent vegetation around the perimeter including, *<i>Typha latifolia</i> and <i>Persicaria decipiens</i>. This pool appears semi-permanent and was drawn down below the reed beds in autumn (&lt; 30 cm depth) and increased in volume during spring. Some woody debris in water. Five frog species were recorded calling from the dam and surrounding riparian habitat during the targeted surveys, including Spotted Marsh Frog <i>Limnodynastes tasmaniensis</i>, Striped Marsh Frog <i>Limnodynastes peronii</i>, Southern Brown Tree Frog <i>Litoria ewingii</i>, Whistling Tree Frog <i>Litoria verreauxii</i>, Common Froglet <i>Crinia signifera</i> and Pobblebonk <i>Limnodynastes dumerillii</i>.</p> <p>Two large River Red Gums adjacent to the dam provide perching sites for wetland birds including, Australian Wood Duck <i>Chenonetta jubata</i> and potential habitat for Advisory listed- Nankeen Night Heron. A Spotless Crake <i>Porzana tabuensis</i> was recorded within the dense vegetation of the drainage line leading from the dam during spring 2015. A nest of the highly aggressive and invasive *European Wasp *<i>Vespula germanica</i> nest was located on the southern bank of the dam and should be eradicated.</p>	<p>Advisory-listed Latham's Snipe (previously recorded); Crakes /rails; and High diversity of common frog species.</p>

Fauna Habitat	Key Attributes	Potential / known key species
	<p>The invasive and predatory *Eastern Gambusia was not recorded within the dam during any of the site assessments. The apparent absence of this species is of particular note and greatly increases the value of habitat for native frogs and potentially fish species such as the EPBC Act-listed Dwarf Galaxias <i>Galaxiella pusilla</i> that is considered to have some potential to utilise the ephemeral and more permanent habitat in the Reserve (discussed further below in Section 5.2.10).</p> <p>The drainage lines including the main east-west drain and older north south drain provide ephemeral habitat for water dependant species. Shallow inundation after rain events (e.g. autumn and spring c. 5 cm depth in east-west drain) was observed. A likely burrow of a Burrowing Cray <i>Engaeus</i> sp. was recorded along the east-west drain in Management Zone 3. No frogs were observed, nor heard calling from the north-south or east-west drainage lines during the assessment.</p> <p>The ephemeral wetland in Management Zone 4 was damp but did not hold water during the 2015 assessments. Grassy weed invasion has highly modified this area. This depression provides foraging habitat after heavy rains for bird species such as Masked Lapwings <i>Vanellus miles</i>, Ibis, White-faced Heron <i>Egretta novaehollandiae</i> and potentially breeding habitat for frogs.</p> <p>Prior to the increase in slashing regularity from c. 2011 Latham’s Snipe and other waterbirds were commonly seen in the reserve. While it is uncertain that the increase in slashing has contributed to this decline (the species has declined internationally in recent years), it is likely to make the site less attractive for snipe utilisation.</p> <p>The current study did not include an aquatic survey of fish and macroinvertebrates – to better understand and manage the aquatic ecological values onsite (e.g. Dwarf Galaxia) and aquatic fauna survey would be beneficial.</p>	
<p>Exotic lawn with scattered trees: Management Zone 1.</p>	<p>The open grassy exotic lawns provide low quality habitat for most fauna species, except for locally common open-country bird species (e.g. Australian Magpie <i>Gymnorhina tibicen</i>, Magpie-lark <i>Grallina cyanoleuca</i> and Crested Pigeon <i>Ocyphaps lophotes</i>). Birds such as White-faced Heron, Australian Wood Duck and Ibis will utilise the grassy areas for foraging, particularly when inundated. Masked Lapwing was recorded breeding within the open grassy vegetation of Management Zone 1.</p> <p>The grassy lawn is regularly slashed to reduce biomass.</p> <p>It is understood that a recent increase in the regularity of slashing of the lawn areas has shown a decline in the observations of some waterbirds that prefer long grass as refuge (e.g. Latham’s Snipe).</p>	<p>Advisory-listed Latham’s Snipe (previously recorded – City of Greater Dandenong)</p>

### 5.2.9 Landscape Values

National Drive Reserve supports woodland that is regarded as “highly significant, being the most extensive area of Red Gum in the region and providing the best example of fauna habitat typical to such environments” (DTPLI 2015). The Environmental Significance Overlay (ESO 2) that covers eastern woodland block (Management Zone 3) within the Reserve relates to this ecological value (DTPLI 2015).

The Reserve is surrounded by largely industrial land uses, with very poor connectivity to other remnants in the region for all but the most mobile of fauna species. Cyclone fencing surrounds the Reserve on all sides to protect it from inappropriate public access. The drainage channels outside the Reserve on the southern and eastern boundaries provide limited connectivity for aquatic fauna species with barriers such as roads, culverts and other structures present. A number of small wetlands are located on the eastern side of the railway line to the south-east of the Reserve.

### 5.2.10 Significant Species

A total of 40 significant fauna species have previously been recorded within 5 km of the study area (see Appendix 4), as identified from records held in the Victorian Biodiversity Atlas (DELWP 2015a). These include:

- Eight species listed as threatened under the EPBC Act;
- Eleven species listed as threatened under the FFG Act; and
- Twenty-one species classified as threatened in Victoria (DSE 2013).

Most of these species are unlikely to occur within the study area due to an absence of suitable habitat. For example, the study area does not provide habitat for waders such as Curlew Sandpiper *Calidris ferruginea*, Ruddy Turnstone *Arenaria interpres*, Wood Sandpiper *Tringa glareola*, Common Sandpiper *Actitis hypoleucos*, Common Greenshank *Tringa nebularia* and Marsh Sandpiper *Tringa stagnatilis* (Appendix 4). Further, a number of threatened duck species recorded within the DRA, prefer large, open and deep water bodies including, Australasian Shoveler *Anas rhynchos*, Hardhead *Aythya australis* and Musk Duck *Biziura lobata* and are considered unlikely to use the small dam. In addition, the predominantly spring / summer flowering River Red Gums are unlikely to provide a foraging resource for the autumn/winter migrant EPBC Act-listed Swift Parrot *Lathamus discolor* during most typical years.

While some of the habitat within the Reserve supports high values, the surrounding landscape values and connectivity has been highly modified and as such the Reserve has become isolated from other habitats that currently or previously supported threatened fauna species.

The Department of Environment EPBC Protected Matters Search Tool (DoE 2015a) identified an additional six species, listed as threatened under the EPBC Act and one species listed under the FFG Act (White-bellied Sea-Eagle), but which had never been recorded in the fauna DRA within the VBA (see Appendix 4). The DoE database predicts the occurrence of these species on the basis of broad drainage basins and Bioclim modelling. Thus, the predicted occurrences for some species highlighted in the data search extend well beyond their actual range. For example, the Regent Honeyeater *Anthochaera phrygia* [listed as Critically Endangered under the EPBC Act, listed as threatened under the FFG Act and classified



as Critically Endangered in Victoria (DSE 2013)] is very rare in northern Victoria, and considered to be extinct in southern Victoria.

Threatened species and species listed under the Migratory and/or Marine Overfly Schedules of the EPBC Act, and their Habitat Suitability Rating (HSR), are given in Appendix 4. Those species with a habitat suitability rating of greater than 0.5 (or Moderate or Higher) (Appendix 4) are considered below.

### Species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

One EPBC Act-listed species was recorded during the 2015 assessments:

**Grey-headed Flying Fox** *Pteropus poliocephalus* [listed as Vulnerable under the EPBC Act, listed as threatened under the FFG Act and classified as Vulnerable in Victoria (DSE 2013)] is a canopy-feeding frugivore and nectarivore, which feeds primarily on nectar and pollen from Eucalyptus and related genera and fruit (particularly figs *Ficus* spp. Lilly Pilly *Acmena* spp., plum *Prunus* spp.), from a variety of habitats including rainforests, tall sclerophyll forests and woodlands, Melaleuca swamps, as well as making use of urban gardens (indigenous and exotic), street trees and cultivated fruit crops. None of the vegetation communities used by the Grey-headed Flying-fox produce continuous foraging resources throughout the year; therefore, the species has developed complex migration traits in response to ephemeral and patchy food resources (DoE 2014). A large camp of Grey-headed Flying Fox is located along the Yarra River, within Yarra Bend Park at Kew. Approximately 10,000 bats roost permanently within this camp, with another 40,000 flying-foxes from New South Wales and Queensland augmenting this population during summer, when they visit southern Australia to take advantage of summer food supplies. Flying-foxes can travel 20-50 km from their roost sites to feed. Their movements and local distribution are usually governed by climate, and flowering and fruiting of major food plants (Menkhorst 1995).

There is one record of Grey-headed Flying Fox within the DRA (DELWP 2015a, see Appendix 4). This record is from Centre Road, Hallam, c. 3 km to the north-east of the Reserve in 2011. During the current assessment, dozens of Flying Fox were observed flying overhead during the spotlighting survey for owls. While, none were recorded foraging within the Reserve, it is likely that this species would utilise the eucalypts for foraging when flowering. The surrounding area, including riparian vegetation along Eumemmerring Creek and street trees may also provide some foraging resources for this species.

Given that the permanent camp at Yarra Bend Park is located within c. 32 km of the Reserve (i.e. within the distance for regular foraging) and the Reserve provides an abundance of eucalypts for foraging/roosting, it is considered that the Grey-headed Flying-Fox would use the study area during times of flowering and as such this species is considered to have a Moderate Habitat Suitability Rating (Moderate HSR).

Planting more Swamp Gum *Eucalyptus ovata*, which is a winter flowering eucalypt, will likely benefit this species.

One additional EPBC Act-listed species has been recorded within 5 km of the Reserve and is considered to have a Moderate Habitat Suitability Rating (Moderate HSR):

**Dwarf Galaxias** *Galaxiella pusilla* [listed as Vulnerable under the EPBC Act, listed as threatened under the FFG Act and classified as Endangered in Victoria (DSE 2013)] is endemic to south-eastern Australia.

This species typically prefers swampy floodplain environments, but can also be found in creeks and rivers. These preferred environments fall into two types of habitat critical for the species: primary habitats have permanent water; and secondary habitats that have intermittent or ephemeral water regimes (Saddler et al. 2010; Humphries 1986). Primary habitats (permanent water sites) are responsible for long term survival of the species (McGuckin 2001). Self-sustaining populations can be established in secondary habitats, but these populations can be lost when the habitat dries out and recolonisation is reliant on the movement of fish from primary habitat. The Dwarf Galaxias is opportunistic, using floodplains and creeks for range extensions during flood events. Newly inundated environments are advantageous as they can provide food for the growth of young and often, have an absence of predators. Spawning has been noted in seemingly unsustainable habitats like puddles created by vehicle wheel marks, pools in low lying grassed paddocks, sand pits and farm dams (Chirs Bloink, Aquatic Ecologist, pers. comm.; Bloink 2012; Saddler, et al. 2010).

The current distribution of the Dwarf Galaxias is generally fragmented and patchy, which, is thought to be primarily due to the loss and degradation of lowland, shallow, swampy freshwater habitat (Sadler et al. 2010). Within 5 km of the Reserve, there are 26 records of Dwarf Galaxias recorded between 2005 and 2009 (DELWP 2015a). The main population is located in table drains, roadside channels and wetlands north of the Hallam Main Drain, along O-Grady's and Centre Road, Hallam (c. 2.4 km north of the reserve). This species has also been recorded to the south within the upper reaches of the Eastern Contour Drain (Bloink 2012).

The Reserve is connected (barriers unknown) to these populations of Dwarf Galaxias above via Hallam Main Drain, Eumemmering Creek, the Eastern Contour Drain, and the network of smaller drains that link to the southern end of National Drive Road and into the reserve. The Reserve itself provides some potentially suitable habitat for Dwarf Galaxias. The ephemeral drainage lines would provide suitable habitat during larger flooding events and the dam provides more permanent habitat that supports native aquatic and fringing riparian vegetation. Critically, this waterbody does not appear to support a resident population of the invasive \*Eastern Gambusia, a key threat to Dwarf Galaxias populations (Wager & Jackson 1993).

Given the opportunistic nature of this species and ability to utilise floodwaters to disperse into new habitats and the connectivity to a known population within relatively close proximity to the Reserve, there is some potential that Dwarf Galaxias may have made their way into the dam during high flow events in the past. As such, this species is considered to have a Moderate Habitat Suitability Rating (Moderate HSR) and it is recommended that a targeted survey by a qualified aquatic ecologist be undertaken to determine their presence.

### Species listed under the Victorian Flora and Fauna Guarantee Act 1988

In addition to the FFG Act-listed Grey-headed Flying Fox discussed above, the following threatened species was recorded during the 2015 microbat surveys:

**Yellow-bellied Sheath-tailed Bat** *Saccolaimus flaviventis* (listed as threatened under the FFG Act) is a very distinctive and large bat up to 87 mm long (Churchill 1998). This species is a wide ranging species, occurring through tropical Australian and eastern states and is a vagrant to Victoria during spring and summer. This species occurs in a wide variety of environments from wet and dry sclerophyll forests, open woodland, grasslands and desert and relies mostly on hollows for roosting (known occasionally to

use building and mammal burrows in treeless areas) (Churchill 1998). Yellow-bellied Sheath-tailed Bats are excellent fliers, flying high and fast above the canopy to catch insects. There had been no records of this species within 5 km of the Reserve (DELWP 2015) until this survey. This species breeds from December to March (Churchill 1998). This species was recorded on the mobile bat detectors during the spring 2015 surveys. The seasonal movements of this species are not well known. As such it is unknown whether this species would regularly return to the Reserve to forage/breed during the southerly movements in spring and summer each year. Regardless of this, given the suitability of the woodland habitat for foraging, the presence of multiple small to medium sized hollows suitable for roosting, the Yellow-bellied Sheath-tailed Bat is considered to have a Moderate Habitat Suitability Rating (Moderate HSR) within the Reserve.

Installation of Bat boxes may benefit this species.

### Species classified as threatened in Victoria by DELWP (DSE 2013, DSE 2009)

Three Advisory-listed fauna species previously recorded within 5 km of the Reserve (DELWP 2015a) are considered to have a Moderate Habitat Suitability Rating within the study area.

**Nankeen Night Heron** *Nycticorax caledonicus hilli* [classified as 'Near Threatened' in Victoria (DSE 2013)] occupies a wide variety of wetland habitats from littoral and estuarine habitats to terrestrial freshwater wetlands and grasslands, sometimes making use of wet meadows, flooded grasslands and seepage from springs (Marchant and Higgins 1990). They typically forage in areas where shelter from emergent or ground vegetation is provided. The Nankeen Night Heron is known to regularly occur in urban areas, where it frequently makes use of urban wetlands and ornamental ponds (Marchant and Higgins 1990). There is one record for this species within the DRA in 2011 at Hallam South Road, Hallam. Within the Reserve, the reed beds within the dam and dense vegetation within the drainage line leading from the dam to the south of the Reserve, is considered to provide some suitable foraging habitat for this species, with the surrounding remnant eucalypts providing potential roosting/perching sites during the day. Nankeen Night Heron is considered to have a moderate Habitat Suitability Rating (Moderate HSR) within the study area given the presence of some suitable habitat.

**Latham's Snipe** *Gallinago hardwickii* [classified as Near Threatened in Victoria (DSE 2013) and listed under the Migratory and Marine overfly provisions of the EPBC Act] is a non-breeding migrant to the south-east of Australia between October and March. This species is typically found in small groups or singly in dense cover of freshwater wetlands. Latham's Snipe utilise varied vegetation around wetlands including sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. They are also known to occasionally occur within crops and pasture. There are 22 records of this species within the fauna DRA between 1977 and 2002 (DELWP 2015a). The most recent record of Latham's Snipe in 2002 is located from Lynbrook, west of Cranbourne Swamp. Latham's Snipe have been previously recorded within the Reserve in 1998 (Donaldson 1998). Given the frequency of records of this species within the fauna DRA, the Reserve provides some habitat values for this species, including the reed bed within the dam and dense sedges and grassy vegetation within the southern drain. Flooded pasture may also be utilised by this species. Slashing of grassy vegetation will reduce habitat availability for this species by reducing cover necessary for this highly cryptic species. Nevertheless, this species is considered to have a Moderate Habitat Suitability Rating.

Less frequent slashing of the lawn and wetlands will likely benefit this species.

**Common Long-necked Turtle** *Chelodina longicollis* [classified as Data Deficient in Victoria (DSE 2013)] is associated with freshwater habitats in south-eastern Australia, from South Australia to Queensland; it occupies a variety of aquatic habitats, preferentially in ephemeral, shallow waterbodies, where other turtle species are absent. The Common Long-necked Turtle is often encountered on land (e.g. females may move 500 m or more from water) and is able to aestivate (i.e. dormancy during dry periods). It may be excluded by other turtle species and fish in more permanent systems. This species generally nests in spring to early summer and is an obligate carnivore (Chessman 1988; Wilson and Swan 2008; Howard et al. 2011). There are two records of the Common Long-necked Turtle in the fauna DRA. The most recent record of this species is from 2011 at Lynbrook Wetlands (Banjo Patterson Park), c. 1.6 km from the Reserve and connected via the southern and eastern drainage lines outside the Reserve to the wetlands. This species is considered to have a moderate Habitat Suitability Rating (Moderate HSR) within the study area.

### Species listed under the Migratory and Marine-overfly Schedules of the EPBC Act

Twenty-five bird species occurring in the fauna DRA or listed as potentially occurring [or suitable habitat potentially occurring - EPBC Protected Matters Search Tool (DoE 2015a)] are listed under the EPBC Act as Migratory and/or Marine-overfly species (Appendix 4). While some of these species are considered to have a moderate or higher Habitat Suitability Rating (see Appendix 4), the study area does not:

- support an ecologically-significant proportion of the National populations of any species (e.g. >18 individuals for Latham's Snipe); nor
- constitute critical or limiting habitat.

## 6 Updated Reserve Management Plan

Provided below is the updated management plan for the Reserve. This includes management obligations remaining to fulfil the requirements of the 10 year Vegetation Offset Management Plan for M2 Estate Council Reserve, National Drive, Lyndhurst (ABZECO 2008), and on-going management commitments. The key management issue for the Reserve is the eradication or control of high threat weed species. A 10-year implementation schedule is also presented in Section 7.

As outlined in Section 2.1, the Reserve has been divided into four Management Zones based on vegetation type, condition and required management actions. The Management Zones are largely in line with the Offset Management Plan (ABZECO 2008), with only slight alterations to boundaries to ensure the entire Reserve is captured. These four management zones are:

- **Management Zone 1 – Exotic lawn with remnant trees** scattered individually or in small clustered. This zone is located in the western square block and includes the artificial dam;
- **Management Zone 2 – Open Plains Grassy Woodland** with relatively intact understorey, located in the western block;
- **Management Zone 3 – Densely treed Plains Grassy Woodland** with variously intact or exotic understorey. This zone is located across the entire eastern triangular block; and
- **Management Zone 4 – Degraded wetland** (former Plains Grassy Wetland) located in the north-east corner of the western square block.

Management Actions discussed in this Section have been allocated to one or more of the four Management Zones. The primary management actions to be undertaken include:

- Site security and access (fencing);
- Weed control;
- Controlled burning;
- Ecological thinning;
- Considerations for modifying the drainage;
- Revegetation;
- Pest animal control;
- User related issues;
- Habitat protection and augmentation; and
- Monitoring.

### 6.1 Site Security and Ownership

The study area is currently owned and managed by the City of Greater Dandenong. The responsibility for implementing the management measures outlined in this Management Plan will remain with Council.

The Reserve land was formerly freehold private land and was transferred to Council ownership on 2008. As per the OMP (ABZECO 2008), the approach taken to legally securing the site and achieving site security gains was through the approved transfer of the formerly freehold land to a secure Municipal Reserve for conservation purposes approved by the relevant authority [e.g. as per former Department of Sustainability and Environment's, Vegetation Gain Approach (DSE 2006)].

A Section 173 Agreement under the Victorian *Planning and Environment Act 1987* (s173 Agreement) was also placed on the eastern triangular woodland block (Management Zone 3) during the approvals process for the Development Plan Overlay (Conservation Programs Coordinator, pers. comm.), prior to the development of the OMP. This s173 Agreement is a legal contract registered over the land title, the obligations of which apply to both current and future owners of the land. The western woodland block (Management Zones 1, 2 and 3) has no on-title protective mechanism. The s173 Agreement is not part of the security gain requirements of the OMP (ABZECO 2008).

While the Council manages the Reserve for conservation purposes, the current planning scheme zones do not reflect this. Under the City of Greater Dandenong Planning Scheme, the eastern triangular woodland block (Management Zone 3) is zoned as Farming Zone (FZ) and the eastern square block is zoned as Industrial 1 Zone (I1Z). It is understood that Council intends on submitting a rezoning application for the entire Reserve be rezoned to Public Conservation and Resource Zone (PCRZ) (Conservation Programs Coordinator, pers. comm.). The rezoning of the flora and fauna Reserve to reflect its conservation values would achieve the protection of the site and illustrate recognition of its ecological value in the Municipality.

#### **Key Management Actions:**

- Council to pursue the planning scheme amendment to rezone offset site to more appropriate conservation focused zoning i.e. Public Conservation and Resource Zone (PCRZ).

#### **Performance Measures:**

- The Reserve is rezoned with the primary focus being conservation by Year 2 of this management plan.

## **6.2 Site Access (Fencing)**

Fencing around the perimeter of the Reserve was installed by the developer prior to the preparation of the OMP under instruction from the City of Greater Dandenong and the former Department of Sustainability and Environment (now DELWP) to exclude detrimental human activity (ABZECO 2008). Fencing consists of a 2.1 m black-coated chain wire mesh fence. Three gates are present to allow for access by emergency and maintenance machinery and vehicles and two pedestrian access gates are also present.

The single pedestrian access gate on the western boundary (National Drive) of the Reserve is unlocked on week days and locked on weekends to control public access to the Reserve (Conservation Programs Coordinator, pers. comm.)

There are existing obligations for the maintenance and monitoring of the cyclone fencing surrounding the Reserve as per the OMP (ABZECO 2008). These requirements are outlined below and within Section 7.

**Key Management Actions:**

- On-going monitoring and maintenance of the fence is required indefinitely by Council to ensure on-going exclusion of destructive activities within the Reserve; and
- All fences and/or gates must be maintained in good condition.

**Performance Measures:**

The successful protection of the Reserve via fencing will be measured by:

- The exclusion of unwanted recreational usage of the Reserve;
- Absence of fence breaches; and
- Maintenance of the fencing around the Reserve in good repair at all times.

