APP CORPORATION PTY LIMITED

South Dural Planning Proposal

BIODIVERSITY ASSESSMENT REPORT

SEPTEMBER 2016

WSP | PARSONS BRINCKERHOFF

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APP Corporation Pty Limited

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GLOSSARY

Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: → Genetic diversity — the variety of genes (or units of heredity) in any population. → Species diversity — the variety of species. → Ecosystem diversity — the variety of communities or ecosystems.
Bioregion (region)	A bioregion defined in a national system of bioregionalisation. The study area is in the Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway, R. & Cresswell 1995b).
Critical habitat	The whole or any part or parts of an area or areas of land comprising the habitat of an Endangered species, an Endangered population or an Endangered Ecological Community that is critical to the survival of the species, population or ecological community (Department of Environment and Conservation 2004b). Critical habitat is listed under either the TSC Act or the EPBC Act and both the state (Department of Environment, Climate Change and Water) and Federal (Department of the Sustainability, Environment, Water, Population and Communities) Directors-General maintain a register of this habitat. Capitalisation of the term 'Critical Habitat' in this report refers to the habitat listed specifically under the relevant state and Commonwealth legislation.
Department of the Environment	The department develops and implements national policy, programs and legislation to protect and conserve Australia's natural environment and cultural heritage and administers the EPBC Act. The Commonwealth Department of Department of the Environment was previously known as: → Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) → Department of the Environment, Water, Heritage and the Arts (DEWHA) → Department of Environment and Heritage (DEH) → Department of the Environment and Water Resources (DEWR).
Ecological community	An assemblage of species occupying a particular area.
Environmental weed	Any plant that is not native to a local area that has invaded native vegetation.
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
Exotic	Introduced from outside the area (Stralberg *et al.* 2009). Used in the context of this report to refer to species introduced from overseas.
Minor stream	Includes any stream or part of a stream that is neither a first or second order stream, or that forms any part of a stream as determined in accordance with the Strahler system of determining stream order.

FM Act	NSW *Fisheries Management Act 1994*
GPS	Global Positioning System- a navigational tool which uses radio receivers to pick up signals from four or more special satellites to provide precise determination of location.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.
Indigenous	Native to the area: not introduced (Stralberg *et al.* 2009).
Introduced	Not native to the area: not indigenous (Stralberg *et al.* 2009). Refers to both exotic and non-indigenous Australian native species of plants and animals.
Key threatening processes	A process that threatens, or could threaten, the survival, abundance or evolutionary development of native species, populations or ecological communities (Department of Environment and Conservation 2004b). Key threatening processes are listed under the TSC Act, the FM Act and the EPBC Act. Capitalisation of the term 'Key Threatening Processes' in this report refers to those processes listed specifically under the relevant state and Commonwealth legislation.
LIDAR	Light Detection and Ranging – is a geospatial remote sensing method used for vegetation mapping and refining vegetation boundaries. The LIDAR used as part of this report used a fixed-wing aircraft to refine vegetation boundaries.
Likely	Taken to be a real chance or possibility (Department of Environment and Conservation 2004b).
Local population	The population that occurs within the site, unless the existence of contiguous or proximal occupied habitat and the movement of individuals or exchange of genetic material across the boundary can be demonstrated as defined by Department of Environment and Climate Change (2007b).
Locality	The area within a 10 km radius of the site.
Migratory species	Species listed as Migratory under the EPBC Act relating to international agreements to which Australia is a signatory. These include Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Capitalisation of the term 'Migratory' in this report refers to those species listed as Migratory under the EPBC Act.
Noxious weed	An introduced species listed under the *Noxious Weeds Act 1993*. Under the Act, noxious weeds have specific control measures and reporting requirements.
NSW	New South Wales

Office of Environment and Heritage	Following the 2011 NSW elections, the Department of Environment, Climate Change and Water was abolished as a Division of the Government Service and was added to the NSW Department of Premier and Cabinet, as the Office of Environment and Heritage. Broadly, the Office of Environment works towards a healthy environment cared for and enjoyed by the whole NSW community: manages the state's natural resources, including biodiversity, soils and natural vegetation: manages natural and cultural heritage across the state's land: acts to minimise the impacts of climate change: promotes sustainable consumption, resource use and waste management: regulates activities to protect the environment: and conducts biodiversity, plant, environmental and cultural heritage research to improve decision making. Previously known as: → Department of Environment, Climate Change and Water (DECCW) → Department of Environment and Climate Change (DECC).
Priorities action statements (PAS)	Priorities action statements outline the broad strategies and detailed priority actions to be undertaken in NSW to promote the recovery of Threatened species, population and ecological communities and manage key threatening processes (Department of Environment and Climate Change 2007a).
Protected species	Those species defined as protected under the *National Parks and Wildlife Act 1974*. Includes all native animals, as well as all native plants listed on Schedule 13 of the *National Parks and Wildlife Act 1974*.
Recovery plan	A plan prepared under the TSC Act, FM Act or the EPBC Act to assist the recovery of a threatened species, population or ecological community.
Significant	Important, weighty or more than ordinary.
Species richness	Species richness is simply the number of species present in a sample, community, or taxonomic group. Species richness is one component of the concept of species diversity, which also incorporates evenness, that is, the relative abundance of species (Matteson & Langellotto 2010).
Subject site	Is defined specifically as all land parcels bounded by Hastings Road in the south, New Line Road in the East and Old Northern Road in the west and north in Dural, Glenhaven and Castle Hill, NSW.
Threatened biodiversity	Threatened species, populations or ecological communities as listed under the TSC Act, FM Act or the EPBC Act.
Threatened species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, Endangered or Critically Endangered (collectively referred to as threatened) under the TSC Act, FM Act or the EPBC Act. Capitalisation of the terms 'Vulnerable', 'Endangered' or 'Critically Endangered' in this report refers to listing under the relevant state and/or Commonwealth legislation.
TSC Act	NSW *Threatened Species Conservation Act 1995.*

Viable local population	A population that has the capacity to live, develop and reproduce under normal conditions, unless the contrary can be conclusively demonstrated through analysis of records and references (Department of Environment and Climate Change 2007b).
Weed	A plant growing out of place or where it is not wanted: often characterised by high seed production and the ability to colonise disturbed ground quickly (Stralberg *et al.* 2009). Weeds include both exotic and Australian native species of plant naturalised outside of their natural range.

1 INTRODUCTION

1.1 Project details

In October 2013, a planning proposal was submitted to the Hornsby Shire Council on behalf of the South Dural Residents and Ratepayers Group that sought to rezone land in South Dural (henceforth referred to as the subject site). Subsequently, Hornsby Shire Council prepared a planning proposal which was submitted to the NSW Government Department of Planning and Environment (DP&E). DP&E issued a Gateway Determination on 12 March 2014 which summarised the additional works required to proceed with the rezoning of the subject site. Under the Gateway Determination additional flora and fauna investigations are required.

The land is currently Zoned Rural Landscape (RU2) and Environmental Management (E3) under the Hornsby Shire Council Local Environment Plan (LEP) 2013. Consequently, the biodiversity values of the subject site will be critical factors in the development of a rezoning proposal of the land which would facilitate development in an ecologically sustainable manner.

APP Corporation Pty Limited has been engaged by Statewide Property Ventures to prepare a rezoning proposal for the subject site (the proposal). WSP | Parsons Brinckerhoff has been engaged by APP Corporation Pty Limited on behalf of Statewide Property Ventures to provide an assessment of the site's biodiversity values to inform the development of the proposal.

To facilitate the development of the planning proposal for the site, this biodiversity assessment will be used in conjunction with other environmental studies, to develop a indicative structure plan and to support the rezoning proposal.

1.2 Purpose of this report

The purpose of this report is to examine and describe the biodiversity values and constraints of the site in accordance with the Gateway Determination. The key aims of this Biodiversity Assessment Report are to:

- Identify the likelihood of occurrence of threatened flora and fauna species and their habitats that may occur within the subject site
- Identify the likelihood of occurrence of any endangered flora and fauna populations that may occur within the subject site
- Identify the vegetation communities found on the site through a combination of field surveys, existing mapping and aerial photography interpretation
- Provide a vegetation map that identifies the distribution of all vegetation communities and highlights the presence of relevant threatened ecological communities listed under NSW and Commonwealth legislation
- Identify and map areas of biodiversity value within the subject site, based on a variety of ecological factors that can be utilised for the development of the rezoning proposal and its consideration by Hornsby Shire Council.

1.3 Site context

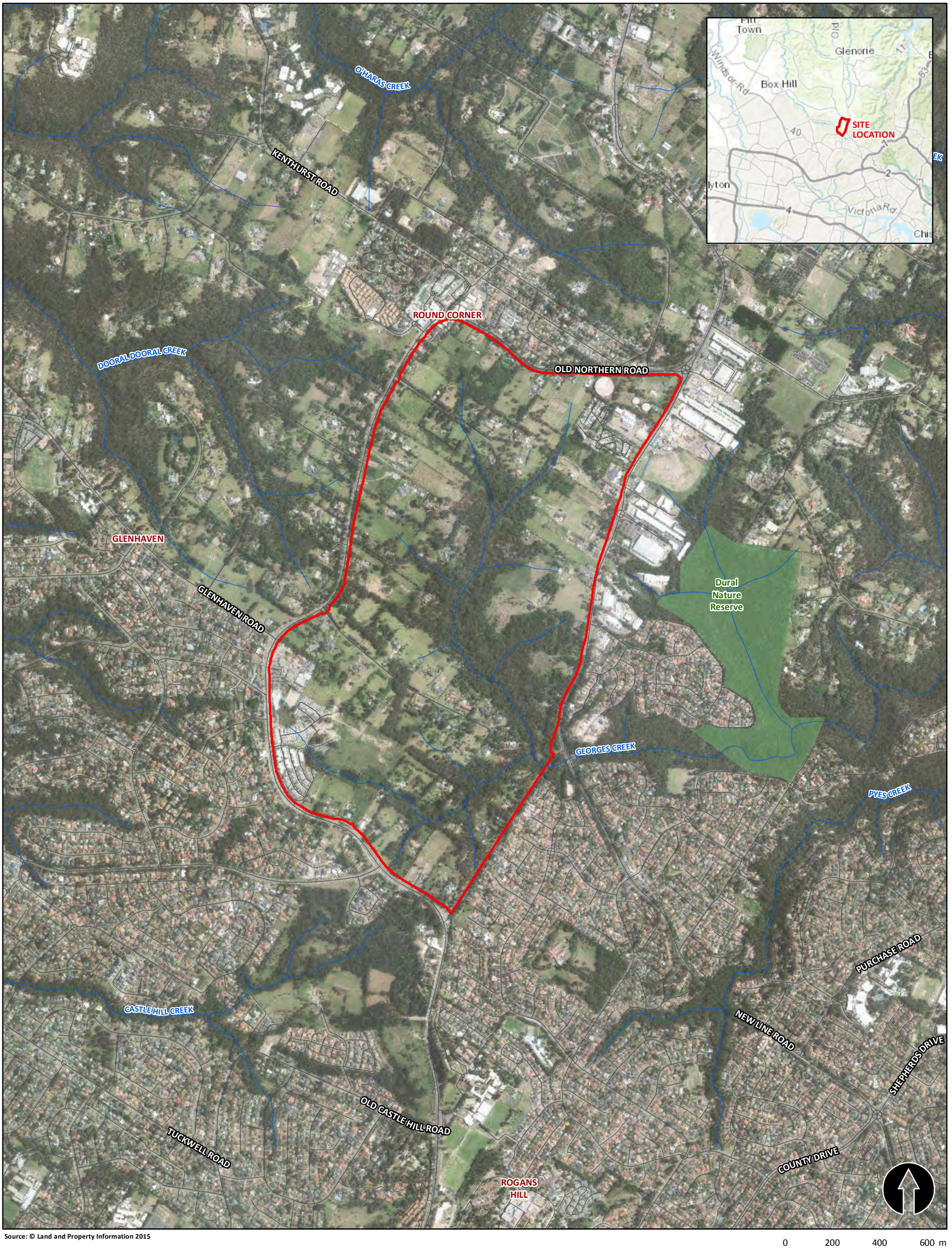
The subject of this report is the biodiversity characteristics of a large land parcel bordered by Old Northern Road, Hastings Road and New Line Road in South Dural, NSW (subject site). The subject site is located in the suburbs of Dural and Castle Hill within the Hornsby Shire Council Local Government Area (LGA), approximately 30 km north-west of the Sydney Central Business District.

The subject site occupies approximately 238 hectares (ha) and current land uses include residential properties, small hobby farms, a retirement village and a variety of commercial premises. The subject site is relatively compact and roughly rectangular in shape. It contains two main internal public roads (Wayfield Road and Franlee Road) and a small road network which services the retirement village.

All elevated areas within the subject generally slope down towards the main channel of Georges Creek which flows in a north-west direction across. Several smaller tributaries branch in a variety of directions from the main channel. The main channel of Georges Creek is largely within a heavily forested gully containing substantial sandstone outcropping. Other waterbodies within the subject site consist of artificial dams which occurs largely in cleared areas of native vegetation.

Native vegetation has previously been cleared from large areas of the site which lie outside of the larger gully and riparian areas, particularly in the west and north-east. The remaining remnant native vegetation generally consists of relatively narrow bands and small patches of forest and isolated remnant trees interspersed with areas of exotic grassland, landscape plantings and residential and commercial development.

Previous studies identified the presence of two threatened ecological communities (Blue Gum High Forest and Sydney Turpentine Ironbark Forest) and one threatened plant species (*Epacris purpurascens* var. *purpurascens*) as occurring within the subject site.



\\APSYDFIL03\proj\A\APP_Corporation\2267036A_SOUTH_DURAL_ECO_STUDY\10_GIS\Projects_Drawings_Figures_Sketches\2267036A_GIS_F007_A2.mxd Author: mitchellem 30/03/2016

Source: © Land and Property Information 2015

0 200 400 600 m

- Waterways
- Roads
- National Parks and Wildlife Services estate
- Study area

Figure 1.1
Project locality and subject site

2 LEGISLATIVE CONTEXT

Commonwealth and State legislation relevant to the protection of biodiversity and this proposal are outlined briefly below. These statutory instruments provide conditions, matters for consideration and requirements to seek authorisation (licences and approvals) to undertake various actions and activities.

2.1 Commonwealth legislation

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, any action that has, would have, or is likely to have a significant impact on a Matter of National Environmental Significance or on Commonwealth land, triggers the Act and may require assessment and approval from the Commonwealth Minister for the Environment.

The nine matters of national environmental significance protected under the *Environment Protection and Biodiversity Conservation Act 1999* are:

- Listed threatened species and ecological communities
- Listed migratory species
- Wetlands of international importance (listed under the Ramsar Convention)
- Commonwealth marine areas
- World heritage properties
- National heritage places
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines)
- A water resource, in relation to coal seam gas development and large coal mining development.

2.2 State legislation

2.2.1 Threatened Species Conservation Act 1995

The Office of Environment and Heritage administers the *Threatened Species Conservation Act 1995*. The *Threatened Species Conservation Act 1995* seeks to protect certain classes of threatened wildlife including threatened species, threatened populations and threatened ecological communities.

Under the Commonwealth *Threatened Species Conservation Act 1995*, any action that has, would have, or is likely to have a significant impact, triggers the Act and requires a species impact statement to be prepared for projects assessed under Part 4 and Part 5 of the *Environmental Planning and Assessment Act 1979*. The content of a species impact statement is outlined in Sections 110–112 of the *Threatened Species Conservation Act 1995* and includes requesting Director-General's requirements.

2.2.2 Fisheries Management Act 1994

The *Fisheries Management Act 1994* establishes provisions for the identification, conservation and recovery of threatened fish, aquatic invertebrates and marine vegetation. The Act also covers the identification and management of key threatening processes which affect threatened species or could cause other species to become threatened (Department of Industry and Investment 2010b).

The Minister for the Department of Primary Industries would need to be notified of any proposed dredging (Part 7 Division 3 of the *Fisheries Management Act 1994*) or reclamation works in accordance with Section 199 of the Act. Part 7, Division 8 clause 219 and 220 of the *Fisheries Management Act 1994* relate to the blockage of a fish passage. If this is required at any stage during the works, a permit is to be sought from the Minister for the Department of Primary Industries under the Act.

2.2.3 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* establishes a system for the identification and control of noxious weeds in NSW. The Act divides noxious weeds into four categories which determine the level of control required. Responsibility for the control of noxious weeds lies with the owner and/or occupier of private land and Crown land, local councils and other public authorities on land they occupy. Under the Act, the Minister for the Department of Primary Industries may declare a plant to be a noxious weed. Control notices can be issued by the Minister and local control authorities to ensure obligations are met.

2.2.4 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* is administered by the Office of Environment and Heritage. It contains provisions that relate to the protection of native terrestrial fauna and some flora and threatened ecological communities. Under the Act it is an offence to harm threatened biodiversity or habitats protected under the Act unless the action is licensed under the *Threatened Species Conservation Act 1995* or is essential for carrying out an activity by a determining authority within the meaning of the *Environmental Planning and Assessment Act 1979* if the determining authority has complied with that Part. Under Section 171 of the Act the Chief Executive of the Office of Environment and Heritage may authorise the harming of threatened and protected flora and fauna species and habitats.

