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Mirvac Group

Report for the former Hoxton Park Airport Development

Ecology Assessment

February 2010

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Glossary

Study Area Components

The following terms are used to describe the various components of this assessment:

- ***'the project'*** : the proposed Employment zone Development at the former Hoxton Park Airport;
- **'*the site***': the area assessed directly in this report;
- **'*study area'*** : the area assessed broadly in this report, including 'the site', adjoining areas of the natural environment and 'the study area's for previous assessments in the vicinity which were included in the literature review for this assessment; and
- '***the locality'*** : the area within a 10km radius around 'the site'.

List of Abbreviations

DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DGRs	Director Generals Requirements
DII	Department of Industry and Investment
DWE	Department of Water and Energy
DoP	Department of Planning
EEC	Endangered Ecological Community
EP&A Act	Environmental Planning and Assessment Act
EPBC Act	Environmental Protection and Biodiversity Conservation Act
LEP	Local Environment Plan (Liverpool City Council)
LGA	Local Government Area (Liverpool City Council)
PSC	Parkes Shire Council
TSC Act	Threatened Species Conservation Act
VMP	Vegetation Management Plan

Executive Summary

GHD has prepared this ecological assessment on behalf of the Mirvac Group for the proposed development at the former Hoxton Park Airport. The proposed development area is located between the M7, the vegetated riparian corridor associated with Hinchinbrook Creek and Cowpasture Road, Hoxton Park ('the site'). There are three component areas of the overall development:

- Employment zone development incorporating warehousing and distribution facilities and associated site infrastructure;
- A future sedimentation basin and spillway; and
- A future access road including a bridge over Hinchinbrook Creek.

The Employment zone component of the development is the focus of the Part 3a Concept Application under Part 3a of the *Environmental Planning and Assessment (*EP&A) *Act*. The sedimentation basin and access road will each be subject to final ecological impact assessments as part of separate Project Applications. Regardless, preliminary ecological assessments and constraints information has been provided in this report to help inform interested parties of the ecological values of these locations.

The area comprising the employment zone development ('the project') is influenced by previous planning and environmental approvals associated with the rezoning process (the area hatched in Figure 2). Clearing to accommodate development is permitted in accordance with the Voluntary Planning Agreement (VPA) (2007) and the associated Offset Strategy (GHD 2007b). The development will be required to provide resources to facilitate the necessary offset works in accordance with the VPA and offset strategy (GHD 2007b).

Development at 'the site' (as described in Glossary) is to be assessed under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act). This ecological assessment has been undertaken to determine the conservation significance of 'the site', identify ecological constraints to future development and identify any likely impacts on flora and fauna.

The key components and objectives of this ecological assessment include:

- Review of existing information including the earlier ecological assessments and environmental plans for 'the site', biodiversity databases and other relevant technical reports and investigations;
- Field surveys and assessment to build on the existing biodiversity information available for 'the site' and immediate surrounds including:
  - An initial two day, one night survey on 16th-17th December 2009 sampling the proposed locations for the sediment pond and access road; and
  - A supplementary three day, two night survey on 19th-21st January 2010 sampling the proposed employment land development, access road and adjoining habitats in the Hinchinbrook Creek riparian corridor.
- Description of the existing environment of 'the site' and surrounding area, including type and condition of vegetation communities, terrestrial and aquatic habitats and overall biodiversity values;

- Assessment of the likelihood of occurrence of threatened species, populations ecological communities and their habitats listed under the TSC Act, FM Act and EPBC Act within 'the study area';
- Assessment of the conservation significance of 'the site' and ecological constraints and opportunities to 'the project';
- Assessment of potential impacts of 'the project' on native flora and fauna, including threatened biota at 'the site'; and
- Preliminary measures to avoid, minimise, mitigate and offset impacts on biodiversity values of 'the study area' in accordance with the Part 3A assessment guidelines.

The vegetation within the 'study area' (as described in Glossary) is extensively modified by historic clearing and ongoing activities. Vegetation communities include intact patches of native forest and partially disturbed and regrowth woodland, derived grassland and artificial wetlands. The most extensive and highest quality native vegetation remnants occur along the Hinchinbrook Creek as an intact riparian corridor along the eastern edge of 'the site'. The majority of this vegetation is consistent with the EEC 'River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions' (RFEF) listed under the TSC Act or the EEC 'Cumberland Plain Woodland – Endangered Community of the Cumberland Plain' (CPW), which is listed under the TSC Act and is also listed as a Critically Endangered Ecological Community under the EPBC Act. There is also a patch of CPW within the footprint for the sediment basin and small remnants and scattered paddock trees representative of this community within the proposed employment zone development.

A moderate diversity of native fauna species were recorded at 'the site', particularly within the Hinchinbrook Creek corridor, including five threatened species observed, all listed as Vulnerable under the TSC Act:

- The Grey-headed Flying Fox (*Pteropus poliocephalus*);
- Eastern Falsistrelle (*Falsistrellus tasmaniensis*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Large Footed Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax ruepelli*).

The Cumberland Land Snail (*Meridolum corneovirens*), listed as Endangered under the TSC Act, is highly likely to occur in CPW at 'the site', based on habitat assessments and recent record in the locality.

Construction for the employment zone would require the clearing or modification of native vegetation within the surface disturbance area. This clearing has already been assessed and is permitted in accordance with the VPA (Biosis, 2006; GHD, 2007b). The proposed employment zone development will remove small patches of Shale Plains Woodland vegetation totalling 1.475 ha in area (GHD, 2007b). The Biosis (2006) Report completed assessments of significance under the EPBC and TSC Acts respectively and concluded that, 'on the basis of the small size, fragmentation and degraded state of the community within 'the study area', the proposed development was not likely to result in a significant impact on the EEC'. Notwithstanding this determination, the development will seek to mitigate this impact through appropriate 'offsetting' mechanisms' implemented within the subject site.

Impacts within the employment zone development footprint have previously been assessed by Biosis (2006) and GHD (2007a). The extent, condition and conservation significance of native vegetation and habitats is equivalent that described in the Biosis (2007) assessment and subsequent GHD (2007a) site surveys in the preparation of the VMP for 'the site'. The impact assessments and assessments of significance provided by Biosis (2007) and offsets strategy presented by GHD (2007b) are appropriate to conditions observed in the current assessment.

No additional surveys, modifications to the development design, mitigation or offsets are required to accompany 'the project' Application for the proposed employment zone development allowing this component of the overall development to proceed without delay.

Based on the findings of this assessment, the proposed future sediment basin and future access road is likely to result in impacts on native vegetation and threatened biota in addition to the impacts identified by Biosis (2006) and GHD (2007a) and compensated for by the existing offsets strategy (GHD, 2007b). The following recommendations are made to inform the development design process for the proposed future sediment basin and future access road only. This advice is provided to avoid or reduce the potential for adverse impacts on threatened biota and their habitats and assist the development approval process for these components of the overall development:

- Retain as much of the remnant native vegetation comprising EECs and containing habitat trees as possible;
- Retain and rehabilitate riparian corridors and drainage channels where possible;
- Enhance connectivity values and habitat linkages through 'the study area' via retained and rehabilitated watercourses. Incorporate existing remnant trees into these where possible and use appropriate local native species in rehabilitation and landscaping areas; and
- Develop a biodiversity offset strategy to offset any residual impacts or impacts not previously covered by the offset strategy (GHD 2007b), on biodiversity of future development on site that cannot be avoided or mitigated through development design and/or implementation of impact amelioration measures.

1. Introduction

1.1 Project Description

GHD has prepared this ecological assessment on behalf of the Mirvac Group for the proposed development at the former Hoxton Park Airport. The proposed development area is located between the M7, the vegetated riparian corridor associated with Hinchinbrook Creek and Cowpasture Road, Hoxton Park ('the site'). There are three component areas of the development:

- Employment zone development incorporating warehousing and distribution facilities and associated site infrastructure;
- A future detention basin and spillway; and
- A future access road including a bridge over Hinchinbrook Creek.

Development at 'the site' is to be assessed under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act), which provides the assessment and approvals process for major infrastructure projects. This ecological assessment has been undertaken to determine the conservation significance of 'the site', identify ecological constraints to future development, confirm previous approvals associated with 'the project' and identify any likely impacts on flora and fauna.

Component areas of the development site are subject to a Concept Plan Application seeking approval for the following:

- General site layout;
- Building Envelopes;
- Land use;
- Operation of the development 24hrs/per day;
- Staging of the development; and
- Land Subdivision.