**Monitoring and Evaluation:**

- Biannual fence checks to be undertaken.

### 6.3 Weed Management

Environmental weeds invade native vegetation, replacing native plants and reducing habitat quality for native animals. Controlling environmental weeds reduces the severity of this threat, benefiting native biodiversity. The weed flora of National Drive Reserve comprises nine noxious weed species (as listed under the *Catchment and Land Protection Act 1994* for the Port Phillip and Western Port CMA region), five Weeds of National Significance (WONS) and numerous other environmental weeds.

To prioritise the management of weeds within the study area, all weed species have been assigned a management priority (high, medium, low) and target (eliminate, control, contain). Species designated for elimination should be managed across the entire site with the goal <1% cover and no mature individuals. Species designated for 'control' should focus primarily on areas of remnant patch vegetation with an understorey score of 15 (Habitat Zones 1, 3 and 4), plus a c. 15 m buffer around these areas. Species designated for containment should not be allowed to increase in abundance above current levels. The current levels of weed cover are outlined in Table 8 – achieving these levels will meet the OMP requirements (ABZECO 2008).

Table 9 lists the 78 weed species identified onsite, along with their management priority and target to be achieved and recommended control methods. The occurrence of weeds of priority management concern is mapped in Figure 7 (Section 6.13). When weed removal creates areas of open ground, weed control should be followed by revegetation as treated weeds will otherwise be replaced with more weeds (the same or different species). As the weed flora is not static, new weed populations will continue to arise onsite. Therefore, the weeds listed for management in Table 9 should not be seen as exhaustive and regular monitoring should be undertaken to identify additional/new weed species and populations requiring management on the site.

It is recommended that weed management activities continue to be documented, detailing Management Zone, species targeted, control methodology, outcome of follow up monitoring and additional actions required.

**Key Management Actions** (see Section 7, Tables 11):

- Eliminate all woody environmental weeds from all Management Zones;
- Ensure high threat weeds (rated as Medium or higher priority) do not increase above 50% (total combined cover for all species) in all areas except Management Zone 4 where they should not exceed 80% (combined cover for all species); and
- Ensure overall weed cover does not exceed current levels (Table 8).

**Performance measures:**

- Refer to Tables 8 and 9 for performance measures.

**Table 8 The performance measures for weed control for each Management Zone based on current weed levels, National Drive Reserve, Dandenong South.**

Management Zone	High threat woody weeds	Other high threat weeds (medium and high priority)	Overall weed cover
1	<1% cover, no reproductively mature individuals	<50% cover (only applies to areas of remnant vegetation)	HZ 4 & 6: <25% cover HZ 5 & 7: <70% cover (only applies to areas of remnant vegetation)
2	<1% cover, no reproductively mature individuals	<50% cover	<50% cover
3	<1% cover, no reproductively mature individuals	<50% cover	HZ 1: <25% cover HZ 2: <80% cover
4	<1% cover, no reproductively mature individuals	<80% cover	<85% cover



**Table 9 Weeds species recorded onsite along with their management priority and target, control methods and recommended timing of control, National Drive Reserve, Dandenong South.****Key:**

\* Exotic species

P	Planted
CaLP	Catchment and Land Protection Act 1994
C	Listed as Regionally Controlled under the CaLP Act
R	Listed as Restricted under the CaLP Act
WONS	Weed of National Significance ( <a href="http://www.weeds.org.au/">www.weeds.org.au/</a> )
W	Listed as a WONS

**Management target**

Eliminate	Aim to eradicate species from the site to <1% cover, continue to manage recruitment so that no plants reach maturity
Control	Control species so that the extent of the population decreases over time. Where populations are relatively small or spatially well-defined, treat as for elimination.
Contain	Do not allow cover to increase above current levels (see Table 8). Prioritise control in HZ1, 3 and 4, within a 15 m buffer around these HZs and in preparation for revegetation.

**Control method(s)***Herbicide treatments*

- 1 Herbicide applied to foliage with spray or wick applicator, etc.; annuals must be sprayed well before seed ripening.
- 2 Cut down and concentrated herbicide immediately applied to stump or stems.
- 3 Stem drilled and injected with concentrated herbicide.

*Physical treatments*

- 4 Physical removal – most plants can be physically removed by hand-weeding or with tools when small and/or isolated but soil disturbance is kept to a minimum.
- 5 Cut stems at ground level (species without basal buds to resprout)
- 6 Investigate mechanical removal or repeated biomass removal to reduce competitiveness, remove all flower heads before they set seed.

**Control timing**

- † Anytime, when plants are in active growth.  
‡ Control before flowering and seed ripening.

**Control priority (for existing populations and future colonisation)**

- High High priority, 1-3 year time frame  
Moderate Moderate priority, >3 year time frame  
Lower Lower priority, target once Medium and High priority weeds have been successfully managed

**Abundance/Distribution**

- MZ Management Zone  
R/L Rare/Localised  
S/C Scattered/Common  
W-s Widespread and sparse  
W-a Widespread and abundant

CaLP	WONS	*	Taxon name	Common name	Management Target	Control methods	Timing	Abundance/Distribution			
								MZ1	MZ2	MZ3	MZ4
<b>High priority weeds (continue/commence management immediately)</b>											
R	W	*	<i>Asparagus asparagoides</i>	Bridal Creeper	Eliminate	1, 4	July-September			R/L	
C		*	<i>Crataegus monogyna</i>	Hawthorn	Eliminate	2, 3	Any time †			R/L	
		*	<i>Eucalyptus botryoides X camaldulensis subsp. camaldulensis</i>	Southern Mahogany X River Red-gum hybrid	Eliminate	2	Any time †	R/L			
		*	<i>Fraxinus angustifolia subsp. angustifolia</i>	Desert Ash	Eliminate	2, 3	Any time †	S/C	R/L		
C	W	*	<i>Genista linifolia</i>	Flax-leaf Broom	Eliminate	1, 2, 4	Any time † ‡			R/L	
C	W	*	<i>Lycium ferocissimum</i>	African Box-thorn	Eliminate	2	Any time †	R/L		S/C	
C		*	<i>Rosa rubiginosa</i>	Sweet Briar	Eliminate	1, 2	Any time †			W-s	R/L
C	W	*	<i>Rubus anglocandicans</i>	Common Blackberry	Eliminate	1	November-March	W-a	S/C	R/L	S/C
C	W	*	<i>Ulex europaeus</i>	Gorse	Eliminate	1, 2	Any time † ‡	W-a	W-a	S/C	
<b>Medium - High priority weeds (continue/commence management immediately where species threatens specific ecological values)</b>											
		*	<i>Paspalum dilatatum</i>	Paspalum	Control	1	Any time † ‡	W-a	S/C	S/C	W-a
		*	<i>Paspalum distichum</i>	Water Couch	Control	1	Any time † ‡	R/L		W-s	W-a
		*	<i>Phalaris aquatica</i>	Toowoomba Canary-grass	Control	1	Any time † ‡	S/C	R/L	R/L	
<b>Medium priority weeds (continue/commence management with higher priority weeds have been controlled/eradicated)</b>											
		*	<i>Acacia floribunda</i>	White Sallow-wattle	Eliminate	2, 3	Any time †			R/L	
		*	<i>Acacia podalyriifolia</i>	Queensland Silver Wattle	Eliminate	2, 3	Any time †			R/L	
		*	<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	Control	1	Any time † ‡	W-a	W-a	W-a	W-a
		*	<i>Bromus catharticus</i>	Prairie Grass	Contain	1	September - November	W-a	W-a	W-a	W-a
		*	<i>Bromus diandrus</i>	Great Brome	Contain	1	September - November		W-a	W-a	
		*	<i>Cenchrus clandestinus</i>	Kikuyu	Contain	1	Any time †	S/C	S/C	R/L	

CaLP	WONS		Taxon name	Common name	Management Target	Control methods	Timing	Abundance/Distribution			
								MZ1	MZ2	MZ3	MZ4
C		*	<i>Cirsium vulgare</i>	Spear Thistle	Control	1, 4	Any time † ‡	R/L	S/C	S/C	
		*	<i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch	Contain	1	Any time † ‡	W-a	W-a	W-a	
		*	<i>Cyperus eragrostis</i>	Drain Flat-sedge	Contain	1, 4	Any time † ‡	R/L		S/C	
		*	<i>Dactylis glomerata</i>	Cocksfoot	Contain	1	Any time † ‡	W-a		W-a	W-a
		*	<i>Dianella</i> sp. aff <i>caerula</i> (branched)	Flax Lily	Eliminate	4	Any time † ‡			R/L	
		*	<i>Dianella</i> sp. aff <i>caerula</i> (unbranched)	Flax Lily	Eliminate	4	Any time † ‡			R/L	
C		*	<i>Dittrichia graveolens</i>	Stinkwort	Control	1	December-February			R/L	
		*	<i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass	Control	1	Any time † ‡	W-a	W-a	W-a	W-a
		*	<i>Ehrharta longiflora</i>	Annual Veldt-grass	Control	1	Any time † ‡	W-a	W-a	W-a	
		*	<i>Gladiolus undulatus</i>	Wild Gladiolus	Control	1	Any time †				S/C
		*	<i>Holcus lanatus</i>	Yorkshire Fog	Contain	1	Any time † ‡	W-a	W-a	S/C	
		*	<i>Juncus articulatus</i> subsp. <i>articulatus</i>	Jointed Rush	Contain	1, 4	Any time † ‡			S/C	R/L
		*	<i>Melaleuca parvistaminea</i>	Rough-barked Honey-myrtle	Eliminate	2, 3	Any time †		R/L		
		*	<i>Phalaris minor</i>	Lesser Canary-grass	Control	1	Any time † ‡	R/L			
		*	<i>Typha latifolia</i>	Lesser Reed-mace	Control	6	Any time † ‡	R/L			
<b>Lower priority weeds (only manage if directly threatening specific ecological values)</b>											
		*	<i>Acetosella vulgaris</i>	Sheep Sorrel	Contain	1	Any time † ‡	W-a	W-a		W-a
		*	<i>Agrostis capillaris</i> var. <i>capillaris</i>	Brown-top Bent	Contain	1	Any time † ‡	W-a	W-a	S/C	W-a
		*	<i>Arctotheca calendula</i>	Cape weed	Contain	1	Any time † ‡	W-s			
		*	<i>Aster subulatus</i>	Aster-weed	Contain	1	Any time † ‡	W-s	R/L	S/C	
		*	<i>Brassica fruticulosa</i>	Twiggy Turnip	Contain	1	Any time † ‡	S/C	R/L	S/C	
		*	<i>Briza maxima</i>	Large Quaking-grass	Contain	1	Any time † ‡		W-a	S/C	
		*	<i>Bromus hordeaceus</i> subsp. <i>hordeaceus</i>	Soft Brome	Contain	1	Any time † ‡			S/C	
		*	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Contain	1	Any time † ‡		R/L		
		*	<i>Conyza</i> sp.	Fleabane	Contain	1	Any time † ‡	R/L		R/L	
		*	<i>Conyza sumatrensis</i> var. <i>sumatrensis</i>	Tall Fleabane	Contain	1	Any time † ‡		R/L	R/L	
		*	<i>Cynosurus echinatus</i>	Rough Dog's-tail	Contain	1	Any time † ‡	S/C			
		*	<i>Daucus carota</i>	Carrot	Contain	1	Any time † ‡			R/L	
		P	<i>Eucalyptus polyanthemos</i>	Red Box	Contain	2	Any time	R/L			
		*	<i>Fumaria bastardii</i>	Bastard's Fumitory	Contain	1	Any time † ‡		W-s		
		*	<i>Fumaria capreolata</i>	White Fumitory	Contain	1	Any time † ‡		S/C		
		*	<i>Galium aparine</i>	Cleavers	Contain	1	Any time † ‡	W-a			W-a
		*	<i>Geranium dissectum</i>	Cut-leaf Crane's-bill	Contain	1	Any time † ‡	W-a	S/C		
		*	<i>Helminthotheca echioides</i>	Ox-tongue	Contain	1	Any time † ‡	S/C	S/C	S/C	
		*	<i>Hypochaeris radicata</i>	Flatweed	Contain	1	Any time † ‡	W-a	W-a	S/C	
		*	<i>Lactuca serriola</i>	Prickly Lettuce	Contain	1	Any time † ‡	R/L	R/L		
		*	<i>Leontodon taraxacoides</i> subsp. <i>taraxacoides</i>	Hairy Hawkbit	Contain	1	Any time † ‡			R/L	
		*	<i>Lolium perenne</i>	Perennial Rye-grass	Contain	1	Any time † ‡	W-a			W-a
		*	<i>Lolium rigidum</i>	Wimmera Rye-grass	Contain	1	Any time † ‡	W-a	W-a	R/L	
		*	<i>Lotus</i> spp. (naturalised)	Trefoil	Contain	1	Any time † ‡	W-a			W-a
		*	<i>Lysimachia arvensis</i>	Pimpernel	Contain	1	Any time † ‡	S/C			

CaLP	WONS	Taxon name	Common name	Management Target	Control methods	Timing	Abundance/Distribution			
							MZ1	MZ2	MZ3	MZ4
		* <i>Medicago polymorpha</i>	Burr Medic	Contain	1	Any time † ‡	R/L			
		* <i>Plantago lanceolata</i>	Ribwort	Contain	1	Any time † ‡	W-a	W-a	S/C	W-a
		* <i>Raphanus raphanistrum</i>	Wild Radish	Contain	1	Any time † ‡	R/L			
		* <i>Romulea rosea var. australis</i>	Onion Grass	Contain	1	Any time † ‡	W-a		R/L	
		* <i>Rumex conglomeratus</i>	Clustered Dock	Contain	1	Any time † ‡	R/L		S/C	S/C
		* <i>Rumex crispus</i>	Curled Dock	Contain	1	Any time † ‡	R/L			R/L
		* <i>Setaria pumila subsp. pumila</i>	Pale Pigeon-grass	Contain	1	Any time † ‡			R/L	
		* <i>Solanum nigrum s.s.</i>	Black Nightshade	Contain	1	Any time † ‡	R/L	R/L	S/C	
		* <i>Sonchus oleraceus</i>	Common Sow-thistle	Contain	1	Any time † ‡	W-s	S/C	R/L	R/L
		* <i>Sporobolus africanus</i>	Rat-tail Grass	Contain	1	Any time † ‡	W-a	W-a		
		* <i>Stellaria media</i>	Chickweed	Contain	1	Any time † ‡		W-a		
		* <i>Taraxacum officinale spp. agg.</i>	Garden Dandelion	Contain	1	Any time † ‡			S/C	
		* <i>Tragopogon porrifolius subsp. porrifolius</i>	Salsify	Contain	1	Any time † ‡	R/L		S/C	S/C
		* <i>Trifolium subterraneum</i>	Subterranean Clover	Contain	1	Any time † ‡	S/C	R/L		
		* <i>Vicia sativa</i>	Common Vetch	Contain	1	Any time † ‡			R/L	
		* <i>Vicia sativa subsp. nigra</i>	Narrow-leaf Vetch	Contain	1	Any time † ‡		R/L		
		* <i>Vicia sativa subsp. sativa</i>	Common Vetch	Contain	1	Any time † ‡	R/L			
		* <i>Vicia sp</i>	Vetch	Contain	1	Any time † ‡	R/L	R/L		
		* <i>Vulpia sp.</i>	Fescue	Contain	1	Any time † ‡	W-a			

### 6.3.1 Biomass reduction

Mowing of terrestrial exotic grass dominated areas of Management Zone 1 should be undertaken regularly to decrease biomass and reduce seed set by exotic species. This should occur throughout the year, particularly in spring and summer when most exotic species are flowering/setting seed. In areas where native species are common, avoid mowing in spring and summer to allow their reproduction. This will involve a brief walk over the areas to be mown by a bushland manager with good grass identification skills prior to mowing in spring and summer to delineate the boundaries between native and exotic grassed area. This boundary can be marked temporarily with flagging tape or spray-paint on the ground as the boundary is likely to change between years.

For Management Zone 4, a rotational slashing regime should be followed to allow approximately one quarter or more of the wetland to remain unslashed for a 12 month period to enhance the habitat values for Latham's Snipe and other wetland birds. The unslashed quarter of the Management Zone should be rotated each year, creating a four-yearly rotation that commences in April/May each year. In addition, none of the wetland should be slashed in spring to minimise potential impacts during the Latham's Snipe peak utilisation period (birds may be present from late winter to early autumn).

Mowing of wet and boggy areas should not occur as this soil disturbance will promote weed invasion. If the ground is boggy when mowing is to occur it should be postponed until the ground has dried out, or undertaken by other means (e.g. brush-cut).

**Key Management Actions** (see Section 7, Table 11):

- Maintain slashing regime in areas dominated by exotic grasses in Management Zone 1 (and to a less extent Management Zones 2 and 3);
- Slashing of Management Zone 4 undertaken on a rotational basis, leaving one quarter of the wetland unslashed for a 12 month period at a time (creating a four yearly rotational slashing regime);
- No slashing of Management Zone 4 to occur in spring; and
- Ensure that slashing of boggy ground does not occur (particularly in Management Zone 4).

**Performance measures:**

- Weed cover does not increase above current levels (refer to Table 8 and 9); and
- No slashing undertaken when the ground is wet and boggy and wheel ruts are not created by slashing (particularly in Management Zone 4).
- One quarter of Management Zone 4 left unslashed for 12 months each year, rotated over four year period
- No slashing of Management Zone 4 undertaken in spring
- No slashing undertaken when the ground is wet and boggy

### 6.3.2 Weed and pathogen hygiene practices

It is essential that weed and pathogen hygiene practices are implemented to reduce the risk of weed propagules and other contagions (e.g. plant pathogens) being transported into/around/from National Drive Reserve on contaminated machinery/equipment/materials/clothing. For example, Serrated

Tussock \**Nassella trichotoma* is commonly spread by contaminated equipment /materials – a small number of plants were recorded within the Reserve most likely introduced in this way.

Section 70A of Victoria's *Catchment and Land Management Act 1994* details the requirement that reasonable precautions must be undertaken to ensure that vehicles, earthworks machinery and/or materials (hay, grain, stone, gravel, soil, plant material, fodder or livestock) do not transport any part of a noxious weed that is capable of growing. While the Act only covers those species listed as noxious, in the case of the study area these protocols should be extrapolated to cover all plant species (i.e. vehicles, machinery and materials should be devoid of any plant material capable of growing)<sup>6</sup>.

Vehicles, equipment and staff entering the site should be free of contagions. This can be undertaken using a variety of methods including: thorough wash-down using a high pressure cleaner (especially around wheel arches and undercarriages of vehicles); air blasting with a compressor for hard to reach places such as radiators; vacuuming interior surfaces of vehicles and machinery; physical removal for contaminant that adhere to machinery; and clothing and equipment such as backpacks can be picked clean to remove seeds caught in fabrics.

**Key Management Actions** (see Section 7, Table 11):

- Ensure vehicles, equipment and personnel are cleaned down and free of weed seeds and pathogens prior to entering the site and immediately after leaving the site; and
- Ensure weeds are not spread within the site or leave the site.

**Performance measures:**

- Weeds are not introduced to new areas after works have occurred.

## 6.4 Controlled Burning

Fire could be used as a management tool for the Reserve as it can be an effective way to control weeds and promote indigenous species. However it can be detrimental if not appropriately managed and/or resourced. The key components for a successful burn are timing, intensity, frequency, pre-burn management and follow-up management.

The OMP recommended using fire as a tool to control biomass and promote regeneration of indigenous species. As yet, none of the burn recommended in the OMP have been undertaken so the proposed burn program has been revised.

It is understood that the use of fire within the Reserve may be more aspirational than likely given the intense resources required to gain approval, prepare for, carry out and undertake follow up management. If resourcing requirements can be attained, a controlled burn should be undertaken as follows.

A small trial burn, approximately 1000 m<sup>2</sup> in area, should be undertaken to monitor and document the vegetation response (indigenous regeneration, weed suppression and health of trees pre- and post-fire).

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<sup>6</sup> The exception being locally indigenous plant material for use in restoration activities; in this case 'clean' ex-nursery stock must be used.

The burn should take place in autumn of Year 2 of this management plan to allow adequate preparation and planning. A Burn Management Plan will need to be prepared by a suitably qualified ecologist/ bushfire management expert to document the most suitable location of the burn, the approvals required, and the pre- and post-burn monitoring and management. Pre-burn management will involve control and seed-head removal of weed species by a knowledgeable and experienced bushland contractor, mowing of vegetation to c. 5 cm around tree trunks and quadrat monitoring of vegetation by experienced ecologist. Three quadrats, permanently marked with short star pickets, should be established to monitor the vegetation by documenting the diversity and cover of each species before and after the burn. All monitoring should be undertaken in spring and continue for three years. After the burn, intensive follow-up weed control will be required (the amount required will depend on the regeneration of indigenous species and weeds post-burn). It is vital that the weed contractors and ecologists are reputable and knowledgeable bushland manager/botanists with good plant identification skills, especially of young plants that are regenerating post burn.

The exact location of the burn within Management Zone 2 will need to be determined in the first year of this management plan so as to avoid areas that may have recently regenerated with woody species (i.e. seedlings that that would likely be killed by fire). A potential suitable area for the trial burn to take place is illustrated in Figure 8 (Section 6.13). If tree health is looking poor prior to the burn taking place (e.g. due to drought or insect attack), then the burn should be postponed or relocated to a different area so as to avoid potential mortality of canopy trees.

**Key Management Actions** (see Section 7, Table 11):

If resources can be attained:

- Prepare a Burn Management Plan for the proposed burn in Year 1;
- Prepare for and undertake a burn in Management Zone 2 in autumn of Year 2 of this management plan; and
- Undertake weed control and quadrat monitoring prior to the burn and for at least three years post-burn.

**Performance measures:**

If resources can be attained:

- Burn Management Plan is prepared in Year 1;
- Burn is undertaken in Year 2;
- Weed cover does not increase above current levels;
- Indigenous plant species increase in diversity and/or proportional abundance; and
- No or very minimal death of canopy trees.

## 6.5 Protection of Significant Trees

It was recommended in the OMP that ecological thinning of River Red-gums be undertaken in Management Zone 3, the eastern triangle. This is because dense stands of eucalypt saplings can deplete soil moisture and nutrients resulting in stress and death of 'old trees'. Although this area contains a high

density of eucalypts, extensive ecological thinning is not recommended as the canopy for the most part appeared quite healthy. It also presents a risk that the individuals selectively killed may actually be better adapted to survive the warmer and drier climate of the future.