2.3 New Biodiversity reforms

On 3 May 2016 the NSW Government released a draft Biodiversity Conservation Bill. This bill would repeal the TSC Act and the NP&W Act (animal and plant provisions only). Key changes include:

→ New biodiversity assessment methodology (BAM) which:

- seeks to establish a single, uniform biodiversity assessment pathway for NSW and replace other existing approaches
- provides for a threshold of "serious and irreversible impacts". Development which has such impacts will not be permitted, unless it is a major project and the relevant approval authority decides it may proceed despite having those impacts.
- will streamline the biodiversity assessment process for:
  - development under the EP&A Act which is likely to significantly affect threatened species, populations and ecological communities and their habitats
  - development which meets or exceeds the proposed BAM threshold criteria; and
  - clearing of native vegetation under the *Local Land Services Act* that requires approval.

→ New biodiversity offsets scheme- The BAM will assist proponents to avoid and then minimise development impacts. If offsets are required for a development proposal, they will be calculated using the new BAM. The new offsets scheme provides:

- a new simplified method for calculating offsets.
- the option to pay into a Biodiversity Conservation Fund to meet offset obligations.

→ Revised biodiversity certification

- to encourage assessment of biodiversity values at early planning stages landowners, not only planning authorities, will be able to apply for biodiversity certification which allows areas of high conservation value to be identified, avoided and protected while identifying areas suitable for clearing and development.

The BAM is still in development and at this stage is unlikely to be finalised until mid to late 2017. The transition provisions for assessment and offsetting have not yet been determined.

2.4 Riparian corridors on waterfront land guidelines

The NSW Office of Water has developed a set of guidelines for riparian corridors on waterfront lands which are regulated under the *Water Management Act 2000*. These guidelines aim to establish and preserve the integrity of riparian corridors to retain or improve environmental function via a set or principals. Controlled actions should be undertaken in accordance with these guidelines in order to minimise impacts on riparian corridors. There are a number of activities allowed to occur on water front lands and in riparian corridors however these must first be approved under the *Water Management Act 2000* and other relevant legislation.

The subject site contains one minor stream (Georges Creek) which occurs as a first, second and third order stream. The associated vegetation riparian zones (VPZ) for each of these orders is provided in Table 2.1.

Table 2.1 Vegetated riparian zones

WATER COURSE TYPE	VEGETATED RIPARIAN ZONE (EACH SIDE OF WATER COURSE)
1st order	10 m
2nd order	20 m
3rd order	30 m

3 METHODOLOGY

This Biodiversity Assessment Report is based on desk-based searches of relevant databases containing previous threatened species records, previous ecological studies and vegetation mapping of the subject site and field survey results. This section outlines the specific methods used to survey and assess biodiversity within and surrounding the site.

3.1 Definitions

For the purpose of this report the following definitions apply:

- **Proposal:** the South Dural Planning Proposal outlined in Section 1.1.
- **Subject site:** is defined as the land parcels bounded by Hastings Road in the south, New Line Road to the east and Old Northern Road to the west and north, in Dural, Glenhaven and Castle Hill, NSW.
- **Locality:** is a 10 km radius from the subject site.
- **Region:** a bioregion defined in a national system of bioregionalisation. For this study this is the Sydney Basin bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway, R & Cresswell 1995a).

All other definitions are provided in the Glossary at the start of this document. The project locality and subject site are shown in Figure 1.1.

3.2 Personnel

The contributors to the preparation of this report, their qualifications and roles are listed in Table 3.1.

Table 3.1 Contributors and their roles

NAME	QUALIFICATION	ROLE
Paul Rossington	BSc, MWldMgt	Senior Ecologist – field survey, report preparation
Tanya Bangel	BSc (Hons), Dip CLM	Ecologist – field survey, report preparation
Alex Cockerill	BSc (Hons)	Principal Ecologist – Project lead and technical review
Emily Mitchell	BDevSt	GIS Consultant – map preparation

All work was carried out under the appropriate licences, including a scientific licence as required under Clause 22 of the National Parks and Wildlife Regulations 2002 and Section 132C of the *National Parks and Wildlife Act 1974,* and an Animal Research Authority issued by the Department of Primary Industries (Agriculture).

3.3 Nomenclature

Names of vegetation communities used in this report are based on the Plant Community Types (PCTs) used in the NSW Vegetation Information System (VIS) Classification 2.1 Database (Office of Environment and Heritage 2016c).

These names are cross-referenced with those used for threatened ecological communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). They are also cross-referenced with existing vegetation mapping using dominant species and structure of the communities in:

- Native vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer *et al.* 2006).
- Native Vegetation Communities of the Hornsby Shire and the 2008 Update (Smith & Smith 2007, 2008).
- Proposed Rezoning of Land – Old Northern Road, Hastings Road and New Line Road, South Dural (Hayes Environmental 2009).

Names of plants used in this document follow Harden (Harden 1992, 1993, 2000, 2002) with reference to PlantNet Royal Botanic Gardens (Royal Botanic Gardens 2016) for recent taxonomic changes. Scientific names are used in this report for species of plant. Scientific and common names (where available) are provided in plant lists in Appendices A. The names of introduced species are denoted with an asterisk (*).

For threatened species of plants, the names used in the OEH Threatened Species Website (Office of Environment and Heritage 2016b) are also provided in the tabulated data in Appendices A where these differ from the names used by Harden or the PlantNet database.

Names of vertebrate fauna follow the Australian Faunal Directory maintained by the Department of the Environment (Department of the Environment 2016a). Common names are used in the report for species of animal. Scientific names are included in species lists found in Appendix B.

3.4 Desktop study

A desktop study was conducted to identify:

- The likely distribution of vegetation communities, based on previous mapping, LIDAR mapping (RPS 2016) and aerial photograph interpretation, for targeted field verification
- A list of threatened species and populations of plants to consider during vegetation surveys and habitat assessment
- A list of threatened species and populations of animals and migratory animals to consider during field-based habitat assessment
- Local landscape-scale features of potential significance to biodiversity; e.g. riparian zones and potential wildlife movement corridors.

The desktop study included analysis of the following information sources:

- Topographic map and aerial photographs.
- LIDAR mapping and surveyor mark-ups completed by RPS (2016).
- Hornsby Shire Council LEP 2013 & Hills Shire Council LEP 2012.
- Noxious weed declarations online database NSW Department of Trade and Investment (Department of Primary Industries (Agriculture) 2016).
- Previous vegetation mapping, ecological studies and other relevant studies of the subject site:
  - Native Vegetation Communities of the Hornsby Shire and the 2008 Update (Smith & Smith 2007, 2008).
  - Native vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands (Tozer *et al.* 2006).
  - Proposed Rezoning of Land – Old Northern Road, Hastings Road and New Line Road, South Dural (Hayes Environmental 2009).
  - Gateway Determination planning proposal (agency reference: PP_2014_HORNS_002_00) to rezone land in South Dural for urban development (Department of Planning and Infrastructure 2014).
  - Bushfire Planning Investigation – Proposed rezoning of land in South Dural (BES 2009).

In addition to the literature listed above database searches of threatened species, populations and communities were conducted in the locality and are summarised below in Table 3.2.

Table 3.2 Database searches

DATABASE	SEARCH DATE	AREA SEARCHES	REFERENCE
PlantNet Database	4/03/2016	10 km radius around Dural and Castle Hill suburbs	Royal Botanic Gardens (2016)
BioNet	8/02/2016	10 km x 10 km centred on the subject site)	Office of Environment and Heritage (2016a)
EPBC Protected Matters Search Tool	21/12/2016	10 km x 10 km centred on the subject site)	Department of the Environment (2016b)
NSW Department of Primary Industries (Fishing and Aquaculture) threatened Aquatic Fauna Database	4/03/2016	Hornsby LGA	Department of Primary Industries (2016)

3.4.1.1 DESKTOP ANALYSIS OF VEGETATION

Preliminary mapping of vegetation community boundaries was undertaken through analysis of existing vegetation mapping and aerial photograph interpretation. Analysis of the aerial photographs was used to identify areas of disturbance (e.g. buildings, vehicle tracks, dams and power lines), vegetation structure and likely native versus exotic species composition throughout the site. This provided an initial definition of vegetation communities into simple structural and disturbance classifications for verification during field surveys.

Where access to vegetation was not available during the survey period vegetation community distribution was extrapolated by visual comparison of vegetation apparent in aerial photography with vegetation in areas which were subject to field survey and through consideration of landscape position and existing vegetation mapping.

Further desktop analysis of the vegetation was undertaken to refine vegetation boundaries. This analysis included a review of ground-truthed vegetation community distribution and condition mapping (WSP | Parsons Brinckerhoff 2016), LIDAR foliage cover mapping (RPS 2016), surveyor LIDAR ground-truthing results (RPS 2016) and aerial interpretation. Broad principals adopted included:

- In areas where access was not available LIDAR foliage cover mapping and aerial interpretation was used to define vegetation boundaries and broad-scale mapping was used to determine vegetation type
- LIDAR foliage cover mapping used to define vegetation boundaries in areas where it reflects ground-truthed surveys
- WSP | Parsons Brinckerhoff mapping used in areas where LIDAR foliage cover was inaccurate i.e. did not record native vegetation or had mapped areas of exotic vegetation
- Surveyor's mark-ups (i.e. scattered trees and vegetation boundaries) was used in areas where vegetation had been ground-thruthed using accurate GPS equipment (RPS 2016).

Results from the LIDAR, ground-thruthing surveys and aerial interpretation were used to produce the final vegetation and conservation significance maps (Figure 4.1 and Figure 6.1).

3.5 Field survey

Field surveys were undertaken from the 15th to the 19th of February 2016, 10th, 17th and 21st March 2016 and 18th and 19th May 2016. These surveys sought primarily to assess the extent and condition of vegetation and fauna habitat, especially for threatened species and ecological communities. The vegetation inspection was used to identify variations in vegetation condition that were not apparent in existing vegetation mapping and to refine vegetation community boundaries. Native vegetation condition was assessed with regard to the

diversity and abundance of native and introduced plant species, vegetation structural complexity and the abundance of mature trees.

The field surveys undertaken are described in Sections 2.5.1 to Section 2.7.

3.5.1 Flora

The floristic diversity and possible presence of threatened species was assessed using a combination of random meander, rapid data points and plot-based (quadrat) surveys generally in accordance with the NSW *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft*) and BioBanking Assessment Methodology (BBAM) (*BioBanking Assessment Methodology 2014* 2014).

3.5.1.1 FIELD VERIFICATION OF EXISTING VEGETATION

Vegetation within the subject site and locality has been mapped at the regional scale in the *'Native Vegetation Communities of the Hornsby Shire'* and 2008 update (Smith & Smith 2007, 2008) and '*Native vegetation of the Southeast NSW: Revised Classification and Map for the Coast and Eastern Tablelands'* (Tozer *et al.* 2006). Additionally the subject site has been previously mapped in a site-specific ecological report prepared by Hayes Environmental (2009).

Field validation (ground-truthing) of the initial vegetation classifications identified from aerial photograph interpretation and existing vegetation mapping Hayes Environmental (2009); (Smith & Smith 2007, 2008; Tozer *et al.* 2006) was undertaken to determine the vegetation types present, their condition and their relationship to threatened ecological community listings under NSW and Commonwealth legislation.

Further surveys were undertaken to refine the vegetation boundaries using LIDAR foliage cover mapping obtained from a fixed-wing aircraft (RPS 2016). The LIDAR foliage cover was ground-truthed in a number of locations with two surveyors to verify accuracy. Results from the LIDAR, ground-truthing surveys and aerial interpretation were used to produce the final vegetation and conservational significance maps (Figure 4.1 and Figure 6.1). Refer Section 2.4.1.1 for further details.

3.5.1.2 QUADRATS

Sixteen quantitative (quadrat/transect) site surveys (Table 3.3) were completed as outlined in the procedure contained in the BBAM (Office of Environment and Heritage 2014a) and described below.

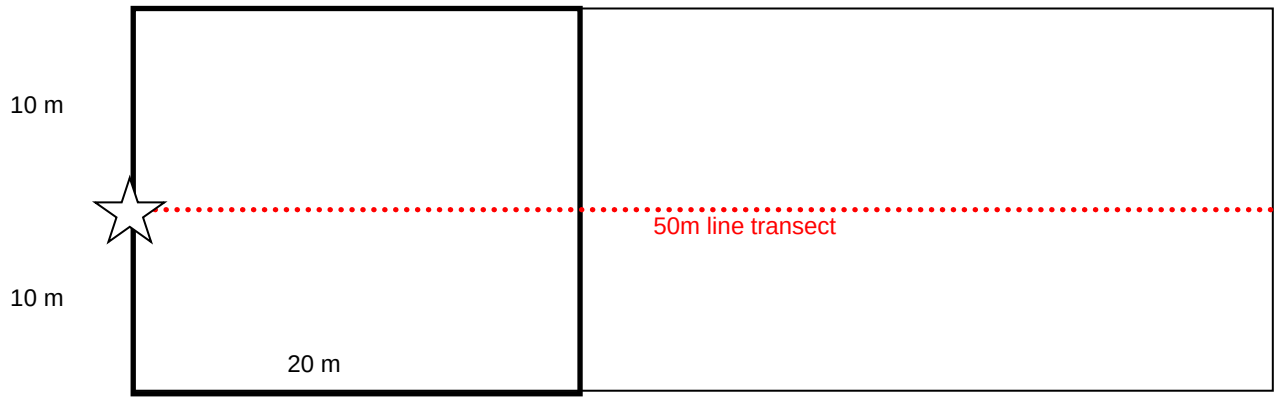


Figure 3.1 Schematic diagram illustrating the layout of the nested 20 m x 50 m and 20 m x 20 m quadrats used the assessment of condition attributes at each site

The following attributes were recorded at each site:

- Location (easting – northing grid type MGA 94, Zone 56).
- Vegetation structure, dominant species and vegetation condition.
- Native and exotic species richness (within a 400 m^2 quadrat): this consisted of recording all species by systematically walking through each 20 m x 20 m quadrat. The cover abundance of each species was estimated.
- Number of trees with hollows (1,000 m^2 quadrat): number of living and dead hollow-bearing trees within each 50 m x 20 m quadrat. A hollow was only recorded if:
  - the entrance could be seen
  - the estimated entrance width was at least 5 cm across
  - the hollow appeared to have depth
  - the hollow was at least 1 m above the ground
  - the centre of the tree was located within the sampled quadrat.
- Total length of fallen logs (1,000 m^2 quadrat): the cumulative total of logs within each 50 m x 20 m quadrat with a diameter of at least 10 cm and a length of at least 0.5 m.
- Native over-storey cover: a visual estimation of the percentage cover (projected foliage cover) of the tallest woody stratum present (>1 m and including emergents); includes both locally indigenous species, and species that are native to NSW but are not locally indigenous.
- Native mid-storey cover: this involved estimating the cover of vegetation between the over-storey stratum and a height of 1 m (i.e. tall shrubs, under-storey trees and tree regeneration).
- Ground cover: this comprised estimating the cover of plants below 1 m in height. The following categories of plants were recorded:
  - native ground cover (grasses): native grasses (Poaceae family native to NSW)
  - native ground cover (shrubs): all woody vegetation below one metre in height and native to NSW
  - native ground cover (other): non-woody vegetation (i.e. vascular plants–ferns and herbs) below one metre in height and native to NSW
  - exotic plant cover: vascular plants not native to Australia.
- Evaluation of regeneration: the estimated proportion of over-storey species present at the site that were regenerating (i.e. saplings with a diameter at breast height ≤5 cm). The maximum value for this measure is one.

Table 3.3 Location of BBAM quadrats/transects

QUADRAT/ TRANSECT ID	VEGETATION COMMUNITY	EASTING[1]	NOTHING[1]	TRANSECT ORIENTATION
BB1	Blackbutt Gully Forest	316742	6268326	130º
BB2	Sydney Turpentine Ironbark Forest	316527	6269189	200º
BB3	Sydney Turpentine Ironbark Forest	316677	6369635	105º
BB4	Sydney Turpentine Ironbark Forest	316837	6269357	20º
BB5	Sydney Turpentine Ironbark Forest	316874	6269475	200º
BB6	Sydney Turpentine Ironbark Forest	316409	6268715	330º
BB7	Blackbutt Gully Forest	316463	6268706	10º
BB8	Sydney Turpentine Ironbark Forest	316250	6268493	105º

QUADRAT/ TRANSECT ID	VEGETATION COMMUNITY	EASTING[1]	NOTHING[1]	TRANSECT ORIENTATION
BB9	Sydney Turpentine Ironbark Forest	316046	6268900	115º
BB10	Sydney Turpentine Ironbark Forest	316907	6268676	15º
BB11	Sydney Turpentine Ironbark Forest	317012	6268683	290º
BB12	Sydney Turpentine Ironbark Forest	316180	6269628	33º
BB13	Sydney Turpentine Ironbark Forest	316866	6269053	320º
BB14	Shale Sandstone Transition Forest	316554	6267684	100º
BB15	Sydney Turpentine Ironbark Forest	316091	6268715	90º
BB16	Sydney Turpentine Ironbark Forest	316342	6267914	300º

(1) GDS 94: Zone 56.

3.5.1.3 RANDOM MEANDER SURVEYS

Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random meander throughout the site recording dominant and key plant species (e.g. threatened species, noxious weeds), boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

3.5.1.4 RAPID DATA POINTS

Fourteen rapid data points were completed within the subject site and in some locations undertaken from a distance with the aid of binoculars (Figure 4.1). Data collected as part of the rapid data points included inferred vegetation community, general soil characteristics, condition of vegetation, and dominant species of the canopy, shrub and where possible groundcover strata.