The Concept Plan Application will be submitted concurrently with a detailed Project Application for the employment zone development which will seek consent for:

- The design, construction and operation of warehouse buildings;
- Fit out and use of warehousing and distribution businesses, including 24/7 operational hours;
- Construction of the required site infrastructure including:
  - Roads;
  - Parking;
  - Drainage;
  - Services and Utilities; and
- Earthworks including excavation and fill.

The future detention basin and future access road across Hinchinbrook Creek will each be subject to final ecological impact assessments as part of separate Project Applications under Part 3a of the EP&A Act.

'The site' forms part of the Hoxton Park Airport Redevelopment and is influenced by previous development approvals. The entire area of the proposed employment zone development ('the project') falls within the area already rezoned by Liverpool City Council (LCC) for development. The Vegetation Management Plan (VMP) for the Hoxton Park Airport Redevelopment (GHD 2007a) has been approved by the then Department of Water and Energy (DWE) and LCC. An offsets strategy for the Hoxton Park Airport Redevelopment (GHD 2007a) has been approved by LCC and the Department of Environment, Climate Change and Water (DECCW). The outcomes/obligations for rehabilitation and management outlined in these plans were included in a Voluntary Planning Agreement (VPA). The employment zone development ('the project') assessed in this report would need to make contributions to the existing agreement in relation to riparian and vegetation management as part of the obligations to deliver the VPA. The proposed detention basin and access road would result in additional impacts not addressed in the GHD (2007b) offsets strategy. Project applications for the future detention basin and future access road would describe additional biodiversity offsets to mitigate these impacts as required.

'The site' location is shown on Figure 1. The area covered by this assessment and indicative layout of the proposed development and associated infrastructure is shown on Figure 2.

1.2 Scope of Report & Director General's Requirements

GHD Pty Ltd (GHD) was engaged by Mirvac to prepare an ecological assessment, to meet the Part 3A *Guidelines for Threatened Species Assessment* (DEC/DPI, 2005). GHD has prepared this assessment to gain an understanding of 'the site's ecology in response to the draft *Director General Requirements (DGR's)*.

Project applications for the future proposed detention basin and future access road would be prepared at a later date.

The assessment is designed to provide information and analysis to demonstrate that feasible alternatives have been considered, that 'the project' has been designed to be consistent with the principles outlined in the DEC/DPI (2005) guidelines, and where there are impacts, that adequate mitigation measures and biodiversity offsets are implemented.

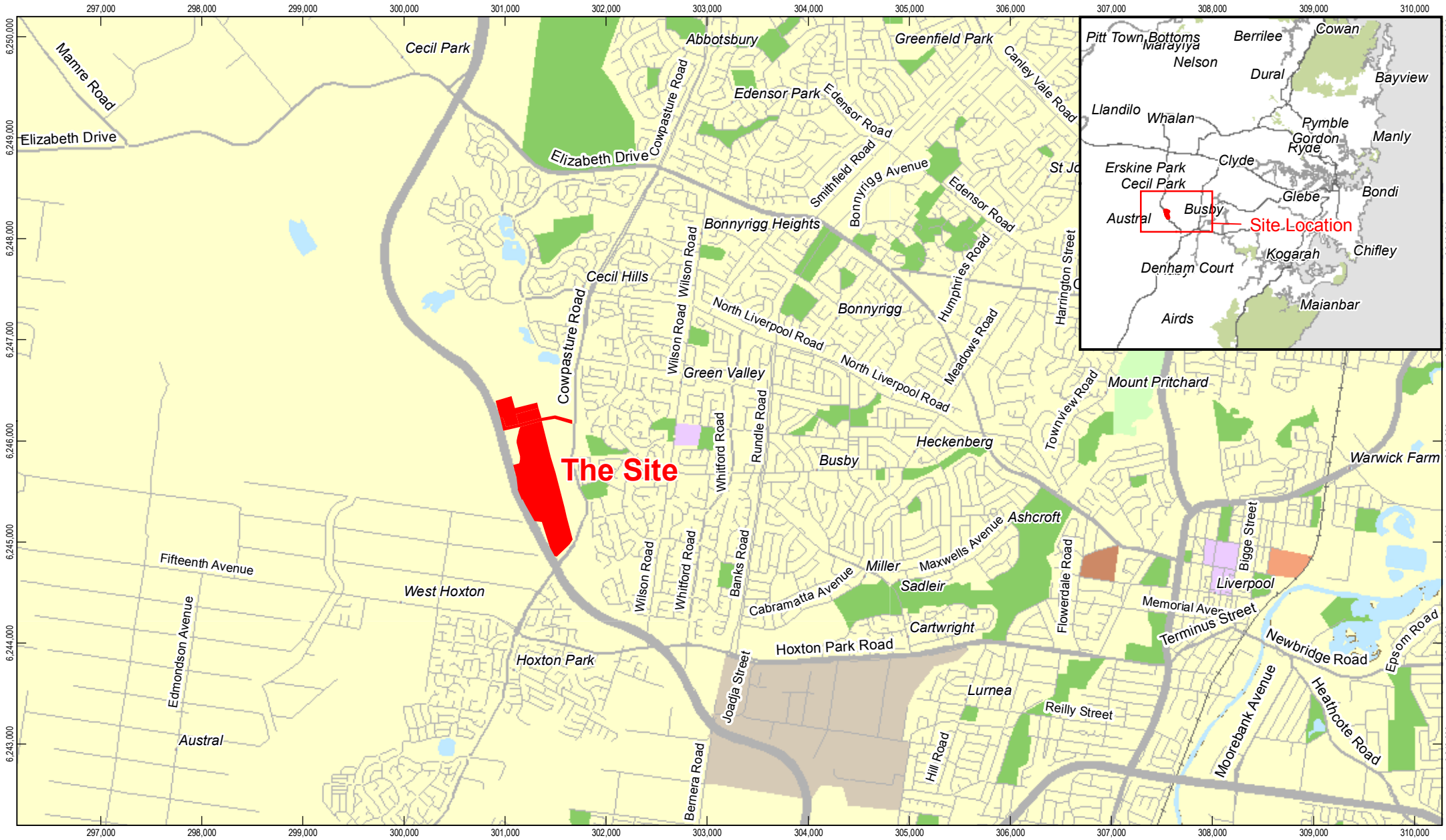
Consideration was also given to the *DEC Draft Threatened Biodiversity Survey and Assessment Guidelines* (2004) with regards to the scope and timing of flora and fauna surveys.

1.3 Objectives of the Ecological Assessment

The key components and objectives of this ecological assessment include:

- Review of existing information including the earlier ecological assessments and environmental plans for 'the site', biodiversity databases, previous planning/environmental approvals and other relevant technical reports and investigations;
- Field surveys and assessment to build on the existing biodiversity information available for 'the site' and immediate surrounds;

- Description of the existing environment of ‘the site’ and surrounding area, including type and condition of vegetation communities, terrestrial and aquatic habitats and overall biodiversity values;
- Assessment of the likelihood of occurrence of threatened species, populations ecological communities and their habitats listed under the TSC Act, FM Act and EPBC Act within ‘the study area’;
- Assessment of the conservation significance of ‘the site’ and ecological constraints and opportunities to ‘the project’;
- Assessment of potential impacts of ‘the project’ on native flora and fauna, including threatened biota at ‘the site’; and
- Preliminary measures to avoid, minimise, mitigate and offset impacts on biodiversity values of ‘the study area’ in accordance with the Part 3A assessment guidelines.



1:50,000 (at A4)

0 250 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

The Site

GHD

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Hoxton Park Airport Development - Ecology Assessment

Job Number 22 - 14911
Revision A
Date 04 FEB 2010

Site Location

Figure 1

G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z001_SiteLocation.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data source: DCDB, NSW Dept of Lands; Street Map, Navigate. Created by: Cwilson, qjchung, bahambly

301,000 302,000

6,246,000 6,245,000

216//DP1111381
213//DP1111381
24//DP1042996
215//DP1111381
214//DP1111381
8//DP1156345
M7 Motorway
22//DP1042996
2//DP875867
1//DP875867
658//DP838730
336//DP829870
27//DP237890
543//DP868318
Hinchinbrook Creek
151//DP816947
424//DP774970
426//DP774970
7//DP237890
211//DP1111381
1//DP1111918
123//DP2475
120//DP2475
119//DP2475
118//DP2475
22//DP1042996
174//DP2475
A//DP413852
B//DP413852
401//DP1049478
177//DP2475
178//DP2475
180//DP2475
1//DP711938
A//DP381267
B//DP381267
2//DP1156345
57//DP1044841
54//DP1044841
53//DP1044841
37//DP1044841
189//DP2475
191//DP2475
193//DP2475
194//DP2475
247//DP2475
248//DP2475
249//DP2475
2//DP1078564
12//DP1108343
253//DP2475
11//DP1089776
34//DP1044841
66//DP1044841
29//DP1044841
Cowpasture Road
Image from Google Earth

Legend

- The Site
- Employment Zone Developement (the Project)
- Sediment Basin & Spill Zone
- Access Road
- Cleared under previous approvals (Biosis, 2006)
- Cadastral Boundaries

1:5,000 (at A3)

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

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Mirvac Group Pty Ltd
Hoxton Park Airport Development - Ecology Assessment

Job Number 22 - 14911
Revision A
Date 23 FEB 2010

Site Layout

Figure 2

G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z002_Site_Layout.mxd

10 Bond Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: DCDB, NSW Dept. of Lands: Cadastre - 19/01/2010; Imagery: Nearmap - 19/01/2010. Created by: qjchung, bahambly

2. Legislative Context

2.1 Introduction

A brief outline of State and Commonwealth ecological legislation and policy of potential relevance to the Proposal is provided below.