Instead of ecological thinning throughout Management Zone 3 (or MZ2 post-burn), a more targeted approach is recommended around the larger older trees if they begin to look stressed as evidenced by a thinning canopy. This will involve assessing the larger older trees and, if they appear to be unhealthy, investigating the cause and potential mitigation actions (e.g. ecological thinning, possum guards/tree bands, supplementary watering, insect management). If ecological thinning is to occur within the vicinity of an old tree, the extent and method of thinning must be determined in consultation with an experienced ecologist.

**Key Management Actions** (see Section 7, Table 11):

- Visually assess the health of the larger older trees on a regular basis during site visits
- If the larger older trees appear to be senescing, undertake mitigation measures to counter the cause(s) in consultation with an experienced ecologist (e.g. ecological thinning, possum guards/tree bands).

**Performance measures:**

- Large trees should not die without an attempt to address senescence.

## 6.6 Drainage

### 6.6.1 Review of previous assessments

As part of the OMP, ABZECO (2008) recommended constructing a drainage swale from the northern corner of the triangle block, through the River Red-gums of Management Zone 3 and discharging into the grassy wetland of Management Zone 4. The water supply for this would consist of roof run-off from the adjacent warehouse given that the natural flows from the area have been modified as a result of the adjoining industrial developments. These changes would feed the wetland to improve the hydrology and ecology of the area. Additional minor modifications to the existing drainage swale were also proposed.

Aquatic Systems Management (2010) built upon these recommendations to devise an extensive system of earthworks to irrigate the reserve with stormwater from outside the natural catchment of the Reserve. The works proposed to irrigate the site included channels, banks/levees/berms, diversion points, a storage dam, and ponds connected with pipes and pumps. This proposal for additional watering of the site is based:

- concerns about reduced inflows to the site in recent years;
- a reduced catchment area as a consequence of modifications associated with development of the land around the reserve; and
- the assumption that the site was formerly part of the Currum Currum Swamp, which as Biosis (2011) correctly point out could not be the case as the site is located on Baxter Sandstone, not swamp deposits.

Jeff Yugovic from Biosis (2011) reviewed the Aquatic Systems Management report and expressed concerns about the removal of vegetation associated with the proposed works and the potential impacts of flooding vegetation that would not naturally be flooded (namely Plains Grassy Woodland). He concludes that there is no justification for the extensive drainage works proposed by Aquatic Systems Management as their assessment incorrectly assumes the site was a natural swamp rather than localised ephemeral wetlands, and because the River Red-gums and other eucalypts have not declined through the millennium drought which finished in 2009.

Due to the conflicting assessments by Aquatic Systems Management and Biosis, Pathways Bushland and Environment (2011; Doug Frood) and Australian Ecosystems (2011; Damien Cook) were commissioned to review the reports. Pathways Bushland and Environment reasoned that:

- the proposed storm water wetlands and irrigation holding ponds would severely compromise the habitat values of the remnant vegetation and would not provide the same ecological values as seasonal wetlands;
- the depth and extent of the shallow graded wetland depressions is determined by topography rather than catchment size so increased water beyond natural levels would overflow and discharge into the Plains Grassy Woodland vegetation rather than result in deeper wetlands;
- Storm water will likely result in higher inflows in summer (which promotes weeds such as \*Paspalum) and is nutrient enriched and otherwise contaminated and consequently ecologically problematic; and
- Weeds are the key issue, and it is unclear if the water retention capacity of the shallow grade wetland in Management Zone 4 would adequately reduce or eliminate \*Paspalum, suggesting that active intervention may be required.

Frood concluded that the hydrology alterations proposed by Aquatic Systems Management were inconsistent with the Reserves goal to maintain the existing biodiversity because they misinterpret the site as a swamp with reduced catchment rather than a woodland with localised ephemeral wetlands. In addition the works proposed would require extra offsetting which contradict the purpose of the site as an offset in the first place. He suggests that if it is deemed desirable to provide additional support for the wetland flora the recommendations for blocking drains at strategic points by ABZECO (2008) would suffice.

The Australian Ecosystem (2011) review notes that there are natural ecological values (flora and fauna) on the site which are adapted to and indeed require shallow seasonal inundation/wetland environments. The existence of some of these values, and potential to re-instate others that he had recorded on site prior to the development of the area, justifies the need to reinstate a shallow seasonal wetting and drying regime in appropriate areas of the site. He concludes that detailed EVC mapping is required to delineate the wetter vegetation types from the drier Plains Grassy Woodland to compare to the proposed inundation areas recommended by Aquatic Systems Management (2010). He stresses that it must be demonstrated that any works will not increase the incidence of summer wetting, as this will favour exotic species such as \*Paspalum, and suggests minor works such as blocking drains should be trialled and assessed. Potential impacts to existing vegetation associated with the construction of dams and associated pipes and levee bank were also acknowledged.



To date, the drainage works completed have comprised minor breakout points to allow water to overflow through the vegetation in the northern part of the densely treed triangle block. These were installed in 2014.

Another hydrology assessment has now been commissioned through GHD, and research into tree health is also being investigated. The results of these assessments are not yet available.

### 6.6.2 Recommended drainage works

Several minor drainage works were undertaken in 2014 to install breakout points in the northern part of the densely treed triangle block to allow stormwater to overflow through the vegetation.

Based on the information reviewed above, it is clear that much of the works proposed by Aquatic Systems Management (2010) are unnecessary and even detrimental to preserving the biodiversity values of the site. Given that the site is secured for conservation as an offset site, removal of native vegetation associated with the construction of the dams, levees, pipes, etc., would not be permitted.

The vegetation of the natural, seasonally wet depression in Management Zone 4 apparently<sup>7</sup> degraded from a 'remnant patch' to not qualifying as native vegetation sometime between 2005 and 2010 as a result of weed invasion, namely by *\*Paspalum dilatatum*. This weed invasion is likely due to changed hydrology as a result of the industrial development and possibly also the end of the drought.

Depending on the results of the latest hydrology assessment, it is anticipated that the following works will ameliorate the wetland to its natural winter wetting and summer drying regime:

- A simple channel regulator that can be easily adjusted (e.g. by inserting planks of wood across the drain) could be installed on the existing north-south drain. This would allow water to flow from the channel into the wetland. A regulator is recommended over a permanent blocking of the drain as it allows the water flow to be 'turned off' during the warmer months (approximately November to April) allowing the wetland to dry out over summer. A topographic survey will be required to determine the maximum height of the channel regulator gate to ensure the degraded wetland does not overflow into the naturally dry Plains Grassy Woodland areas. To achieve this, the regulator must allow water to over-flow it during high flow events. These works could also provide inflows to the treed wet depression within Management Zone 3 (north-east of the confluence of the two drains).
- To protect the water-quality from sedimentation when installing the channel regulator, best-practice water-sensitive construction techniques are to be implemented. The storm water used must not be heavily contaminated (e.g. with industrial waste) beyond Environment Protection Authority (EPA) standards.
- The channel regulator and flood regime should be monitored throughout the year after significant rain events to ensure that the wetland is engaging during winter, not receiving water during summer and not overflowing into areas of dry Plains Grassy Woodland.

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<sup>7</sup> The accuracy of the 2005 assessment has been questioned as Council environment officers have never seen this area qualify as remnant vegetation.

**Key Management Actions** (see Section 7, Table 11):

After completion of the latest hydrology assessment (GHD in prep.) and evaluation of the findings, the following management actions may be undertaken as appropriate. Given that over the past eight years seven hydrology assessments or evaluations will have been undertaken, further hydrology investigations should be avoided as funding could be better spent undertaking on-ground management.

- Undertake topographic survey to determine exact position height of channel regulator in Year 1;
- Install channel regulator in Year 2;
- Revegetate the disturbed ground within one month of completion of construction (see Section 6.7); and
- Monitor channel regulator after high flow events to ensure that water is flowing into the wetland between approximately May and October, and bypassing the wetland between November and April allowing it to dry out.

**Performance measures:**

- Results of latest hydrology assessment and tree health evaluation reviewed and appropriate management actions implemented. Provided the findings are in line with the findings of this report, these may include:
  - Topographic survey undertaken in Year 1;
  - Channel regulator installed in Year 2;
  - Disturbed ground revegetated within one month of construction (or soon after the autumn break if construction occurs between in late spring or summer);
  - The channel regulator and flood levels are monitored regularly after high flow events during the first two years of installation to ensure:
    - The wetland is engaged during high flow events between May and October, and not flooded between November and April allowing it to dry out; and
    - No dryland areas of Plains Grassy Woodland are inundated.

## 6.7 Revegetation

The OMP (ABZECO 2008) detailed a supplementary planting and revegetation program for Management Zones 1-3. This included 79,376 plants broken down by Management Zone as follows:

- Management Zone 1: 10,645 woody species + 6,600 large tufted graminoids = 17,245 plants;
- Management Zone 2: 1,116 woody species + 2,470 large tufted graminoids = 3,586 plants; and
- Management Zone 3:
  - Supplementary Planting Requirements for Understorey Restoration: 4,935 woody species + 44,000 large tufted graminoids = 48,935 plants.
  - Constructed Open Drainage Swale: 150 woody species + 9,460 large tufted graminoids = 9,610 plants.

Of the 79,376 plants, 2,325 were to offset the removal of medium and large old trees as part of the surrounding industrial development (ABZECO 2008). This is a legal requirement and must be undertaken, while all other plantings were recommended to increase the biodiversity values of the site, or to rehabilitate a drainage swale that was to be constructed as part of the hydrology augmentation works.

Thus far the extent of plantings has comprised approximately 1,450 *Acacia paradoxa* plants, many of which do not appear to have survived, to replace the habitat of the stands of Gorse \**Ulex europaeus* that were removed. No other species recommended for planting in the OMP have been planted. Given the low survival rate and lack of diversity utilised, these plantings are not considered adequate to contribute toward the revegetation target in their entirety.

Given the extensive revegetation recommended in the OMP, there is a high chance of failure if adequate resources are not provided, particularly in areas dominated by exotic grasses. As such, the approach to revegetation has been revised with three primary goals:

- Compensate for the removal of remnant vegetation by utilising 2,325 plants to connect Management Zones 2 and 3 (to allow for better faunal passage);
- Rehabilitate areas where weed control has occurred to minimise reestablishment of weeds; and
- Rehabilitate disturbed ground after construction of drainage swale modifications.

The area illustrated for revegetation in Figure 8 (Section 6.13) will connect Management Zones 2 and 3, allowing better movement of native fauna between the two areas. This excludes a 17 m wide gas pipeline easement traverses this area and should not be revegetated. To revegetate this corridor, the recommended species and plantings densities follow that for Plains Grassy Woodland vegetation as provided in Table 10. The corridor is 2.4 ha in size and will require 2,400 plants to be planted and survive, comprising 120 eucalypts (50/ha), 120 understorey trees (50/ha), 960 shrubs (400/ha) and 1200 large tufted graminoids (500/ha) based on the Revegetation Planting Standards (DSE 2006). Plantings of large tufted graminoids should comprise several large clusters that have been closely planted to provide a dense sward that will be more competitive against invasive weeds. Additional plantings may be necessary to ensure that a minimum of 2,325 plants survive long-term (it is advisable to allow an extra 10% to cover plant losses).

The entire corridor should be revegetated with all assigned lifeforms by the end of Year 2 of this management plan, with intensive weed management prior to planting and in subsequent years. Follow up plantings may be necessary to account for plant losses.

To minimise the establishment of weeds after soils disturbance (drainage works, weed control, burrow destruction, etc.), bare or open ground is to be rehabilitated as soon as possible. This will ensure indigenous species have a chance to provide competition and suppression of weeds. Wetland and terrestrial species are recommended for rehabilitation of areas disturbed when modifying the channel system to allow water to flow into Management Zone 4. Suitable species are listed in Table 10 along with the applicable ecological zone based on their tolerance to inundation whereby (Figure 6 illustrates this zonation):

**Terrestrial** – Dryland vegetation that is primarily outside the natural flooding zone.

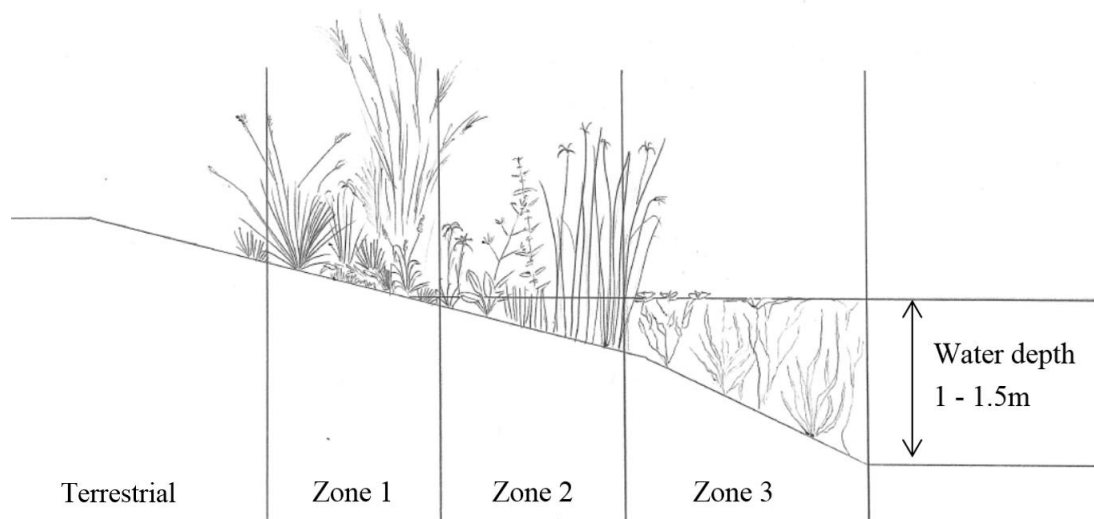
**Zone 1** – Seasonally wet margins to permanently moist; shallow seasonal inundation in lower part of zone.

**Zone 2** – Shallow inundation; upper minimum depth of inundation c. 10 cm; amphibious and emergent aquatic herbs, some straddling Zones 1 and 2.

**Zone 3** – Permanent water; submergent and emergent aquatic-herbs, some straddling Zones 2 and 3.

Judging by the water depths observed in the existing channels during field surveys, it is not expected that any areas will fit the inundation requirements of 'Zone 3'.

For areas of open ground created as a result of weed or pest animal control works, the recommended species and plantings densities suitable for this type of revegetation will be the same as those identified for the corridor between MZ 2 and 3 (Table 10, excluding the recommended number of plants). The only exception would be for areas with boggy soils which should be revegetated with species identified for the drainage works (Table 10).



**Figure 6 Conceptual cross section of the embankment for revegetating wetland environments, showing terrestrial vegetation and wetland vegetation zones 1, 2 and 3**

**Table 10 Recommended species, number of plants and planting densities to revegetate the Plains Grassy Woodland Corridor between Management Zones 2 and 3, National Drive Reserve, Dandenong South.**

**Key: Structural role of plant species**

- A Structural dominant of the vegetation stratum – the sole or predominant species locally or across broader expanses or the whole vegetation zone; with high overall cover within particular location.
- B Localised structural co-dominant (with other species) in vegetation stratum. For groundstorey plantings, the combined number of plants for species within this category should comprise c. 70% of the plantings.
- C Scattered thinly or discontinuously as small groups or isolated individuals with low overall cover. For groundstorey plantings, the combined number

of plants for species within this category should comprise c. 25% of the plantings.

- D Scattered sparsely and infrequently across a wide area. For groundstorey plantings, the combined number of plants for species within this category and category 'E' should comprise c. 5% of the plantings.
- E Localised stands/aggregations in defined environments For groundstorey plantings, the combined number of plants for species within this category and category 'D' should comprise c. 5% of the plantings.
- Ω In wetter depressions only
- ◇ In dam only

Scientific Name	Common Name	Structural Role	Plains Grassy Woodland (corridor between MZ2 and 3, and rehabilitation after weed control works)				Rehabilitation of groundlayer after drainage works		
			Canopy tree	Understorey tree	Medium shrub	Groundlayer	Terrestrial (top of levees)	Zone 1	Zone 2
<b>CANOPY</b>		<b>Density = 50/ha</b>	<b>120 plants</b>						
<i>Eucalyptus camaldulensis</i>	River Red-gum	B	40						
<i>Eucalyptus X studleyensis</i>	Studley Park Gum	B	40						
<i>Eucalyptus ovata var. ovata</i>	Swamp Gum	C	20						
<i>Eucalyptus yarraensis</i>	Yarra Gum	C	20						
<b>UNDERSTOREY TREES</b>		<b>Density = 50/ha</b>		<b>120 plants</b>					
<i>Acacia dealbata</i>	Silver Wattle	C		40					
<i>Acacia melanoxylon</i>	Blackwood	C		40					
<i>Allocasuarina littoralis</i>	Black Sheoak	C		40					
<b>MEDIUM SHRUBS</b>		<b>Density = 400/ha</b>			<b>960 plants</b>				
<i>Acacia verticillata subsp. verticillata</i>	Prickly Moses	C			120				
<i>Allocasuarina paludosa</i>	Scrub Sheoak	C			130				
<i>Banksia marginata</i>	Silver Banksia	C			130				
<i>Leptospermum continentale</i>	Prickly Tea-tree	C			140				
<i>Solanum laciniatum</i>	Large Kangaroo Apple	C			120				
<i>Viminaria juncea</i>	Golden Spray	C			140				
<i>Ozothamnus ferrugineus</i>	Tree Everlasting	D			120				
<i>Melaleuca ericifolia</i>	Swamp Paperbark	E Ω			60				
<b>GROUND LAYER</b>		<b>Density = 6-8/m<sup>2</sup></b>				<b>1200 plants</b>	<b>Density = 10/m<sup>2</sup></b>		
<i>Carex appressa</i>	Tall Sedge	B Ω				✓		✓	
<i>Eleocharis acuta</i>	Common Spike-sedge	B Ω						✓	
<i>Juncus amabilis</i>	Hollow Rush	B Ω						✓	
<i>Microlaena stipoides var. stipoides</i>	Weeping Grass	B				✓	✓		
<i>Pericaria decipiens</i>	Slender Knotweed	B Ω						✓	
<i>Poa labillardierei var. labillardierei</i>	Common Tussock-grass	B				✓	✓		
<i>Themeda triandra</i>	Kangaroo Grass	B				✓	✓		
<i>Acaena novae-zelandiae</i>	Bidgee-widgee	C				✓	✓		
<i>Alisma plantago-aquatica</i>	Water Plantain	C Ω						✓	
<i>Carex inversa</i>	Knob Sedge	C				✓	✓		
<i>Cycnogeton procerum</i> (Broad erect leaves variant)	Common Water-ribbons	C Ω						✓	
<i>Dianella admixta.</i>	Black-anther Flax-lily	C				✓	✓		
<i>Dianella laevis.</i>	Smooth Flax-lily	C				✓	✓		
<i>Eleocharis sphacelata</i>	Tall Spike-sedge	C ◇						✓	
<i>Hemarthria uncinata var. uncinata</i>	Mat Grass	C				✓	✓		
<i>Juncus gregiflorus</i>	Green Rush	C Ω						✓	
<i>Juncus pallidus</i>	Pale Rush	C Ω					✓	✓	
<i>Juncus procerus</i>	Tall Rush	C Ω						✓	
<i>Juncus subsecundus</i>	Finger Rush	C Ω				✓	✓	✓	
<i>Lomandra longifolia subsp. longifolia</i>	Spiny-headed Mat-rush	C				✓	✓		
<i>Pericaria hydropiper</i>	Water Pepper	C Ω						✓	
<i>Rytidosperma caespitosum</i>	Common Wallaby-grass	C				✓	✓		
<i>Rytidosperma racemosum var. racemosum</i>	Slender Wallaby-grass	C				✓	✓		
<i>Rytidosperma setaceum var. setaceum</i>	Bristly Wallaby-grass	C				✓	✓		
<i>Schoenoplectus tabernaemontani</i>	River Club-sedge	C ◇						✓	
<i>Xanthorrhoea minor subsp. lutea</i>	Small Grass-tree	D				✓	✓		
<i>Phragmites australis</i>	Common Reed	E Ω						✓	
<i>Rytidosperma duttonianum</i>	Brown-back Wallaby-grass	E Ω				✓	✓		
<i>Typha domingensis</i>	Narrow-leaf Cumbungi	E ◇				✓			

### 6.7.1 Stages of revegetation

The process of revegetation requires planning, documentation, implementation, monitoring and maintenance, all of which are essential in ensuring success. Each of these stages is discussed below in relation to the Reserve:

1. **Site preparation:** Site preparation will be necessary to varying degrees. This will involve weed control and possibly the provision of jute-matting. While weed control is generally limited to species listed in Table 10, slashing/cutting or spraying of ubiquitous herbaceous species may be required in the revegetation corridor between MZ2 and 3. Tree-guarding is not necessary, provided rabbits and hares are adequately controlled. Should grazing pressure (from rabbits) be found to significantly increase mortality of plants, tree guards should be installed and removed within 3 years of the planting.
2. **Sourcing propagation material:** All plants utilised in revegetation should accord with the following:
  - Propagation material (seeds, cuttings, divisions) should be from indigenous species sourced from the nearest natural population(s) locally or regionally that can sustain a level of collection of material.
  - Sources of propagation material should be recorded by the contractor(s) or other parties involved in revegetation.
  - Plants (tubestock is recommended) are to be of high quality (all plants should appear healthy, roots-systems should be well developed, plants should not be 'root-bound'). Ensure contractors are given sufficient time to undertake collection and growing-on of the tubestock before the projected planting time. Council reserves the right to reject poor-quality tubestock. All plants and propagation material must be correctly identified and named before being utilised in revegetation.
3. **Species placement:** It is important place to plant species in the correct ecological situation for several practical and philosophical reasons, including:
  - Revegetation of this kind demands that plantings make ecological sense, i.e. species 'belong' in particular environments and in plant species associations (or ecological communities).
  - Plants placed in the incorrect physical environment (e.g. too shady or dry) may not perform well or die.

Similarly, it is also important to utilise plant material in the correct structural way, i.e. place species in ecologically plausible population sizes and densities (spacing) distributed in the landscape in a 'natural' way.

4. **Documentation:** By documenting the various components of a revegetation program (e.g. locations and dates of seed collection, provenance of revegetated plants used at a particular site, weed control measures, monitoring, etc.) the success rates of future revegetation can be increased as a greater understanding of 'what works' is achieved and communicated to future practitioners.