3.5.2 Fauna

Fauna surveys were undertaken in conjunction with the flora surveys. The fauna surveys included habitat assessments as well as threatened species targeted diurnal and nocturnal surveys of the subject site. These surveys sought to primarily to identify fauna habitat characteristics present within the subject site.

3.5.2.1 FAUNA HABITAT ASSESSMENT

Fauna habitat assessments were undertaken to assess the likelihood of threatened species of animal (those species known or predicted to occur within the locality from the literature and database review) occurring within the subject site. Fauna habitat assessments were the primary assessment tool in assessing whether threatened species likely to occur within the subject site. Fauna habitat characteristics assessed included:

- Structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources (including Koala feed trees)
- Presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, birds and reptiles
- Presence of the ground cover vegetation, leaf litter, rock outcrops and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians
- Presence of waterways (ephemeral or permanent) and water bodies.

The following criteria were used to evaluate the condition of habitat values:

- **Good:** A full range of fauna habitat components are usually present (for example, old-growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
- **Moderate:** Some fauna habitat components are missing or greatly reduced (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
- **Poor:** Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive clearing in the past.

3.5.2.2 OPPORTUNISTIC SNAIL SEARCHES

Threatened snail searches were undertaken intermittingly in conjunction with other surveys where suitable sheltering micro-habitat (e.g. loosely embedded rocks and logs) was found. These searches included actively searching areas where suitable habitat was found by hand turning and replacing logs, leaf litter and other debris.

3.5.2.3 KOALA HABITAT ASSESSMENTS

Koala habitat assessments were undertaken within the subject site. Koala habitat assessments were primarily based on the vegetation types and vegetation condition within the subject site i.e. structure and floristic characteristics.

During the survey, Koala feed tree species' locations and densities were noted when identified. In addition some Koala food trees were inspected for signs of Koala usage i.e. trees were inspected for presence of Koalas, scratch and claw marks in the trunk and scats around the base of each trees; these surveys were undertaken opportunistically in conjunction with other surveys.

3.5.2.4 SPOTLIGHTING AND CALL PLAY BACK

Spotlighting was used to target arboreal, flying and large ground-dwelling mammals, as well as nocturnal birds, reptiles and amphibians. Spotlighting was completed after dusk in four locations across the subject site focusing predominantly along Georges Creek and patches of remnant vegetation where fauna habitat attributes where highest. Spotlight surveys involved two persons searching transects of a length of approximately 1 km over the course of one hour. The survey concentrated on areas that contain suitable habitat for nocturnal species, with sighted animals identified to the species level.

Call playback was used to survey for the targeted species using standard methods (Debus 1995; Kavanagh & Debus 1994). Call playback was done after dusk at four locations in the study area (same four locations where spotlighting was undertaken).

During the survey an initial listening period of 10 to 15 minutes was undertaken, followed by a spotlight search for 10 minutes to detect any animals in the immediate vicinity. The calls of the target species were then played intermittently for five minutes (Powerful Owl, Sooty Owl, Barking Owl, Masked Owl, Koala and Yellow-bellied Glider) followed by a 10 minute listening period. After the calls were played, another 10 minutes of spotlighting was done in the vicinity to check for animals attracted by the calls, but not vocalising. Calls from Stewart (1998) were broadcast using an MP3 player and amplified through a megaphone.

3.5.2.5 REMOTE CAMERA TRAPPING

Remote cameras traps were strategically established in areas likely to be used as movement pathways by native wildlife such as above waterways and established animal tracks. Cameras are triggered by animal motion and operated and day and night to record targeted species included Spotted-tailed Quoll and Heath Monitor. Two remote cameras (Reconyx HC600) were established in the subject site for a period of four nights.

3.5.2.6 ANABAT DETECTION

Four AnaBat Express units where established in four locations within the subject site each for two consecutive nights to capture ultrasonic echolocation calls for microchipoteran bat species identification and activity monitoring.

3.5.2.7 OPPORTUNISTIC RECORDING OF ANIMALS AND EVIDENCE OF ANIMAL ACTIVITY

Opportunistic sightings of animals were recorded including diurnal birds and reptiles. Evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows etc., was also noted. This provided indirect information on animal presence and activity.

3.6 Likelihood of occurrence assessment

The likelihood of threatened and migratory and threatened species populations occurring within the study area was assessed against the criteria outlined in Table 3.4.

Species subject to likelihood of occurrence assessments were those identified during the desktop and field-based investigations and any additional species considered having the potential to occur in the professional opinion of contributors to this assessment.

Table 3.4 Likelihood of occurrence assessment

LIKELIHOOD OF OCCURRENCE	CRITERIA
Known	→ The species was observed in the study area either during the current survey or during another recent survey.
High	A species has a high likelihood of occurrence if: → the study area contains or forms part of a large area of high quality suitable habitat → important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are abundant within the study area → the species has been recorded recently in similar habitat in the locality → the study area is likely to support a resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration.
Moderate	A species has a moderate likelihood of occurrence if: → the study area contains or forms part of a small area of high quality suitable habitat → the study area contains or forms part of a large area of marginal habitat → important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are sparse or absent within the study area → the study area is unlikely to support a resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration but is likely to be used occasionally during seasonal movements and/or dispersal.

LIKELIHOOD OF OCCURRENCE	CRITERIA
Low	A species has a moderate likelihood of occurrence if: → potentially suitable habitat exists but the species has not been recorded recently (previous 10 years) in the locality despite intensive survey (i.e. the species is considered to be locally extinct) → the species is considered to be a rare vagrant, likely only to visit the study area very rarely; e.g. during juvenile dispersal or exceptional climatic conditions (e.g. extreme drought conditions in typical habitat of inland birds).
None	→ Potentially suitable habitat is absent from the study area.

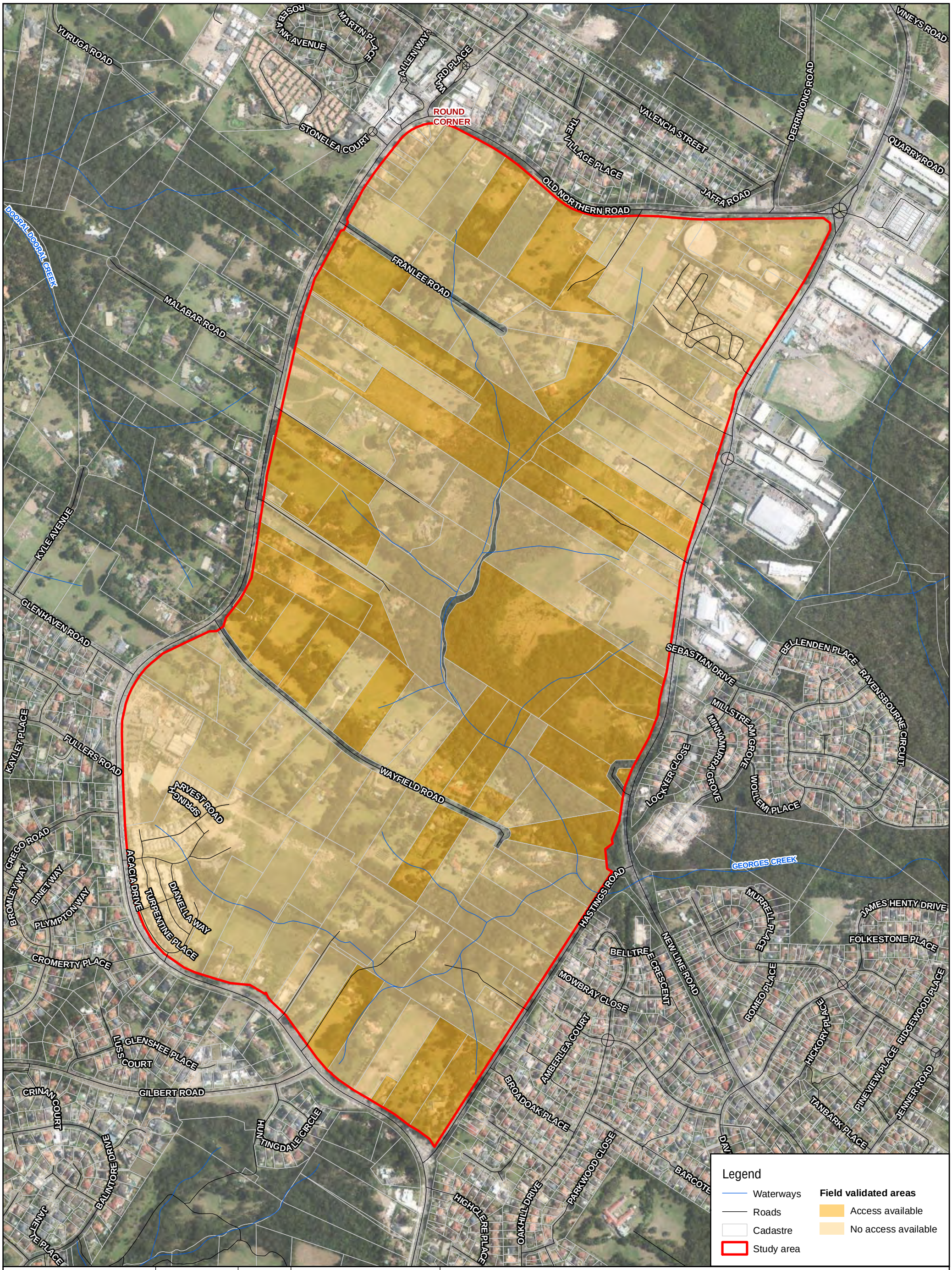
3.7 Limitations

The subject site is composed of over 100 land parcels. Access was not available to all land parcels at the time of the survey. The access that was available during the survey period is illustrated in Figure 3.2. Consequently, large areas within the subject site could not be accessed or verified. Access was also restricted in a number of locations as a result of dense patches of woody exotic vegetation i.e. *Lantana camara** and *Ligustrum* spp.*.

Where access on foot was restricted or limited but adjacent areas were accessible, vegetation community boundaries, condition and threatened flora and fauna habitat attributes were extrapolated from a distance with the aid of binoculars. Where the vegetation could not be viewed existing vegetation mapping of the area, aerial photo interpretation and LIDAR foliage cover mapping was used.

Even where field surveys are undertaken, no sampling technique can totally eliminate the possibility that a species is present on a site. For example, some species of plant may be present in the soil seed bank and some fauna species use habitats on a sporadic or seasonal basis and may not be present on site during surveys. Where surveys were conducted outside the optimal time for detecting a particular species, or field surveys were of limited scope, a precautionary approach was taken and it was assumed that the species was present if suitable habitat was observed. Similarly, for areas of vegetation that were not accessible for field verification, vegetation was presumed to be of the community shown in what was considered to be the most accurate available pre-existing vegetation mapping.

The conclusions in this report are based upon the limited data acquired for the site during environmental field surveys and desktop assessment and are, therefore, merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of species and the distribution of vegetation types. Also, it should be recognised that site conditions, including the presence of threatened species, can change with time.



Map: 2267036A_GIS_F008_A3	Author: mitchellem	
Date: 15/07/2016	Approved by: -	

Data source: © Land and Property Information 2015

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Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

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Figure 3.2
Available property access

4 EXISTING ENVIRONMENT

The topography of the subject site predominantly consists of undulating shallow incline slopes which converge along the Georges Creek. Soil on the upper slopes of the subject site appears to be influenced by shale lenses interbedded with sandstone transitioning to pure sandstone as elevations lower towards Georges Creek.

The subject site is currently utilised for residential properties, small hobby farms, small businesses and a retirement village. These land uses extend to the adjacent land which also includes large remnants of native vegetation, schools and commercial areas.

Broad subject site classification criteria are listed in Table 4.1.

Table 4.1 Broad subject site classification criteria

CRITERIA	LOCATION
Council	Hornsby Shire Council Local Government Area Hills Shire Council Local Government Area
Bioregion; subregions	Sydney Basin; Pittwater and Cumberland subregions
Catchment Management Area (CMA); subregions	Hawkesbury Nepean CMA
Botanical subdivision	Central Coast
Mitchell Landscape	Pennant Hills Ridges and Hornsby Plateau
Noxious Weed Control Area	The Council of the Shire of Hornsby

4.1 Vegetation communities

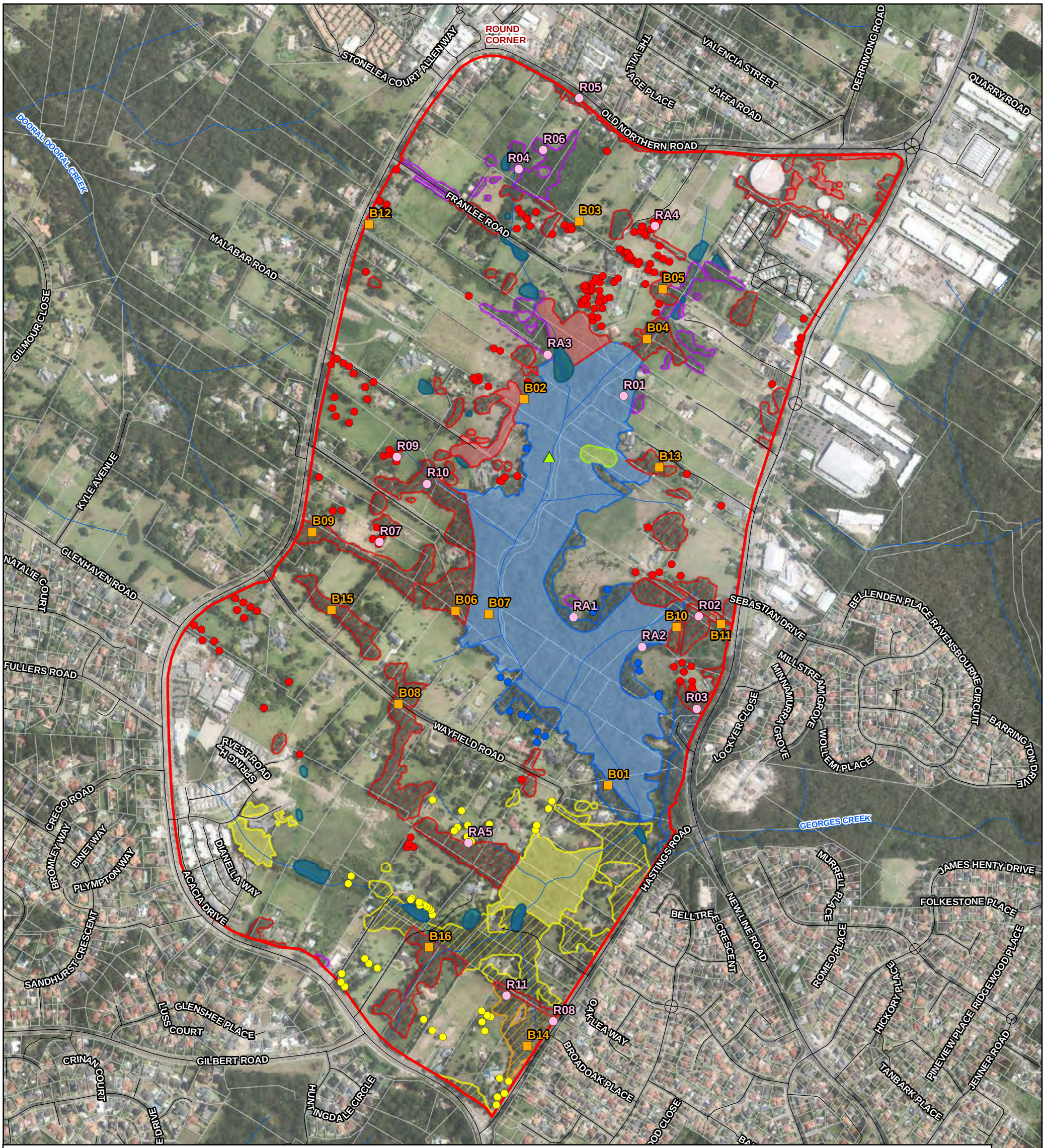
Desktop analysis of the exiting vegetation mapping and ground-truthing during field surveys identified six vegetation communities as being present within the subject site. One of these communities is a non-native vegetation assemblage.

Table 4.2 below lists the vegetation communities, whilst their extent within the subject site is illustrated in Figure 4.1.