2.2 Commonwealth Legislation

2.2.1 Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The purpose of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Commonwealth Minister for the Environment, Water, Heritage and the Arts.

In January 2007 the Commonwealth and NSW governments signed a Bilateral Agreement which allows DEWHA to accredit the assessment regimes under Part 3A, Part 4 and Part 5 of the EP&A Act for assessment purposes under the EPBC Act. The Bilateral Agreement applies only to proposals that the Commonwealth Environment Minister has determined are controlled actions under the EPBC Act, with the exception of nuclear actions (DoP, 2007).

The EPBC Act identifies matters of national environmental significance as:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

The Administrative Guidelines for the EPBC Act (DEH, 2006) set out criteria intended to assist in determining whether an action is controlled and hence requires approval. In particular, the Guidelines contain criteria for determining whether a proposed action is likely to have a 'significant impact' on a matter of national environmental significance (NES). Should the proponent deem the proposal likely to have a significant impact on a matter of NES, a referral to the Commonwealth Minister for the Environment would be undertaken to obtain a determination as to whether the proposal is a 'controlled action' requiring Commonwealth approval.

The EPBC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened and migratory species or ecological communities listed under the Act that have been previously recorded within the locality of 'the site' and hence could occur, subject to the habitats present;
- Targeted field surveys for species and ecological communities listed under the Act;
- Development of suitable impact mitigation and environmental management measures for threatened species and ecological communities, where required;
- Assessment of potential impacts on the Ramsar wetland; and
- Assessment of potential impacts on threatened species.

2.3 State Legislation

2.3.1 Environmental Planning & Assessment Act 1979

The *Environmental planning and Assessment Act* (EP&A Act) forms the legal and policy platform for development assessment and approval in NSW and aims to, *inter alia*, 'encourage the proper management, development and conservation of natural and artificial resources'. It is anticipated that development of 'the site' will be a major project according to the provisions of Part 3A of the EP&A Act, with the Minister for Planning as the approval authority for 'the project' Application. An Environmental Assessment (EA) for 'the project' would be prepared. This assessment has been prepared with due consideration of the Act and DEC/DPI (2004) guidelines for assessments under Part 3A to provide inputs to the future preparation of an EA.

2.3.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides legal status for biota of conservation significance in NSW. The Act aims to, *inter alia,* 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

- The listing of 'threatened species, populations and ecological communities' (threatened biota) with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, vulnerable species and communities listed under Schedule 2;
- The listing of 'Key Threatening Processes' (KTPs) (under Schedule 3);
- The preparation and implementation of Recovery Plans and Threat Abatement Plans; and
- Requirements or otherwise for the preparation of Species Impact Statement (SIS).

The TSC Act has been addressed in the current assessment through:

- Desktop assessment to identify the threatened biota that have been previously recorded within the locality of 'the site' and hence have the potential to occur at 'the site' and be affected by 'the project';
- Targeted field surveys for threatened biota;
- Habitat assessments, to determine whether habitat features and resources for threatened biota are present at 'the site', and hence whether threatened biota are likely to occur and be affected by 'the project';

- Identification of KTPs operating at ‘the site’, in terms of the extent, timing and severity of their operation;
- Assessment of the extent to which ‘the project’ will affect the operation of any KTPs at ‘the site’;
- Development of suitable impact mitigation and environmental management measures for threatened biota, where required; and
- Assessment of potential impacts on threatened biota.

2.3.3 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations.

The FM Act lists threatened species of freshwater fish, aquatic invertebrate and macroinvertebrate species, endangered populations and aquatic ecological communities and key threatening processes. The FM Act has been addressed in the current assessment through:

- Desktop assessment to identify the threatened aquatic biota that have been previously recorded within ‘the locality’ of ‘the site’ and hence have the potential to occur at ‘the site’ and be affected by ‘the project’;
- Habitat assessments, to determine the conservation significance of aquatic habitats at ‘the site’;
- Development of suitable impact mitigation and environmental management measures for aquaticbiota, where required; and
- Assessment of potential impacts on aquatic biota.

These assessments have concluded that ‘the project’ incorporating measures to avoid or mitigate impacts is likely to avoid significant impacts on affected aquatic entities.

2.3.4 Noxious Weeds Act 1993 (NW Act)

The NW Act is a NSW government instrument outlining the definition, declaration, and control of noxious weeds throughout the State. Local government bodies have the responsibility to ensure land owners comply with the Act within their LGA boundaries.

For a plant to be declared a Noxious Weed it must be considered to pose a serious threat to humans, agriculture and/or the environment. There must also be consideration given to the feasibility of control and enforcement of those methods. Plants are declared noxious by order of the Minister for Agriculture.

Landowners or occupiers have obligations under the Act to control any declared weed on their property. Council is required to conduct inspections of private properties to check compliance with the Act and Noxious Weed Officers have the authority to issue control notices for any breach. The weeds currently listed as noxious in the Maitland local control area are listed in the declaration.

The objectives of this Act are as follows:

- Reduce the negative impact of weeds on the economy, community and environment of this State by establishing control mechanisms to:
- Prevent the establishment in this State of significant new weeds;
- Restrict the spread in this State of existing significant weeds;

- Reduce the area in this State of existing significant weeds; and
- Provide for the monitoring of and reporting on the effectiveness of the management of weeds in this State.

Details of noxious weeds recorded in 'the study area' are included in Section 5 and Appendix A of this report.

2.3.5 Water Management Act 2000 (WM Act)

Section 91 of the WM Act specifies that a person must not undertake a controlled activity in or near a river, lake or estuary, without a controlled activity approval.

The proposed access road will cross an intermittent watercourse. No water extraction or storage is proposed. A culvert will be required to cross the watercourse and this is an activity that requires a permit under Section 91.

2.3.6 National Parks and Wildlife Act 1974 (NPW Act)

The objects of this Act are as follows:

- Conservation of nature, including, the conservation of habitat, biological diversity, landforms and landscapes.
- Conservation of objects, places or features of cultural value within the landscape, including places, objects and features of significance to Aboriginal people and the people of NSW.
- Fostering public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation.
- Providing for the management of land reserved under this Act in accordance with the management principles applicable for each type of reservation.

The nearest Nature Reserve is Kemps Creek Nature Reserve, located approximately 6 km northwest of the Proposal. 'The project' is not anticipated to impact on this or any other Nature Reserve or National Park.

2.4 State Environmental Planning Policies (SEPPs)

2.4.1 SEPP 44 - Koala Habitat Protection

State Environmental Planning Policy 44 (SEPP 44) aims to encourage the 'proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline'.

Schedule 1 of SEPP 44 lists the local government areas (LGAs) to which SEPP 44 applies. 'The site' is within the Liverpool City Council (LGA).

SEPP 44 requires that, before granting consent for Development Application under Part 4 of the EP and A Act, on land over 1 hectare in area, a consent authority must be satisfied as to whether or not the land is 'potential' and 'core' Koala habitat.

As 'the project' is a major project subject to Part 3A of the EP and A Act, SEPP 44 does not technically apply. Notwithstanding, the general principles of the SEPP have been considered.

Under the SEPP, potential Koala habitat is defined as 'an area 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'. Schedule 2 lists the main koala feed tree species.

Core Koala habitat, is defined as 'an area of land with a resident breeding population of Koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population'.

As discussed in Section 4, the principles of SEPP 44 were addressed through targeted surveys for Koalas and Koala feed trees and searches for signs of recent Koala activity.

2.4.2 SEPP 19 - Bushland in Urban Areas

The general aim of SEPP 19 is to protect and preserve bushland within the urban areas referred to in Schedule 1 of the Policy because of:

- Its value to the community as part of the natural heritage;
- Its aesthetic value; and
- Its value as a recreational, educational and scientific resource.