5. **Planting:** Planting can be undertaken as soon as the autumn break has occurred. Plants should be watered at the time of planting (to reduce air pockets around the root zone), and follow-up watering should only be undertaken in the event of drought stress.
6. **Monitoring and maintenance:** It is of utmost importance that the revegetation is monitored. Effectively timed monitoring will allow various degradation processes (e.g. weed invasion, grazing) to be managed before they adversely affect the revegetation. Maintenance timing should coincide with ecological timelines (e.g. undertake weed control before seed-set). All plant losses should be replaced unless mortality has been the result of unmanageable site conditions (e.g. prolonged drought).

**Key Management Actions** (see Section 7, Table 11):

- Indigenous nursery engaged to supply tubestock immediately after commencement of this management plan to allow revegetation to occur after the autumn break in Year 2 of this management plan. This will allow the nursery time to collect seed and propagate healthy plants;
- Revegetate habitat corridor between Management Zones 2 and 3 with 2,400 plants comprising a diversity of species from different life forms as documented in Table 10. Revegetation should occur in Year 2 to allow adequate preparation (weed control, seed collection and propagation, etc.);
- Revegetate bare ground created by weed and pest animal control works using medium shrub and ground-layer species detailed in Table 10. Revegetation should occur within one month of disturbance, unless between November and February in which case revegetation should occur immediately after the autumn break; and
- Bare ground created during hydrology manipulation works should be revegetated with groundstorey species at a density of 6-8 plants per m<sup>2</sup>. Revegetation should occur within one month of disturbance, unless between November and February in which case revegetation should occur immediately after the autumn break.

**Performance measures**

- Nursery engaged soon after commencement of this management plan;
- Corridor revegetated by end of Year 2;
- Survivorship of corridor planting monitored at 3 and 6 months, 1, 2 and 4 years after planting (watering undertaken if deemed necessary to ensure survival);
- Survival of 2400 plants in the habitat corridor (plant losses replaced to ensure 2400 plants survive);
- All areas of bare ground created by weed or pest animal control works or drainage works revegetated within one month of disturbance, or soon after the autumn break if between November and February; and
- Survivorship of corridor planting monitored at 3 and 6 months, 1, 2 and 4 years after planting.

## 6.8 Pest Animal Control

Introduced animals pose a threat to the biodiversity values of the Reserve through predation (e.g. Fox \**Vulpes vulpes* and Cats \**Felis catus*) and/or degradation of native vegetation and fauna habitats (e.g. European Rabbit \**Oryctolagus cuniculus*).

Pest animal species of concern within the Reserve include: rabbits; foxes; European honey bee \**Apis mellifera*; and European Wasp \**Vespula germanica*. The presence of feral Cats on-site is unknown, although none have been detected in the twice yearly spotlighting surveys undertaken since 2013 by City of Greater Dandenong.

As a land manager, Council have a legal responsibility to control declared pest animal species under the *Catchment and Land Protection (CaLP) Act 1994* (amended 2003) (see Appendix 1).

These species and management strategies for their control are outlined below.

### Rabbits

Rabbits are listed as threatening process under FFG Act and EPBC Act (DEWHA 2008a). Ongoing monitoring and control of rabbits is required to comply with improvement gain offsetting obligations as outlined in the OMP for a period of 10 years (ABZECO 2008) (as per Sections 7).

Rabbits pose a threat to the flora and fauna values within the Reserve through: land degradation [e.g. erosion of soil] and over-grazing, particularly with regard to revegetation efforts. Even low densities of rabbits can impede efforts to revegetate particular sites. High numbers of rabbits could also potentially support elevated densities of Foxes, to the detriment of native fauna species.

Very little evidence of an active rabbit population within the Reserve was observed during the assessment. Old rabbit warrens and potentially one new warren were observed (see Figure 7 in Section 6.13 for location of mapped warrens). No fresh scats were observed on-site. If present, the population density of rabbits is low/very low within the Reserve. However, under favourable conditions rabbit numbers can expand rapidly.

Since 2010 annual spotlight surveying of rabbits, foxes and cats has been undertaken, the results of which determine if baiting/trapping is required. To date, both baiting and trapping has taken place every year since 2012 (Conservation Programs Coordinator, pers. comm.). Continued monitoring and control of rabbits is required. The key management actions outlined below for rabbits within the Reserve are consistent with the objectives of the OMP (ABZECO 2008).

### Exotic Predators (Foxes and Cats)

Predation of native wildlife by cats and foxes is listed as a threatening process under the FFG Act and EPBC Act (DEWHA 2008b, 2015).

Foxes impact native fauna species principally through predation (DEWHA 2008b). Within the Reserve, fauna species such as the Common Ringtail and Brushtail Possums, wetland birds, frogs and reptiles may be particularly vulnerable. Multiple scats and two separate observations of a single fox were recorded within the Reserve during nocturnal assessments. It is unknown whether these sightings represent one or multiple individuals. No fox dens were observed in the Reserve. Evidence of a deceased Australian White Ibis may represent predation by a fox. Fox trapping has been previously undertaken within the Reserve (Conservation Programs Coordinator, pers. comm.). Monitoring of foxes should occur and control (trapping) implemented as required (see Table 10).



Feral cats pose a significant threat to native wildlife through predation (Bezuijen and McMahon 1999; Barratt 1995, 1997, 1998). Cats appear to selectively prey upon small mammals, particularly nocturnal ground and tree-dwelling species. After mammals, birds appear to be the most preyed upon fauna (Bezuijen and McMahon 1999). The presence of feral cats should be monitored and control (trapping) implemented as necessary. Recommendations are provided below and summarised in Section 7, Table 11.

#### European Honey bees and Wasps

The use of nesting hollows and floral resources by the feral honeybee is listed as threatening process under the FFG Act.

\*Feral Honey Bees are those that occur in colonies, usually in hollows, independently of managed hives that are maintained by beekeepers. Honeybees can potentially impact on fauna species in two ways: competition for tree hollows; and secondly via competition for floral resources. Hollow dependant fauna species such as arboreal mammals, parrots, microchiropteran bats that rely on hollows for shelter and breeding can be excluded from utilising this critical limited resource (Wood and Wallis 1998; Pyke 1999; Soderquist 1999). Swarms of honeybees were observed in the Reserve and at least two hollows are occupied by a honey bee colony within LT15 and LT 28 (see Figure 7 in Section 6.13).

The \*European Wasp is a highly aggressive invasive species native to Europe. Nests are usually underground in holes dug in the soil, but they may also use tree trunks and artificial structures. Wasps are opportunistic predators and scavengers and will feed on almost any carbohydrate or protein including, invertebrates and carrion. Wasps are particularly aggressive when defending their nest and accidental disturbance of a nest can pose a significant threat to people and native fauna. Other impacts from wasps may include preying on native invertebrate fauna, competition with native animals for food and disrupting natural ecosystem processes (Beggs and Rees 1999).

A suitably qualified contractor should be engaged to undertake all bee and wasp control within the Reserve (see management actions below).

#### **Key Management Actions** (see Section 7, Table 11):

- Engage a suitably qualified contractor to undertake pest animal control on-site.
- Control rabbits (and foxes) through the continued removal of harbour (i.e. provided by weed species, particularly woody weeds such as \*Gorse or \*Blackberry) and hand collapsing of rabbit warrens. Baiting for rabbits is currently not recommended due to the potential impacts on native and potentially domestic animals. In addition, rabbits moving in from adjoining areas are likely to compromise the success of any baiting program, unless neighbouring properties also participate. If in the future baiting is considered necessary, consideration must be given to addressing and minimising potential safety issues e.g. notifying surrounding businesses, Reserve users, warning signage, minimum distances to waterbodies. The use of chemicals must also comply with current legislation (Agricultural and Veterinary Chemicals Code Act 1994). Works associated with the control of rabbits should not impact on native vegetation;
- As the fox is a highly mobile animal (the fence is not fox proof and would be difficult to maintain that way), and would occur in surrounding areas, any control action on foxes would be potentially futile unless surrounding land managers and owners also took similar action in a co-ordinated community-based scheme over a large area (Saunders et al. 1995, Morton et al.

1999). However, any den sites located in the Reserve will be destroyed [through den fumigation followed by destruction (e.g. collapsing dens)];

- If control of foxes is necessary due to noticeable impacts on native fauna, soft jaw traps are recommended. These traps are considered to be the most appropriate devices (as they do not kill the animals) to use within a Reserve with public access. A poisoning program is not recommended within the Reserve;
- Control feral bee hives and wasp nests within 12 months of Management Plan approval, and future hives /nest are controlled promptly following detection;
- Fox and rabbit control must be undertaken in accordance with standard operating procedures (SOPs) where they exist e.g. SOPs by the NSW Department of Primary Industries can be located here: <http://www.pestsmart.org.au/pest-animal-species/european-rabbit/> (e.g. Sharp 2012: Standard Operating Procedure – FOX005: Trapping of foxes using padded-jaw traps);
- Liaise and coordinate with other land managers during pest animal control programs (VicRail, DELWP, local businesses). Raise awareness that leaving food waste and rubbish may encourage foxes and other pest animals, such as rodents;
- Ongoing monitoring will be required to determine whether foxes and rabbits are increasing in number and/or are significantly impacting on native vegetation. Consider the use of monitoring / survey methods that allow the determination of robust density estimates (e.g. spotlight transects for rabbits or sand-pad grids for foxes).
- Monitor for feral cats in the Reserve and undertake control (trapping) as required. Encourage local businesses to report observations of feral cats within the Reserve; and
- Document all actions (management and monitoring) undertaken as part of a pest animal control program.

### Performance Indicators

- Active warrens or fox dens are controlled promptly following detection; and
- No long-term increase in either the abundance of pest animals, or detectable impacts to vegetation and fauna habitat.

### Monitoring and Evaluation

- The results of pest animal monitoring will be reviewed every 12 months and any detectable increase in rabbit or fox numbers, or increase in impacts attributable to these pest species, will require the initiation of pest animal control works. Refine pest animal management approach and effectiveness as required;
- Undertake monitoring twice per year (e.g. April and October) for abundance of rabbits within the Reserve looking for individuals as well as diggings, droppings and warrens;
- Monitor for signs of active fox dens, feral cats, rabbit scratching and active warren entrances. This can give an indication as to when (and if) control works are needed;
- Consider monthly monitoring for signs of foxes during the breeding period (August to October);

- Monitoring and documentation of pest animals, including management activities as required, should begin as soon as possible, and continue in perpetuity;
- Document eradication programs; and
- Review the performance of pest animal contractor(s).

## 6.9 User Related Issues

National Drive Reserve has recently (August 2015) been opened up for public access between 9 am and 3 pm, Monday to Friday (Conservation Programs Coordinator, pers. comm.). The objective of opening the Reserve is to attract employees from the surrounding businesses/factories to enjoy the Reserve on their lunch breaks. Council is also considering the use of the Reserve for education bookings with local schools/institutions (Conservation Programs Coordinator, pers. comm.). While the Reserve will not be subject to high use activities, even passive recreational activities may impact biodiversity values through direct (e.g. trampling by foot traffic) and indirect impacts (e.g. disturbance). As such, management of recreational activities is essential to ensuring the long-term sustainability of biodiversity values in the Reserve.

During the diurnal assessments in spring, multiple members of the public were observed utilising the tracks within the Reserve between the hours of 12 pm and 3 pm. Interactions with members of the public during site assessments resulted in many positive comments about the ability to access this site for passive recreational purposes (Authors, pers. obs.).

As the Reserve is now open for public access, the City of Greater Dandenong has the opportunity to play an integral role in community education of environmental values and in the support of community initiatives within the Reserve. Most members of the public are likely to have a poor understanding of the biodiversity values of the Reserve and education campaigns can be used to illustrate conservation values, fauna populations and conflicts that may arise with recreational usage. Public education using a variety of media can create community understanding of environmental issues within National Drive Reserve. Media options range from publications, mail outs, interpretive signage and direct discussions with key stakeholders. The information provided should target the people most likely to utilise the Reserve, such as local business/factories and schools/institutions.

The objectives of managing public access and education are to:

- Provide an opportunity for the public to experience and enjoy local flora and fauna values within the Reserve;
- Minimise human impact on the biological values of the Reserve;
- Discourage access to sensitive habitats (e.g. waterbodies and ephemeral depressions when inundated).
- Educate visitors about the biological values of the Reserve, including.
  - Provision of interpretive signage which aims to:
    - Provide an educational experience for visitors;
    - Encourage visitors to care about the environment; and

- Minimise the environmental damage caused by various activities by explaining the potential consequences.
- To engage the public (e.g. surrounding businesses) in relation to biodiversity issues and support local activities within the Reserve.

**Key Management Actions** (see also Section 7, Table 11):

- Maintain formal tracks to encourage path use and discourage the use of informal tracks through vegetation;
- Sign post revegetation zones to discourage access, or temporarily fence if signage alone is not adequate;
- Prohibit dogs;
- Continue to prohibit riding of trail bikes;
- Prohibit the removal of fallen timber and other plant material;
- Enforce a strict 'no dumping policy' for rubbish or litter (e.g. erect signs summarising littering fine amounts). Signage near entrance would be helpful to explain that leaving food waste and rubbish may encourage pest animals such as foxes and rodents;
- Provision of nest boxes for hollow dependent fauna (e.g. bats boxes) should only be considered if resources are available to monitor and maintain boxes (e.g. removing exotic \*honey bees and birds such as \*Common Myna's);
- Educate and encourage awareness and action on managing indigenous vegetation/fauna habitats and the fauna species they support. The information could be made available in the form of on-site interpretive signage, via the City of Greater Dandenong website, fact sheets to promote and educate the surrounding businesses /public about the values and reasons for protection of biodiversity within the Reserve;
- Translate information into the main languages spoken in the City of Greater Dandenong;
- Encourage surrounding businesses to join a 'Friends of' group for the Reserve and participate in management activities such as planting/revegetation days, flora monitoring (e.g. health of River Red-gums); or fauna monitoring (e.g. nest box checking, Melbourne Water Frog census);
- Investigate the feasibility of using interpretive signage to enhance visitor understanding and enjoyment and provide incentive (knowledge) to protect these areas. Signage could include information on the following topics:
  - Significant native vegetation (i.e. largest River Red-gum stand in the region), including the importance of this species as fauna habitat (e.g. for hollow dependant fauna species);
  - Types of threatened native fauna found within area (e.g. Grey-headed Flying Fox, Yellow-bellied Sheath-tailed Bat and Latham's Snipe);
  - Snakes – signage to be used along paths to alert residents of the potential for snakes in the area and would address:

- The importance of snakes within a faunal community, promote their ecological and biodiversity values and likely habitats;
  - The protection of all snakes under the Wildlife Act 1975; and
  - Outline the appropriate behaviour (for people) in areas where snakes may be present to protect both humans and snakes.
- Weed hot spots. Signs would identify areas that are being managed for weed invasions and encourage avoidance of areas to eliminate the spread of seeds between sites.
  - Information discouraging the feeding of ducks in the dam. Feeding ducks artificial food (e.g. bread) may cause a number of problems including:
    - Poor nutrition, which could lead to health problems;
    - An imbalance of populations to favour those species that are commonly fed (often exotic duck species thus creating competition for native ducks); and
    - Eutrophication of waterbodies.
  - Prohibition of domestic pets from entering the Reserve (e.g. domestic cats and dogs) and their potential impacts on fauna populations and habitat:
    - Domestic dogs may pose a threat to native wildlife, often via indirect processes such as disturbance (e.g. individuals or flocks of foraging/roosting birds to take flight (e.g. Ibis) and may flush birds from nests during incubation and breeding) rather than direct predation; and
    - Nutrient enrichment or eutrophication associated with dog faeces can exacerbate weed infestation and increase pollution of storm water, as well as transmit potential diseases to humans (from faeces).
  - Fire Danger, including the risks and dangers of fire and when restrictions occur.

**Performance Indicators:**

- No impacts to native vegetation and fauna habitat caused by recreational usage; and
- Engaged and interested Reserve users – involvement in conservation activities (weed removal/planting etc.).

**Monitoring and Evaluation:**

- Monitor the frequency and types of activities in the Reserve to determine any adverse impacts on habitat such as trampling on existing vegetation or revegetation.

## 6.10 Habitat Protection and Augmentation

The OMP (ABZECO 2008) outlines the key Net Gain obligations for the protection, maintenance and enhancement of fauna habitat values within the Reserve. These and other activities are addressed within this updated plan. The objective of fauna habitat protection and augmentation are to: preserve the current terrestrial fauna habitat values and enhance particular habitat attributes required to

maintain species diversity; protect existing habitat for wetland dependant fauna; and to reinstate values associated with ephemeral depressions.

Nest boxes can be considered for use to augment the number of natural hollows present within the Reserve. These nest boxes can be dispersed throughout the remnant vegetation on trees that lack hollows (see Figure 3 for location of hollow bearing trees). Nest boxes come in a multitude of designs that target particular fauna groups/species such as mammals, birds and bats.

Nest boxes require active management to ensure that pest species do not use and out-compete native fauna. Designs are available that may exclude some pest species. It is recommended to use nest boxes only if sufficient resources are available to maintain and monitoring the use of boxes. A friends group or other community interest group could be considered for this.

Native species likely to utilise nest boxes (depending on style of nest box) within National Drive Reserve include:

- Bats (e.g. FFG Act-listed Yellow-bellied Sheathtail Bat, Gould's Wattled Bat, White-striped Freetail Bat);
- Owls (e.g. Boobook Owl);
- Parrots (e.g. Red-rumped Parrot and Eastern Rosella). The highly abundant Rainbow Lorikeet is likely to utilise and compete with other parrots for use of nest boxes; and
- Possums (Common Brushtail Possum but also some potential for the Common Ringtail Possum - although they prefer to make their own 'drey' in dense shrubby vegetation). Common Brushtail Possums are abundant within the reserve so the use of nest boxes designed for possums is considered unnecessary. Over-abundant Brushtail Possums may result in a decline in canopy health.

BirdLife Australia provides nest box plans for a range of bird species including Southern Boobook Owl (see <http://www.birdsinbackyards.net/Nest-Box-Plans>). Guidelines for use and type of nest boxes for wildlife are also available in the Land for Wildlife Notes: Nest Boxes for Wildlife (DNRE 2002b).

**Key Management Activities** (see also Section 7, Table 11):

- Control weed and pest animals as per Sections 6.3 and 6.8;
- Manage and monitor recreational usage as per Section 6.9;
- Retain hollow bearing trees and dead stags that provide shelter, roosting and nesting sites for birds and mammals. Figure 3 shows the location of large old trees including, hollowing bearing trees and stags in the Reserve. If sufficient resources are available, consider the use of artificial nest boxes to augment the number of natural tree hollows within the Reserve;
- Only consider the use of nest boxes if adequate resources are available for maintenance and monitoring. Consider alternative Friends or community groups that may be involved;
- Nest boxes should be selected based on the species targeted for habitat enhancement. Nest box design is targeted to specific fauna groups through the size, shape, placement and size of opening access (see DNRE 2002b);

- Placement and orientation of nest boxes is important and is outlined in DRNE (2002b). Different species prefer different box placement such as more open areas for bat boxes and in trees over water for some bird species;
- Disperse nest boxes around Management Zones 1, 2 and 3 in trees that lack hollows;
- Monitoring of the fauna movement (into or out) of the entrance hole is preferable to inspection inside the box. Frequent inspection inside the box is likely to lead to desertion of the nest box;
- Should a nest box be frequented by a pest species it should be closed for a period of time, removing the nesting materials and/or eggs of a pest bird;
- Employ a qualified contractor to eliminate pest species from nest boxes including \*Starlings, \*Common Mynas, \*Sparrows, and \*Honey bees that may take advantage of the nest box.
- Maintain leaf litter and woody debris that provide foraging sites for insectivorous birds and shelter for reptiles and implementing large logs. Net Gain obligations are associated with the placement of large logs must be met. Logs have been placed in Management Zone 1. There appears to have been no log augmentation in Management Zones 2 and 3:
  - Fallen limbs from trees should be removed from tracks and re-distributed to augment areas of fauna habitat.
- Implement revegetation as per Section 6.7 to fulfil Net Gain obligations in OMP (ABZECO 2008). Revegetation / supplementary planting aims to also improve fauna habitat (ABZECO 2008) through the provision of more fruiting / floral resources and diversity and complexity in habitat structure;
- Continue to avoid the use of pesticides within or in close proximity to all water bodies;
- Enhance the existing ephemeral wetland through diversion of stormwater flows and providing seasonal habitat for frogs and wetland bird species (see Section 6.6). Allow dense emergent or fringing vegetation within depressions to potentially attract more cryptic water dependent bird species (e.g. crakes and rails);
- Monitor native fauna species and address management options if they become problematic (i.e. overabundant):
  - Common Brushtail Possum: Possums are often considered to be overabundant in the urbanised parklands. It is very difficult to define the term 'overabundance'. The term largely has to do with human values and as such tends to involve subjective, value laden judgements open to controversy. The abundance of possums within a given area will depend on many factors including the size of the reserve, availability of food and nesting resources, competition and predation. Therefore, the overabundance of possums in a given area must be evaluated on a site by site basis, with health of trees (e.g. foraging resource) providing some indication as to the requirements for population management.
    - Possum control should only be undertaken if severe damage to vegetation caused by feeding is observed. Methodology to manage possum populations is provided by DELWP (2015d).

- Undertake regular observation and monitoring of tree health to determine the need to manage possums. Where tree damage is perceived to be caused by possums, engage a zoologist to conduct a nocturnal survey to determine the possum species and size of populations in the Reserve and immediate vicinity. Engage an arborist or ecologist to provide a tree or vegetation health report.
- Undertake management actions for possum control only when the health of a tree or vegetation community is endangered, and in strict accordance with DELWP guidelines. At present, the health of the trees at National Drive does not indicate an overabundance of possums.
- Noisy Miners (*Manorina melanocephala*): The Noisy Miner often becomes highly abundant in urban reserves and small fragmented woodland or forest patches. This species is a highly aggressive, colonial breeder that out-competes and excludes smaller native birds from their territories. The Land and Water (2008) lists the control of 'overabundant' birds in particular the Noisy Miner as one of the ten key steps for conserving biodiversity in highly modified landscapes. The reduction of biodiversity as a result of Noisy Miner populations is listed as a potentially threatening process under the FFG Act.
  - Monitor the number of Noisy Miners present within the Reserve. If considered to be increasing dramatically, causing a reduction in bird diversity on-site, liaise with DELWP and discuss control option for 'overabundant' and aggressive native fauna bird species. At present, Noisy Miners are not thought to be over abundant.

**Performance Indicators:**

- Maintain permanent fencing and access control;
- Maintain low numbers of pest animals;
- Reduce the cover of high threat woody weeds;
- Fulfil Net Gain obligations for revegetation;
- Maintain and enhance diversity of fauna species utilising the Reserve;
- Maintain logs and woody debris; and
- Maintain and monitor nest boxes.