Table 4.2 Vegetation communities mapped within the subject site

VEGETATION COMMUNITIES RECORDED WITHIN THE SUBJECT SITE	NSW PLANT COMMUNITIY TYPE ID[1]	BIOMETRIC VEGETATION TYPE ID[1]	HAYES MAPPING[2]	HORNSBY SHIRE VEGETATION MAPPING[3]	NATIVE VEGETATION OF SOUTHEAST NSW[4]	THREATENED ECOLOGICAL COMMUNITY	EXTANT (HA)
Blackbutt Gully Forest	PCT1181: Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest in sandstone gullies of western Sydney, Sydney Basin	HN586	Blackbutt Gully Forest	Blackbutt Gully Forest (Community L1)	Hinterland Sandstone Gully Forest (DSF p152)	Not listed	29.7
Sydney Turpentine Ironbark Forest	PCT 1281: Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	HN604	Sydney Turpentine Ironbark Forest	Turpentine-Ironbark Forest (Community TI)	Sydney Turpentine Ironbark Forest (WSF p87)	Sydney turpentine-ironbark forest (Endangered – TSC Act) Turpentine-Ironbark Forest in the Sydney Basin Bioregion (Critically Endangered – EPBC Act)	22.0
Shale Sandstone Transition Forest	PCT 1395: Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	HN556	Not mapped	Shale/Sandstone Transition Forest (Community SS)	Cumberland Shale Sandstone Transition Forest (GW p2)	Shale/sandstone transition forest (Endangered – TSC Act) Shale Sandstone Transition Forest in the Sydney Basin Bioregion (Endangered – EPBC Act)	1.4
Blue Gum High Forest	PCT 1237: Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion	HN596	Blue Gum High Forest	Blue Gum Shale Forest (Community BG1)	Blue Gum High Forest (WSF p153)	Blue Gum High Forest of the Sydney Basin Bioregion (Critically Endangered - TSC Act and EPBC Act)	10.5
Acacia regrowth	–	–	Not mapped	Not mapped	Not mapped	Not listed	3.6
Highly disturbed areas with no or limited native vegetation	–	–	Not mapped	Not mapped	NV: Modified or Disturbed Land	Not listed	169.1

(2) Sourced from Vegetation Information System (VIS) Classification 2.1 (Office of Environment and Heritage 2016c)
(3) Sourced from previous field validated ecological study undertaken within the subject site (Hayes Environmental 2009)
(4) Sourced from Native Vegetation Communities of the Hornsby Shire (Smith & Smith 2007, 2008)
(5) Sourced from Native Vegetation of southeast NSW (Tozer *et al.* 2010; Tozer *et al.* 2006)
(6) TSC Act = *Threatened Species Conservation Act 1995*, EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*.



Legend

- Waterways
- Roads
- Cadastre
- Study area

Vegetation survey points

- Survey plot
- Rapid assessment point

Threatened species of plant

- *Epacris purpurascens var. purpurascens*
- *Epacris purpurascens var. purpurascens patch (approximate)*

Scattered trees

- Blackbutt Gully Forest (Poor condition)
- Blue Gum High Forest (CEEC) (Poor condition)
- Sydney Turpentine Ironbark Forest (CEEC) (Poor condition)

Vegetation communities

- Acacia regrowth
- Blackbutt Gully Forest (Good condition)
- Blackbutt Gully Forest (Moderate condition)
- Blackbutt Gully Forest (Poor condition)
- Blue Gum High Forest (CEEC) (Good condition)
- Blue Gum High Forest (CEEC) (Moderate condition)
- Shale Sandstone Transition Forest (CEEC) (Moderate condition)
- Sydney Turpentine Ironbark Forest (CEEC) (Good condition)
- Sydney Turpentine Ironbark Forest (CEEC) (Moderate condition)
- Sydney Turpentine Ironbark Forest (CEEC) (Poor condition)

Miscellaneous ecosystems

- Water bodies, rivers, lakes, streams (not wetlands)
- Highly disturbed areas with no or limited native vegetation

Map: 2267036A_GIS_F005_A6	Author: mitchellem
Date: 15/07/2016	Approved by: -

Data source: © Land and Property Information 2015

0 120 240 m

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Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

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Figure 4.1
Vegetation communities and threatened species of plants recorded

4.1.1 Blackbutt Gully Forest

This is the dominant vegetation type in the core of the subject site occurring predominantly within gullies associated with Georges Creek on Hawkesbury Sandstone. This community was also recorded as the dominant vegetation type in the previous ecological study (Hayes Environmental 2009). The vegetation type is generally in good to moderate condition with high native floristic diversity and relatively low weed species diversity. Some areas of this community, particularly in the north, experienced sparse to dense woody weed infestations. Despite this disturbance, much of this wed-infested vegetation is likely to have high regeneration potential under appropriate management.

A summary description of this community is provided in Table 4.3 and shown in Photo 4.1 and Photo 4.2.

Table 4.3 Summary of characteristics of Blackbutt Gully Forest

STRATA	HEIGHT RANGE (M)	FOLIAGE COVER (%)	DOMINANT SPECIES
Canopy	8–24	0–65	*Eucalyptus pilularis, Angophora costata, Syncarpia glomulifera, Eucalyptus resinifera*, *Corymbia gummifera* and *Corymbia eximia.*
Sub-canopy	2–15	0–60	*Allocasuarina torulosa, Allocasuarina littoralis, Pittosporum undulatum*, *Ceratopetalum gummiferum* and *Elaeocarpus reticulatus*. In some locations the sub-canopy is dominated by exotic species i.e. *Ligustrum lucidum** and *Ligustrum sinense**.
Shrub stratum	0.2–3	0–70	*Breynia oblongifolia, Lomatia silaifolia, Persoonia linearis, Polyscias sambucifolia, Zieria smithii, Leucopogon juniperinus, Maytenus silvestris* and *Pittosporum undulatum*. In some locations the shrub stratum is dominated by exotic species i.e. *Lantana camara**, *Ligustrum sinense** and *Ligustrum lucidum**.
Groundcover	0.1–0.6	0–80	*Dianella caerulea, Pteridium esculentum, Entolasia stricta, Lomandra longifolia, Schoenus melanostachys, Poa affinis, Smilax glyciphylla* and *Oplismenus aemulus*. In some locations the groundcover did experience high levels of weeds species including *Ehrharta erecta**, *Ligustrum sinense** saplings and *Lonicera japonica**.
NSW PCT/BVT	PCT1181/HN586: Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest in sandstone gullies of western Sydney, Sydney Basin.		
Conservational significance	High-moderate-low: This community does not form part of any listed threatened ecological community under either the TSC ACT or the EPBC Act. This community does however provide habitat for a variety of threatened flora and fauna species including *Epacris purpurascens* var. *purpurascens* which is found within this vegetation type. In addition this community also creates a substantial riparian wildlife corridor linking vegetation within the subject site to other large remnants of vegetation within the locality. Its conservation significance varies with its condition and fauna habitat value. Core areas with highly landscape connectivity values have high significance; peripheral areas in moderate and good condition have moderate significance and low condition peripheral areas are of relatively low significance.		
Condition	Good: Areas of good condition Blackbutt Gully Forest predominantly occur within the southern portion of the community's distribution. Within these areas the community has a high native species richness, low density of exotic species and is relatively intact i.e. few clearings, paths etc. Moderate: Areas of moderate condition Blackbutt Gully Forest predominantly occur along the peripheries and towards the northern portion of the community's distribution. Within these areas the community retained a canopy layer and sub-canopy however the shrub layer and groundcover were dominated by exotic species with low native species recorded.		
Extent and distribution within the site	This community covered the majority of the subject site forming a wide vegetated riparian corridor along Georges Creek covering an extant of 29.7 ha or 13% of the subject site. The community is situated in gullies on Hawkesbury Sandstone (sandstone outcropping observed within this community). This community intergrades with the Sydney Turpentine Ironbark Forest and Blue Gum High Forest communities as elevation increased and the geology begun to change i.e. higher shale influences.		

Photo 4.1 Blackbutt Gully Forest (Good condition)

Photo 4.2 Blackbutt Gully Forest (Moderate condition)

4.1.2 Sydney Turpentine Ironbark Forest

This is the second most dominant vegetation type within the subject site occurring on shale soils and undulating topography. The community generally intergrades with Blackbutt Gully Forest where the geology began to experience shale influences. This community was also recorded in the previous ecological study which identified it predominantly from within the northern portion of the subject site only (Hayes Environmental 2009). These areas were confirmed in most locations however this community was also recorded towards the southern portion of the subject site which has been previously mapped as Blue Gum High Forest.

Sydney Turpentine Ironbark Forest within the subject site is in good to poor condition and subsequently has varying levels of regeneration potential. This community in some locations contains intact floristic characteristics of most stratum (high condition) whilst some areas contain only isolated remnant trees within an otherwise agricultural landscape (low condition).

A summary description of this community is provided in Table 4.4 and shown in Photo 4.3 and Photo 4.4.

Table 4.4 Summary of characteristics of Sydney Turpentine Ironbark Forest

STRATA	HEIGHT RANGE (M)	FOLIAGE COVER (%)	DOMINANT SPECIES
Canopy	4–25	0–65	*Eucalyptus paniculata, Syncarpia glomulifera, Angophora costata, Eucalyptus punctata, Eucalyptus saligna, Eucalyptus acmenoides* and *Eucalyptus resinifera* within the occasional *Eucalyptus pilularis,* and *Corymbia gummifera*.
Sub-canopy	2–10	0–70	*Syncarpia glomulifera, Pittosporum undulatum, Acacia parramattensis, Acacia decurrens* and *Acacia implexa*. In some locations the sub-canopy is dominated by exotic species i.e. *Ligustrum lucidum** and *Ligustrum sinense*.*
Shrub stratum	0.4–4	0–70	*Bursaria spinosa, Platylobium formosum, Ozothamnus diosmifolius, Leucopogon juniperinus, Dodonaea triquetra* and juvenile *Pittosporum undulatum*. In some locations the shrub stratum is dominated by exotic species i.e. *Lantana camara** as well as *Ligustrum sinense** and *Ligustrum lucidum** juveniles.
Groundcover	0.1–1.5	0–100	*Pratia purpurascens, Microlaena stipoides, Austrostipa pubescens, Dichondra repens, Paspalidium distans, Pseuderanthemum variabile, Cyperus gracilis, Carex inversa, Themeda triandra, Eustrephus latifolius, Dianella caerulea, Entolasia stricta* and *Lomandra longifolia*. In some locations the groundcover did experience high levels of weeds species including *Ehrharta erecta*, Ligustrum sinense** saplings and *Pennisetum clandestinum**.
NSW PCT/BVT	PCT 1281/HN604: Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion.		
Conservational significance	High-moderate: This community forms part of the Sydney turpentine-ironbark forest (listed as Endangered under the TSC Act) and Turpentine-Ironbark Forest in the Sydney Basin Bioregion (listed as Critically Endangered under the EPBC Act) threatened ecological communities. This community also provides habitat for a variety of threatened flora and fauna species and creates wildlife corridors linking vegetation within the subject site to other large remnants of vegetation within the locality. Low: These areas generally small isolated patches of paddock trees with an otherwise exotic shrub and groundcover. These areas generally provided poor condition to other patches of remnant vegetation.		

Condition	Good: Areas of good condition Sydney Turpentine Ironbark Forest predominantly occur immediately adjacent to good condition Blackbutt Gully Forest. Within these areas the community has a high native species richness, low density of exotic species and is relatively intact i.e. few clearings, paths etc. Moderate: Areas of moderate condition Sydney Turpentine Ironbark Forest within the subject site are medium sized patches of remnant vegetation or vegetation along the periphery of good condition patches. Within these areas the community has an intact canopy layer and sub-canopy however the shrub layer and groundcover are dominated by exotic species with low to moderate native species diversity. Poor: Areas of low condition Sydney Turpentine Ironbark Forest occur as small patches of remnant trees within an otherwise agricultural landscape. Generally this community contained a low native species diversity.
Extent and distribution within the site	This community occurs on undulating country on shale soils covering an extant of 22.0 ha or 9% of the subject site. The community occurs on shale soils or in transitional areas where it intergrades with Hawkesbury Sandstone. This community intergrades with the Blackbutt Gully Forest, Shale Sandstone Transition Forest and Blue Gum High Forest communities.

Photo 4.3 Good-moderate condition Sydney Turpentine Ironbark Forest

Photo 4.4 Low condition Sydney Turpentine Ironbark Forest

4.1.3 Shale Sandstone Transition Forest

This vegetation type occurs in only a single location towards the intersection of Hastings Road and Old Northern Road. The community generally intergrades with Sydney Turpentine Ironbark Forest and Blue Gum High Forest where the geology experienced shale influences. This community was not recorded in the previous ecological study (Hayes Environmental 2009).

A summary description of this community is provided in Table 4.5 and shown in Photo 4.5.

Table 4.5 Summary of characteristics of Shale Sandstone Transition Forest

STRATA	HEIGHT RANGE (M)	FOLIAGE COVER (%)	DOMINANT SPECIES
Canopy	12–23	20–30	*Eucalyptus tereticornis* (dominant), *Eucalyptus paniculata, Eucalyptus punctata, Eucalyptus crebra* and *Eucalyptus saligna.*
Sub-canopy	3–10	0–5	*Pittosporum undulatum, Acacia implexa* and *Acacia parramattensis.*
Shrub stratum	1–3	0–5	*Olea europaea subsp. cuspidata**
Groundcover	0.1–1	60–80	*Microlaena stipoides, Oplismenus imbecillis, Dichondra repens* and *Pratia purpurascens*. In some locations the groundcover did experience high levels of weeds species including *Paspalum dilatatum*, Ehrharta erecta** and *Sida rhombifolia**.

NSW PCT/BVT	PCT 1395/HN556: Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin.
Conservational significance	High-moderate: This community forms part of the Shale/sandstone transition forest (listed as Endangered under the TSC Act) and Shale Sandstone Transition Forest in the Sydney Basin Bioregion (listed as Endangered under the EPBC Act) threatened ecological communities. This community also provides habitat for a variety of threatened flora and fauna species and forms part of wildlife corridors that links within the locality.
Condition	Moderate: Areas of moderate condition Shale Sandstone Transition Forest generally retained an intact canopy layer however lacked one or more other stratum i.e. sub-canopy, shrub layer and/or groundcover which are co-dominated by exotic and native species.
Extent and distribution within the site	This community occurs in only a single location towards the intersection of Hastings Road and Old Northern Road covering an extant of 1.4 ha or 1% of the subject site. The community is situated on shale soils integrating with Sydney Turpentine Ironbark Forest and Blue Gum High Forest.

Photo 4.5 Shale Sandstone Transition Forest within the subject site

4.1.4 Blue Gum High Forest

This vegetation type occurs only within the southern portion of the subject site. The community intergrades with Sydney Turpentine Ironbark Forest, Blackbutt Gully Forest and Shale Sandstone Transition Forest where the geology experience shale influences. Access to areas where this community was previously mapped was limited. As these areas could not be accessed or field verified, a precautionary approach was taken in mapping these areas in accordance with the previous vegetation mapping for the subject site (Hayes Environmental 2009). Further field verification would be required to confirm this community's presence.

A summary description of this community is provided in Table 4.6 and Photo 4.6.

Table 4.6 Summary of characteristics of Blue Gum High Forest (based on Tozer, 2010 and Hayes Environmental 2009)

STRATA	HEIGHT RANGE (M)	FOLIAGE COVER (%)	DOMINANT SPECIES
Canopy	12–28	20–45	*Eucalyptus saligna, Angophora floribunda* and *Eucalyptus paniculata.*
Sub-canopy	3–6	0–10	*Acacia implexa, Pittosporum undulatum* and *Brachychiton acerifolius.*
Shrub stratum	1–3	0–5	*Acacia implexa* and *Pittosporum undulatum.* In some locations the shrub stratum is dominated by exotic species i.e. *Rubus fruticosus** as well as *Ligustrum sinense** and *Ligustrum lucidum**.
Groundcover	0.1–1	80–90	*Microlaena stipoides, Dichondra repens, Oplismenus imbecillis* and *Pseuderanthemum variabile.* In some locations the groundcover is characterised by high levels of weed cover including *Tradescantia fluminensis** and *Ehrharta erecta**.
NSW PCT/BVT	PCT1237/HN596: Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion.		
Conservational significance	High: This community is consistent with the Blue Gum High Forest of the Sydney Basin Bioregion threatened ecological community which is listed as Critically Endangered under both the TSC Act and EPBC Act. This community also provides habitat for a variety of threatened flora and fauna species and creates a wildlife corridor linking vegetation within the subject site to other large remnants of vegetation within the locality.		
Condition	Good: Areas of good condition Blue Gum High Forest were unable to be accessed during the survey. The good condition areas mapped within the subject site are assumed to have a high native species richness, low density of exotic species and relatively intact structure given its position in the landscape i.e. few clearings, paths etc. Moderate: Areas of moderate condition Blue Gum High Forest predominantly occur along the peripheries of the community within and immediately adjacent private residences. Within these areas the community generally retained an intact canopy layer however lacked one or more other stratum i.e. sub-canopy, shrub layer and/or groundcover.		
Extent and distribution within the site	This community occurs only within the southern portion of the subject side covering an extant of 10.5 ha or 4% of the subject site. The community intergrades with Sydney Turpentine Ironbark Forest, Blackbutt Gully Forest and Shale Sandstone Transition Forest where the geology experience shale influences.		

Photo 4.6 A disturbed patch of vegetation apparently representing an intergrade between Blue Gum High Forest and Sydney Turpentine Ironbark Forest within the subject site

4.1.5 Acacia regrowth

This vegetation type occurs within the north west corner of the subject site in areas that have previously been highly modified through vegetation clearing and soil disturbance but have recently been left unused and unmanaged. Areas of this vegetation type which were subject to field survey area in relatively poor condition existing as regrowth *Acacia* species and the occasional native groundcover species, otherwise dominated by exotic species.

The Acacia regrowth vegetation recorded within the subject site consists of some shrub and groundcover species (two shrub and three groundcover disturbance tolerant species) characteristic of the Endangered Sydney Turpentine Ironbark Forest vegetation community as listed in the NSW Scientific Committee Final Determination (NSW Scientific Committee 1998b). It is likely, given the vegetation's location in the landscape, underlying geology and proximity to other vegetation remnants, that the vegetation was previously Sydney turpentine-ironbark forest. Although considered to have once been Sydney turpentine-ironbark forest the vegetation has been severely disturbed as a result of long-term intensive agricultural practices. This land use has resulted in the long-term absence of canopy tree species which are unlikely to now occur in the soil seed bank and regeneration potential is low.