Under SEPP 19, development consent is required from the local council for the carrying out of a proposal that will disturb bushland zoned or reserved for public open space. SEPP 19 also applies to land adjoining land zoned or reserved for public open space.

Liverpool LGA is listed under Schedule 1 of SEPP 19 as an area to which the policy applies. The Proposal adjoins land to the east that is zoned or reserved for public open space.

'The project' will disturb native vegetation as described in the offset strategy (GHD 2007b) with this clearing being permitted as long as obligations described in the VPA are met.

3. Site Description

3.1 Site Location & Layout

The proposed Hoxton Park Airport redevelopment is located at the former Hoxton Park Airport, in the south west of Sydney, NSW ('the site'). 'The site' is located between the M7 Westlink Freeway and Cowpasture Road and is entered via Cowpasture Road. To the immediate east of the former airport is the Hinchinbrook Creek riparian corridor which contains intact native vegetation and will be the subject of riparian rehabilitation works. 'The site' is located in the Liverpool Local Government Area (LGA), between the suburbs of Cecil Park, Cecil Hills, West Hoxton, Green Valley and Hinchinbrook (refer Figure 1).

There are three component areas of 'the site' that will be subject to development approvals:

- Employment zone development incorporating future retail precincts, warehousing and associated access roads and carparks;
- A future detention basin and spillway; and
- A future access road for proposed residential developments to the north of 'the site'.

The indicative layout of the development site is shown on Figure 2.

The area of the proposed employment zone development ('the project') is dominated by cleared and extensively modified land associated with the former airport. It consists of a flat landform containing asphalt former runways and access roads surrounded by derived grassland. 'The site' contains a number of former airport buildings and associated infrastructure including carparks, drains, fences and landscaped gardens. There are a number of small pockets of native vegetation surrounding drains along the eastern boundary of 'the site', some isolated remnant 'paddock' trees and some patches of native wetland plants within existing drains and basins.

'The site' for the future detention basin and spillway contains remnant and regenerating native vegetation including a patch of Cumberland Plain Woodland. Two unnamed drainage lines run through the central portion of the basin area. The future spillway footprint contains derived grassland, wetland vegetation along a drainage line and regenerating Cumberland Plain Woodland.

The future access road passes through the Hinchinbrook Creek riparian corridor. The riparian corridor contains remnant and regenerating native vegetation. Vegetation within the riparian zone of the creek line is predominately Alluvial Woodland (River Flat Eucalypt Forest). These communities grade to Shale Hills Woodland (Cumberland Plain Woodland) outside the riparian zone.

The Hinchinbrook Creek riparian corridor adjoins the eastern boundary of the site. Farther east is Cowpasture Road and the suburb of Hichinbrook which predominantly contains low density residential development. Immediately to the north is a future commercial / retail uses development which will eventually provide a buffer for the future 200 (approximately) dwellings which are planned for construction further north on the same site. Farther north is the Cecil Hills High School and beyond that the Cecil Hills residential sub-division.

The M7 adjoins the western boundary of 'the site'. The M7 is a 4 lane connecting the M2, M4 and M5 motorways through the outer suburbs of Sydney. Beyond the M7 is a Mirvac / Landcom joint venture called Parkbridge which will accommodate approximately 700 residential lots. The area to the northwest of 'the site' contains a large stand of remnant vegetation, known as the Spotted Gum Forest, and beyond that the Western Sydney Parklands.

Cowpasture Road, which is currently being upgraded by the RTA, bounds the southern part of 'the site'. Beyond Cowpasture Road is vacant land which is zone RU1 – Primary Production.

Field surveys included areas of native vegetation and habitat adjoining 'the site' (the 'study area'). Database searches were undertaken based on a 10 km radius of 'the study area' (the 'locality').

3.2 Geology, Soils and Topography

The subject site is located on a relatively level area of low topographic relief. The unnamed creek to the north of the subject site contains a variety of channels and pools, with some eroded creek banks being moderately inclined to steep.

Reference to the 1:100 000 Blacktown soil landscape map (Hazelton et al 1989) indicates that the subject site occurs on gently undulating rises on Wianamatta Group Shales. Hinchinbrook Creek is described as a fluvial landscape occurring on floodplains, valley flats and drainage depressions of the channels on the Cumberland Plain.

3.3 Hydrology

Hinchinbrook Creek occurs in 'the study area', which forms part of the wider Georges River catchment further east.

An unnamed drainage line runs through the central portion of the basin area, from the M7 underpass in the west to a culvert and drain beneath the former airport runway and then eastwards to Hinchinbrook Creek. There are an additional two artificial ephemeral drainage lines and freshwater wetlands.

Numerous named creeks and unnamed tributaries also occur in the surrounding area as well as ephemeral drainage lines and freshwater wetlands. Most of the named creeks are associated with narrow corridors of native riparian vegetation.

3.4 Climate

The Commonwealth Bureau of Meteorology website provides climatic information for 'the site' taken from Bankstown Airport weather station (closest station to site). A review of this data indicated that the mean rainfall peaks in summer and ranges from 108.8 mm in February down to 44.6 mm in July and September. Mean daily maximum temperatures range from 28.1°C in summer to 17.2°C in winter with mean minimum temperatures ranging from 18.0°C in summer down to 5.1°C in winter (Bureau of Meteorology 2009).

4. Methodology

4.1 Desktop Assessment

4.1.1 Literature Review

GHD has completed a review of known ecological and riparian constraints for the Hoxton Park airport site. The review has been completed in accordance with GHD's proposal dated 7th December 2009 (GHD Ref: 22/01030/14/1125). The review was based on information provided by Mirvac (or held by GHD with permission to use provided by Mirvac) and including the following:

- GHD (2007a) *Vegetation Management Plan for Hoxton Park Airport*, November 2007;
- GHD (2007b) *Offset Strategy Hoxton Park Airport*, November 2007;
- GHD (2007c) *Seven Part Test – Hoxton Park Airport*;
- JBA Urban Planning Consultants (2009), *Part 3A Request for Minister's Declaration – Warehouse and Distribution Facilities, Hoxton Park*, December 2009;
- Biosis Research (2006) *Flora and Fauna Assessment of the Stage 1 Subdivision, Hoxton Park Airport*, July 2006;
- Proposed zoning plan, development plan (Concept Site Plan – Option 6 SK O7) and maps/figures associated with ecology and open space management; and
- New South Wales National Parks and Wildlife Service (2002) Native Vegetation Maps of the Cumberland Plain, Western Sydney.

4.1.2 Database Searches

Records, and potential occurrences, of threatened species, populations and endangered ecological communities were extracted from the following databases for a 10 km radius around 'the study area':

- The NSW Department of Environment, Climate Change and Water's (DECCW) Wildlife Atlas for threatened biota listed under the TSC Act which have been recorded within the locality;
- The Commonwealth Department of Environment, Water and Heritage and the Arts (DEWHA) Protected Matters Search Tool for Matters of National Environmental Significance (NES) listed under the EPBC Act which may occur in the area;
- BioNet database (which comprises records from the Royal Botanic Gardens, Australian Museum, State Forests, DECCW and NSW Fisheries collections).
- Birds Australia's The New Atlas of Australian Birds (Barrett et al. 2003) and Birdata online database search tool; and
- The NSW Department of Environment, Climate Change and Water's (DECCW) Threatened Species Profile online database (Cumberland CMA sub-region).

4.2 Field Surveys

Two field surveys were conducted for this ecological assessment:

- An initial two day, one night survey on 16th-17th December 2009 sampling the proposed locations for the sediment pond and access road; and
- A supplementary three day, two night survey on 19th-21st January 2010 sampling the proposed employment land development, access road and adjoining habitats in the Hinchinbrook Creek riparian corridor.

Field survey techniques and conditions are described below.

4.2.1 Flora Survey

Flora survey methods used during the current field surveys are described below.

Vegetation Mapping and Habitat Resources

Remnant vegetation in 'the study area' was assigned a vegetation community type based on vegetation composition, soil type, and NPWS (2002) interpretive guidelines. Vegetation communities were verified through characterisation of all vegetation within 20 m x 20 m quadrats placed randomly within the vegetation communities, consistent with DEC (2004) guidelines. Random meander surveys were used to compile a species list for small or fragmented patches. Additional survey effort was performed in all vegetation patches with the potential to be endangered ecological communities (EEC's), or where vegetation type or structure changed. All species present within each quadrat were recorded along with a cover abundance ranking. The locations of vegetation survey quadrats and random meander surveys are indicated on Figure 3.