**Monitoring and Evaluation:**

- Regular inspections of the nest boxes is required (monthly during August - November recommended) to observe use by native fauna or to prevent its use by pest species. Consider engaging community groups for nest box monitoring.
- Monitor key threats to fauna habitat in the reserve including, weed invasion, pest animals, disturbance from recreational activities. Management activities associated with enhancement of fauna habitat through weed and pest animal control are outlined within Sections 6.3 and 6.8.



### 6.11 Aquatic fauna survey

To better understand the aquatic fauna that utilise the site, an aquatic fauna survey should be undertaken. This will need to target fish, eels and macroinvertebrates, among other aquatic fauna. Of particular interest is the EPBC-Act listed Dwarf Galaxia *Galaxiella pusilla* which are best surveyed in autumn.

#### Key Management Actions:

- Undertake aquatic fauna survey in autumn by Year 2.
- Depending on survey results, amend management actions as appropriate.

#### Performance Indicators:

- Aquatic fauna survey undertaken in autumn by Year 2.

#### Monitoring and Evaluation:

- Resurvey in Year 10 to incorporate results into the next version of the management plan.

### 6.12 Monitoring

A monitoring program is required to track the progress of management works to ensure that the program is progressing successfully. It allows early identification of threats that are not being adequately addressed, and provides documentation of actions as they are achieved. Good documentation will ultimately allow initiation of adaptive management where targets aren't being met.

The monitoring program will involve a brief site visit and summary report in Years 3, 6 and 10. The site visit will allow threats to be assessed (e.g. presence of woody weeds, weed cover, pest animals), photo-points established as part of this management plan to be retaken (Appendix 5), and progress of other management actions to be documented (e.g. hydrological works, revegetation). The reports will evaluate the progress toward achieving all management actions listed in Section 7, Table 11, and determine if additional input is required to achieve the targets.

In Year 10, before completion of this management plan, a new updated and revised management plan should be prepared incorporating the findings of the Year 10 monitoring report and a revision of the values and threats.

#### Key Management Actions (see Section 7, Table 11):

- Prepare a Monitoring report in Years 3, 6 and 10 including evaluation of progress of management actions and re-taking of photo-points.
- Revise and update this management plan in Year 10.

#### Performance measures:

- Monitoring reports produced in Years 3, 6 and 10 with targets/standards for each management action achieved and comparison of photo-points from all previous years.
- Successful completion of this management plan with all management action standards/targets achieved.
- Revised and updated management plan prepared in Year 10.

### 6.13 Mapping of management issues

The following figures illustrate components of the above discussed management issues, as follows:

- Occurrences of weeds of management concern are illustrated Figure 7;
- Occurrences of pest animal habitats (warrens, dens, nests, hives) are in Figure 7;
- A potentially suitable area within which the small trial burn could occur is shown Figure 8; and
- The habitat corridor to be revegetated to link Management Zones 2 and 3 is in Figure 8.

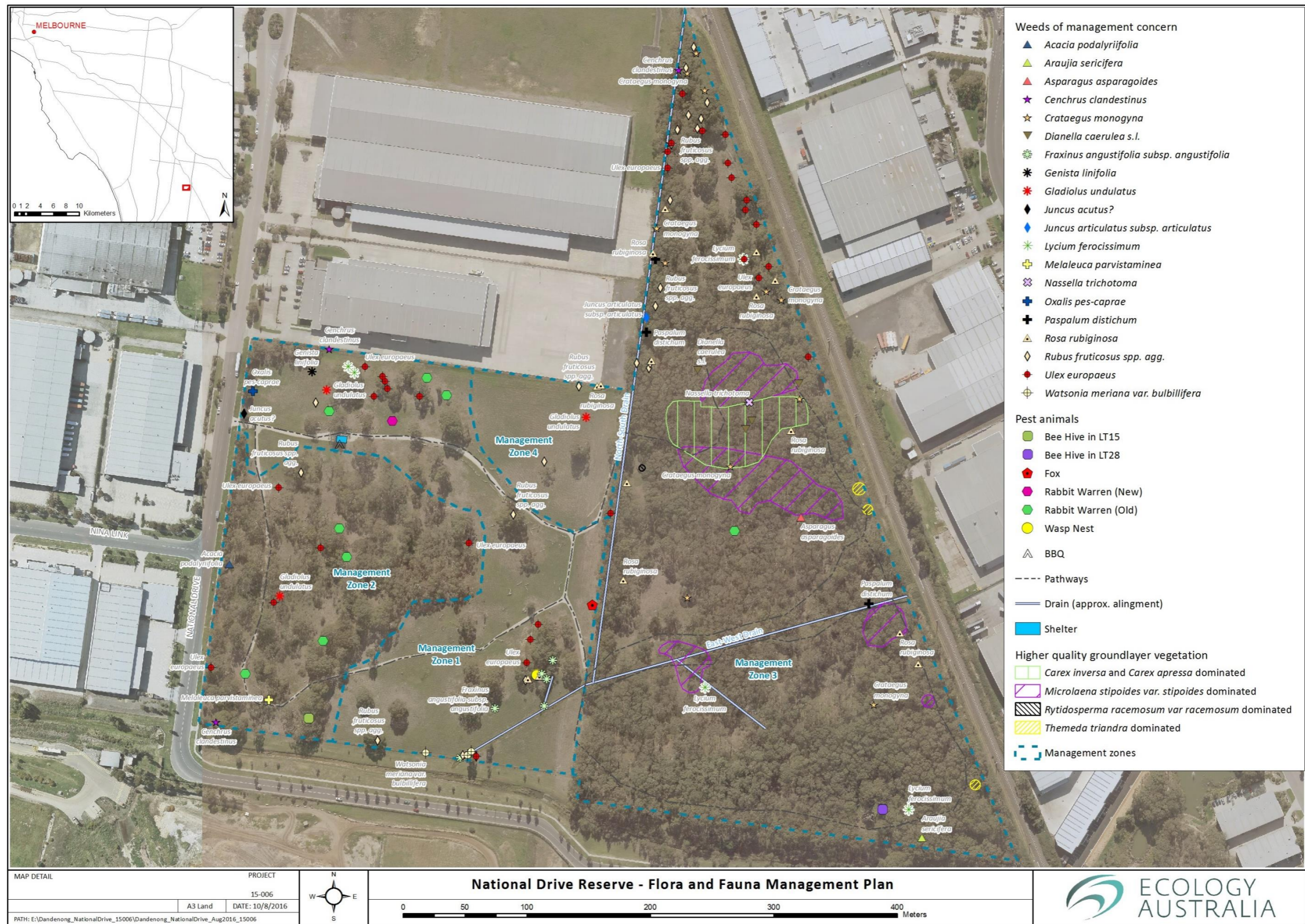


Figure 7 The occurrence of weeds of management concern and pest animal habitat within the study area, National Drive, Dandenong South. Note, due to the abundance of \**Ulex* and \**Rubus*, these species were not mapped across the entire site.

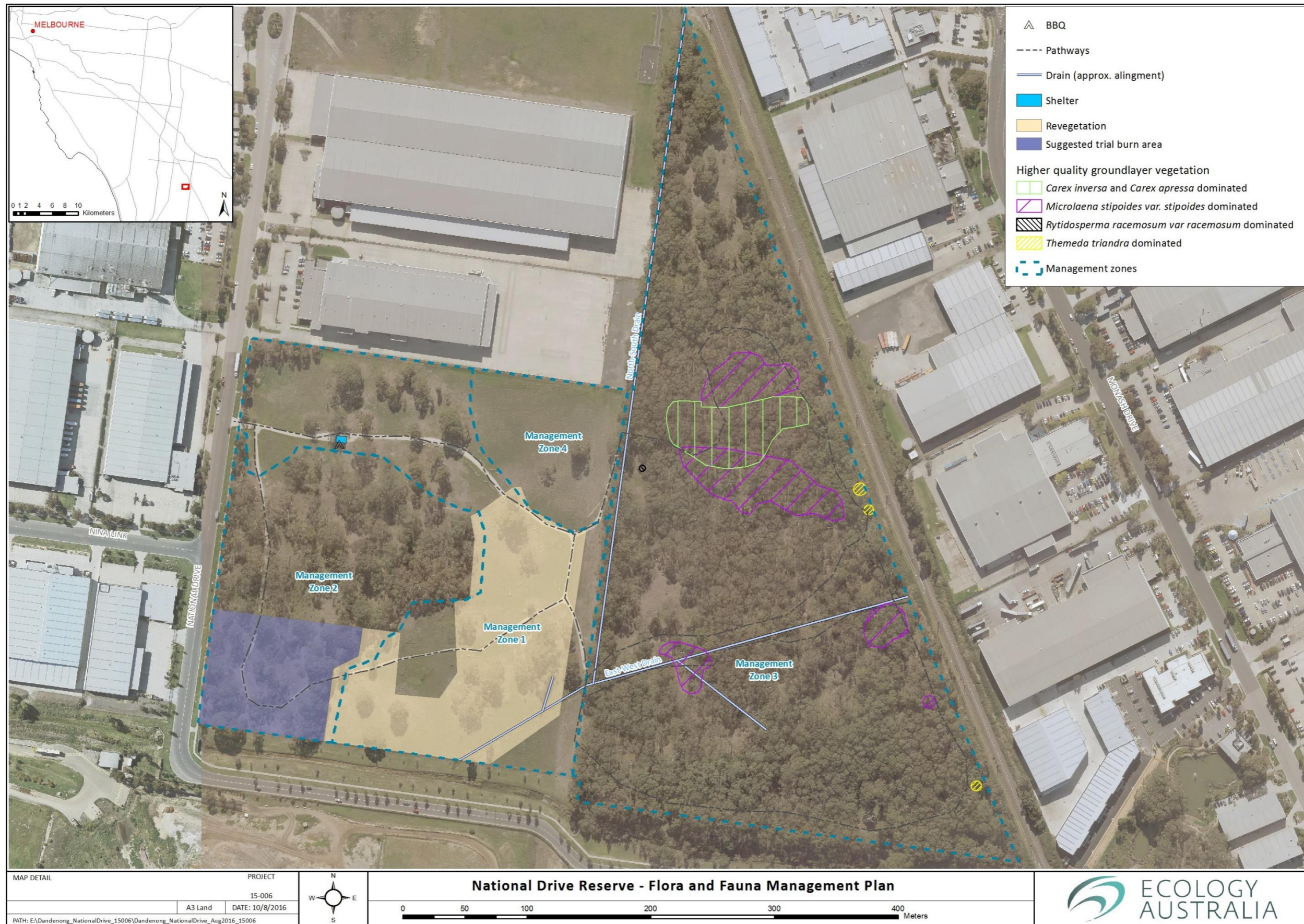


Figure 8 Potentially suitable area for the trial burn to occur and the area to be revegetated to create a habitat corridor between Management Zones 2 and 3, National Drive Reserve, Dandenong South.

## 7 Summary of Management Recommendations and Work Schedule

The recommended management actions to protect and enhance ecological values within National Drive Reserve over the next 10 years are provided below in Table 11. These management actions take into account the obligations of the OMP under the former Net Gain policy (Ecology Australia 2016) and other activities required to address key issues outlined within Section 6. Standards to be achieved for each management action are provided, along with the assigned priority level, whereby:

- Priority 1 – actions that are a legal obligation under the former Net Gain Framework, the *Environment Protection and Biodiversity Conservation Act 1999*, the *Flora and Fauna Guarantee Act 1988*, or the *Catchment and Land Protection Act 1994*, or actions that are best management practices and will help achieve the actions that are legal obligations; and
- Priority 2 – actions that are not a legal obligation but considered best practice management for conserving flora and fauna values.

The appropriate season(s) and year(s) for each management action to occur have been assigned, along with the applicable Management Zones. Legal obligations under the Net Gain policy (as set out in the OMP by ABZECO (2008)) and other legislative / policy / guidelines are also identified.

**Table 11 Management Actions for Years 1 to 10 (2016 - 2026) to maintain and improve the biodiversity values of the site, National Drive Reserve, Dandenong South.**

Priority	Management Issue	Action	Season/Frequency	Year(s)	Standard to be achieved	Legal obligation	MZ1	MZ2	MZ3	MZ4
1	Site Security	Council to pursue a planning scheme amendment to rezone offset site to Public Conservation and Resource Zone (PCRZ).	Any	1	Change zoning to Public Conservation and Resource Zone by 2017.	Yes	✓	✓	✓	✓
1	Site Access (fencing) (Section 6.2)	On-going monitoring and maintenance of the fence is required indefinitely to ensure exclusion of destructive activities. All fences and/or gates must be maintained in good condition.	Any	1-10	Biannual checks to be undertaken. Maintain fence and gates in good working order to ensure on-going exclusion of destructive activities within the Reserve. Absence of fence breaches.	No	✓	✓	✓	✓
1	Weeds	Eliminate all woody environmental weeds.	All year	1-10	< 1% weed cover by year 2 and maintained for duration of management plan and beyond	Yes	✓	✓	✓	✓
1	Weeds	Ensure high threat weeds (rated as medium or higher priority) do not increase above current levels.	All year	1-10	Medium or higher priority weeds do not increase above 50% cover in all areas except Management Zone 4 where they should not exceed 80% cover	Yes	✓	✓	✓	✓
1	Weeds	Ensure overall weed cover does not exceed above current levels.	All year	1-10	MZ1 (only applies to areas of remnant vegetation): <25% weed cover in HZ 4 & 6; <70% weed cover in HZ 5 & 7 MZ2: <50% weed cover MZ3: <25% weed cover in HZ 1; <80% weed cover in HZ 2 MZ4: <85% weed cover	Yes	✓	✓	✓	✓
1	Weeds – Biomass reduction	Maintain slashing regime in areas dominated by exotic grasses in Management Zone 1 (and to a less extent Management Zones 2 and 3); Ensure that slashing of boggy ground does not occur.	All year, four times per year	1-10	Weed cover does not increase above current levels, biomass levels maintained No slashing undertaken when the ground is wet and boggy and wheel ruts are not created by slashing.	No	✓	(✓)	(✓)	
1	Weeds – Biomass reduction	To optimise habitat for Latham's Snipe and other wetland birds: Slashing of Management Zone 4 undertaken on a rotational basis, leaving one quarter of the wetland unslashed for a 12 month period at a time (creating a four yearly rotational slashing regime); No slashing of Management Zone 4 to occur in spring and no slashing when the ground is wet and boggy.	(December) January to July (August)	1-10	One quarter of MZ4 left unslashed for 12 months each year, rotated over four year period No slashing undertaken in spring (peak season for Latham's Snipe) No slashing undertaken when the ground is wet and boggy and wheel ruts are not created by slashing.	No				✓
2	Controlled burn	If resources can be attained, prepare a Burn Management Plan for the proposed burn in Year 1.	Commence immediately	1	Burn Management Plan is prepared in Year 1	No		✓		
2	Controlled burn	If resources can be attained, prepare for and undertake a burn in Management Zone 2 in Year 2 of this management plan.	Autumn	2	Burn is undertaken in Year 2 No or very minimal death of canopy trees	No		✓		

Priority	Management Issue	Action	Season/Frequency	Year(s)	Standard to be achieved	Legal obligation	MZ1	MZ2	MZ3	MZ4
2	Controlled burn	If resources can be attained, undertake follow up management and monitoring post-burn.	Monitoring prior to burn and at 6, 12, 24 and 36 months post-burn. Regular management for three years post-burn	2-5	Weed cover does not increase above current levels Indigenous plant species increase in diversity and/or proportional abundance	No		✓		
2	Protection of Significant Trees	Visually assess the health of the larger older trees on a regular basis during site visits. If the larger older trees appear to be senescing, undertake mitigation measures to counter the cause(s) in consultation with an experienced ecologist (e.g. ecological thinning, possum guards/tree bands)	Any	Any as necessary	Large trees should not die without an attempt to address senescence.	No			✓	
1	Drainage Augmentation	Review findings of latest hydrology assessment (GHD) and tree health research and implement management actions as appropriate. Depending on the findings, these may include installing a channel regulator as follows:  - Undertake topographic survey to determine exact position height of channel regulator in Year 1.  - Install channel regulator in Year 2.  - Revegetate the disturbed ground within one month of completion of construction (see Section 6.7).  - Monitor channel regulator after high flow events to ensure that water is flowing into the wetland between approximately May and October, and bypassing the wetland between November and April allowing it to dry out.	Any  Any  Late summer or early autumn when soils are dry  After autumn break (c. April)  After high flow events in all seasons	1  1  2  2  2-4	Latest investigations reviewed and management recommendations evaluated in Year 1  Topographic survey undertaken in Year 1.  Channel regulator installed and functioning by end of Year 2.  Disturbed ground revegetated within one month of construction (or soon after the autumn break if construction occurs between in late spring or summer).  The channel regulator and flood levels are monitored regularly after high flow events during the first two years of installation to ensure: - The wetland is engaged during high flow events between May and October, and not flooded between November and April allowing it to dry out. - No dryland areas of Plains Grassy Woodland are inundated.	Yes ^		✓  ✓  ✓  ✓	✓  ✓  ✓	✓  ✓  ✓
1	Revegetation	Indigenous nursery engaged to supply tubestock immediately after commencement of this management plan to allow revegetation to occur after the autumn break in Year 2 of this management plan. This will allow the nursery time to collect seed and propagate healthy plants.	Within one month of commencement of this management plan	1 (immediately)	Nursery engaged soon after commencement of this management plan (c. 2 months).	Yes	✓			

Priority	Management Issue	Action	Season/Frequency	Year(s)	Standard to be achieved	Legal obligation	MZ1	MZ2	MZ3	MZ4
1	Revegetation	Revegetate habitat corridor between Management Zones 2 and 3 with 2,400 plants comprising a diversity of species from different life forms.	Between autumn break and October	1-2	Corridor revegetated by end of Year 2 with all specified lifeforms. Survival of 2,325 plants in the habitat corridor. Plant losses replaced to ensure 2,325 plants survive.	Yes	✓			
1	Revegetation	Monitor survivorship of corridor planting at 3 and 6 months, 1, 2 and 4 years after planting	Spring (or as otherwise specified for first year of monitoring)	1-5	Survivorship of corridor planting monitored at 3 and 6 months, 1, 2 and 4 years after planting. Undertake watering of planted plants if necessary. Survival of 2,325 plants in the habitat corridor. Plant losses replaced to ensure 2,325 plants survive.					
1	Revegetation	Revegetate bare ground created by weed and pest animal control works using medium shrub and large tufted graminoids.	Between autumn break and October	1-10	All areas of bare or open ground created by weed or pest animal control works revegetated within one month or soon after the autumn break if between November and February.	No	✓	✓	✓	✓
1	Revegetation	Bare ground created during hydrology manipulation works (if undertaken) revegetated with ground storey species at required densities. Revegetation occurs within one month of disturbance unless between November and February in which case revegetation occurs immediately after the autumn break.	Between autumn break and October	1	All areas of bare ground created by drainage works revegetated within one month, or soon after the autumn break if between November and February.	No			✓	✓
1	Pest Animals	Undertake on-going monitoring and control of rabbits within the Reserve to meet Net Gain obligations of the OMP. See Section 6.8 for monitoring and control prescriptions.	Monitor: Twice yearly - April and October. Hand collapse warren: Any. Remove Harbour: Any.	1-10	Active warrens are controlled promptly following detection. No long-term increase in either the abundance of rabbits, or detectable impacts to vegetation and fauna habitat. Undertake monitoring twice per year (e.g. April and October) for abundance of rabbits within the Reserve looking for individuals as well as diggings, droppings and warrens.	Yes	✓	✓	✓	✓
1	Pest Animals	Undertake on-going monitoring for foxes and control as necessary. See Section 6.8 for monitoring and control prescriptions.	Monitor: monthly btw August to October. Hand collapse dens: Any. Remove Harbour: Any.	1-10	Active fox dens are controlled promptly following detection. No long-term increase in either the abundance of foxes, or detectable impacts to fauna. Consider monthly monitoring for signs of foxes during the breeding period (August to October).	Yes	✓	✓	✓	✓
2	Pest Animals	Engage a suitably qualified contractor to control feral bee hives and wasp nests within 12 months of commencement of Management Plan.	Control: spring/summer.	1	No long-term increase in the abundance of honey bees and wasps on-site.	No	✓	✓	✓	✓
2	Pest Animals	Control all future hives /nests promptly following detection.	Control: spring/summer.	2-10	No long-term increase in the abundance of honey bees and wasps on-site.	No	✓	✓	✓	✓
2	Pest Animals	Undertake monitoring and document all management actions as part of a pest animal control program.	All year	1-10	Monitor for signs of active fox dens, feral cats, rabbit scratching and active warren entrances. This can give an indication as to when (and if) control works are needed. All management activities and the success of those actions documented. Review the results of monitoring every 12 months and adapt management as necessary as required.	No	✓	✓	✓	✓



Priority	Management Issue	Action	Season/Frequency	Year(s)	Standard to be achieved	Legal obligation	MZ1	MZ2	MZ3	MZ4
1	Pest Animals	Review the effectiveness of pest animal monitoring / control and refine pest animal management approach and as required.	Annually	1-10	No long-term increase in either the abundance of pest animals, or detectable impacts to vegetation, fauna habitat or fauna populations.	No	✓	✓	✓	✓
1	Habitat Protection and Augmentation	Undertake works discussed in Section 6.10, including weed and pest animal control, revegetation, managing recreational use, retaining trees, maintaining leaf litter and woody debris, and enhancing the existing ephemeral wetland in MZ4.	All year	1-10	Weeds controlled as per Section 6.3. Pest animals managed as per Section 6.8. Revegetation undertaken as per Section 6.7. Permanent fencing maintained recreational access managed as per Section 6.2 and 6.9. Logs and woody debris do not decrease across the reserve. Drainage is modified to allow winter flooding and summer drying of the degraded wetland as per Section 6.6.	Yes	✓	✓	✓	✓
2	Habitat Protection and Augmentation	If sufficient resources are available to maintain and monitor, consider the use of nest boxes within the reserve to augment habitat for various hollow dependant fauna species.	Installation – Any Monitoring – monthly between September and January.	Any	Nest boxes erected will be monitored regularly (monthly between September and January recommended) for signs of occupation by native or pest animal species. Pest animals and their offspring will be removed from nest boxes by a qualified contractor or staff.	No	✓	✓	✓	
2	Habitat Protection and Augmentation	Monitor native fauna species that may be problematic (i.e. highly abundant), such as Common Brushtail Possum and Noisy Miner, as discussed in Section 6.10. Liaise with DELWP if impacts from these species are occurring.	Any	1-10	No adverse impacts to biodiversity values from 'over-abundant' native fauna species.	No	✓	✓	✓	
1	User Related Issues	Monitor and manage recreational use within the Reserve as per Section 6.9.	Any	1-10	No impacts to native vegetation and fauna habitat caused by recreational usage.	Yes	✓	✓	✓	✓
2	User Related Issues	Implement educational program, targeting reserve users as outlined within Section 6.9.	Any	1-10	Engaged and interested Reserve users – involvement in conservation activities (weed removal/planting etc.).	No	✓	✓	✓	✓
1	Aquatic fauna survey	Undertake aquatic fauna survey (vertebrate and macroinvertebrate), particularly targeting Dwarf Galaxias.	Autumn	2, 10	Survey undertaken by appropriately qualified and experienced Aquatic Ecologist	No	✓		✓	✓
1	Monitoring	Prepare a monitoring report in Years 3, 6 and 10 including progress evaluation for management actions, re-taking of photo-points, and follow-up activities required.	Once every c. 3 years	3, 6, 10	Monitoring reports produced in Years 3, 6 and 10 with targets/standards for each management action achieved and comparison of photo-points from all previous years. Successful completion of this management plan with all management action standards/targets achieved.	Yes	✓	✓	✓	✓
1	Revise and update Management Plan	Review and update this management plan in its final year to update management actions to address contemporary values and threats.	Any	10	Updated management plan prepared prior to completion of the 10 year period applicable to this management plan.	Yes	✓	✓	✓	✓

<sup>^</sup> Legal obligation to undertake drainage works is unclear. Drainage works are required as part of the OMP (ABZECO 2008) but do not contribute to the gains attributed. The works proposed in this management plan are scaled back in comparison to those in the OMP, and the primary objective of the proposed works is to reduce weed cover in Management Zone 4 which is a legal obligation.