Although the Acacia regrowth recorded does contain a few species characteristic of the threatened ecological community it is not considered consistent with the Endangered Sydney turpentine-ironbark forest vegetation community listed under the TSC Act. The Acacia regrowth vegetation type did not contain a eucalypt canopy or eucalypt saplings and therefore its structure does represent a forest, woodland or isolated remnant trees. Additionally given the long-term absence of tree canopy species and intense agricultural practices undertaken on the land it is considered unlikely that the soil seed bank contains a diversity of native species other than those disturbance tolerant species recorded.

Therefore, the Acacia regrowth recorded is not consistent with the NSW Scientific Committee Final Determination for Sydney Turpentine Ironbark Forest or any other community. However, it should be noted that some areas of this vegetation have only been identified through analysis of aerial photography and it is possible that these areas may have high native species diversity and may be attributable to a PCT and a

corresponding threatened ecological community. This can only be reliably determined by additional field surveys.

A summary description of this community is provided in and shown in Table 4.7 and Photo 4.7.

Table 4.7 Summary of characteristics of Acacia regrowth

STRATA	HEIGHT RANGE (M)	FOLIAGE COVER (%)	DOMINANT SPECIES
Canopy	5–8	30–50	*Acacia parramattensis* and *Acacia implexa.*
Sub-canopy	2–5	0–60	Generally absent or consisted of *Ligustrum lucidum** and *Ligustrum sinense*.*
Shrub stratum	0.4–2	0–60	Juvenile *Ligustrum lucidum** and *Ligustrum sinense*.*
Groundcover	0.1–1.5	80–100	Generally dominated by exotic species such as *Ehrharta erecta*,* and *Galium aparine*.* Some areas dominated by native species including *Microlaena stipoides, Oplismenus aemulus* and *Commelina cyanea.*
NSW PCT/BVT	Not consistent with any NSW PSCT/BVT.		
Conservational significance	Low: The surveyed areas are co-dominated by exotic vegetation with a very limited suite of native plant species. These areas provide at best marginal, low condition habitat for threatened species.		
Condition	Poor: This community is in low condition co-dominated by exotic species and contains few native species. The structural integrity of this vegetation type is low as it generally lacks one or more strata and is almost entirely surrounded by highly disturbed land with little or no native vegetation.		
Extent and distribution within the site	This community occurs within the north portion of the subject site covering an extant of 3.6 ha, approximately 2% of the subject site. The community is found on shale soils and is generally located at the interface between Sydney Turpentine Ironbark Forest and highly disturbed land with no or limited native vegetation.		

Photo 4.7 Acacia regrowth within the subject site

4.1.6 Highly disturbed areas with no or limited vegetation

This vegetation type occurs across the subject site in areas subjected to past and current land uses such as agriculture and residential development. As a result, this vegetation type is in poor condition and not consistent with any native vegetation community. Within this community there are a number of isolated and scattered remnant trees which are mapped in Figure 4.1.

A summary description of this community is provided in Table 4.8 and shown in Photo 4.8.

Table 4.8 Summary of characteristics of highly disturbed areas within no or limited vegetation

STRATA	HEIGHT RANGE (M)	FOLIAGE COVER (%)	DOMINANT SPECIES
Canopy	5–20	0–30	Generally absent. If present generally consisted of planted exotic tree species such as *Cinnamomum camphora** or non-indigenous planted native species such as *Grevillea robusta, Eucalyptus microcorys* and *Lophostemon confertus.* In some locations scattered remnant native tree species are present such as *Eucalyptus paniculata, Eucalyptus saligna* and *Eucalyptus punctata* are present.
Sub-canopy	2–10	0–70	Generally absent or dominated by exotic or planted species such as *Ligustrum lucidum** and *Ligustrum sinense*.*
Shrub stratum	0.4–2	0–100	Generally dominated by planted and exotic species such as *Lantana camara**, *Rubus fruticosus** as well as *Ligustrum sinense** and *Ligustrum lucidum** juveniles.
Groundcover	0.1–1.0	0–100	Generally dominated by exotic species such as *Ehrharta erecta*, Pennisetum clandestinum**, *Tradescantia fluminensis**, *Galium aparine*, Senecio madagascariensis** and *Ligustrum sinense** seedlings.
NSW PCT/BVT	Not consistent with any NSW PCT/BVT.		
Conservational significance	Low: These areas generally contain planted or exotic vegetation with no or limited native vegetation. These areas provide limited habitat for threatened species and generally created small to large gaps between remnant vegetation reducing connectivity within the subject site. Some of the remnant native tree species are consistent with the Sydney Turpentine Ironbark threatened ecological community listed under the TSC Act, despite being located within otherwise exotic vegetation.		
Condition	Poor: This community is in low condition as it is dominated by planted and exotic species. The structural integrity of this vegetation type generally lacks one more stratum and has low regeneration potential.		
Extent and distribution within the site	This community occurs throughout the subject site covering an extant of 169.1 ha or 71% of the subject site. The community is not associated with any particular soil or geology type instead is associated with previous and current disturbances such as clearing for agriculture and residential development. This community borders all other native vegetation communities recorded.		

Photo 4.8 Highly disturbed land with no or limited vegetation

4.2 Noxious weeds recorded

Fifteen of the species of plant recorded are listed as noxious weeds under the *Noxious Weeds Act 1993* for the Council of the Shire of Hornsby noxious weed control area (Table 4.9). In addition, *Asparagus aethiopicus* (Asparagus Fern), *Asparagus asparagoides** (Bridal Creeper), *Dolichandra unguis-cati** (Cat's Claw Creeper), *Rubus fruticosus** (Blackberry complex), *Lantana camara** (Lantana) and *Senecio madagascariensis** (Fireweed) are listed as a Weeds of National Significance (Australian weeds committee 2016).

Table 4.9 Noxious and weeds of national significance identified within the subject site

SCIENTIFIC NAME	COMMON NAME	NOXIOUS WEEDS ACT 1993 CONTROL CLASS[1]	WEEDS OF NATIONAL SIGNIFICANCE
*Araujia sericifera**	Moth vine	Class 4	–
*Asparagus aethiopicus**	Asparagus Fern	Class 4	Yes
*Asparagus asparagoides**	Bridal Creeper	Class 4	Yes
*Cinnamomum camphora**	Camphor laurel	Class 4	–
*Dolichandra unguis-cati**	Cat's Claw Creeper	Class 3	–
*Hypericum perforatum**	St. Johns Wort	Class 4	–
*Genista monspessulana**	Cape Broom	Class 3	Yes

SCIENTIFIC NAME	COMMON NAME	NOXIOUS WEEDS ACT 1993 CONTROL CLASS[1]	WEEDS OF NATIONAL SIGNIFICANCE
*Lantana camara**	Lantana	Class 4	Yes
*Ligustrum lucidum**	Large-leaved Privet	Class 4	–
*Ligustrum sinense**	Privet – narrow-leaf	Class 4	–
*Lonicera japonica**	Japanese Honeysuckle	Class 4	–
*Ochna serrulata**	Ochna	Class 4	–
Olea europaea subsp. *cuspidate**	African Olive	Class 4	–
*Rubus fruticosus**	Blackberry complex	Class 4	Yes
*Senecio madagascariensis**	Fireweed	Class 4	Yes

(1) Control Categories under the *Noxious Weeds Act 1993*: Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority. Class 3: The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed (Department of Primary Industries (Agriculture) 2016).

4.3 Fauna habitats

Broad-scale fauna habitats included large tracts of native forest exhibiting a variety of different age cohorts of trees, open grassland, riparian vegetation and freshwater streams. Micro-habitat features within these habitat included dead standing trees (stags), hollow-bearing trees, fallen timber, rock outcrops, constructed dams with fringing aquatic vegetation. Due to its diversity of vegetation, landform and micro-habitat features the site is likely to be able to support a fairly high diversity of native animal species.

Fauna habitat present within the subject site contains a range of important habitat features for local native fauna. The mature trees in the subject site provide tree hollow resources of various sizes for a range of animal species such as bats, birds and arboreal mammals. Sandstone rock outcrops are present and frequent within the Blackbutt Gully Forest vegetation type and provide potential sheltering habitat for a variety of animals, particularly reptiles. Rock outcropping is predominantly located within the core Georges Creek riparian corridor, with little to no bush rock located in any other areas.

The native vegetation observed within the subject site occurs as both canopy-only areas and as remnant vegetation within structural integrity still intact. Native shrubs and groundcovers occur predominantly within the vegetation located in proximity to Georges Creek riparian corridor. These areas have a moderate to high density of understorey due, at least in part, to the apparent absence of fire in recent years. The remainder of the native vegetation (including canopy only vegetation) generally occurs within low density rural-residential properties where the shrub layer and groundcover have been removed or replaced with exotic and planted species.

The main aquatic habitat on site occurs within the Hawkesbury Sandstone gully where Georges Creek consists of pools and riffles with ephemeral flow. During periods of heavy rainfall Georges Creek would flow readily and collect the runoff from the majority of the subject site. In addition there are a series of shallow and deep ephemeral to permanent constructed dams predominantly within the agricultural properties. These aquatic habitats provide habitat for amphibian, reptile, mammals, invertebrates and bird species.

4.4 Corridors and connectivity

Wildlife corridors can be defined as ‘retained and/or restored systems of (linear) habitat which, at a minimum, enhance connectivity of wildlife populations and may help them overcome the main consequences of habitat fragmentation’(Wilson, A & Lindenmayer 1995a; Wilson, A. & Lindenmayer 1995b). Corridors can provide

ecological functions at a variety of spatial and temporal scales from daily foraging movements of individuals, to broad-scale genetic gradients across biogeographical regions. Wildlife corridors are critical for the maintenance of ecological processes and the movement of wildlife. Corridors and landscape connectivity between large areas of native vegetation allow migration, colonisation and interbreeding of flora and fauna. The removal of native vegetation and wildlife corridors can result in isolation of wildlife habitat areas and lead to the breakdown of ecological process and decline in biodiversity. It is important that corridors are maintained and where possible enhanced as they play an important role in maintaining biodiversity across a landscape.

The subject site occurs adjacent to large tracts of intact native vegetation to the east (Dural Nature Reserve), west (vegetation that links up to Holland Reserve), south (Castle Hill Heritage Park) and to the north (vegetation that links up to Marramarra National Park). The major connectivity links within the subject site occurs from east to west between Dural Nature Reserve and Holland Reserve and the riparian corridor along Georges Creek.

The vegetation within the centre of the site, particularly along George's Creek, forms part of important linkages to Dural Nature Reserve, Holland Reserve and Marramarra National Park.

5 THREATENED BIODIVERSITY

5.1 Threatened flora

One threatened flora species was recorded within the subject site during field surveys conducted as part of this study; *Epacris purpurascens* var. *purpurascens*. This species was recorded from within the Blackbutt Gully Forest vegetation community at two separate locations as illustrated in Figure 4.1. The occurrence of the species recorded is estimated to contain over 100 individuals located in a relatively high density patch with a single outlying individual.

In addition to *Epacris purpurascens* var. *purpurascens,* 45 other threatened flora species are known or predicted to occur within a 10 km extent of the subject site (Appendix A). Of these, 12 threatened flora species have been identified as having a moderate to high potential to occur within the subject site.

Table 5.1 Threatened flora species with a moderate or high likelihood of occurrence in the subject site

SCIENTIFIC NAME	COMMON NAME	TSC ACT[1]	EPBC ACT[2]	LIKELIHOOD OF OCCURRENCE
Epacris purpurascens var. purpurascens	**–**	**V**	**–**	**Recorded**
Acacia pubescens	Downy Wattle	V	V	Moderate
Callistemon linearifolius	Netted Bottle Brush	V	–	Moderate
Darwinia biflora	–	V	V	Moderate
Syzygium paniculatum	Magenta Lilly Pilly	E	V	Moderate
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Moderate
Persoonia hirsuta	Hairy Geebung	E	E	Moderate
Persoonia mollis subsp. maxima	–	E	E	Moderate
Pomaderris brunnea	–	V	V	Moderate
Galium australe	Tangled Bedstraw	E	–	Moderate
Asterolasia elegans	–	E	E	Moderate
Zieria involucrata	–	E	V	Moderate
Pimelea curviflora var. curviflora	–	V	V	Moderate

(1) Listed as a Vulnerable (V) and Endangered (E) under the TSC Act.
(1) Listed as Vulnerable (V) and Endangered (E) under the EPBC Act.

5.2 Threatened fauna

Three threatened fauna species were recorded from the subject site during field surveys conducted as part of this report; Little Eagle, Powerful Owl and Grey-headed Flying-fox. Habitats for these and other threatened species occur throughout the subject site.

In addition to the three threatened species recorded a total of 47 other threatened fauna species are known or predicted to occur within a 10 km extent of the subject site (Appendix B). Of these, a total of 24 species have been identified as having a moderate to high potential to occur within the subject site due to suitable available habitat (Table 5.2).

Table 5.2 Threatened fauna species with a moderate or high likelihood of occurrence in the subject site

SCIENTIFIC NAME	COMMON NAME	TSC ACT[1]	EPBC ACT[2]	LIKELIHOOD OF OCCURRENCE
Amphibians				
Pseudophryne australis	Red-crowned Toadlet	V	–	High
Birds				
Hieraaetus morphnoides	**Little Eagle**	**V**	**–**	**Recorded**
Ninox strenua	**Powerful Owl**	**V**	**–**	**Recorded**
Stagonopleura guttata	Diamond Firetail	V	–	Moderate
Petroica phoenicea	Flame Robin	V	–	Moderate
Callocephalon fimbriatum	Gang-gang Cockatoo	V, E2	–	High
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	–	Moderate
Glossopsitta pusilla	Little Lorikeet	V	–	High
Tyto novaehollandiae	Masked Owl	V	–	Moderate
Tyto tenebricosa	Sooty Owl	V	–	Moderate
Lophoictinia isura	Square-tailed Kite	V	–	Moderate
Lathamus discolor	Swift Parrot	E1	CE	Moderate
Daphoenositta chrysoptera	Varied Sittella	V	–	Moderate
Mammals				
Pteropus poliocephalus	**Grey-headed Flying-fox**	**V**	**V**	**Recorded**
Cercartetus nanus	Eastern Pygmy-possum	V	–	Moderate
Phascolarctos cinereus	Koala	V	V	Moderate
Isoodon obesulus	Southern Brown Bandicoot	E1	E	Moderate
Dasyurus maculatus	Spotted-Tailed Quoll (Southern Subspecies)	V	E	Moderate
Petaurus australis	Yellow-bellied Glider	V	–	Moderate
Microchripoteran bats				
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	–	High
Miniopterus australis	Little Bent-wing Bat	V	–	High
Myotis macropus	Southern Myotis, Large-footed Myotis	V	–	High
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	–	High
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	–	High

SCIENTIFIC NAME	COMMON NAME	TSC ACT[1]	EPBC ACT[2]	LIKELIHOOD OF OCCURRENCE
Mormopterus (Micronomus) norfolkensis	Eastern Freetail Bat	V	–	High
Scoteanax rueppellii	Greater Broad-nosed Bat	V	–	High
Reptiles				
Varanus rosenbergi	Heath Monitor (Rosenberg's Goana)	E	–	Moderate
Invertebrates				
Pommerhelix duralensis	Dural Woodland Snail	–	E	High

(1) Listed as an Endangered Population (E2), Vulnerable (V) and Endangered (E1) under the TSC Act.
(2) Listed as Vulnerable (V) or Endangered (E) or Critically Endangered (CE) under the EPBC Act.

5.3 Endangered populations

Three endangered populations have been listed for the Hornsby Shire Council Local Government Area. These endangered populations include:

- Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas
- *Darwinia fascicularis* subsp. *oligantha* population in the Baulkham Hills and Hornsby Local Government Areas
- Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield.

Of these species only the Gang-Gang endangered population is considered likely to have a moderate or higher likelihood of occurring within the subject site due to the suitable habitat (Appendix B).

5.4 Threatened ecological communities

Threatened ecological communities (Vulnerable, Endangered and Critically Endangered) are listed under the TSC Act, FM Act and EPBC Act.

Three threatened ecological communities were recorded within the study area. These communities included:

- Sydney Turpentine Ironbark Forest – listed as Endangered under the TSC Act and Critically Endangered under the EPBC Act
- Blue Gum High Forest – listed as Critically Endangered under the TSC Act and EPBC Act
- Shale Sandstone Transition Forest – listed as Endangered under the TSC Act and Critically Endangered under the EPBC Act.

More details regarding these threatened ecological communities are provided below.

5.4.1 Sydney Turpentine Ironbark Forest

Sydney Turpentine Ironbark Forest was recorded in two broad condition variations within the subject site which include:

- Patches with intact native canopy and native species at least co-dominant in all layers present; some of these patches have a very limited diversity and abundance of shrub layer species but a moderately diverse suite of native groundcover species
- Small clumps of trees and individual trees with very little or no native shrub and groundcover species present.

5.4.1.1 STATE LISTED SYDNEY TURPENTINE IRONBARK FOREST

Sydney Turpentine Ironbark Forest is listed as Endangered under the TSC Act. All of the mapped Sydney Turpentine Ironbark Forest recorded within the subject site, regardless of its condition class, contains, or is likely to contain, sufficient characteristic species and to conform to the NSW Scientific Committee Final Determination (NSW Scientific Committee 1998b) for the community which specifically includes the following statement:

- 'the structure of the community was originally forest, but may now exist as woodland or as remnant trees'
- 'In many of these LGAs…. only remnant trees may remain. These may have particular ecological and genetic significance and may be important sources of propagation material for use in rehabilitation projects'.