Biophysical setting, including vegetation structure, geomorphology and habitat resources were described for each vegetation type. Notes were taken on canopy cover, numbers of tree-hollows, fallen debris, presence of wetland and aquatic habitat the dominant species, soil type and condition and the level of weed invasion and any other signs of disturbance. Reference was made to DECCW (2010b) threatened species profiles and EEC identification guidelines as appropriate. This was considered important for assessing the presence of Cumberland Plain EEC's, listed under both the TSC and EPBC Acts at 'the site' and verifying the conservation significance of vegetation (i.e. areas of core and support for core habitat) identified and mapped by DECCW (NPWS 2002). Vegetation maps were developed to sub-divide the native vegetation at 'the site' in accordance to its condition (i.e. canopy cover, degree of disturbance) and conservation significance, to provide a more detailed guide to the level of associated constraints.

The data gathered has been used to help ascertain areas of high ecological value and constraint level across 'the site'.

Targeted Flora Survey

Targeted flora surveys were undertaken in areas of threatened species habitat, via random meander transects. The locations of threatened species were mapped using GIS. Any specimens that required verification, or for which identification was problematic were sent to the Herbarium at the Royal Botanic Gardens for verification. The data gathered has been used to help ascertain areas of high ecological value and constraint level on 'the site'.

4.2.2 Fauna

GHD utilised the following methods to detect native fauna on site and to determine the likelihood of threatened fauna species and/or their habitats occurring within 'the site'. Assessments were also made to

ascertain the potential importance of these areas for native fauna in general. Fauna survey techniques and locations are indicated on Figure 3.

Habitat Assessment

An assessment of the nature and condition of habitats, specific resources and features of relevance for native fauna such as arboreal mammals, bat species and macropods were undertaken throughout 'the site'. In addition, indirect evidence of fauna (i.e. scats, shells, feathers, fur, tracks, dens, nests, scratches, chew marks and owl wash) was also recorded.

Mapping of Hollow-bearing Trees

Hollow-bearing trees are an essential habitat feature for numerous fauna, including arboreal mammals, bats, owls and other hollow-dependent bird species. All hollow-bearing trees and hollow bearing stags (dead trees) observed within 'the study area' were marked using a hand-held GPS and mapped using GIS.

Targeted Searches for the Cumberland Land Snail (Meridolum corneovirens)

Targeted searches for the threatened Cumberland Plain Land Snail were undertaken across 'the site' in areas of appropriate habitat. Searches included lifting fallen timber, woody debris and leaf litter at the base of trees in areas of remnant woodland vegetation.

Riparian Habitat Assessments

Preliminary riparian habitat assessments were undertaken, including an assessment of the extent and condition of watercourses in 'the study area', their conservation value and their potential value as habitat for threatened aquatic biota.

Diurnal Bird Surveys

Diurnal bird surveys were conducted at dawn and dusk when birds are typically most active in areas of suitable habitat. Targeted surveys were conducted for at least 40 minutes, through approximately 2ha of habitat, as well as opportunistic observations recorded throughout the field surveys. Birds were identified from observations or call identification.

Herpetofauna

In areas of appropriate habitat, GHD undertook targeted surveys for frogs and reptiles, including threatened amphibian species such as the Green and Golden Bell Frog (*Litoria aurea*). Surveys included diurnal searches for basking frogs and tadpoles, searches under rocks, logs and other ground debris, and nocturnal creek and dam side spotlighting. GHD also aimed to identify the presence of Plague Minnow (*Gambusia holbrooki).* This species is known to prey upon the eggs and tadpoles of the Green and Golden Bell Frog (DECCW, 2010b) and thus a viable population is less likely with the presence of Plague Minnow.

Spotlighting

Spotlighting for arboreal fauna, nocturnal avifauna and amphibians was carried out over three nights. Walked transects were conducted for at least one hour, over approximately one kilometre, targeting suitable habitat for arboreal habitat for mammals and nocturnal birds. Water bodies, woody debris, shedding-bark on tree trunks and other suitable substrate was systematically checked using a head lamp targeting frogs, small mammals and reptiles. Additional slowly-driven transects along access roads were performed for approximately one hour per evening.

Call Playback

Call playback was undertaken over three nights during the field survey targeting threatened forest owls and arboreal mammals. Calls were played for a period of 10-15 minutes followed by a listening period of 5-10 minutes. This was repeated twice followed by spotlighting within the surrounding area.

Anabat

The echolocation calls of insectivorous bats were recorded at six locations across 'the study area' over three nights using ultrasonic detectors (Anabat II Bat Detectors, Titley Electronics, Ballina NSW) and stored on compact flash (CF) memory cards for later computer analysis. Prior to field placement, each detector was calibrated and set to operate at the same sensitivity level (7, the maximum is 10). Detectors were orientated at a 45 degree angle on the ground in suitable flyways near open water on each night of the study period. The anabats were activated just before dusk and retrieved each morning.

Recorded calls were identified using zero-crossing analysis and AnalookW software (version 3.6g, Chris Corben 2009) by visually comparing call traits. Craig Grabham (GHD) undertook analysis of bat calls from the 15-16 December 2009 field survey and Glenn Hoye (Fly by Night) analyses calls from the 19-21 January 2010 survey. No reference calls were collected during the survey. The *Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay *et al*. 2004) was used as a guide to call analysis. Due to the high level of variability and overlap in call characteristics, a conservative approach (i.e. assumed presence) was taken when analysing calls.

Due to variability in the quality of calls and the difficulty in distinguishing some species, the identification of each call was assigned a confidence rating (see Mills *et al.* 1996; Duffy *et al.* 2000) as summarised in Table 1. Nomenclature follows Churchill (2008).

Table 1 Confidence rating Applied to Microbat Calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call types or species call lacks sufficient detail.
PO - Possible	Call characteristics are comparable with the species, but there exists a reasonable probability of confusion with one or more bat similar species or quality or length of call prohibits a confident identification.
Species Group	Call made by one of two or more species. Call characteristics overlap making it to difficult to distinguish between species e.g. *C. gouldii/M. ridei* *Nyctophilus spp.* The calls of *Nyctophilus geoffroyi* and *N. gouldi* cannot be distinguished during the analysis process and are therefore lumped together.

Incidental Records and Opportunistic Sightings

Any incidental sightings of fauna or records of fauna tracks and scats were noted and where necessary collected for further identification.

4.2.3 Survey Effort

Survey techniques and effort over the two field surveys are detailed in Table 2. Survey locations are indicated on figure 3.

Table 2 Survey Techniques and Effort

Target Species	Survey Technique	Survey Effort
General Flora and Vegetation Communities	Quadrats, vegetation mapping, opportunistic flora	10 Quadrats Mapping of vegetation communities across 'the site' Random meander surveys throughout 'the site'
Threatened flora and incidental flora	Random meander targeted searches	Throughout the entire site
Riparian Assessments	General assessment of riparian vegetation condition	Along identified watercourses and around dams
Arboreal Birds and Mammals	Hollow-bearing tree mapping	Throughout 'the site'
	Spotlighting	Six person-hours over three nights
	Diurnal bird surveys	Five person-hours over three days
	Searches for tracks, scats and other traces of threatened fauna	Throughout site and around identified habitat trees
	Call play-back	Three sessions in remnant vegetation and wetland areas over three nights
Cumberland Plain Land Snail	Targeted searches in leaf litter, grasses at the base of trees and under ground debris in areas of potential habitat	Throughout site where suitable habitat was identified
Microchiropteran Bats	Anabat	Two Anabat units in three locations over three nights
Amphibians	Targeted diurnal and nocturnal searches for frogs, including Green and Golden Bell Frog (GGBF)	All dams and any identified watercourses
Reptiles	Active searches in suitable habitat	Throughout site

4.3 Conservation significance

Conservation status of species and communities recorded across ‘the study area’ were determined with reference to the following:

- The TSC Act for State significance;
- The EPBC Act for National significance; and
- The NPWS (1997) *Western Sydney Urban Bushland Biodiversity Survey* for regional significance.

301,000 302,000

6,246,000

M7 Motorway

Hinchinbrook Creek

Cowpasture Road

6,245,000

Image from Google Earth

Legend

- The Site
- Employment Zone Development (the project)
- Cleared under previous approvals (Biosis, 2006)

Survey Effort

- Anabat Recording
- Call Playback
- Vegetation Quadrat
- Random Meander Vegetation Survey

1:5,000 (at A3)

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

GHD

CLIENTS | PEOPLE | PERFORMANCE

Mirvac Group Pty Ltd
Hoxton Park Airport Development - Ecology Assessment

Job Number 22-14911
Revision A
Date 23 FEB 2010

Survey Effort

Figure 3

G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z003_Survey_Effort.mxd

10 Bond Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: DCDB, NSW Dept. of Lands: Cadastre - 19/01/2010; Imagery: Nearmap - 19/01/2010. Created by: qjchung, bahambly

4.3.1 Survey Conditions

The weather from the 16th-17th December 2009 was generally hot, calm and fine. Temperatures reached around 43.1 degrees Celsius during the day, dropping to 20.7 degrees Celsius during the night. No rain was experienced during the field surveys.