## 8 Fire ecology and safety

As this Section is designed to be extractable from this Management Plan document, the following overview of the Management Zones is as provided in Sections 2.1.

The National Drive Reserve is divided into four Management Zones that will require similar management actions. These zones are based on vegetation type, quality and management activities required to protect and enhance the ecological values. While the number of Management Zones remains consistent with that of the previous Offset Management Plan (ABZECO 2008), the boundaries of the zones have been slightly modified to ensure that all areas of the Reserve are allocated a zoning and hence management prescriptions. These four management zones are detailed below.

**Management Zone 1 – Exotic lawn with remnant trees** scattered individually or in small clusters. This zone is located in the western square block and includes small degraded patches of Plains Grassy Woodland, Scattered Trees and the artificial dam and drain (Aquatic Herbland). Aside from the wetland vegetation, the understorey is almost wholly exotic and is regularly slashed to keep the biomass down.

**Management Zone 2 – Open Plains Grassy Woodland** with relatively intact understorey, located in the western block. This zone comprises an open eucalypt canopy over a largely indigenous understorey of grasses with scattered shrubs and other herbaceous species. Grassy weeds are common though infrequently dominate;

**Management Zone 3 – Densely treed Plains Grassy Woodland** with variously intact or exotic understorey. This zone covers the entire eastern triangular block. It contains the most quality variation of all the management zones as the ground layer varies from high to very-low cover of indigenous species. The wet depressions and artificial drains that traverse this Management Zone add additional complexity; and

**Management Zone 4 – Degraded wetland** (former Plains Grassy Wetland) located in the north-east corner of the western square block. In 2008, this area was considered to comprise adequate indigenous vegetation cover to qualify as a remnant patch of Plains Grassy Wetland (ABZECO 2008), though this may have been overstated at the time (City of Greater Dandenong, pers. comm.). Compared to the 2008 survey the weed cover has now increased and indigenous cover decreased to the point that it no longer represents remnant vegetation. This area continues to receive inflows of water that can inundate the depression after high flow events and keep the soils wetter for longer compared to adjoining areas. In some places the ground has been disturbed by the installation of the Hastings-Dandenong gas pipeline and previous four wheel drive activities and slashing machinery when the soils were wet and boggy. This soil disturbance may explain at least some of the increased weed cover and decreased indigenous cover which can be seen in the wheel rutted/disturbed areas. Decreased water inputs during the millennium drought (1996-2010) have likely also contributed to the decline in quality across the wetland.

### 8.1 Fuel hazard assessments

#### 8.1.1 Fire fuel hazard assessments

The *Overall Fuel Hazard Assessment Guide* (DSE 2010) considers bark type and quantity, and elevated, near-surface and surface fine fuel levels, to rank the overall fuel hazard into one of five categories: Low, Moderate, High, Very High and Extreme. Three fire fuel hazard assessments were completed in each of

Management Zones 1-3 and two were undertaken in the smaller Management Zone 4 (Table 12). Overall, the fuel hazard for Management Zones 2-4 (the woodlands and degraded wetland) was determined to be High, while for Management Zone 1 (lawn with remnant trees) the hazard was assessed as Moderate.

Fuel loads consist of bark which was for the most part smooth sometimes with long ribbons hanging in the branches. These ribbons act as a ladder during a fire to bring the flames up into the canopy and can also be responsible for causing spot fires long distances away. The elevated fuel layer of shrubby species was a minor component of the vegetation for the majority of the reserve, while ground layer fuels such as grasses and rushes were abundant (note that if it weren't for the mowing that occurs the ground layer fuels in Management Zone 1 would be much higher). Organic litter on the surface varied being most abundant in the densely treed triangle block (MZ 3) and lowest in the open woodland and lawn areas (MZ 1 and 2).

Given that the fire hazard assessments determined the average overall fuel hazard ratings for each Management Zone to be Moderate or High, the Reserve is not considered to be a significant fire hazard. The one assessment that achieved the highest fuel hazard rating (Very High) was a small area within the open woodland of Management Zone 2 that had a large number of shrubs present. This small area is well away from buildings and factories and therefore does not present a substantial risk to property.

By ensuring that these Plains Grassy Woodland vegetation communities remain primarily grassy rather than shrubby, the overall fuel hazard is not expected to rise significantly.

## 8.2 Fire history and ecology

Information on the fire history of the site is virtually non-existent. It appears that there have been no wildfires or planned burns within the Reserve for many decades as there are no records of such disturbances available on the biodiversity interactive map (DEPI 2015b). No other sources of information have alluded to a fire in the area.

There is always an inherent risk of wildfire in any bushland reserve. This could be started deliberately (e.g. arson), accidentally (e.g. cigarette butts, adjoining factory fires), or naturally (e.g. lightning strike). Human caused fires are very difficult to predict and, given the isolated nature of the Reserve (i.e. not connected to other areas of extensive vegetation), these are the mostly likely factor to cause a fire within the site. The severity of a bushfire is not expected to be unmanageable as the fuel hazard of the site is around the middle of the range and the site has good vehicle access through the internal track network as well as access from the adjoining roads, rail reserve and factories. One limitation is access to the internal tracks through the main entrance gate by emergency services. Unless they can get access to a key to enter the site, they will need to damage the lock and chain to gain entry.

Predicting wildfire behaviour is difficult given the range of contributing factors, which include (but are not limited to) the type, condition, arrangement and amount of fuels; climatic conditions on the day as well as preceding the fire; and cause of ignition. Given the right conditions (though it is considered unlikely), a canopy fire could erupt, which is considered undesirable on several levels. For any prescribed fires, the intent should be to ensure that the fire does not reach the canopy, both for safety reasons, and because the intensity of a canopy fire often results in detrimental impacts to eucalypts and other plant species as well as fauna. Grass-fires, particularly in areas of long grass can be fast moving and

intense, however the slashing regime that occurs in Management Zone 1 will continue to reduce the biomass and hence reduce the intensity of a grass-fire.

### 8.3 Impacts to ecological values

The indigenous vegetation of Victoria's grassy woodlands has evolved symbiotically with fire, which plays a regenerative role for many species within these communities. The relationship with fire may be expressed biologically in many species (e.g. requirement for fire to release seed from storage structures, or to stimulate germination), while ecologically fire may be necessary to open up dense and often species-poor ground-layer vegetation, allowing a diversity of species to regenerate. As many of the wetland flora species have underground rhizomes or storage organs, a fire in seasonally wet areas is unlikely to have significant negative impacts on the native flora. Weeds can also benefit from wildfire or controlled burns so it is very important that any fire is followed by monitoring and frequent weed control works to assist the indigenous species to regenerate. This should occur for a minimum of two years after a fire.

Wildfires and prescribed burns are likely to result in some mortality of fauna species and short term disturbance to fauna habitat. However, the regeneration of native flora species/communities may create long-term benefits through enhancement of fauna habitat within the reserve. As stated above, prescribed burns should not reach the canopy, protecting arboreal mammals and birds, and critical habitat resources such as tree hollows. Ideally, a fire regime that provides patchiness and heterogeneity in the environment is recommended. This approach to fire management is widely considered to be an appropriate management regime to maintain biodiversity (Burrows and Wardell-Johnson 2004; Gills et al 2003).

### 8.4 Recommendations for a controlled burn

Conducting a controlled burn in the Reserve is not essential to reduce fuel hazard, but presents the opportunity to assist regeneration of indigenous plant species. As per the OMP (ABZECO 2008), a controlled burn is recommended; however it should be undertaken on a small-scale, trial basis with pre- and post-burn monitoring and management.

The risk of fire killing trees is a serious consideration that needs to be well planned for in the preparation phase (e.g. mow vegetation c. 5 cm high and remove fuels within c. 1 m of tree trunks). Another risk is the promotion of weeds if post-fire management is inadequate as the problematic weeds identified onsite are often more vigorous at recolonising and regenerating disturbed areas than indigenous species. If weeds are allowed to flourish after fire they can outcompete indigenous plant species, potentially before they have had a chance to reproduce and restore the depleted soil-stored seed bank. As such, high quality and intensive weed follow-up management is essential if a fire is to go ahead.

To adequately prepare for a planned burn, a Burn Management Plan should be prepared one year prior to the proposed burn to allow appropriate preparation and planning. This Plan would involve input from an ecologist/bush fire management specialist, to:

- Determine the most appropriate location for the burn to occur so as to minimise risk of the fire escaping and avoiding susceptible plants/habitats;
- Predict the most likely behaviour of a fire at that location;

- List the legislative and policy requirements to undertake such a burn;
- Detail the pre-burn management works required to prepare the site (e.g. weed control, steps to avoid permanent damage to trees);
- Detail the post-burn management that will be required to ensure the indigenous plants have the best chance at regeneration; and
- Describe the pre- and post-fire vegetation monitoring program.

Table 12 Results of the 11 Fuel Hazard Assessments, National Drive Reserve, Dandenong South (18 September 2015). Recorders: John Kershaw, Fiona Sutton, Geoff Carr.

Management Zone (MZ)		MZ 1			MZ 2			MZ 3			MZ 4	
Vegetation type		Exotic lawn with remnant trees			Open Plains Grassy Woodland			Densely treed Plains Grassy Woodland			Degraded wetland	
Date		18/09/2015	18/09/2015	18/09/2015	18/09/2015	18/09/2015	18/09/2015	18/09/2015	18/09/2015	18/09/2015	18/09/2015	18/09/2015
Assessors		FSutton	FSutton	FSutton	FSutton	FSutton	FSutton	FSutton	FSutton	FSutton	FSutton	FSutton
Location		National Drive Reserve			National Drive Reserve			National Drive Reserve			National Drive Reserve	
Plot information	Plot no.	MZ1 - A	MZ1 - B	MZ1 - C	MZ2 - A	MZ2 - B	MZ2 - C	MZ3 - A	MZ3 - B	MZ3 - C	MZ4 - A	MZ4 - B
	Zone	55	55	55	55	55	55	55	55	55	55	55
	Easting	345076	345149	345185	345194	345076	345119	345421	345505	345396	345296	345304
	Northing	5788490	5788240	5788254	5788378	5788325	5788481	5788321	5788166	5788494	5788445	5788413
Canopy height	Avg height to top (m)	0	14	15	12	16	20	18	20	17	18	0
	Avg height to base (m)	0	1.5	1	1.5	2	1	6	8	9	<1	0
Bark fuel (20m radius)	Stringybark fuel hazard	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	Ribbon bark fuel hazard	NP	NP	NP	High	High	High	Moderate	Moderate	Moderate	NP	NP
	Other fuel bark hazard	Low	Moderate	Moderate	NA	NA	High	NA	NA	NA	High	Low
	Overall bark fuel hazard	Low	Moderate	Moderate	High	High	High	Moderate	Moderate	Moderate	High	Low
Elevated fuel layer	EF % cover	0	<1	15	2	30	10	1	<1	15	1	0
	EF% dead	0	<1	2	<1	30	2	<1	<1	10	1	0
	EF veg height (m)	0	0.4	12	1.5	2	2.5	0.6	1	1.2	1.2	0
	Elevated fuel hazard	Low	Low	Low	Low	High	Low	Low	Low	Low	Low	Low
Near-surface fuel layer	NS% cover	90	50	70	60	80	80	40	80	20	60	60
	NS % dead	5	<10	<10	10	30	10	10	10	<10	1	20
	NS avg height (cm)	15	10	25	15	30	15	20	30	20	10	10
	NS fuel hazard	Very High	High	High	Very High	Extreme	Very High	High	Extreme	Moderate	Very High	Very High
Surface fuel layer (10 m radius)	Surface litter % cover	25	40	25	70	20	60	80	80	90	50	60
	Avg litter depth (mm)	10	10	15	20	10	12	30	25	50	30	40
	Surface fuel hazard	Low	Low	Moderate	Moderate	Low	Low	High	Very High	Very High	Moderate	Moderate
Combined surface and near-surface fine fuel hazard calculation	Combined hazard	High	Moderate	High	Very High	Very High	High	Very High	Extreme	Very High	Very High	Very High
<b>Overall Fuel Hazard calculation ^</b>		<b>MODERATE</b>	<b>MODERATE</b>	<b>MODERATE</b>	<b>HIGH</b>	<b>VERY HIGH</b>	<b>HIGH</b>	<b>HIGH</b>	<b>HIGH</b>	<b>HIGH</b>	<b>HIGH</b>	<b>HIGH</b>
Are the plots representative of the average fuels across the sampling location?		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Notes		-	-	-	-	-	-	-	-	-	-	-
<b>Average Fuel Hazard for Management Zone</b>		<b>MODERATE</b>			<b>HIGH</b>			<b>HIGH</b>			<b>HIGH</b>	

^ Scale of ratings: Low, Moderate, High, Very High, Extreme.

## 9 References

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**Appendix 1** Fauna Survey Techniques used to investigate fauna species and habitat – National Drive Reserve Flora and Fauna Management Plan

Survey Technique	Autumn 2015		Spring 2015	
	Number of Locations / Surveys	Dates and Total Person Hours	Number of Locations / Surveys	Dates and Total Person Hours
General site inspection / habitat assessment	One survey across the Reserve.	Early autumn 23 March 2015 14 person hours	n/a	n/a
Diurnal bird surveys (random meander)	Two dusk surveys undertaken prior to autumn nocturnal surveys. Plus incidental records from other assessments.	Early to mid-autumn 8 April and 5 May 2015 c. 4 person hours	One dusk survey undertaken prior to the spring nocturnal survey. Plus incidental records from other assessments.	Mid-spring 12 October 2015 c. 2 person hours
Nocturnal birds (call play-back and spotlighting)	One survey at a single location.	Early to mid-autumn 8 April 2015 c. 2 person hours	One survey at a single location.	Mid-spring 12 October 2015 c. 2 person hours
Nocturnal frog surveys (call play-back and spotlighting)	Two surveys in autumn targeting Southern Toadlet within the margins of the dam, drainage lines and other wet depressions.	Early to mid-autumn 8 April and 5 May 2015 c. 12 person hours	One frog survey in spring targeting the dam and drainage lines (within and adjacent to the Reserve).	Mid-spring 12 October 2015 c. 4 person hours
Nocturnal arboreal mammal surveys (spotlighting)	One survey in autumn (6 transects across the Reserve).	Early to mid-autumn 8 April 2015 c. 4 person hours	One survey in spring (6 transects across the Reserve).	Mid-spring 12 October 2015 c. 4 person hours
Microbat surveys	One survey in autumn (2 locations within the Reserve)	Early autumn 23 March till 29 March 2015 (6 consecutive nights @ 8 hrs recording = 48 hours of recording)	One survey in spring (2 locations within the Reserve)	Mid-spring 19 to 21 October 2015 (2 consecutive nights @ 8 hrs recording = 16 hours of recording)
Remote Sensing infrared cameras	n/a	n/a	One survey period of 14 consecutive nights Nine cameras (9 surveys locations) placed across the Reserve	Mid-spring 5 to 19 October 2015 (14 consecutive nights @ 8 hrs recording = 112 hours of recording)
Diurnal - active reptile surveys	n/a	n/a	One survey in spring at four locations across the Reserve.	19 October 2015 c. 1.5 person hours

**Appendix 2** Legislation, policy and guidelines relevant to the National Drive Flora and Fauna Management Plan under a National, State, Regional and local context

Legislation or Policy	Scope	When it applies	Relevance to National Drive Reserve
<b>Federal</b>			
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	<p>Pertains to matters of national environmental significance including Ramsar Wetlands, listed threatened species and Ecological communities, listed migratory species and Commonwealth Marine Areas.</p> <p>The proponent is obliged to refer matters to the Commonwealth Environment Minister if such values may be affected by a proposed action. The Department of the Environment, Water, Heritage and the Arts decides whether there will be a significant impact and if it needs to be a 'controlled action'. The commonwealth can intervene to modify or block an action if it deems this necessary for the protection of a species or community of national significance.</p>	<p>Public and Private land.</p> <p>A referral is necessary whenever a proposed action is considered likely to impact on a species or ecological community listed in the Act.</p>	<p>One EPBC Act-listed fauna species was recorded during the 2015 assessments: Grey-headed Flying Fox. This species is considered to have a Moderate HSR within the reserve. One additional EPBC Act-listed species (Australian Painted Snipe) was recorded in 1989 adjacent to the study area. This species is considered to have a low HSR within the Reserve.</p>
Australia's Biodiversity Conservation Strategy 2010 - 2030	Provides a national framework to guide biodiversity conservation policies and programmes of the Commonwealth, State and Territories, so that Australia's biodiversity is healthy, resilient to threats and valued.	Private and public land. Protection of habitat.	The City of Greater Dandenong has the responsibility to protect biological diversity and promote ecologically sustainable development throughout the municipality.
Threat Abatement Plan for the predation by the European Red Fox (DEWHA 2008a)	Threat abatement plans provide for the research, management, and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities.	Private and public land. Protection of terrestrial habitats through the control of feral animals that predate on native fauna	Foxes are known to predate on a variety of native and exotic fauna species in the study area. Trapping for foxes has previously occurred within the Reserve. A coordinated fox control program with adjoining stakeholders is recommended should numbers increase significantly following monitoring.
Threat Abatement Plan for the predation by feral cats (DoE 2015)	Threat abatement plans provide for the research, management, and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities.	Private and public land. Protection of terrestrial habitats through the control of feral animals that predate on native fauna	It is unknown if predation by feral cats is an issue for native wildlife in the Reserve. No control is currently undertaken.
Threat Abatement Plan for competition and land degradation by European rabbits (DEWHA 2008b)	Threat abatement plans provide for the research, management, and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities.	Private and public land.	Rabbit abundance within the Reserve is low. The City of Greater Dandenong is actively involved in monitoring for the presence of this species within the Reserve. Rabbit control and monitoring is a Net Gain obligation of the OMP (ABZECO 2008).
<b>State</b>			
<i>Flora and Fauna Guarantee Act 1988</i>	The FFG Act lists species and ecological communities recognised as rare or threatened in Victoria. Under the Act, there are also provisions for listing of threatening processes and Protected Flora. Protected Flora include those species listed as threatened under the Act, plant species that belong to listed communities and plant species that are not threatened, but require protection for other reasons (e.g. from over-collection - orchids).	Public land (may have implications for private to the extent planning authorities enforce).	<p>Two FFG Act-listed fauna species were recorded within the Reserve during the 2015 assessment: Grey-headed Flying Fox and Yellow-bellied Sheath-tail Bat. These species are considered to have a moderate HSR within the Reserve. FFG Act-listed Great Egret has also previously been recorded within the Reserve (Cook 2011).</p> <p>Eight potential threatening processes listed under the FFG Act are relevant to flora, fauna and their habitats in National Drive Reserve:</p> <ul style="list-style-type: none"> <li>Invasion of native vegetation by Blackberry <i>Rubus fruticosus</i> L. agg.</li> <li>Invasion of native vegetation by environmental weeds.</li> <li>Loss of large woody debris from Victorian native forests and woodland.</li> <li>Loss of hollow bearing trees from Victorian native forests.</li> <li>Predation of native wildlife by the introduced Red Fox <i>Vulpes vulpes</i>.</li> <li>Predation of native wildlife by the cat, <i>Felix catus</i>.</li> <li>Threats to native flora and fauna arising from the use by the feral honeybee of nesting hollows and floral resources.</li> <li>Reduction in biodiversity resulting from Noisy Miner (<i>Manorina</i></li> </ul>

Legislation or Policy	Scope	When it applies	Relevance to National Drive Reserve
			<i>melanocephala</i> ) populations in Victoria.
<i>Wildlife Act 1975</i>	Lists protected fauna species.	Private and public land.	Some proposed uses and management of protected fauna must be licensed under the Act. A permit is required from DELWP under the Act to 'take' protected wildlife such as possums.
<i>Catchment and Land Protection Act 1994</i> (CaLP Act) (amended 2003)	Provides a legislative framework for the management of land including the control of declared noxious weeds and pest animals. The 2007 amendments include a revised list of noxious weeds and increased maximum penalties for poor land management.	Private and public land. If pest plants or animals are detected (or other poor land management practices identified) land managers are given notice and fined if no action is taken.	Noxious weeds that are declared under the Act and found within the Reserve will require control. If land managers are given notice and no action is undertaken, a fine may be issued. Pest animal control must also be undertaken by Council.
Victoria's Permitted Clearing of Native Vegetation – Biodiversity Assessment Guidelines	Guides how the impacts to Victoria's biodiversity should be considered when assessing an application for permit to remove native vegetation.	Private and public land.	Any actions that remove, lop or destroy native vegetation within the Reserve will need to be assessed under the Permitted Clearing Regulations.
<i>Planning and Environment Act 1987</i> (Amended 2003)	Sets out objectives for planning in Victoria. One of these objectives is 'to provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity'.	Private and public land.	Is implemented through the City of Greater Dandenong with permits required to remove native vegetation.
<i>Environment Protection Act 1970</i> (Amended 2006)	The Environment Protection Act 1970 established the powers, duties and functions of the EPA. The key aims of the Act include the sustainable use and holistic management of the environment and encouraging a co-operative approach to environment protection.	Private and public land.	The stormwater and run-off needs to be managed to protect native vegetation.
State Environmental Protection Policy (Waters of Victoria) 1999	State Environmental Protection Policy (Waters of Victoria) 1999 sits under the Environment Protection Act 1970. The State Environment Protection Policies (SEPPs). SEPPs are important as they provide goals and blueprints to protect the environment for the community both now and into the future. The SEPP Waters of Victoria 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).	Private and public land.	The stormwater and run-off needs to be managed to protect native vegetation.
Victorian Water Act (1989)	The Victorian Water Act (1989) was designed to enable integrated management of surface water and groundwater and to eliminate inconsistencies in the treatment of surface water and groundwater resources and waterways. The mechanism to achieve this is through the development of water management plans and licensing provisions.	Private and public land.	The stormwater and run-off needs to be managed to protect native vegetation.
Domestic (Feral and Nuisance) Animal Act 1994.	The purpose of this Act is to promote animal welfare, the responsible ownership of dogs and cats and the protection of the environment by feral and nuisance dogs and cats.	Private and public land.	Uncontrolled domestic dogs, cats and feral foxes may directly and indirectly impact on environmental values within the Reserve.
The Urban Stormwater Best Practice Environmental Management Guidelines (BPEMG) (CSIRO 1999)	The Best Practice Guidelines are used to assist urban catchment managers protect storm water quality and urban run-off into waterways. It includes environmental performance objectives, tools, best practices and examples of storm water management plans.	Private and public land.	The stormwater and run-off needs to be managed to protect native vegetation.
<b>Local</b>			
Local Planning Policy	Contains the Municipal Strategic Statement (MSS) and Local Planning Policies. MSS encapsulates significant planning directions for the municipality and in turn provides the strategic basis for the application of the zones, overlays and particular provisions in the planning scheme.	Public and private land. A planning scheme is binding on all people and corporations on every Minister, government department, public authority and municipal council.	Permits are required to remove native vegetation.
Environment Sustainability Strategy (2010)	The strategy provides the framework and policy direction to guide Council in achieving environmental sustainability through both the community and its operations. The strategy covers: biodiversity; water; waste; sustainable transport; and climate change.	Private and public land.	The City of Greater Dandenong aims to manage biodiversity values across the municipality.