5.4.1.2 COMMONWEALTH LISTED SYDNEY TURPENTINE IRONBARK FOREST

Turpentine-Ironbark Forest in the Sydney Basin Bioregion is listed as Critically Endangered under the Commonwealth EPBC Act.

To be listed as Critically Endangered under the Commonwealth EPBC Act, the vegetation must be consistent with the criteria outlined in the Commonwealth Listing Advice on Turpentine-Ironbark Forest of the Sydney Basin Bioregion (Department of Environment and Conservation 2004a). The criteria are listed below:

- The vegetation contains some characteristic components from all structural layers (tree canopy, small tree/shrub midstorey, and understorey)
- Tree canopy cover is greater than 10 per cent and remnant size is greater than one hectare
- However, remnants with tree canopy cover less than 10 per cent are also included in the ecological community, if the fragments are greater than one hectare in size and occur in areas of native vegetation in excess of 5 hectares in area.

The Sydney Turpentine Ironbark Forest recorded within the study area occurs in three condition types:

- Poor – contains canopy species only, generally occurring as isolated paddock trees or small stands. This condition type does not contain characteristic components of all structural layers and where less than one hectare in size. This condition class it not considered consistent with the Commonwealth listed Turpentine-Ironbark Forest as it does not contain characteristic components of all structural layers and patches are generally less than 1 hectare.
- Moderate – this condition type generally occurs in a disturbed nature varying from remnant canopy tree species within only a lawn understorey to remnants that contain canopy species with few sub-canopy, shrub and groundcover species. Patch size of this condition type varied from below 1 hectare to greater than 1 hectare within some patches connected to areas of native vegetation greater than 5 hectares. This condition class has areas that are consistent and areas that are not consistent with the Commonwealth listed Turpentine-Ironbark Forest given their variation in floristic composition, patch size and connectivity to other remnants.
- Good – although disturbed (from weed invasion and precious vegetation clearing) patches of this condition type contain characteristic components of all structural layers and are greater than one hectare in size. In addition this community type is connected to areas of native vegetation larger than 5 hectares. This condition class is considered consistent with the Commonwealth listed Turpentine-Ironbark Forest as it contains characteristic components of all structural layers, is greater than 1 hectare and connects to large areas of native vegetation in excess of 5 hectares.

The Acacia regrowth vegetation recorded within the subject site did not contain characteristic components from all structural layers (only sub-canopy and groundcover) and the patch sizes where less than one hectare. Therefore, the Acacia regrowth recorded within the subject site is not consistent with the Commonwealth listed Turpentine-Ironbark Forest in the Sydney Basin Bioregion.

5.4.2 Blue Gum High Forest

. Where access to previously mapped Blue Gum High Forest was available the vegetation was ground-truthed. In these locations the majority of previously mapped Blue Gum High Forest was determined to be consistent with Sydney Turpentine Ironbark Forest.

Due to restricted access during the survey period, some areas previously mapped as Blue Gum High Forest were unable to be surveyed and thereby existing vegetation mapping was relied upon at these locations. Further field verification would be required to identify this community's possible presence and distribution in areas where access was restricted.

5.4.2.1 STATE LISTED BLUE GUM HIGH FOREST

Blue Gum High Forest in the Sydney Basin Bioregion is listed as Critically Endangered under the NSW TSC Act.

It is assumed that areas of this community previously mapped within the subject site consists of some canopy, shrub and groundcover species characteristic of the Critically Endangered Blue Gum High Forest vegetation community as listed in the NSW Scientific Committee Final Determination (Office of Environment and Heritage 2014b). The vegetation consistent with this threatened ecological community is likely to be modified as a result of past and current land uses i.e. vegetation clearing. A precautionary approach has been taken assuming that vegetation within the subject site mapped as this community is consistent with the TSC Act listed Blue Gum High Forest. Further investigations would have to be undertaken to verify this conclusion.

5.4.2.2 COMMONWEALTH LISTED BLUE GUM HIGH FOREST

Blue Gum High Forest of the Sydney Basin Bioregion is listed as Critically Endangered under the Commonwealth EPBC Act.

To be listed as Critically Endangered under the EPBC Act, the vegetation must be consistent with the criteria outlined in the Commonwealth Listing Advice on Blue Gum High Forest of the Sydney Basin Bioregion (Department of the Environment 2014). The criteria are listed below:

- The vegetation contains some characteristic components from all structural layers (tree canopy, small tree/shrub midstorey, and understorey).
- Tree canopy cover is greater than 10 per cent and remnant size is greater than one hectare.
- However, remnants with tree canopy cover less than 10 per cent are also included in the ecological community, if the fragments are greater than one hectare in size and occur in areas of native vegetation in excess of five hectares in area.

Not all previously mapped Blue Gum High Forest were able to be ground-truthed and therefore the distribution, floristic diversity and remnant size of Blue Gum High Forest within the subject site are unknown. As a precautionary approach all areas of Blue Gum High Forest are considered to be consistent with the EPBC Act listing for the Critically Endangered Blue Gum High Forest community. Further ground-truthing investigations would have to be undertaken to make a final conclusion.

5.4.3 Shale Sandstone Transition Forest

5.4.3.1 STATE LISTED SHALE SANDSTONE TRANSITION FOREST

Shale/sandstone transition forest is listed as Endangered under the NSW TSC Act. The vegetation within the study area consists of some canopy, shrub and groundcover species characteristic of the Endangered Shale/sandstone transition forest vegetation community as listed in the NSW Scientific Committee Final Determination (NSW Scientific Committee 1998a). The vegetation community was recorded from one

location within the subject site (Figure 4.1) occurring in a disturbed condition as a result of regular vegetation clearing/maintenance i.e. under scrubbing and mowing of shrub and groundcover stratum. Whilst the canopy cover remains intact, the shrub layer is mostly absent and the groundcover exists as a mix of native and exotic species. Given that the native canopy cover remains and some native species are evident within the sub-canopy and groundcover layers this community may contain additional species in a soil seed bank.

The NSW Scientific Committee Final Determination for the community does not contain specific guidance regarding condition thresholds for the community. It does, however contain the following statement which suggests that sites which have been subject to disturbance and an associated reduction in apparent native plants species diversity may still be included in the definition of the threatened community:

- 'Depending on the disturbance history of a particular site a proportion of the species may be present only in the soil seed bank'.

Given that the community contains an intact canopy cover and a mix of characteristic native sub-canopy and groundcover species and may contain a native soil seed bank the Shale Sandstone Transition Forest recorded within the subject site is considered to be consistent with the TSC Act listed for Shale/sandstone transition forest.

5.4.3.2 COMMONWEALTH SHALE SANDSTONE TRANSITION FOREST

Shale Sandstone Transition Forest is listed as Critically Endangered under the Commonwealth EPBC Act.

To be listed as Critically Endangered under the EPBC Act, the vegetation must be consist with the criteria outlined in the Commonwealth Draft Conservation Advice for Shale Sandstone Transition Forest in the Sydney Basin Bioregion {Department of the Environment, 2014 #4233}. The criteria are listed below:

- Limited to the Sydney Basin Bioregion
- Generally occur below 350 m above sea level
- Occur at the transition between shales and sandstones of the Wianamatta and Hawkesbury Groups, including the transitional Mittagong Formation
- Occur as forest or woodland, and may have a grassy or shrubby understorey
- Typically dominated by canopy species *Eucalyptus punctata* (Grey Gum), *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus fibrosa* (Broad-leaved Ironbark). Other eucalypt species likely to be present, especially in areas within low sandstone influence such as *Eucalyptus tereticornis* (Forest Red Gum)
- Typically has a shrub layer but varies in it structure and floristics such as *Bursaria spinosa, Kunzea ambigua, Persoonia linearis, Ozothamnus diosmifolius* and *Hibbertia aspera* dependent on the location
- Typically has a diverse ground cover layer dominated by grasses and herbs.

In addition Shale Sandstone Transition Forest is classified into four condition classes dependent upon vegetation patch size and percentage cover of perennial understorey vegetation cover of native species and presence of mature trees. The class classifications are detailed below in Table 5.3.

Table 5.3 Commonwealth condition criteria analysis for Shale Sandstone Transition Forest

CATEGORY	RATIONALE	PATCH SIZE (HA)	NATIVE PERENNIAL UNDERSTOREY VEGETATION COVER[1]	PRESENCE OF TREES
A – Moderate condition class	Represented by medium to large-size patch as part of a larger native vegetation remnant and/or with mature trees	>0.5	>30%	Contiguous with a native vegetation remanent >1ha in size And/or Patch has at least one tree with hollows or one large locally indigenous tree. If >1ha density of at least one mature tree with hollow per ha is required.
B – Moderate condition class	**Represented by medium to large size patch with high quality native understorey**	**>0.5**	**>50**	**–**
C – High condition class	Represented by medium to large size patch with very high quality native understorey	>0.5	>70	–
D – High Condition Class	Represented by large size patch with high quality native understorey	>2	>50	–

1) Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing stems. Measurements of perennial understorey vegetation cover exclude annuals, cryptograms, leaf litter or exposed soil.

The Shale Sandstone Transition Forest vegetation community recorded within the subject site is considered consistent with the Commonwealth listing of the Critically Endnagered community. The vegetation within the site is consistent with the criteria listed above, patch size of approximately 1.4 ha, contains approximately 60% native perenial groundcover, is contiguous with other native vegetation communities remnants >2 ha in size and has no tree hollows; therefore the Shale Sandstone Transition Forest within the subject site is consistent with category B – Moderate condition class.

5.5 Migratory species

Migratory species are protected under international agreements, to which Australia is a signatory, including JAMBA, CAMBA, RoKAMBA and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered Matters of NES and are protected under the EPBC Act.

No migratory species were recorded within the subject site. A total of sixteen EPBC listed migratory species are known or predicted to occur within a 10 km extent of the subject site (Appendix B). Of these, a total of ten species have been identified as having a moderate to high potential to occur within the subject site due to suitable available habitat (Table 5.4).

Table 5.4 Migratory listed species with a moderate or higher likelihood of occurrence in the subject site

SCIENTIFIC NAME	COMMON NAME	LIEKLIHOOD OF OCCURENCE
Monarcha melanopsis	Black-faced Monarch	Moderate
Ardea (Bubulcus) ibis	Cattle Egret	Moderate
Ardea (Casmerodius) modesta	Eastern Great Egret	Moderate

SCIENTIFIC NAME	COMMON NAME	LIEKLIHOOD OF OCCURENCE
Apus pacificus	Fork-tailed Swift	Moderate
Gallinago hardwickii	Latham's Snipe	Moderate
Charadrius veredus	Oriental Plover	High
Rhipidura rufifrons	Rufous Fantail	High
Myiagra cyanoleuca	Satin Flycatcher	Moderate
Symposiarchus trivirgatus	Spectacled Flycatcher	Moderate
Hirundapus caudacutus	White-throated Needletail	High

5.6 SEPP 44 – Koala habitat

Three koala feed tree species listed under Schedule 2 of SEPP 44 – Koala Habitat Protection (SEPP 44) were recorded within the subject site; *Eucalyptus punctata* (Grey Gum), *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus microcorys* (Tallowwood). Potential Koala habitat, as defined under SEPP 44 includes areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

These species occur generally at varying density (percentage of the total number of canopy trees) as described below:

Eucalyptus punctata (Grey Gum) occurs at varying relative abundance across all PCTs on the site as described below:

- Estimated at 5% in PCT 1395 Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin
- Approximately 5–10% in PCT 1281/HN604: Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
- Estimated at <5% PCT1181/HN586: Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest in sandstone gullies of western Sydney, Sydney Basin.

While the overall density of *Eucalyptus punctata* is estimated at 5–10% in PCT 1281/HN604 (Turpentine – Grey Ironbark open forest), some areas of this vegetation type are likely to have >15% koala feed tree species.

Eucalyptus tereticornis (Forest Red Gum) is dominant in the occurrence of PCT 1395 (Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest) on the site as described below with an estimated relative abundance of 80%.

Occasional planted specimens of *Eucalyptus microcorys* (Tallowwood) are found in gardens and other cleared areas; this species is not indigenous in NSW south of the Hawkesbury River.

Therefore, areas within the subject site, particularly PCT 1395, provide potential Koala habitat as defined by Regulation 4 of SEPP 44.

Koala habitat assessments were undertaken within the subject site during the survey period. Due to restricted access surveys were primarily based on the vegetation types and vegetation condition within the subject site i.e. structure and floristic characteristics.

During the survey, Koala feed tree species, locations and densities were noted when identified. In addition some Koala food trees were inspected for signs of Koala usage i.e. trees were inspected for presence of

Koalas, scratch and claw marks in the trunk and scats around the base of each tree. These surveys were undertaken in conjunction with other surveys.

No evidence of Koala activity was observed during the limited survey undertaken to inform this report. Presence of unrestrained dogs as well as the occurrence of roads and fencing around some property boundaries makes the regular utilisation of this area by Koalas unlikely. Some of the remnant vegetation located within the subject site may be used intermittingly by dispersing juvenile Koalas or roaming males which may traverse the locality in searches of mates or unoccupied territories. The subject site is, however, considered to provide only marginal Koala habitat.

Under Clause 16 of SEPP 44 – Koala Habitat Protection (SEPP 22), an environmental assessment must be undertaken of land that is proposed to be zoned or rezoned, to assess if core koala habitat is present. Based on the results of the field and desktop assessments undertaken, the subject site does not represent core Koala habitat as defined under Regulation 4 of SEPP 44 – Koala Habitat. Under Clause 9 of SEPP 44, a Koala Management Plan is only required should core koala habitat be identified on site. Therefore, in accordance with SEPP 44, a Koala Management Plan is not required for this site.

5.7 Local council Koala management plan

The Hornsby Shire Council and Hills Shire Council Local Government areas in which the subject site is located do not have Koala management plans or habitat mapping at present.

5.8 Federal Koala habitat assessment

Database searches conducted for the proposal did not locate any records of Koala in the subject site and Koalas were not recorded during the limited survey undertaken to inform this report. The Department of the Environment Koala Habitat Assessment Tool (2014) was utilised to determine the quality of Koala habitat in the subject site and if it contained habitat critical to the survival of the Koala (refer Figure 5.1).

Attribute	Score	Inland	Coastal
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	Evidence of one or more koalas within the last 2 years.
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 10 years.	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years.
	0 (low)	None of the above.	None of the above.
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	Has forest or woodland with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	Has forest or woodland with only 1 species of known koala food tree present.
	0 (low)	None of the above.	None of the above.
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	Area is part of a contiguous landscape ≥ 500 ha.
	+1 (medium)	Area is part of a **contiguous landscape** < 1000 ha, but ≥ 500 ha.	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.
	0 (low)	None of the above.	None of the above.
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, **OR** Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, **OR** Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	

Figure 5.1 Koala habitat assessment tool

Table 5.5 Completed Koala habitat assessment tool for the study area

ATTRIBUTE	SCORE	HABITAT APPRAISAL	
Koala occurrence	0	**Desktop**	Database searches conducted for the proposal did not locate any records of Koala within 2 km the subject site.
		On-site	No Koalas or traces of Koalas were recorded during the limited ecological surveys undertaken to inform this report.
Vegetation structure and composition	2	**Desktop**	LGA vegetation mapping and database searches indicate that *Eucalyptus microcorys, Eucalyptus tereticornis, Eucalyptus moluccana, Eucalyptus punctata* and *Eucalyptus resinifera* are present and likely to be present in the subject site.
		On-site	Habitat ground-truthing was carried out during field surveys and three feed tree species listed under SEPP 44 Schedule 2 were identified within the study area: *Eucalyptus punctata*, *Eucalyptus tereticornis* and *Eucalyptus microcorys*. *Eucalyptus resinifera* was also recorded during the ground-truthing surveys. This species is listed as Koala food trees in the Central Coast koala food tree table provided by OEH.
Habitat connectivity	0	The majority of the habitat within the subject area is located within an existing disturbed area. Riparian vegetation along George's Creek does provide a vegetation linkage to other patches of intact vegetation within the locality. The vegetation linkages within the subject site are however intersected by Old Northern Road, New Line Road and Hastings Road. Although a culvert does occur under New Line Road Koalas are unlikely to utilise it as a passage way.	
Key existing threats	0	**Desktop**	Desktop assessment did not show any Koala road kill or Koala death records within 2 km or the study area.
		On-site	The status of dog populations and level of predation is not known. Dogs were observed within some properties in the subject site. In addition, the fact that the subject site is bounded by three major roads increases roadkill risk.
Recovery value	0	Due to the small size of the continuous landscape, vegetation composition and level of threats present the habitat is considered unlikely to be an important for the recovery of the Koala. Large patches of vegetation (particularly to the north east of the site) are more likely to be important for the recovery of the Koala, however, the habitat within the study area is not considered to effectively contribute to these areas, as it is somewhat isolated by intervening areas of residential development and busy roads and is unlikely to support a viable populations of Koalas.	
Total	**2**	**Decision: not critical habitat to the survival of the Koala – assessment of significance not required.**	

A score of 2 out of 10 was determined for the Koala habitat in the study area based on the Koala habitat assessment tool (Figure 5.1 and Table 5.5). Impact areas that score four or less using the habitat assessment tool for the Koala do not contain habitat critical to the survival for the Koala. Based on this value, the subject site does not contain critical habitat to the survival of the Koala.