Weather conditions were ideal for the detection of frogs at 'the site', as temperatures were relatively high at night; however, no rainfall was experienced. Furthermore, weather conditions were ideal for the detection of native reptiles and bat activity levels potentially present at 'the site'. Wind during dawn bird surveys was light. There was a close-to-full moon throughout the survey period and moderate spill from the nearby operations of the M7 Motorway. Moderate to high noise levels were experienced. Conditions through the nocturnal surveys were not ideal for the detection of small nocturnal fauna, nocturnal birds or larger mammals. This is not expected to have any impact on the results for 'the project' area as available habitat is very limited.

The weather from the 19th-21st January 2010 was also warm, calm and fine with cooler nights. Temperatures increased across the survey period from approximately 29.1 to 40.4 degrees Celsius during the day and from 11.9 to 15.4 degrees Celsius at night. No rain was experienced during this survey period.

Weather conditions were not ideal for the detection of frogs at 'the site', as there was no rainfall during the survey period. This is not expected to have any impact on the results for 'the project' area as available habitat is very limited. Weather conditions were favourable for the diurnal detection of native reptiles, as daytime temperatures were high. Wind during dawn bird surveys was light. Although the moon was less than quarter-full moon throughout the survey period there was moderate light spill from the nearby operations of the M7 Motorway. Moderate to high noise levels were experienced. Conditions through the nocturnal surveys were not ideal for the detection of small nocturnal fauna, nocturnal birds or larger mammals due to background light and noise. This is not expected to have an adverse impact on the results for 'the project' area as available habitat is very limited.

Table 4-3 below shows the temperatures and rainfall data during the field surveys.

Table 4-3 Daily weather observations at Camden during the survey period (BOM, 2010)

Date	Minimum Temp (Degrees Celsius)	Max Temp (Deg Cel)	Rainfall (mm)
16/12/2009	20.7	35.2	0
17/012/2009	17.3	43.1	0
19/1/2010	10.6	29.1	0
20/1/2010	11.9	36.2	0
21/1/2010	15.4	40.4	0

4.4 Staff Qualifications

Qualified GHD field ecologists undertook the field surveys. Staff qualifications and experience are presented in Table 4-4.

Table 4-4 GHD Personnel and Qualifications

Name	Position / Project Role	Qualifications	Relevant Experience
Ben Harrington	Ecologist / field surveys and reporting	Bachelor of Science, Masters of Science (Physical Geography), Macquarie University	6+ years
Jessica Walker	Environmental Scientist / field surveys and reporting	Bachelor of Environmental Science and Management (Living Systems), Newcastle University	2 + years
Rowena Hamer	Graduate Ecologist/ field surveys and reporting	Bachelor of Science (Hons) (Biological Science), University of New South Wales	1 + years

4.5 Limitations

This survey was preliminary in nature and was designed to identify possible ecological constraints to future development based on targeted surveys and an overall assessment of habitat value. This survey was not designed to enable detection of all species, either resident or transitory to 'the site', but rather was aimed at providing an overall assessment of the ecological values of 'the study area', with particular emphasis on endangered ecological communities, threatened species and their habitats.

Flora surveys are also limited in terms of the time of year surveys are undertaken, and the flowering times of some cryptic threatened plant species that may be present on 'the site' (e.g. *Pimelea spicata, Pterostylis saxicola etc*). Notwithstanding this limitation the majority of ''the site'' has been disturbed by historic clearing and grazing and these species have a low potential to occur (refer Appendix B).

Finally, the presence of some threatened species on 'the site' such as Large Footed Myotis (*Myotis macropus*), are tentative identifications based on spotlight detection and ultrasonic Anabat detection. Further spotlighting and trapping would be required within the Hinchinbrook corridor to confirm the presence, or otherwise, of these species which can be mistaken for non-threatened species. These species were not identified within 'the project' area due to lack of suitable habitat.

5. Results

The following information describes the results of the ecological assessment for the 'study area'. A summary of results relevant to the area of impact from the proposed employment zone development ('the project') include:

- Scattered 'paddock trees' and small 'clumps' of vegetation indicative of Shale Plains Woodland totalling an area of approximately 1.475 ha (as described in this report and the Offset Strategy, GHD 2007b);
- Drains, sediment detention ponds and depressions supporting a variety of freshwater wetland vegetation species (not considered to meet the description of *Freshwater Wetlands*); and
- Derived tussock grasslands, dominated by introduced pastures.

5.1 Flora

5.1.1 Flora Species

Approximately 161 flora species were identified within 'the study area', however, given the seasonal limitations of the survey the total number of flora present at 'the site' is likely to be higher. Of the species identified approximately 35% were introduced species.

A list of plant species recorded during the field survey is presented in Appendix A.

5.1.2 Vegetation communities

The vegetation within 'the study area' is extensively modified by historic clearing and ongoing activities. Vegetation communities include intact patches of native forest and partially disturbed and regrowth woodland, derived grassland and artificial wetlands. The most extensive and highest quality native vegetation remnants occur along the Hinchinbrook Creek as an intact riparian corridor along the eastern edge of 'the site'. The majority of this vegetation is consistent with the EEC 'River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions' (RFEF) listed under the TSC Act or the EEC 'Cumberland Plain Woodland – Endangered Community of the Cumberland Plain' (CPW), which is listed under the TSC Act and is also listed as a Critically Endangered Ecological Community under the EPBC Act. There is also a patch of CPW within the footprint for the future sediment basin and small remnants and scattered paddock trees representative of this community within the proposed employment zone development.

'The site' contains areas of highly degraded vegetation dominated by exotic plants which would have historically supported EECs but would not qualify as EEC in its present condition. Exotic vegetation dominates the footprint for the proposed employment zone development ('the project'). These include exotic grasslands and patches of environmental weeds. There are also areas of 'disturbed cleared land' associated with access tracks, runways and buildings.

Vegetation communities were mapped within 'the study area' according to the community descriptions provided in NPWS mapping of the Cumberland Plain (NPWS, 2002). Vegetation at 'the site' is shown on Figure 4 and described below. Not all disturbed cleared land was mapped in detail; for instance all exotic and native vegetation at 'the site' contains disturbance associated with access tracks, fence lines and

other structures that would reduce overall area of vegetation cover. Therefore the vegetation mapping and area calculations included in this assessment are all approximate.

Shale Plains Woodland

Shale Plains Woodland occurs on higher ground within the Hinchinbrook Creek riparian corridor, within the footprint for the sediment basin and as small remnants within the proposed employment zone development.

These have been described in detail in the Biosis Research Flora and Fauna Report (2006) and are identified as Cumberland Plain Woodland (Shale Plains Woodland). Dominant canopy species include Spotted Gum (*Corymbia maculata*), Thin leaved Stringybark (*Eucalyptus eugenoides*), Broad-leaved Apple (*Angophora subvelutina*), Forest Red Gum (*Eucalyptus tereticornis*), and Grey Box (*Eucalyptus moluccana*).

The dominant mid-storey species are Blackthorn (*Bursaria spinosa*) and Daviesia species (*Daviesia genistifolia; Daviesia ulicifolia*). Other mid-storey species include Parramatta Green Wattle (*Acacia parramattensis*), Hickory Wattle (*Acacia implexa*), White Sallow Wattle (*Acacia floribunda*) with and a mixture of native and exotic groundcover species.

The understorey is relatively sparse and patchy and is dominated by dense growth of Blackthorn and Daviesia species in many areas. Native groundcover species include native tussock grasses, such as Purple Wiregrass (*Aristida ramosa*) and Kangaroo Grass (*Themeda triandra*), herbs such as Ivy Goodenia (*Goodenia hederacea*) and *Einadia trigonos* and scramblers such as *Glycine microphylla*.

The understorey was moderately infested by environmental weeds, the most abundant of which were African Love Grass (*Eragrostis curvula*), Purpletop (*Verbena bonariensis)* and Paddys Lucerne (*Sida rhombifolia*).