**Appendix 3** Flora species recorded within the study area and their abundance within each Management Zone, National Drive Reserve, Dandenong South (5 March and 18 September 2015). Recorders: John Kershaw, Fiona Sutton, Geoff Carr

**Key:**

\* = Exotic species; P = Planted

EPBC = Environment Protection and Biodiversity Conservation Act 1999: E = listed as endangered; V = listed as vulnerable

FFG = Flora and Fauna Guarantee Act 1988: L = listed as threatened; X = not eligible for listing.

VROT = Victorian Rare or threatened species as classified by DELWP (DEPI 2014): e = endangered; v = vulnerable; r = rare; k = poorly known but thought to be rare or threatened.

RegS = Regionally Significant: RS = considered to be a Regionally Significant record in the greater Melbourne region.

CaLP = Catchment and Land Protection Act 1994: C = Regionally Controlled ; R = Restricted.

WONS = Weed of National Significance: W = listed as one of 32 Weeds of National Significance.

**Abundance Distribution:** MZ = Management Zone; R/L = Rare or localised; S/C = Scattered and/or common; W-s = Widespread and sparse; W-a = Widespread and abundance.

^ Not observed during field surveys by Ecology Australia. Were confirmed onsite by works crew in winter and spring 2016 after substantial rains.

EPBC	FFG	VROT	RegS	CaLP	WONS		Taxon name	Common name	Abundance/Distribution			
									MZ1	MZ2	MZ3	MZ4
							* <i>Acacia floribunda</i>	White Sallow-wattle		R/L		
							<i>Acacia melanoxylon</i>	Blackwood	R/L	R/L	R/L	
							<i>Acacia paradoxa</i>	Hedge Wattle	S/C	S/C	S/C	
							* <i>Acacia podalyriifolia</i>	Queensland Silver Wattle		R/L		
							<i>Acacia verticillata</i> subsp. <i>verticillata</i>	Prickly Moses	R/L			
							<i>Acaena novae-zelandiae</i>	Bidgee-widgee			R/L	
							* <i>Acetosella vulgaris</i>	Sheep Sorrel	W-a	W-a		W-a
							* <i>Agrostis capillaris</i> var. <i>capillaris</i>	Brown-top Bent	W-a	W-a	S/C	W-a
			RS				<i>Allocasuarina littoralis</i>	Black Sheoak		R/L		
			RS				<i>Allocasuarina paludosa</i>	Scrub Sheoak			R/L	
			RS				<i>Alternanthera denticulata</i> s.s.	Lesser Joyweed			R/L	
							<i>Amphibromus nervosus</i>	Common Swamp Wallaby-grass				S/C^
							* <i>Anthoxanthum odoratum</i>	Sweet Vernal-grass	W-a	W-a	W-a	W-a
							* <i>Apiaceae</i> spp.	Umbellifer			R/L	
							* <i>Arctotheca calendula</i>	Cape weed	W-s			
			RS				<i>Arthropodium strictum</i> s.s.	Chocolate Lily		R/L		
				R	W		* <i>Asparagus asparagoides</i>	Bridal Creeper			R/L	
							* <i>Aster subulatus</i>	Aster-weed	W-s	R/L	S/C	
			RS				<i>Bossiaea prostrata</i>	Creeping Bossiaea		R/L		
							* <i>Brassica fruticulosa</i>	Twiggy Turnip	S/C	R/L	S/C	
							* <i>Briza maxima</i>	Large Quaking-grass		W-a	S/C	
							* <i>Bromus catharticus</i>	Prairie Grass	W-a	W-a	W-a	W-a
							* <i>Bromus diandrus</i>	Great Brome		W-a	W-a	
							* <i>Bromus hordeaceus</i> subsp. <i>hordeaceus</i>	Soft Brome			S/C	
							<i>Callitriche</i> spp.	Water Starwort				R/L
							<i>Carex appressa</i>	Tall Sedge	S/C	W-s	S/C	
							<i>Carex inversa</i> (non-tufted)	Knob Sedge			S/C	
							<i>Carex inversa</i> (tufted)	Knob Sedge		S/C	W-s	
							<i>Carex</i> spp.	Sedge				S/C
							<i>Cassinia arcuata</i>	Drooping Cassinia			R/L	
							* <i>Cenchrus clandestinus</i>	Kikuyu	S/C	S/C	R/L	
				C			* <i>Cirsium vulgare</i>	Spear Thistle	R/L	S/C	S/C	
							* <i>Conyza bonariensis</i>	Flaxleaf Fleabane		R/L		
							* <i>Conyza</i> spp.	Fleabane	R/L		R/L	
							* <i>Conyza sumatrensis</i> var. <i>sumatrensis</i>	Tall Fleabane		R/L	R/L	
							<i>Crassula decumbens</i>			R/L		
				C			* <i>Crataegus monogyna</i>	Hawthorn			R/L	
							* <i>Cynodon dactylon</i> var. <i>dactylon</i>	Couch	W-a	W-a	W-a	
							* <i>Cynosurus echinatus</i>	Rough Dog's-tail	S/C			
							* <i>Cyperus eragrostis</i>	Drain Flat-sedge	R/L		S/C	
							* <i>Dactylis glomerata</i>	Cocksfoot	W-a		W-a	W-a
							* <i>Daucus carota</i>	Carrot			R/L	
			RS				<i>Dianella admixta</i>	Black-anther Flax-lily		R/L		
			RS				<i>Dianella laevis</i>	Smooth Flax-lily		R/L	R/L	
							* <i>Dianella</i> sp. aff <i>caerulea</i> (branched)	Flax Lily			R/L	
							* <i>Dianella</i> spp. aff <i>caerulea</i> (unbranched)	Flax Lily			R/L	
			RS				<i>Dichondra repens</i>	Kidney-weed	R/L		R/L	

EPBC	FFG	VROT	RegS	CaLP	WONS		Taxon name	Common name	Abundance/Distribution			
									MZ1	MZ2	MZ3	MZ4
				C		*	<i>Dittrichia graveolens</i>	Stinkwort			R/L	
						*	<i>Ehrharta erecta</i> var. <i>erecta</i>	Panic Veldt-grass	W-a	W-a	W-a	W-a
						*	<i>Ehrharta longiflora</i>	Annual Veldt-grass	W-a	W-a	W-a	
							<i>Eleocharis acuta</i>	Common Spike-sedge	S/C		W-s	W-a
							<i>Epilobium hirtigerum</i>	Hairy Willow-herb	R/L	R/L	S/C	S/C
			RS				<i>Eryngium vesiculosum</i>	Prickfoot			R/L	S/C
						*	<i>Eucalyptus botryoides</i> X <i>camaldulensis</i> subsp. <i>camaldulensis</i>	Southern Mahogany X River Red-gum hybrid	R/L			
							<i>Eucalyptus camaldulensis</i> subsp. <i>camaldulensis</i>	River Red-gum	R/L	S/C	W-a	
							<i>Eucalyptus ovata</i> var. <i>ovata</i>	Swamp Gum		R/L	S/C	R/L
						P*	<i>Eucalyptus polyanthemos</i>	Red Box	R/L			
						P	<i>Eucalyptus viminalis</i> subsp. <i>viminalis</i>	Manna Gum	R/L			
		e					<i>Eucalyptus</i> X <i>studleyensis</i>	Studley Park Gum	S/C	W-a	R/L	R/L
		r					<i>Eucalyptus yarraensis</i>	Yarra Gum	R/L	R/L		
						*	<i>Fraxinus angustifolia</i> subsp. <i>angustifolia</i>	Desert Ash	S/C	R/L		
						*	<i>Fumaria bastardii</i>	Bastard's Fumitory		W-s		
						*	<i>Fumaria capreolata</i>	White Fumitory		S/C		
						*	<i>Galium aparine</i>	Cleavers	W-a			W-a
				C	W	*	<i>Genista linifolia</i>	Flax-leaf Broom		R/L		
						*	<i>Geranium dissectum</i>	Cut-leaf Crane's-bill	W-a	S/C		
			RS				<i>Geranium gardneri</i>	Rough Crane's-bill			R/L	
							<i>Geranium</i> spp.	Crane's Bill			S/C	
						*	<i>Gladiolus undulatus</i>	Wild Gladiolus				S/C
							<i>Glyceria australis</i>	Australian Sweet-grass				S/C^
							<i>Haloragis heterophylla</i>	Varied Raspwort			R/L^	
						*	<i>Helminthotheca echioides</i>	Ox-tongue	S/C	S/C	S/C	
			RS				<i>Hemarthria uncinata</i> var. <i>uncinata</i>	Mat Grass		R/L		
						*	<i>Holcus lanatus</i>	Yorkshire Fog	W-a	W-a	S/C	
						*	<i>Hypochaeris radicata</i>	Flatweed	W-a	W-a	S/C	
							<i>Juncus amabilis</i>	Hollow Rush	S/C		S/C	S/C
						*	<i>Juncus articulatus</i> subsp. <i>articulatus</i>	Jointed Rush			S/C	R/L
							<i>Juncus gregiflorus</i>	Green Rush		R/L	R/L	
							<i>Juncus holoschoenus</i>	Joint-leaf Rush				S/C
							<i>Juncus kraussii</i> subsp. <i>australiensis</i>	Sea Rush		R/L		
							<i>Juncus pallidus</i>	Pale Rush	S/C	S/C	S/C	
							<i>Juncus sarophorus</i>	Broom Rush	R/L		S/C	
							<i>Juncus</i> spp.	Rush	R/L			
							<i>Juncus subsecundus</i>	Finger Rush		R/L		
							<i>Kunzea ericoides</i> s.l.	Burgan		R/L		
							<i>Lachnagrostis filiformis</i> s.s.	Common Blown-grass		R/L	S/C	
						*	<i>Lactuca serriola</i>	Prickly Lettuce	R/L	R/L		
							<i>Landoltia punctata</i>	Thin Duckweed	R/L			
						*	<i>Leontodon taraxacoides</i> subsp. <i>taraxacoides</i>	Hairy Hawkbit			R/L	
			RS				<i>Lepidosperma longitudinale</i>	Pithy Sword-sedge		R/L		
							<i>Leptospermum continentale</i>	Prickly Tea-tree	R/L	S/C	W-a	
						P	<i>Leptospermum lanigerum</i>	Woolly Tea-tree	W-a			
						*	<i>Lolium perenne</i>	Perennial Rye-grass	W-a			W-a
						*	<i>Lolium rigidum</i>	Wimmera Rye-grass	W-a	W-a	R/L	
			RS				<i>Lomandra filiformis</i> (rhizomatous green)	Wattle Mat-rush		R/L		
			RS				<i>Lomandra filiformis</i> (very glaucous, tufted)	Wattle Mat-rush		R/L		
			RS				<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush			S/C	
			RS				<i>Lomandra longifolia</i> subsp. <i>longifolia</i>	Spiny-headed Mat-rush		S/C	R/L	
						*	<i>Lotus</i> spp. (naturalised)	Trefoil	W-a			W-a
				C	W	*	<i>Lycium ferocissimum</i>	African Box-thorn	R/L		S/C	
						*	<i>Lysimachia arvensis</i>	Pimpernel	S/C			
							<i>Lythrum hyssopifolia</i>	Small Loosestrife			R/L	
						*	<i>Medicago polymorpha</i>	Burr Medic	R/L			
							<i>Melaleuca ericifolia</i>	Swamp Paperbark			W-a	
						*	<i>Melaleuca parvistaminea</i>	Rough-barked Honey-myrtle		R/L		
							<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass	S/C	W-a	R/L	
			RS				<i>Muellerina eucalyptoides</i>	Creeping Mistletoe		R/L		
			RS				<i>Myriophyllum crispatum</i>	Upright Water-milfoil	R/L			
							<i>Oxalis exilis</i>	Shady Wood-sorrel		R/L	R/L	
							<i>Oxalis perennans</i>	Grassland Wood-sorrel		R/L	S/C	
						*	<i>Paspalum dilatatum</i>	Paspalum	W-a	S/C	S/C	W-a



EPBC	FFG	VROT	RegS	CaLP	WONS		Taxon name	Common name	Abundance/Distribution			
									MZ1	MZ2	MZ3	MZ4
							* <i>Paspalum distichum</i>	Water Couch	R/L		W-s	W-a
			RS				<i>Persicaria decipiens</i>	Slender Knotweed	R/L			
							* <i>Phalaris aquatica</i>	Toowoomba Canary-grass	S/C	R/L	R/L	
							* <i>Phalaris minor</i>	Lesser Canary-grass	R/L			
							<i>Phragmites australis</i>	Common Reed			S/C	
							* <i>Plantago lanceolata</i>	Ribwort	W-a	W-a	S/C	W-a
			RS				<i>Poa labillardierei</i> var. <i>labillardierei</i>	Common Tussock-grass	W-a	S/C	W-a	R/L
							<i>Poa</i> spp.	Tussock Grass		S/C		
							<i>Pteridium esculentum</i>	Austral Bracken	R/L			
							<i>Ranunculus</i> spp.	Buttercup				R/L
							* <i>Raphanus raphanistrum</i>	Wild Radish	R/L			
							* <i>Romulea rosea</i> var. <i>australis</i>	Onion Grass	W-a	S/C	R/L	
				C			* <i>Rosa rubiginosa</i>	Sweet Briar			W-s	R/L
				C	W		* <i>Rubus anglocandicans</i>	Common Blackberry	W-a	S/C	R/L	S/C
							<i>Rumex brownii</i>	Slender Dock		R/L	R/L	
							* <i>Rumex conglomeratus</i>	Clustered Dock	R/L		S/C	S/C
							* <i>Rumex crispus</i>	Curled Dock	R/L			R/L
							<i>Rytidosperma caespitosum</i>	Common Wallaby-grass			S/C	
							<i>Rytidosperma geniculatum</i>	Kneed Wallaby-grass	R/L			
							<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	Slender Wallaby-grass		R/L	R/L	
							<i>Rytidosperma semiannulare</i>	Wetland Wallaby-grass			R/L	
							<i>Rytidosperma</i> spp.	Wallaby Grass			R/L	
							<i>Schoenoplectus tabernaemontani</i>	River Club-sedge	R/L			
							<i>Senecio quadridentatus</i>	Cotton Fireweed		R/L	R/L	
							* <i>Setaria pumila</i> subsp. <i>pumila</i>	Pale Pigeon-grass			R/L	
			RS				<i>Solanum laciniatum</i>	Large Kangaroo Apple		R/L	R/L	
							* <i>Solanum nigrum</i> s.s.	Black Nightshade	R/L	R/L	S/C	
							* <i>Sonchus oleraceus</i>	Common Sow-thistle	W-s	S/C	R/L	R/L
							* <i>Sporobolus africanus</i>	Rat-tail Grass	W-a	W-a		
							* <i>Stellaria media</i>	Chickweed		W-a		
							* <i>Taraxacum officinale</i> spp. <i>agg.</i>	Garden Dandelion			S/C	
							<i>Themeda triandra</i>	Kangaroo Grass		S/C	R/L	
							* <i>Tragopogon porrifolius</i> subsp. <i>porrifolius</i>	Salsify	R/L		S/C	S/C
			RS				<i>Tricoryne elatior</i>	Yellow Rush-lily		R/L		
							* <i>Trifolium subterraneum</i>	Subterranean Clover	S/C	R/L		
							* <i>Typha latifolia</i>	Lesser Reed-mace	R/L			
				C	W		* <i>Ulex europaeus</i>	Gorse	W-a	W-a	S/C	
							* <i>Vicia sativa</i>	Common Vetch			R/L	
							* <i>Vicia sativa</i> subsp. <i>nigra</i>	Narrow-leaf Vetch		R/L		
							* <i>Vicia sativa</i> subsp. <i>sativa</i>	Common Vetch	R/L			
							* <i>Vicia</i> spp.	Vetch	R/L	R/L		
			RS				<i>Viminaria juncea</i>	Golden Spray	R/L		R/L	
							* <i>Vulpia</i> spp.	Fescue	W-a			
			RS				<i>Xanthorrhoea minor</i> subsp. <i>lutea</i>	Small Grass-tree		R/L		

**Appendix 4** Fauna species recorded within the study area during the 2015 assessments (March 23 and October 21 2015) and historic records, National Drive Reserve, Dandenong South. Recorders: Ruth Marr Darren Quin, Jonathon Ricciardello.
**Key:**

VU = Vulnerable under the EPBC Act

L – Listed under the FFG Act 1988

nt – classified as Near Threatened under the Victorian Advisory List (DSE 2013), cr – Critically Endangered under the Victorian Advisory List, v – Vulnerable under the Victorian Advisory List.

Mi – Migratory species under the EPBC Act 1999, M – Marine overfly species under the EPBC Act 1999,

\* denotes introduced species

Scientific Name	Common Name	Status	Records (1998-2012)	2015	Habitat	EA Survey technique	Reference
<b>Birds</b>							
<i>Coturnix ypsilophora australis</i>	Brown Quail		✓		Grassland, edge of woodland.		Cook 2011
<i>Ocyphaps lophotes</i>	Crested Pigeon		✓	✓	Grassland, sparse treed areas.	Obs	Ecology Australia 2015; Yugovic and Barnes 2010
<i>Porzana tabuensis</i>	Spotless Crake		✓	✓	Cryptic species occurring in vegetated drainage line. May use emergent vegetation around dam.	Obs	Cook 2011; Ecology Australia 2015
<i>Vanellus miles</i>	Masked Lapwing		✓	✓	Open grassland, damp and inundated depressions. Breeding recorded on-site.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Gallinago hardwickii</i>	Latham's Snipe	Mi, M, nt,	✓		Wetlands, drainage lines and flooded grasslands with dense vegetation cover.		Donaldson 1998;
<i>Rostratula australis</i>	Australian Painted Snipe	M, V, L, cr	✓		Highly Cryptic. Variety of shallow terrestrial wetlands, muddy margins and mosaic of low, patchy vegetation. Recorded in 1989 in drainage line adjacent to the study area.		Cook 2011
<i>Threskiornis molucca</i>	Australian White Ibis		✓	✓	Dam, drainage lines and surrounding open grassland.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Threskiornis spinicollis</i>	Straw-necked Ibis		✓	✓	Dam, drainage lines and surrounding open grassland. Small numbers roosting in <i>E. camaldulensis</i> woodland.	Obs, Spotlighting	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Ardea modesta</i>	Eastern Great Egret	Mi, M, L, v,	✓		Wide variety of wetlands and waterways, inundated grasslands, drainage channels.		Cook 2011
<i>Egretta novaehollandiae</i>	White-faced Heron		✓	✓	Wetlands, drainage channel, inundated grassland and depressions. Roosting in <i>E. camaldulensis</i> adjacent to the dam.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Anas superciliosa</i>	Pacific Black Duck		✓	✓	All waterbodies, dam, drainage channel and inundated grassland would be utilised for foraging.	Obs	Donaldson 1998, Ecology Australia 2015
<i>Chenonetta jubata</i>	Australian Wood Duck			✓	Dam, Drainage line and surrounding grassland. Roosting in <i>E. camaldulensis</i> adjacent to the dam. Variety of potential hollows for nesting present.	Obs	
<i>Anas castanea</i>	Chestnut Teal		✓		Uses variety of wetlands, trees with hollows or short grasslands for nesting.		Donaldson 1998; Conservation Programs Coordinator pers.comm
<i>Dacelo novaeguineae</i>	Laughing Kookaburra			✓	Woodland habitat, hollows for breeding present.	Obs	Ecology Australia 2015
<i>Hieraetus morphnoides</i>	Little Eagle		✓		Open woodland and grassland habitats for foraging.		Conservation Programs Coordinator pers. comm.
<i>Haliastur sphenurus</i>	Whistling Kite		✓		Woodland, open grasslands and wetlands for foraging.		Donaldson 1998
<i>Ninox novaeseelandiae</i>	Southern Boobook			✓	Woodland, hollows for nesting.	Spotlighting	Ecology Australia 2015