6 CONSERVATION SIGNIFICANCE AND ECOLOGICAL CONSTRAINT

Conservation significance mapping of the site was undertaken to facilitate the development of proposed land use zoning. The level of conservation significance has been ranked based on the ecological attributes outlined within Table 6.1. Mapping of ecological constraints within the subject site is provided in Figure 6.1.

Table 6.1 Ecological constraints ranking and subsequent conservational significance within the subject site

ECOLOGICAL CONSTRAINT RANK AND CONSERVATIONAL SIGNIFICANCE	ECOLOGICAL ATTRIBUTE
High	→ Core areas of moderate to high condition native vegetation (irrespective of threatened ecological community listing status); likely to be of high importance to populations of threatened species and/or to have high value for animal movement. → Large, contiguous patches of threatened ecological communities in moderate condition. → All high condition catches of threatened ecological communities. → Areas occupied by populations of Threatened flora species (such as *Epacris purpurascens* var. *purpurascens*).
Moderate	→ Peripheral areas of non-threatened native vegetation in moderate to good condition; likely to be of moderate importance to populations of threatened species and/or to make a moderate contribution to local animal movement. → Medium-sized patches of threatened ecological communities in low condition. → Small low condition areas of threatened ecological communities which are contiguous with moderate and/or high condition patches.
Low	→ Low species richness patches of regrowth native plants with low structural diversity; e.g. *Acacia* spp. regrowth with not little or no occurrence of over-storey (e.g. eucalypt) species and artificial dams containing native aquatic vegetation. → Individual over-storey indigenous tree species which do not form part of a contiguous patch of native vegetation; i.e. *Eucalyptus* spp., *Corymbia* spp., *Angophora* spp., and *Syncarpia glomulifera;* these trees may, nonetheless, still be consistent with one or other threatened ecological community listing (e.g. Sydney Turpentine ironbark Forest). → Very small, highly disturbed, isolated patches of threatened ecological communities with minimal native understorey.

6.1 High ecological constraints

The presence of high conservation significance areas does not necessarily entirely preclude development in these locations. However, these areas are likely to be considered, by Local, State and Commonwealth regulatory authorities, to be the least suitable for residential zoning. Any proposed development that would affect a substantial area identified as having high conservation significance would require significant assessment, mitigation and offsetting with the lowest certainty of potential outcome.

6.1.1 Core areas of native vegetation and habitat

The core area of continuous native vegetation in the central part of the site is considered to be of high conservation significance because:

- It contains an area of continuous native vegetation which is of sufficient size to support a wide variety of animal species including some threatened species and larger species of native animals which area less likely to persist in smaller and/or fragmented patches of habitat
- It contains microhabitats that are likely to be important to native animals, including aquatic habitat (frog breeding habitat), riparian vegetation (likely to be suitable for owl roosting), rock crevices and potential bird nesting sites that are more distant from human habitation and associated disturbance
- It forms the essential core of a potential wildlife corridor connecting areas of native vegetation and habitat on the site with the surrounding landscape and providing a linkage between areas outside the site, particularly in the north-west and south-east.

6.1.2 High value patches of threatened ecological communities

Threatened ecological communities are distinct assemblages of plants and animals that occur together in a particular area, which are threatened with extinction due to significant reductions in extent, degradation and often very restricted distribution. Conservation of threatened ecological communities is particularly important as it helps to protect threatened species, undiscovered and poorly known taxa (e.g. invertebrates and fungi) and the biological processes critical to maintaining a healthy environment.

The contribution of individual areas of threatened ecological communities to conservation is affected by factors including:

- The diversity and relative abundance of native and exotic species within a patch of the community
- Patch size and configuration; i.e. larger patches and patches with high area to edge ratio are less prone to disturbance and less likely to lose component species
- Location with regard to other patches of the same community and patches of other native vegetation communities; areas of a community which are in close proximity to other patches of the same community or other similar communities are more likely to experience positive interactions including seed/spore dispersal, pollen exchange and animal movements.

High value patches of threatened ecological communities are those which:

- Have moderate to high diversity and relative abundance of native plant species and a relatively low diversity and relative abundance of exotic plant species
- Are large and with a high area to edge ratio
- Are moderate in size but located in close proximity to other moderate or large areas of the community and/or other related native vegetation communities.

6.1.3 Threatened plant populations

Areas which contain substantial populations of threatened plant species are of high conservation significance for such species. The only threatened species of plant recorded on the site to date is *Epacris purpurascens* var. *purpurascens,* which is listed as Vulnerable under the TSC Act. The occurrence of the species recorded is estimated to contain over 100 individuals located in a relatively high density patch with a single outlying individual (Figure 4.1).

6.2 Moderate ecological constraints

6.2.1 Peripheral areas of native vegetation and habitat

The peripheral areas of native vegetation, adjacent to the central part of the site are considered to be of moderate conservation significance because:

- They contain similar habitat to the core (high conservation value) area of the site, however, it is generally in poorer condition due to higher levels of disturbance and associated weed invasion
- They contain a lower diversity and density of microhabitats that are likely to be important to native animals (e.g. aquatic/riparian habitat and rocky outcropping) than the core (high conservation value) area of the site and the habitats they do contain are more likely to be affected by existing human habitation and associated disturbance
- They are at the periphery of a potential wildlife corridor connecting areas of native vegetation and habitat on the site with the surrounding landscape; they are considered beneficial to local wildlife movement but not essential.

6.2.2 Moderate value patches of threatened ecological communities

Moderate value patches of threatened ecological communities are those which:

- Have a moderate to low diversity and relative abundance of native plant species and a relatively high diversity and relative abundance of exotic plant species
- Are of moderate size and/or have a relatively low area to edge ratio
- Are small but located in close proximity to other large areas of the community and/or other related native vegetation communities.

6.3 Low conservation value

6.3.1 Low value patches of native vegetation and habitat

Small, fragmented areas of native vegetation, including isolated trees and patches of *Acacia* spp. regrowth with little other native vegetation, and other highly disturbed areas of native vegetation are considered to be of low conservation significance because:

- They are likely to be marginal as habitat for a variety of native species of animal, including some less disturbance-sensitive threatened species (e.g. Grey-headed flying-fox) due to their low native plant diversity, low structural diversity and high levels of disturbance and associated weed dominance
- They contain a very low diversity and density of microhabitats types that are likely to be important to native animals and the microhabitats they do contain are very likely to be affected by existing human habitation and associated disturbance
- They are at outside of potential wildlife corridors and they are considered be of relatively low benefit to local wildlife movement.

6.3.2 Low value patches of threatened ecological communities

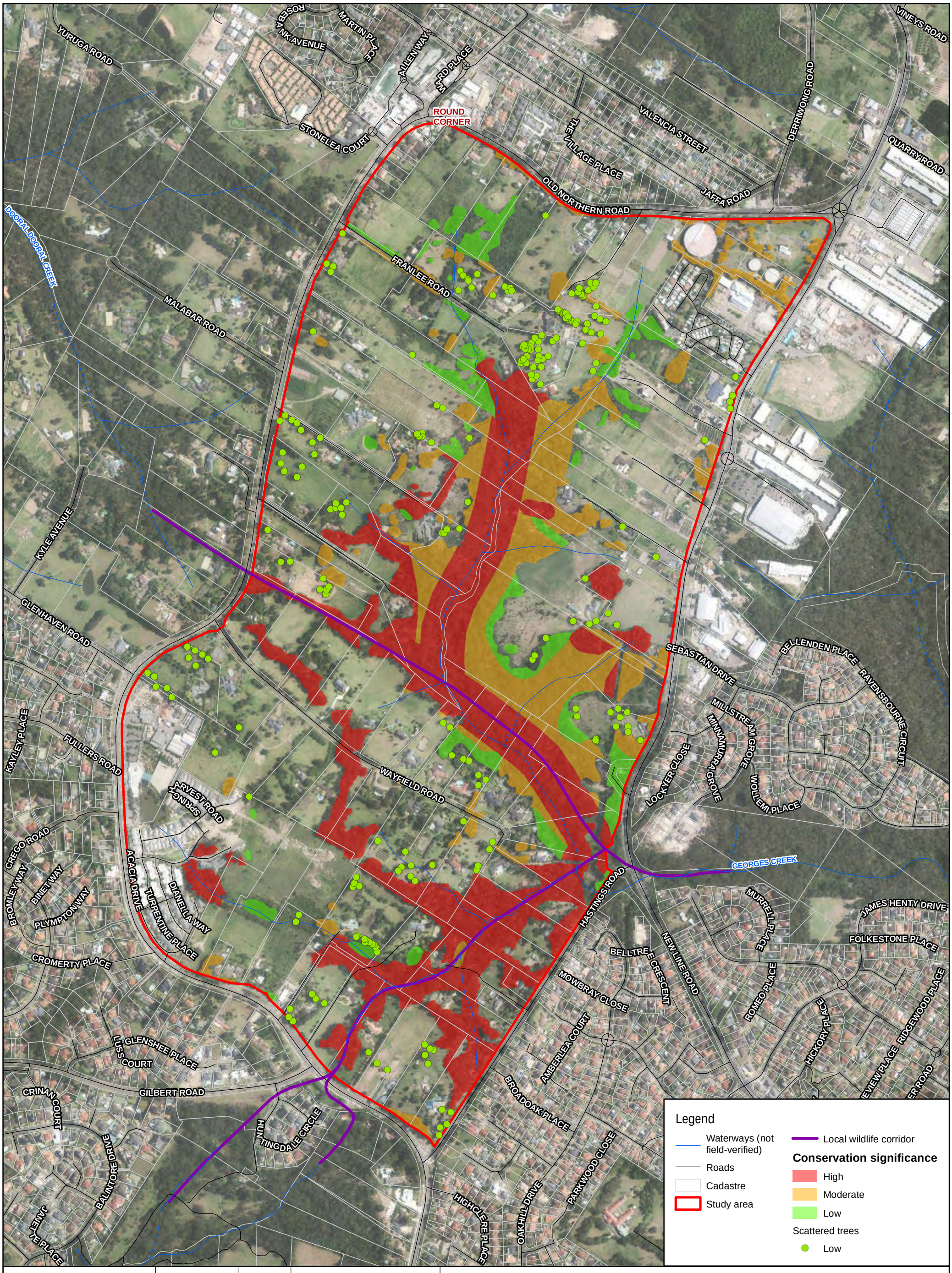
Low value patches of threatened ecological communities are those which:

- Have a very low diversity and relative abundance of native plant species and a very high diversity and relative abundance of exotic plant species
- Are small in area, consisting of individual, isolated trees and small clumps of trees with a very low area to edge ratio.

6.4 Areas of minimal conservational significance

All highly disturbed areas with no or limited native vegetation outside buffer areas have not been assigned an ecological constraints class.

Areas not classified with an ecological constraint class as they exhibit a dense cover of exotic grasses, planted vegetation areas of bare soil, buildings, paved areas and other miscellaneous materials and structures with little or no native vegetation and minimal habitat value. These areas also have a very low habitat structural diversity, generally lack important micro-habitat features and are hence of very low potential value as habitat for threatened species, populations and ecological communities.



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Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

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South Dural Planning Proposal

Figure 6.1
Conversation significance

7 CONCLUSIONS

This Biodiversity Assessment Report comprises the findings of the desktop investigation and field surveys completed to identify the broad scale distribution of ecological attributes and associated values and constraints in the subject site.

7.1 Ecological attributes

The key ecological attributes of the subject site are as follows:

- The presence of poor, moderate and high condition Sydney Turpentine Ironbark Forest, which is listed as an Endangered ecological community under the TSC Act and Critically Endangered under the EPBC Act (22.0 ha)
- The presence of moderate and high condition Blue Gum High Forest, which is listed as Critically Endangered under the TSC Act and EPBC Act (10.5 ha)
- The presence of moderate condition Shale Sandstone Transition Forest, which is listed as Endangered under the TSC Act and Critically Endangered under the EPBC Act (1.4 ha)
- The presence of a substantial corridor of riparian vegetation along Georges Creek which has ecological values in terms of the protection of water quality in the aquatic ecosystems onsite and downstream; this corridor also is also likely to be important to local wildlife habitat connectivity
- A known population of a threatened plant species i.e. *Epacris purpurascens* var. *purpurascens*
- Threatened fauna species known to use the habitat attributes on the site i.e. Powerful Owl, Grey-headed Flying-fox and Little Eagle
- Potential habitat for 12 threatened flora species listed under the TSC Act and/EPBC Act
- Potential habitat for 24 threatened fauna species listed under the TSC ACT and/or EPBC Act and 10 additional species of fauna listed as Migratory under the EPBC Act.

7.2 Ecological constraints

Based on the desktop analysis and the field survey, areas have been identified that pose differing constraints to future development over parts of the subject site (Figure 6.1).These constraints have been ranked based on specific ecological attributes forming high, moderate and low constraints classes.

The total area of each constraint class is summarised in Table 7.1.

Table 7.1 Ecological constraints and area distribution over the subject site

ECOLOGICAL CONSTRAINT	AREA (HA)
High	38.8
Moderate	21.5
Low	8.7
Total	**69.0**

The presence of high, moderate and low ecological constraints areas does not necessarily entirely preclude development in these locations. However, these areas are likely to be considered, by Local, State and Commonwealth regulatory authorities, to be the least suitable for residential zoning. Any proposed development that would affect a substantial area identified as having high, moderate or low conservation significance would require significant assessment, mitigation and offsetting with the lowest certainty of potential outcome.

The ecological constraints mapping provided has been utilised during the development of the rezoning proposal in order to avoid and/or minimise impacts on biodiversity. The current proposed rezoning plan has avoided rezoning areas of high, medium or low ecological constraints (aside from acacia regrowth) for urban development in aims of excluding them from future development under this proposal. The proposal has used differing housing typologies in order to retain vegetation wherever possible. For example the use of higher density housing and green spaces within areas that contain low ecological constraints in order to retain scattered trees.

All highly disturbed areas with no or limited native vegetation, outside of buffer areas around identified wildlife corridors, have not been assigned to an ecological constraint class. Based on studies to date, these areas appear to pose little to no restriction on future development of the site. As such these areas have been the focus of lower density housing.

As the proposed rezoning is designed to generally limit substantial development to areas of minimal and low conservation significance, and protect the key ecological values of the site, it would not be unlikely to have a significant adverse impact on the ecological values of the locality. Development controls and the implementation of environmental management measures associated with future development of the site may also provide opportunities to enhance the long-term viability of vegetation and associated habitat and strengthen riparian and habitat linkage with adjoining vegetated areas; thereby leading to long term positive ecological outcomes within the locality.

The rezoning proposal has been developed around maximum vegetation retention. Should native vegetation require removal during later stages of the project (i.e. Development Application stage once the structure plan has been approved), additional investigations may be required in order to seek approval from the relevant government agencies and determine offsetting requirements. Offsetting requirements, if required, will need to be considered at this later stage as they are likely to be determined in accordance with the new biodiversity legislation to be introduced over the upcoming years. Based on offsetting policies and draft legislation the removal of native vegetation is likely to require offsets in the future.

This biodiversity assessment was undertaken to facilitate the development of an indicative structure plan to support a rezoning application in aims of achieving the best possible ecological outcome (Figure 7.1). This has been achieved via the utilisation of diverse housing typologies which has ultimately resulted in maximising vegetation retention. The retained vegetation will provide flora and fauna habitats and wildlife corridors within the broader landscape and may provide opportunities in the future to enhance the long-term viability of vegetation, habitats as well as riparian and wildlife corridors.