Drainage lines through the Alluvial Woodland support dense patches of Cumbungi (*Typha orientalis*) and Common Reed (*Phragmites australis*) and more open areas covered with Tall Sedge (*Carex appressa*), *Juncus usitasis*, Pale Knotweed (*Persicaria lapathiphyllum*) and *Cyperus prismatocarpus*.

The community had good leaf litter but relatively little coarse woody debris. In many places the groundcover was disturbed by past grazing, track construction or ongoing impacts from trail bike riders.

There are small regrowth patches of Alluvial Woodland associated with un-mown land on the former airport site. These patches are less diverse and feature more severe weed infestation. They consist of occasional remnant trees or dense stands of Parramatta green Wattle with an understorey of turf grasses, environmental weeds and occasional native grasses, herbs and wetland plants.

Patches of woodland mapped as Shale Plains Woodland on Figure 4 qualify as the EEC CPW as listed under the TSC Act (DECCW, 2010b). These areas also meet the DEWHA condition criteria for the Critically Endangered EC listed under the Commonwealth EPBC act.

Alluvial Woodland

Alluvial Woodland in ‘the study area’ occurs as an intact riparian corridor along Hinchinbrook Creek and as small regenerating patches limited to un-mown portions within the former airport site.

The vegetation along Hinchinbrook Creek is in excellent condition with high biodiversity, despite on-going grazing and encroaching development. This site demonstrates a diversity of age class in the canopy, which is uncommon in the remnant bushland of western Sydney.

The dominant canopy species are Cabbage Gum (*Eucalyptus amplifolia*) and Swamp Oak (*Casuarina glauca*) with occasional Spotted Gum and Rough-barked Apple.

The dominant mid-storey species include Prickly-leaved Paperbark (*Melaleuca stypheloides*) and Blackthorn. Other mid-storey species include Parramatta Green Wattle (*Acacia parramattensis*), Hickory Wattle (*Acacia implexa*), White Sallow Wattle (*Acacia floribunda*) and Daviesia's. 'the site' also contained species that indicated it had had not been impacted by fire for some time. These included Coffee Bush (*Breynia oblongifolia*), Hairy Clerodendrum (*Clerodendrum tomentosum*), Mock Olive (*Notelea longifolia*) and Rough-fruit Pittosporum (*Pittosporum revolutum*).

Understorey species composition varies with proximity to Hinchinbrook Creek. Higher portions of the levee support Blady Grass (*Imperata cylindrica*), Three-awned Spear Grass (*Aristida* sp.), Native Raspberry (*Rubus parviflorus*) and Spiny-headed Mat-rush (*Lomandra longifolia*). Beneath the denser canopy closer to the drainage line the understorey is composed of shade tolerant species including dense growth of the environmental weeds environmental weeds Wandering Trad (*Tradescantia albiflora*) and Ehrharta (*Ehrharta erecta*) interspersed with native herbs such as Whiteroot (*Pratia purpurascens*) and Kidney Weed (*Dichondra repens*)

Within Hinchinbrook Creek there is in a diverse suite of native wetland and riparian species, including Tall Spike-rush (*Eleocharis sphacelata*), Pale Knotweed and Spike-sedges (*Juncus* spp.). Aquatic species within the creek channel include *Myriophyllum variifolium* and Swamp Lily (*Ottelia ovalifolia subsp. ovalifolia*).

Large-leaved Privet (*Ligustrum lucidum*), Blackberry (*Rubus fruticosus*) and Small-leaved Privet are present throughout the riparian strip and form dense stands completely suppressing native vegetation in some places.

This vegetation community is consistent with the TSC Act listed EEC 'River Flat Eucalypt Forest on Coastal Floodplains'.

There are small regrowth patches of Alluvial Woodland associated with un-mown land in the vicinity of drains on the former airport site. These patches are less diverse and feature more severe weed infestation than Hinchinbrook Creek. They consist of dense stands of juvenile Swamp Oak with an understorey of environmental weeds and occasional native grasses, herbs and wetland plants.

Away from the river there is a sparse, patchy cover of native shrubs including *Pomaderris elata* and *Acacia* spp. There is a moderate to dense cover of shade-tolerant native sub-shrubs, ferns and grasses, including Fishweed (*Einadia trigonos*), Bracken (*Pteridium esculentum)*, Kidney Weed (*Dichondra repens*) and Weeping Grass (*Microlaena stipoides* var. *stipoides)*.

Freshwater Wetlands

Drains, sediment detention ponds and depressions throughout 'the site' support a variety of freshwater wetland vegetation species. Species composition and structure varies with inundation frequency, water depth and disturbance history. Deep, near permanent drains support dense patches of Cumbungi and Common Reed. Shallower, unlined drains and depressions support Tall Sedge (*Carex appressa*), *Juncus usitasis* and *Cyperus prismatocarpus*. The freshwater wetlands feature moderate infestation with exotic grasses, especially Kikuyu (*Pennisetum clandestinum)* and herbs, such as Fireweed and Inkweed (*Phytolacca octandra*).

It is likely that Freshwater Wetlands are a derived community formed from the clearing of Shale Plains Woodland and modification for site drainage. This community does not qualify as the TSC Act EEC.

The deepest drains are in good condition and almost completely covered by native semi-aquatic plants. Shallower marshes are in moderate to poor condition, with localised degradation through grazing, trampling by livestock, and dumping of construction rubble.

Derived Tussock Grassland

There are areas of Derived Tussock Grassland at 'the site' which are a product of historic removal of trees from areas that would probably have supported Shale Plains Woodland. The Derived Tussock Grassland features occasional shrubs and juvenile *Eucalyptus*, is in close proximity to intact woodland, and may have the capacity to regenerate into woodland vegetation. These areas would qualify as a highly degraded and modified form of the EEC CPW as listed under the TSC Act (DECCW, 2010c). These areas do not meet the DEWHA condition criteria for the Critically Endangered EC listed under the Commonwealth EPBC act.

Dominant species included a dense groundcover of tussock grasses such as Kangaroo Grass (*Themeda australis*), Shorthair Plumegrass (*Dichelachne micrantha*) and Plains Grass (*Austrostipa aristiglumis*) interspersed with Common Couch (*Cynodon dactylon*). Herbaceous environmental weeds are sub-dominant and include Dandelion (*Taraxacum officinalis*) and Fireweed (*Senecio madagascariensis*).

This community contains some trees, including juvenile Swamp Oak, however these only occur as isolated patches and not contribute to the vegetation structure of the community (hence its classification as grassland).

This community is in good condition, with evidence of moderate grazing pressure and relatively minor weed invasion.

Exotic Grassland

The majority of the grassland at 'the site' is heavily modified, regularly mown and dominated by exotic species. The most abundant species are the exotic pasture species and the weeds African Love Grass and Paspalum (*Paspalidium dilatum*). There are occasional native tussock grasses including Purple Wire Grass, Plains Grass and Kangaroo Grass. Herbaceous environmental weeds are locally abundant and include Spearthistle (*Cirsium vulgare*), Dandelion (*Taraxacum officinalis*) and Fireweed (*Senecio madagascariensis*).

Overall vegetation cover is dominated by exotic pasture species and herbaceous environmental weeds such that the Exotic Grassland does not comprise a native vegetation community. This community has little conservation value and limited potential for regeneration of native plants.

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216//DP1111381

2//DP875867

213//DP1111381

24//DP1042996

215//DP1111381

1//DP875867

658//DP838730

336//DP829870

214//DP1111381

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501//DP856114

247//DP2475

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11//DP1089776

34//DP1044841

301,000

302,000

Legend

- The Site
- Employment Zone Development (the project)
- Cleared under previous approvals (Biosis, 2006)
- Cadastral boundaries

Vegetation

- Alluvial Woodlands
- Derived Tussock Grassland
- Disturbed/ Cleared Land
- Exotic Grassland
- Freshwater Wetlands
- Shale Plains Woodlands

1:5,000 (at A3)

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

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Vegetation

Figure 4

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Data Source: DCDB, NSW Dept. of Lands: Cadastre - 19/01/2010; Imagery: Nearmap - 19/01/2010. Created by: qjchung, bahambly

5.2 Fauna

5.2.1 Fauna Species

A moderate diversity of native fauna species were recorded at 'the site' during the GHD December 2009 and January 2010 field surveys, including 3 mammals, 56 birds, 5 reptiles and 4 frogs, as listed in Appendix A. Five threatened species were observed, all listed as Vulnerable under the TSC Act:

- The Grey-headed Flying Fox (*Pteropus poliocephalus*);
- Eastern Falsistrelle (*Falsistrellus tasmaniensis*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Large Footed Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax ruepelli*).

There were a further five exotic mammals and three exotic birds recorded.