Scientific Name	Common Name	Status	Records (1998-2012)	2015	Habitat	EA Survey technique	Reference
<i>Tyto javanica</i>	Pacific Barn Owl			✓	Open Woodland, roosts in hollows by day. Hollows for nesting / roosting .	Call-playback response	Ecology Australia 2015
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet		✓	✓	Any treed habitat, woodland and isolated trees, move in response to floral/fruited resources.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Cacatua tenuirostris</i>	Long-billed Corella		✓		Grassy Woodland and grasslands, feeding on grass seeds.		Cook 2011
<i>Platycercus elegans</i>	Crimson Rosella		✓	✓	Woodland/Forests, usually wetter vegetation communities, forages on seeds, insects and blossoms. Hollows for nesting.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Platycercus eximius</i>	Eastern Rosella		✓	✓	Open woodland, feeding on seeds, fruits, buds flowers and insects often from the ground.	Obs	Ecology Australia 2015 ; Conservation Programs Coordinator pers. comm.
<i>Psephotus haematonotus</i>	Red-rumped Parrot		✓	✓	Woodland, hollows for nesting	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Petrochelidon neoxena</i>	Welcome Swallow		✓	✓	Woodland and Grassland feeding on insects.	Obs	Ecology Australia 2015
<i>Petrochelidon nigricans</i>	Tree Martin		✓		Forages aerially over grassland, woodland and wetlands for insects.		Cook 2011
<i>Rhipidura albiscarpa</i>	Grey Fantail		✓	✓	Woodland habitat foraging on flying insects.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Rhipidura leucophrys</i>	Willie Wagtail		✓	✓	Open woodland, isolated trees, often near wetland habitat. Feeds on invertebrates on ground and aerially.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Petroica boodang</i>	Scarlet Robin		✓		Woodland and open forest where it forages on or near ground for invertebrates.		Donaldson 1998
<i>Pachycephala pectoralis</i>	Golden Whistler		✓		Woodland, forest, feeding on a variety of invertebrates		Donaldson 1998; Conservation Programs Coordinator pers. comm.
<i>Pachycephala rufiventris</i>	Rufous Whistler			✓	Woodland, shrubland and forests, feeding on insects and some seeds, fruits.	Obs	
<i>Colluricincla harmonica</i>	Grey Shrike-thrush			✓	Woodlands / forests using woody debris and leaf litter to search for invertebrates.	Obs	Ecology Australia 2015
<i>Acanthiza pusilla</i>	Brown Thornbill			✓	Woodlands, often with dense shrubby vegetation.	Obs	
<i>Grallina cyanoleuca</i>	Magpie-lark		✓	✓	Woodland, grassland, breeding habitat	Obs and cameras	Ecology Australia 2015; Donaldson 1998; Conservation Programs Coordinator pers. comm.
<i>Falcunculus frontatus</i>	Crested Shrike-tit		✓		Woodlands and forests, often in wetter habitats. Forages mainly on insects.		Donaldson 1998; Conservation Programs Coordinator pers. comm.
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		✓	✓	Woodland/Forest, forages on invertebrates on canopy and ground.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Cincloramphus mathewsi</i>	Rufous Songlark		✓		Open grassland and grassy woodland. Feeds on ground on invertebrates.		Cook 2011
<i>Cisticola exilis</i>	Golden-headed Cisticola		✓		Wetlands and inundated grasslands. Invertebrates and seeds eaten amongst dense vegetation.		Cook 2011

Scientific Name	Common Name	Status	Records (1998-2012)	2015	Habitat	EA Survey technique	Reference
<i>Malurus cyaneus</i>	Superb Fairy-wren		✓	✓	Woodland and grassy vegetation with dense, low shrubs for cover. Forages mostly on the ground for invertebrates.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Melithreptus lunatus</i>	White-naped Honeyeater		✓		Woodland and open forest feeding on nectar and insects and their products (honeydew).		Donaldson 1998
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater		✓	✓	Open woodland, forests, near waterbodies, linked to Red Gums. Feeding on nectar, insects and their products (honeydew).	Obs and cameras	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater		✓		Woodland feeding on nectar from flowers and insects, spiders and fruit.		Donaldson 1998
<i>Manorina melanocephala</i>	Noisy Miner		✓	✓	Woodland and isolated trees in grassland feeding on nectar, fruit and insects. Can aggressively out compete other native species.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Anthochaera chrysoptera</i>	Little Wattlebird		✓		Woodland and isolated trees feeding on nectar from flowering eucalypts. Also insect's fruits will be taken.		Conservation Programs Coordinator pers. comm.
<i>Anthochaera carunculata</i>	Red Wattlebird		✓	✓	Woodland and isolated trees feeding on nectar from flowering eucalypts. Also insect's fruits will be taken.	Obs	Donaldson 1998; Conservation Programs Coordinator pers. comm.; Ecology Australia 2015
<i>Artamus cyanopterus</i>	Dusky Woodswallow			✓	Woodland, foraging on insects and nectar from flowers.	Obs	Ecology Australia 2015
<i>Oriolus sagittatus</i>	Olive-backed Oriole		✓		Woodland and scattered isolated trees feeding on insects and fruit.		Cook 2011
<i>Cracticus torquatus</i>	Grey Butcherbird			✓	Woodland, predating on smaller birds, reptiles, insects and foraging on fruits and seeds. Breeding within the Reserve.	Obs	Ecology Australia 2015
<i>Gymnorhina tibicen</i>	Australian Magpie		✓	✓	Woodland and grassland habitat. Foraging on insects and their larvae.	Obs and cameras	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Corvus mellori</i>	Little Raven		✓	✓	Woodland and grassland, foraging mostly on the ground for invertebrates and human scraps.	Obs and cameras	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<i>Pardalotus striatus</i>	Striated Pardalote			✓	Woodland and shrublands, feeding in foliage on insects and their larvae.	Obs	Ecology Australia 2015
* <i>Streptopelia chinensis</i>	Spotted Turtle-Dove		✓	✓	Urban and agricultural, open woodland. Feeds on grains, seeds.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
* <i>Turdus merula</i>	Common Blackbird		✓	✓	Urban and surrounding bushland. Feeds on variety of invertebrates, seeds and fruit on the ground.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
* <i>Passer montanus</i>	Eurasian Tree Sparrow		✓		Woodland and scattered isolated trees.		Conservation Programs Coordinator pers. comm.
* <i>Passer domesticus</i>	House Sparrow		✓	✓	Mostly around urban and cultivated areas and surrounding woodland, shrubs. Foraging on insects, spiders, fruits, seeds and human scraps.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
* <i>Acridotheres tristis</i>	Common Myna		✓	✓	Urban and agricultural areas, sparse treed and open woodland. This highly aggressive and invasive species competes with and predated on native wildlife.	Obs	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
* <i>Sturnus vulgaris</i>	Common Starling		✓	✓	Urban and agricultural areas, large flocks feed on seeds and insects.	Obs and cameras	Ecology Australia 2015; Conservation Programs Coordinator pers. comm.
<b>Mammals</b>							

Scientific Name	Common Name	Status	Records (1998-2012)	2015	Habitat	EA Survey technique	Reference
<i>Trichosurus vulpecula</i>	Common Brushtail Possum			✓	Woodland with variety of hollows, feeds on leaves, fruits and occasionally small animals on ground and in canopy.	Indirect, Spotlighting and Cameras	Ecology Australia 2015
<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum			✓	Tree dwelling. Woodland, dense shrubs and mid-storey trees. One old drey observed. Nesting/shelter also in hollows. Feeds on foliage, fruits and flowers.	Indirect, Spotlighting	Ecology Australia 2015
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V, L, v		✓	Recorded flying overhead. Suitable foraging habitat when eucalypts in flower. Potential roosting habitat in canopy trees.	Obs Spotlighting	Ecology Australia 2015
<i>Tadarida australis</i>	White-striped Freetail Bat			✓	Woodland and urban areas, roosts in hollows during day, under bark, or cavities.	Spotlighting / heard; Bat detectors spring	Ecology Australia 2015
<i>Saccolaimus flaviventis</i>	Yellow-bellied Sheath-tail Bat	L		✓	Vagrant to Victoria, woodland habitat, hollows for roosting during day and flies high and fast over canopy and treeless areas for insects.	Bat detectors, spring	Ecology Australia 2015
<i>Mormopterus planiceps</i>	Southern Freetail bat			✓	Woodland, forages at canopy level or over open land. Roosts in hollows or man-made structures during day.	Bat detectors, spring	Ecology Australia 2016
<i>Chalinolobus morio</i>	Chocolate Wattled Bat			✓	Urban and wooded environments. Hollows or man-made cavities for roosting by day. Fast and agile flier catching mostly insects such as moths.	Bat detectors, spring	Ecology Australia 2017
<i>Chalinolobus gouldi</i>	Gould's Wattled Bat			✓	Variety of habitats. Roosting by damp in tree stumps, bird nests and man-made structures.	Bat detectors, autumn and spring	Ecology Australia 2015
<i>Vespadelus darlingtoni</i>	Large Forest Bat			✓	Woodland, roosting in colonies during the day in hollows. Feeds on variety of invertebrates.	Bat detectors, autumn and spring	Ecology Australia 2015
<i>Falsistrellus tasmaniensis</i>	Eastern Falsistrellus			✓	Woodland using hollows for roosting by day. Hunts flying insects just above or below canopy.	Bat detectors, spring	Ecology Australia 2016
<i>Vespadelus vulturnus</i>	Little Forest Bat			✓	Woodland, roosting in colonies during the day in hollows. Agile fliers that hunt for insects amongst the canopy.	Bat detectors, spring	Ecology Australia 2017
<i>Nyctophilus sp</i>	Long-eared Bat			✓	Woodlands and grassland, roosts in small hollows, crevices and under bark. Will forage for flying insects amongst low foliage, on the ground or in flight.	Bat detectors, spring	Ecology Australia 2018
<i>Vespadelus darlingtoni</i> / <i>V. Regulus</i> / <i>V. vulturnus</i>	Forest Bat Sp			✓	Woodland, hollows.	Bat detectors, autumn and spring	Ecology Australia 2015
<i>*Oryctolagus cuniculus</i>	European Rabbit		X	✓	Grassland and woodland. Warrens for shelter, dense shrubs used as shelter/harbor.	Obs	Ecology Australia 2015; Yugovic and Barnes 2010
<i>*Vulpes vulpes</i>	Red Fox			✓	Urban, agricultural and bushland environments. Man-made structure and dens for shelter. Predates of variety of small mammals, birds, reptiles, frogs, insects and plant material including fruit.	Indirect and direct Obs, Spotlighting	Ecology Australia 2015;
<i>*Rattus rattus</i>	Black Rat			✓	Urban and natural environments. Burrows or tree cavities, scrapes used for shelter. Omnivorous.	Cameras	Ecology Australia 2015;
<b>Reptiles</b>							
<i>Lampropholis guichenoti</i>	Garden Skink			✓	Urban and natural treed. Hunts small invertebrates by day.	Obs	Ecology Australia 2015

Scientific Name	Common Name	Status	Records (1998-2012)	2015	Habitat	EA Survey technique	Reference
<i>Acritoscincus duperreyi</i>	Eastern Three-lined Skink		✓		Woodland, shelter amongst leaf litter, tussocks etc., feeding on insects and other small invertebrates.		Donaldson 1998
<i>Austrelaps superbus</i>	Lowland Copperhead		✓		Woodland, grassland often near water. Feeds on insects, frogs, lizards and snakes.	Anecdotal	Regular recent observations by City of Greater Dandenong staff. Yugovic and Barnes 2010
<b>Frogs</b>							
<i>Limnodynastes peronii</i>	Striped Marsh Frog			✓	Dam, dense emergent and fringing vegetation for cover. Associated with permanent water. Breeds in ponds, ditches and flooded grassland.	Obs and Spotlighting	Ecology Australia 2015; Yugovic and Barnes 2010
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog			✓	Dam, drainage line and surrounding riparian and terrestrial vegetation. Shelters in cracks in the ground, under rocks during dry periods. Breeds in still waters, dams, ponds, swamps, flooded grassland.	Obs and Spotlighting	Ecology Australia 2015
<i>Neobatrachus sudellae</i>	Common Spadefoot Toad		✓		Burrows underground and becomes active after rains, woodland and grassland habitats. Breeds in ponds, dams and ditches.		Damien Cook pers. obs 2003 (cited in Cook 2011)
<i>Crinia signifera</i>	Common Froglet		✓	✓	Dam, drainage line and surrounding riparian and terrestrial vegetation. Shelter under rocks, logs and other debris away in moist depressions.	Obs and Spotlighting	Ecology Australia 2015; Yugovic and Barnes 2010
<i>Litoria ewingii</i>	Southern Brown Tree Frog			✓	Dam, drainage line, flooded grassland and surrounding riparian and terrestrial vegetation. Agile climber. Will breed in any still water, ponds, dams, lakes, roadside ditches.	Obs and Spotlighting	Ecology Australia 2015
<i>Limnodynastes dumerilii</i>	Pobblebonk			✓	Burrowing frog, the dam, drainage line and surrounding riparian and terrestrial vegetation would be used for foraging.	Obs and Spotlighting	Ecology Australia 2015
<i>Litoria verreauxi</i>	Whistling Tree Frog			✓	Mostly ground dwelling. Breeds in ponds, dams, ditches etc. Dam, drainage line and surrounding riparian and terrestrial vegetation.	Obs and Spotlighting	Ecology Australia 2015
<b>Invertebrates</b>							
<i>Engaeus sp.</i>	Burrowing Cray			✓	Damp environments, drainage lines, margins of the dam and other depressions. Digs burrows with distinct chimney shaped hole.	Indirect Obs and Spotlighting	Ecology Australia 2015

**Appendix 5** Threatened and Migratory/Marine fauna species recorded within the Victorian Biodiversity Atlas (DELWP 2015a) within the 5 km radius of the study area (Data Review Area or DRA) or listed as potentially occurring or suitable habitat potentially occurring under the DoE EPBC Protected Matters database (DoE 2015a) and Habitat Suitability Ratings., National Drive Reserve, Dandenong South.

EPBC – Environment Protection and Biodiversity Conservation Act 1999  
 NAP – National Action Plan  
 FFG – Flora and Fauna Guarantee Act 1988  
 Vic Ad: Advisory List of Threatened Vertebrate Fauna in Victoria – DSE 2013.  
 CE – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; DD – Data Deficient.  
 L – Listed under the FFG Act 1988.  
 Mi – Migratory species under the EPBC Act 1999  
 M – Marine overfly species under the EPBC Act 1999  
 Count – Number of records in Fauna DRA; NR – No records of the species in the Fauna DRA  
 HSR = Habitat Suitability Rating  
 \* denotes introduced species  
 # denotes species or species habitat listed as potentially occurring under the EPBC Protected Matters database (DoE 2015)

Scientific Name	Common Name	EPBC	FFG	Vic Ad	Count	HSR
<b>EPBC</b>						
<i>Rostratula australis</i>	Australian Painted Snipe	E	L	CE	1	Low
<i>Lathamus discolor</i>	Swift Parrot	E, M,	L	E	1	Low
<i>Galaxiella pusilla</i>	Dwarf Galaxias	V	L	E	23	Moderate
<i>Litoria raniformis</i>	Growling Grass Frog	V	L	E	4	Low
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	L	V	1	Moderate
<i>Synemon plana</i>	Golden Sun Moth	CE	L	CE	1	Low
<i>Botaurus poiciloptilus</i>	Australasian Bittern	EN	L	E	8	Low
<i>Polytelis anthoepus monarchoides</i>	Regent Parrot	V	L	V	1	Negligible
# <i>Anthochaera phrygia</i>	Regent Honeyeater	CE	L	CE	NR	Negligible
# <i>Isoodon obesulus obesulus</i>	Southern Brown Bandicoot (Eastern)	E	L	NT	NR	Negligible
# <i>Pseudomys fumeus</i>	Smoky Mouse	E	L	E	NR	Negligible
# <i>Prototroctes maraena</i>	Australian Grayling	V	L	V	NR	Negligible
# <i>Pseudomys novaehollandiae</i>	New Holland Mouse	V	L	V	NR	Negligible
# <i>Nannoperca obscura</i>	Yarra Pygmy Perch	V	L	V	NR	Negligible
<b>FFG</b>						
# <i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	M	L	v	NR	Low
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler		L	E	1	Negligible
<i>Ardea modesta</i>	Eastern Great Egret	Mi, M	L	V	25	Low-moderate
<i>Egretta garzetta nigripes</i>	Little Egret	M	L	E	2	Low
<i>Oxyura australis</i>	Blue-billed Duck		L	E	10	Low
<i>Melanodryas cucullata cucullata</i>	Hooded Robin		L	NT	2	Low
<i>Ardea intermedia</i>	Intermediate Egret	M	L	E	1	Low
<i>Lewinia pectoralis pectoralis</i>	Lewin's Rail		L	V	1	Low
<i>Porzana pusilla palustris</i>	Baillon's Crake		L	V	2	Low-moderate
<i>Accipiter novaehollandiae novaehollandiae</i>	Grey Goshawk		L	V	1	Low
<i>Grantiella picta</i>	Painted Honeyeater		L	V	1	Low
<i>Pseudophryne semimarmorata</i>	Southern Toadlet		L	V	1	Low
<b>Vic Advisory</b>						
<i>Gallinago hardwickii</i>	Latham's Snipe	Mi, M		NT	22	Moderate
<i>Hirundapus caudacutus</i>	White-throated Needletail	Mi, M		V	21	Low
<i>Calidris ferruginea</i>	Curlew Sandpiper	Mi		E	9	Low
<i>Arenaria interpres</i>	Ruddy Turnstone	Mi		V	1	Low
<i>Limosa lapponica</i>	Bar-tailed Godwit	Mi, M		V	1	Low
<i>Chelodina longicollis</i>	Common Long-necked Turtle			DD	2	Moderate
<i>Macquaria ambigua</i>	Golden Perch			NT	2	Low
<i>Phalacrocorax varius</i>	Pied Cormorant			NT	5	Low
<i>Chlidonias hybridus javanicus</i>	Whiskered Tern			NT	5	Low
<i>Platalea regia</i>	Royal Spoonbill			NT	22	Low
<i>Nycticorax caledonicus hillii</i>	Nankeen Night Heron			NT	1	Moderate
<i>Circus assimilis</i>	Spotted Harrier			NT	1	Low
<i>Larus pacificus pacificus</i>	Pacific Gull			NT	39	Low
<i>Tringa glareola</i>	Wood Sandpiper	Mi, M		V	2	Low
<i>Actitis hypoleucos</i>	Common Sandpiper	Mi, M		V	1	Low
<i>Tringa nebularia</i>	Common Greenshank	Mi, M		V	2	Low
<i>Tringa stagnatilis</i>	Marsh Sandpiper	Mi, M		V	1	Low
<i>Anas rhynchos</i>	Australasian Shoveler			V	14	Low
<i>Aythya australis</i>	Hardhead			V	22	Low
<i>Biziura lobata</i>	Musk Duck			V	12	Low
<i>Falco subniger</i>	Black Falcon			V	1	Low
<b>Migratory and/or Marine</b>						
<i>Grallina cyanoleuca</i>	Magpie-lark	M			103	High
<i>Charadrius bicinctus</i>	Double-banded Plover	Mi			5	Low
<i>Calidris ruficollis</i>	Red-necked Stint	Mi			9	Low

<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Mi			8	Low
<i>Merops ornatus</i>	Rainbow Bee-eater	Mi			1	Low-Moderate
<i>Ardea ibis</i>	Cattle Egret	Mi, M			6	Low-Moderate
<i>Apus pacificus</i>	Fork-tailed Swift	Mi, M			3	Low
<i>Rhipidura rufifrons</i>	Rufous Fantail	Mi, M			10	Low
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Mi, M			10	Low
# <i>Pandion cristatus</i>	Osprey	Mi, M			NR	Low
# <i>Monarcha melanopsis</i>	Black-faced Monarch	Mi, M			NR	Low



**Appendix 6** Photo-point details, National Drive Reserve, Dandenong South

Eight photo-points were taken across the site, as detailed Table 13 and illustrated in Plates 6-13.

**Table 13** Details for the eight photo-points taken within the study area, National Drive Reserve, Dandenong South.

Photo-point #	Date	Zone	Easting	Northing	Bearing	Panorama	Recorder	MZ	Notes
1	5/03/2015	55	345587	5788241	280°	No	Fiona Sutton	3	Taken from track looking toward very large River Red-gum
2	5/03/2015	55	345051	5788460	160° and 120°	No	Fiona Sutton	1, 2	Taken at the split in the access track near the northern entrance off National Drive. Star picket inserted next to road.
3	5/03/2015	55	345067	5788322	0°	Yes	Fiona Sutton	2	Captures the increasing front of <i>Kunzea</i> as the population expands.
4	5/03/2015	55	345509	5788146	45°	Yes	John Kershaw	3	Taken from in from of the bench seat located in HZ2.
5	5/03/2015	55	345488	5788311	240°	Yes	John Kershaw	3	Taken from HZ1 at an existing white stake at the edge of the drainage channel (stake NOT replaced with star picket)
6	5/03/2015	55	345404	5788683	345°	Yes	John Kershaw	3	Taken from HZ2 in the north of the triangle block. Stake is located at the base of a juvenile River Red-gum c. 3 m tall with two stems.
7	18/09/2015	55	345304	5788450	255° and 315°	No	Fiona Sutton	4	Taken from under VL <i>Eucalyptus X studleyensis</i> looking at 'degraded wetland' area (MZ4). Dominated by exotic grasses ( <i>Paspalum dilatatum</i> , <i>Cynodon dactylon</i> var. <i>dactylon</i> ) with consistent but sparse cover of <i>Eleocharis acuta</i> .
8	18/09/2015	55	345304	5788413	355°	No	Fiona Sutton	4	Taken from the bubble tap (no star picket) looking at the wetland area. Tussocks in the foreground are <i>Eryngium ovinum</i> , darker green in distance between trees is <i>Eleocharis acuta</i> .



**Plate 6 Photo-point 1 in Management Zone 3, National Drive Reserve.**



**Plate 7** Photo-point 2 in Management Zones 1 looking toward Management Zone 2, National Drive Reserve.



Plate 8 Photo-point 3 in Management Zone 2, National Drive Reserve, Dandenong South.



Plate 9 Photo-point 4 in Management Zone 3, National Drive Reserve, Dandenong South.



Plate 10 Photo-point 5 in Management Zone 3, National Drive Reserve, Dandenong South.



Plate 11 Photo-point 6 in Management Zone 3, National Drive Reserve, Dandenong South.



**Plate 12 Photo-point 7 in Management Zone 4, National Drive Reserve, Dandenong South.**



**Plate 13 Photo-point 8 in Management Zone 4, National Drive Reserve, Dandenong South**