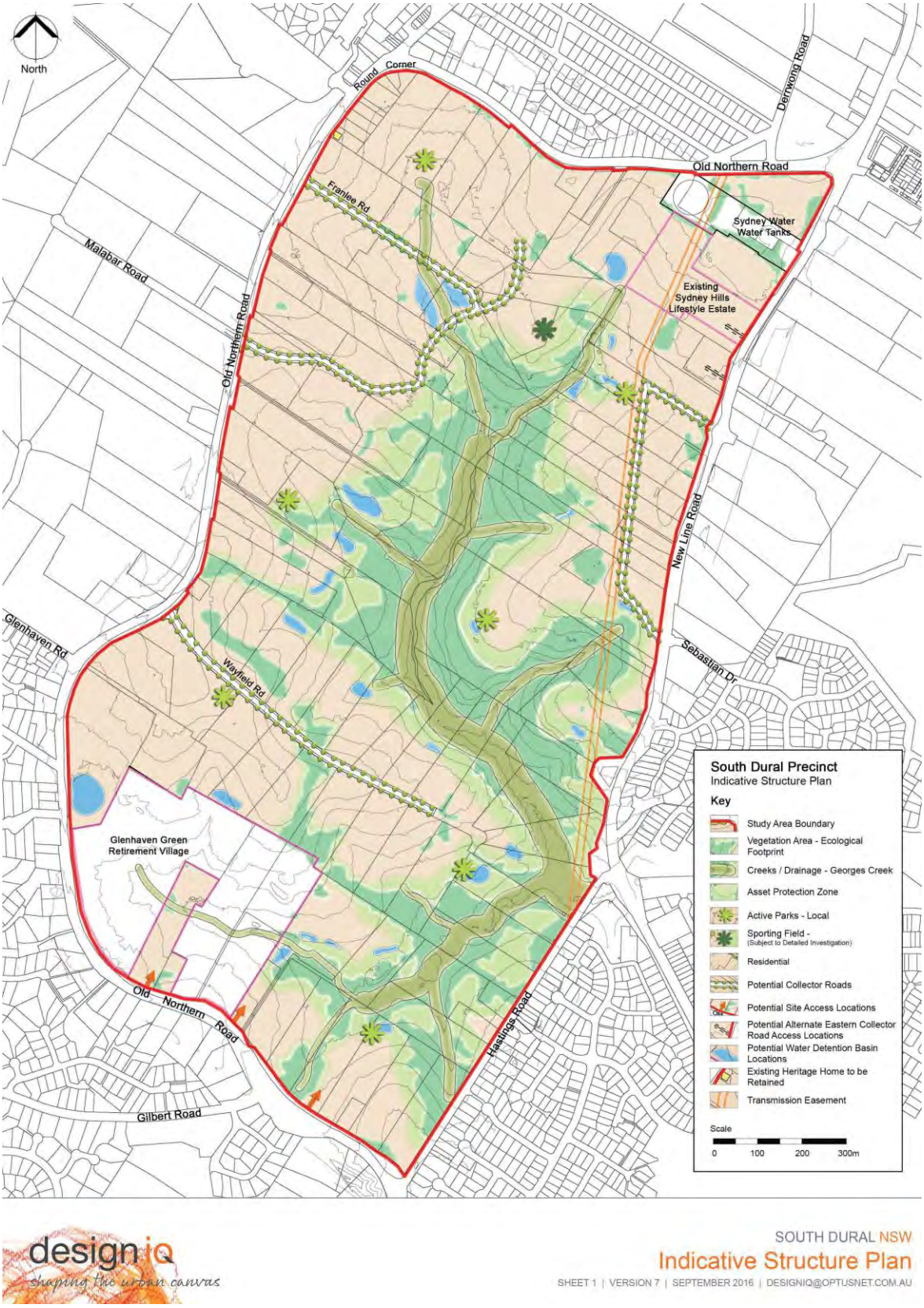

Figure 7.1 Indicative Structure Plan

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Appendix A

THREATENED PLANTS

Appendix B

THREATENED ANIMALS

Appendix C

FLORA SPECIES RECORDED

Table C.1 Plant species recorded from within the subject site/study area

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS[1]	TSC ACT STATUS[2]	NATIVE
Acanthaceae	*Brunoniella australis*	Blue Trumpet			Native
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower			Native
Adiantaceae	*Cheilanthes sieberi*	Mulga Fern			Native
Alliaceae	*Agapanthus praecox*	Agapanthus			Exotic
Altingiaceae	*Liquidambar styraciflua*	Liquidambar			Exotic
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed			Native
Anthericaceae	*Arthropodium milleflorum*	Vanilla Lily			Native
Anthericaceae	*Chlorophytum comosum*				Exotic
Anthericaceae	*Tricoryne elatior*	Yellow Autumn-lily			Native
Apiaceae	*Hydrocotyle peduncularis*				Native
Apiaceae	*Xanthosia pilosa*	Woolly Xanthosia			Native
Apocynaceae	*Parsonsia straminea*	Common Silkpod			Native
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax			Native
Asclepiadaceae	*Araujia sericifera*	Moth Vine			Exotic
Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern			Exotic
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper			Exotic
Asparagaceae	*Asparagus officinalis*	Asparagus			Exotic
Asteliaceae	*Cordyline stricta*	Narrow-leaved Palm Lily			Native
Asteraceae	*Ageratina adenophora*	Crofton Weed			Exotic
Asteraceae	*Bidens pilosa*	Cobblers Pegs			Exotic
Asteraceae	*Chrysanthemoides monilifera subsp. monilifera*	Boneseed			Exotic
Asteraceae	*Cirsium vulgare*	Spear Thistle			Exotic
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane			Exotic
Asteraceae	*Conyza sp.*				Exotic
Asteraceae	*Cotula australis*	Common Cotula			Native
Asteraceae	*Gamochaeta americana*	American Cudweed			Exotic
Asteraceae	*Hypochaeris radicata*	Catsear			Exotic
Asteraceae	*Lagenifera stipitata*	Blue Bottle-daisy			Native
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood			Native

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS[1]	TSC ACT STATUS[2]	NATIVE
Asteraceae	*Senecio madagascariensis*	Fireweed			Exotic
Asteraceae	*Sigesbeckia orientalis*				Native
Asteraceae	*Solenogyne bellioides*				Native
Asteraceae	*Soliva sessilis*	Bindyi			Exotic
Asteraceae	*Taraxacum officinale*	Dandelion			Exotic
Basellaceae	*Anredera cordifolia*	Madeira Vine			Exotic
Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda			Exotic
Bignoniaceae	*Macfadyena unguis-cati*	Cats Claw Creeper			Exotic
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine			Native
Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle			Exotic
Caryophyllaceae	*Paronychia brasiliana*	Chilean Whitlow Wort			Exotic
Caryophyllaceae	*Polycarpon tetraphyllum*	Four-leaved Allseed			Exotic
Caryophyllaceae	*Stellaria media*	Common Chickweed			Exotic
Casuarinaceae	*Allocasuarina littoralis*	Black Sheoak			Native
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak			Native
Celastraceae	*Maytenus silvestris*	Narrow-leaved Orangebark			Native
Chenopodiaceae	*Einadia hastata*	Berry Saltbush			Native
Chenopodiaceae	*Einadia polygonoides*				Native
Chenopodiaceae	*Einadia trigonos*	Fishweed			Native
Clusiaceae	*Hypericum gramineum*	Small St Johns Wort			Native
Commelinaceae	*Commelina cyanea*	Native Wandering Jew			Native
Commelinaceae	*Tradescantia fluminensis*	Wandering Jew			Exotic
Convolvulaceae	*Dichondra repens*	Kidney Weed			Native
Cunoniaceae	*Ceratopetalum gummiferum*	Christmas Bush			Native
Cyperaceae	*Carex inversa*	Knob Sedge			Native
Cyperaceae	*Cyathochaeta diandra*	Sheath Sedge			Native
Cyperaceae	*Cyperus eragrostis*	Umbrella Sedge			Exotic
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge			Native
Cyperaceae	*Cyperus sp.*				Native
Cyperaceae	*Cyperus sp2.*				Native

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS[1]	TSC ACT STATUS[2]	NATIVE
Cyperaceae	*Cyperus tetraphyllus*				Native
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge			Native
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge			Native
Cyperaceae	*Schoenus melanostachys*	Black Bog-sedge			Native
Davalliaceae	*Nephrolepis cordifolia*	Fishbone Fern			Native
Dennstaedtiaceae	*Pteridium esculentum*	Bracken			Native
Dilleniaceae	*Hibbertia aspera*				Native
Dilleniaceae	*Hibbertia sp.*				Native
Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash			Native
Elaeocarpaceae	*Tetratheca thymifolia*	Black-eyed Susan			Native
Epacridaceae	*Epacris purpurascens var. purpurascens*		V	V	Native
Epacridaceae	*Leucopogon juniperinus*	Long-flower Beard-heath			Native
Epacridaceae	*Leucopogon lanceolatus*	Lance Beard Heath			Native
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush			Native
Euphorbiaceae	*Euphorbia peplus*	Petty Spurge			Exotic
Euphorbiaceae	*Phyllanthus hirtellus*	Thyme Spurge			Native
Euphorbiaceae	*Poranthera microphylla*				Native
Fabaceae (Faboideae)	*Bossiaea obcordata*	Spiny Bossiaea			Native
Fabaceae (Faboideae)	*Genista monspessulana*	Montpellier Broom			Exotic
Fabaceae (Faboideae)	*Glycine clandestina*	Twining Glycine			Native
Fabaceae (Faboideae)	*Glycine microphylla*	Small-leaf Glycine			Native
Fabaceae (Faboideae)	*Glycine sp.*				Native
Fabaceae (Faboideae)	*Glycine tabacina*				Native
Fabaceae (Faboideae)	*Kennedia rubicunda*	Red Kennedy Pea			Native
Fabaceae (Faboideae)	*Lotus sp.*				Native

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS[1]	TSC ACT STATUS[2]	NATIVE
Fabaceae (Faboideae)	*Platylobium formosum*	Handsome Flat-pea			Native
Fabaceae (Faboideae)	*Pultenaea flexilis*				Native
Fabaceae (Faboideae)	*Trifolium repens*	White Clover			Exotic
Fabaceae (Faboideae)	*Trifolium sp.*				Exotic
Fabaceae (Faboideae)	*Vicia sp.*				Exotic
Fabaceae (Mimosoideae)	*Acacia decurrens*	Black Wattle			Native
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle			Native
Fabaceae (Mimosoideae)	*Acacia linifolia*	Flax-leaved Wattle			Native
Fabaceae (Mimosoideae)	*Acacia longissima*	Narrow-leaved Wattle			Native
Fabaceae (Mimosoideae)	*Acacia parramattensis*	Parramatta Wattle			Native
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses			Native
Geraniaceae	*Geranium homeanum*	Rainforest Cranes-bill			Native
Goodeniaceae	*Brunonia australis*	Blue Pincushion			Native
Goodeniaceae	*Goodenia heterophylla*				Native
Iridaceae	*Dietes grandiflora*				Exotic
Iridaceae	*Patersonia glabrata*	Leafy Purple-flag			Native
Iridaceae	*Romulea rosea*	Onion Grass			Exotic
Juncaceae	*Juncus sp.*				Native
Lauraceae	*Cassytha sp.*				Native
Lauraceae	*Cinnamomum camphora*	Camphor Laurel			Exotic
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern			Native
Lobeliaceae	*Pratia purpurascens*	Whiteroot			Native
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush			Native
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush			Native
Lomandraceae	*Lomandra multiflora*				Native

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS[1]	TSC ACT STATUS[2]	NATIVE
Lomandraceae	*Lomandra obliqua*				Native
Lomandraceae	*Lomandra sp.*				Native
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry			Native
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow			Exotic
Malvaceae	*Sida rhombifolia*	Paddys Lucerne			Exotic
Meliaceae	*Melia azedarach*	White Cedar			Native
Menispermaceae	*Stephania japonica*				Native
Myrtaceae	*Angophora costata*	Sydney Red/Rusty Gum			Native
Myrtaceae	*Angophora floribunda*	Rough-barked Apple			Native
Myrtaceae	*Corymbia citriodora*				Exotic
Myrtaceae	*Corymbia eximia*	Yellow Bloodwood			Native
Myrtaceae	*Corymbia gummifera*	Red Bloodwood			Native
Myrtaceae	*Eucalyptus acmenioides*				Native
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark			Native
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark			Native
Myrtaceae	*Eucalyptus pilularis*	Blackbutt			Native
Myrtaceae	*Eucalyptus punctata*	Grey Gum			Native
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany			Native
Myrtaceae	*Eucalyptus saligna*	Sydney Blue Gum			Native
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum			Native
Myrtaceae	*Leptospermum sp.*				Native
Myrtaceae	*Leptospermum trinervium*	Paperbark Tea-tree			Native
Myrtaceae	*Syncarpia glomulifera*	Turpentine			Native
Ochnaceae	*Ochna serrulata*	Mickey Mouse Plant			Exotic
Oleaceae	*Jasminum polyanthum*	White Jasmine			Exotic
Oleaceae	*Ligustrum lucidum*	Large-leaved Privet			Exotic
Oleaceae	*Ligustrum sinense*	Small-leaved Privet			Exotic
Oleaceae	*Olea europaea subsp. cuspidata*				Exotic
Orchidaceae	*Cryptostylis sp.*				Native
Oxalidaceae	*Oxalis corniculata*	Creeping Oxalis			Exotic

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS[1]	TSC ACT STATUS[2]	NATIVE
Oxalidaceae	*Oxalis latifolia*	Large-leaf Wood-sorrel			Exotic
Oxalidaceae	*Oxalis perennans*	Grassland Wood-sorrel			Native
Oxalidaceae	*Oxalis pes-caprae*	Soursob			Exotic
Oxalidaceae	*Oxalis sp.*				Native
Passifloraceae	*Passiflora edulis*	Common Passionfruit			Exotic
Passifloraceae	*Passiflora suberosa*	Cork Passionfruit			Exotic
Phormiaceae	*Dianella caerulea*				Native
Phormiaceae	*Dianella caerulea var. producta*				Native
Phormiaceae	*Dianella longifolia*				Native
Phytolaccaceae	*Phytolacca octandra*	Inkweed			Exotic
Pinaceae	*Pinus sp.*				Exotic
Pittosporaceae	*Billardiera scandens*	Appleberry			Native
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn			Native
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum			Native
Plantaginaceae	*Plantago gaudichaudii*	Narrow Plantain			Native
Plantaginaceae	*Plantago lanceolata*	Lambs Tongues			Exotic
Poaceae	*Agrostis capillaris*	Browntop Bent			Exotic
Poaceae	*Andropogon virginicus*	Whisky Grass			Exotic
Poaceae	*Anisopogon avenaceus*	Oat Speargrass			Native
Poaceae	*Aristida vagans*	Threeawn Speargrass			Native
Poaceae	*Austrostipa pubescens*				Native
Poaceae	*Austrostipa ramosissima*	Stout Bamboo Grass			Native
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass			Exotic
Poaceae	*Bromus catharticus*	Prairie Grass			Exotic
Poaceae	*Cynodon dactylon*	Common Couch			Native
Poaceae	*Dichelachne inaequiglumis*	Loose Plume-grass			Native
Poaceae	*Dichelachne sp.*				Native
Poaceae	*Digitaria ciliaris*				Exotic
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass			Native

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS[1]	TSC ACT STATUS[2]	NATIVE
Poaceae	*Echinopogon caespitosus*				Native
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass			Native
Poaceae	*Ehrharta erecta*	Panic Veldtgrass			Exotic
Poaceae	*Entolasia marginata*	Bordered Panic			Native
Poaceae	*Entolasia stricta*	Wiry Panic			Native
Poaceae	*Imperata cylindrica*	Bladey Grass			Native
Poaceae	*Microlaena stipoides*				Native
Poaceae	*Oplismenus aemulus*				Native
Poaceae	*Oplismenus imbecillis*	Creeping Beard Grass			Native
Poaceae	*Panicum simile*	Two-colour Panic			Native
Poaceae	*Paspalidium distans*	Spreading Panic-grass			Native
Poaceae	*Paspalum dilatatum*	Paspalum			Exotic
Poaceae	*Pennisetum clandestinum*	Kikuyu Grass			Exotic
Poaceae	*Poa affinis*				Native
Poaceae	*Rytidosperma sp.*				Native
Poaceae	*Setaria gracilis*	Slender Pigeon Grass			Exotic
Poaceae	*Themeda triandra*	Kangaroo Grass			Native
Polygonaceae	*Acetosa sagittata*	Rambling Dock			Exotic
Polygonaceae	*Rumex brownii*	Swamp Dock			Native
Portulacaceae	*Portulaca oleracea*	Pigweed			Native
Primulaceae	*Anagallis arvensis*	Scarlet/Blue Pimpernel			Exotic
Proteaceae	*Grevillea robusta*	Silky Oak			Native
Proteaceae	*Lomatia silaifolia*	Crinkle Bush			Native
Proteaceae	*Persoonia levis*	Broad-leaved Geebung			Native
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung			Native
Proteaceae	*Persoonia pinifolia*	Pine-leaved Geebung			Native
Ranunculaceae	*Clematis aristata*	Mountain Clematis			Native
Rosaceae	*Rubus fruiticosus*	Blackberry complex			Exotic
Rubiaceae	*Galium leptogonium*				Exotic
Rubiaceae	*Opercularia aspera*	Coarse Stinkweed			Native

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS[1]	TSC ACT STATUS[2]	NATIVE
Rubiaceae	*Opercularia varia*	Variable Stinkweed			Native
Rubiaceae	*Pomax umbellata*	Pomax			Native
Rubiaceae	*Richardia stellaris*				Exotic
Rutaceae	*Murraya paniculata*				Exotic
Rutaceae	*Zieria smithii*	Sandfly Zieria			Native
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush			Native
Scrophulariaceae	*Veronica arvensis*	Wall Speedwell			Exotic
Scrophulariaceae	*Veronica plebeia*	Trailing Speedwell			Native
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsparilla			Native
Solanaceae	*Solanum chenopodioides*	Whitetip Nightshade			Exotic
Solanaceae	*Solanum mauritianum*	Wild Tobacco Bush			Exotic
Solanaceae	*Solanum nigrum*	Black-berry Nightshade			Exotic
Solanaceae	*Solanum prinophyllum*	Forest Nightshade			Native
Solanaceae	*Solanum pseudocapsicum*	Madeira Winter Cherry			Exotic
Sterculiaceae	*Brachychiton acerifolius*	Illawarra Flame Tree			Native
Thymelaeaceae	*Pimelea linifolia*	Slender Rice-flower			Native
Ulmaceae	*Celtis sinensis*	Chinese Nettle Tree			Exotic
Verbenaceae	*Clerodendrum tomentosum*				Native
Verbenaceae	*Lantana camara*	Lantana			Exotic
Verbenaceae	*Verbena bonariensis*	Purpletop			Exotic
Verbenaceae	*Verbena officinalis*	Common Verbena			Exotic
Violaceae	*Hybanthus monopetalus*	Slender Violet-bush			Native
Vitaceae	*Cayratia clematidea*	Slender Grape			Native

(1) Listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
(2) Listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and/or listed as protected under Schedule 13 Protected native plants of the NSW *National Parks and Wildlife Act 1974*.