Birds

A moderate diversity of native birds was recorded at 'the site' (56 species) from a range of guilds (i.e. species with different niches or lifestyles). Guilds and species observed included:

- Small woodland insectivorous birds, such as several thornbill (*Acanthiza*) species, the White-browed Scrubwren (*Sericornis frontalis)*, Spotted Pardalote (*Pardalotus punctatus)* and Striated Pardalote (*Pardalotus striatus*);
- Larger forest and woodland birds, including the Olive-backed Oriole (*Oriolus sagittatus*) and Red Wattlebird (*Anthochaera carunculata*);
- Open country species such as the Australian Magpie (*Gymnorhina tibicen*), Galah (*Eolophus roseicapillus*) and Pied Butcherbird (*Cracticus nigrogularis*);
- Birds of moist grasslands and wetlands, including the Australian Wood Duck (*Chenonetta jubata*), White-necked Heron (*Ardea pacifica*) and Masked Lapwing (*Vanellus miles*); and
- Raptors, including the Nankeen Kestrel (*Falco cenchroides*), Brown Goshawk (*Accipiter fasciatus*) and Black-shouldered Kite (*Elanus axillaris*).

The exotic pest bird species Common Myna (*Acridotheres tristis*) and the highly-competitive native Noisy Miner (*Manorina melanocephala*) were abundant at 'the site', as is typical of disturbed bushland remnants. Moreover, across the majority of 'the site' only generalist or open country species were observed which are tolerant of cleared or disturbed areas. Although the overall number of both guilds and species recorded confirms that 'the study area' contains valuable habitat resources, which support a diverse range of species requiring differing habitat attributes (Keast *et al*., 1985), these habitat resources are mostly confined to the Hinchinbrook Creek corridor and to small patches of regrowth vegetation surrounding drainage culverts. The remnant patch of Shale Plains Woodland in the vicinity of the proposed sediment basin features healthy and diverse native vegetation with an intact canopy and diverse vegetation structure but supported a limited suite of native birds. Only large generalist species such as Crested Pigeon (*Ocyphaps lophotes*), Australian Raven (*Corvus coronoides*) and Noisy Miners were observed in this patch of vegetation. It is likely that the small patch size, isolation and dominance of these aggressive native species has limited the habitat value of this patch for other native bird species.

Mammals

Only two species of native non-flying mammals were observed during field surveys, Sugar glider (*Petaurus breviceps*) and Eastern Grey Kangaroo (*Macropus giganteus*), and these were only recorded within the vegetation surrounding Hinchinbrook Creek.

Foraging Grey-headed Flying Fox were heard within the Hinchinbrook Creek corridor during spotlighting. It is likely that this species would forage in flowering eucalypts and fruiting exotic species in the corridor. No roosting camps were observed at 'the site'. An important roost camp for this species is located at Cabramatta Creek, approximately 10km away.

Anabat recordings allowed the definite identification of five species of a possible 21 species known or expected to occur within 'the locality'and the probable or possible recording of a further seven species (refer Table 5). Gould's Wattled bat (*Chalinolobus gouldii*) was the most frequently recorded species. Four species listed as Vulnerable under the TSC Act were recorded as potentially occurring at 'the site' on the basis of probable or possible call identifications:

- Eastern Falsistrelle (*Falsistrellus tasmaniensis*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Large Footed Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax ruepelli*).

Although bat activity was recorded for each hour of sampling, overall bat activity for the survey period sampled was low: typically one to two calls per hour throughout the recording period.

Anabat results are summarised in Table 5.

Table 5 Anabat recording results.

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Anabat Confidence Level
White-striped Mastiff Bat	*Tadarida australis*			C
Eastern Freetail Bat	*Mormopterus sp. 2*			C
Gould's Wattled bat	*Chalinolobus gouldii*			C
Chocolate Wattled Bat	*Chalinolobus morio*			Pr
Eastern Falsistrelle	*Falsistrellus tasmaniensis*	V		Po
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	V		Pr
Large-footed Myotis	*Myotis macropus*	V		Pr
Unidentified Long-eared Bat	*Nyctophilus sp.*			C

Common Name	Scientific Name	TSC Act Status	EPBC Act Status	Anabat Confidence Level
Greater Broad-nosed Bat	*Scoteanax ruepellii*	V		Pr
Eastern Broad-nosed Bat	*Scotorepens orion*			Pr
Little Forest Bat	*Vespadelus vulturnus*			C
Unidentified Forest Bat	*Vesdadelus sp.*			Pr

Five common exotic species were observed within 'the study area', the Dog (*Canis lupus* familiaris), Fox *(Vulpes vulpes*), Domestic Cat (*Felis catus*), Rabbit (*Oryctolagus cuniculus*) and Domestic Cow (*Bos tauros*).

Reptiles and frogs

Five species of reptiles were observed, predominately within the Hinchinbrook Creek corridor and regrowth vegetation surrounding drainage culverts along the western boundary of 'the site'. The Pale-flecked Garden Sun-skink (*Lampropholis guichenotti*) and the Delicate Litter Skink (*Lampropholis delicata*) were observed foraging in leaf litter or under woody debris. Red-bellied Black Snakes (*Pseudechis porphyriacus*) and Eastern Water-skinks (*Eulamprus quoyii*) were observed both in and around Hinchinbrook Creek and moist habitats associated with drainage culverts on 'the site'. The Eastern Long-necked Tortoise (*Chelodina longicollis*) was associated with aquatic habitats on site.

A low diversity of native frogs was recorded at 'the site', probably due to the dry weather rather than a lack of suitable habitat. Eastern Dwarf Tree Frogs (*Litoria fallax*), Peron's Tree Frogs (*Litoria peronii*), Common Eastern Froglets (*Crinia signifera*) and Spotted Marsh Frogs (*Limnodynastes tasmaniensis*) were heard calling in low numbers in the marshy areas surrounding the artificial drainage lines and culverts across 'the site'. Database searches indicate the presence of amphibian species such as the Green Tree Frog (*Litoria caerulea*), Eastern Sign-bearing Froglet (*Crinia parinsignifera*), Smooth Toadlet (*Uperoleia laevigata*) and the Brown-striped Frog (*Limnodynastes peronii*) in the locality. It is likely that these frog species would also occur at 'the site'.

Invertebrates

No Cumberland Plain Land Snails were recorded at 'the site', despite targeted searches through suitable habitat at 'the site'. During periods of drought this species can burrow into the soil to escape the dry conditions (DECCW, 2010b). The weather was very dry and hot throughout both site surveys and so the species cannot be reliably discounted as occurring in locations of suitable habitat at 'the site'. Given the presence of suitable Shale Plains Woodland habitat and large numbers of records of the species immediately to the west of 'the site' (refer Figure 6) the species is considered a high probability of occurring in 'the study area'.

A moderate diversity and abundance of invertebrates were noted under ground debris that would appear to be typical of relatively healthy native vegetation. These invertebrates were not identified to species level nor recorded in detail.

Fish

Three fish species were observed opportunistically during aquatic habitat assessments. The majority of fish observed were two exotic pest species: Plague minnow (*Gambusia holbrookii*) were abundant in all aquatic habitats at 'the site', including small drains and sediment ponds; and Common carp (*Cyprinus carpio*) were abundant in Hinchinbrook Creek. A single Long-finned eel (*Anguilla reinhardtii*) was recorded in Hinchinbrook Creek. It is likely that aquatic habitats at 'the site' would support a number of other species, potentially including other native fish species.

5.2.2 Fauna habitats

'The site' contains areas of 'Core habitat' and 'Support for Core habitat' according to NPWS Conservation Significance mapping (NPWS, 2002). More detailed habitat assessments were undertaken during field surveys in order to refine the conservation significance of fauna habitats and to assess the potential presence of native fauna (especially threatened species) not directly observed during the surveys.

Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species previously recorded in 'the study area'.

The habitat assessment identified the following main habitat types at 'the site':

Native Woodland and Forest

Woodland and forest at 'the site' varies from moderate condition (small patches surrounded by exotic grassland) to good condition (large patches of Shale Plains Woodland, the Hinchinbrook Creek riparian corridor). Edge effects are likely to reduce the value of smaller habitat remnants in 'the study area'. Exotic weeds, especially Blackberry and Wandering Trad, have inhibited understorey plant species diversity across much of 'the site'. However exotic weeds contribute to the overall structural diversity of the vegetation and would provide shelter and food resources for native fauna. Overall native woodland and forest at 'the site' contains good native plant diversity, moderate quantities of hollow-bearing trees and stags and moderate recruitment of juveniles and seedlings. Based on these habitat attributes woodland and forest at 'the site' would be expected to support a reasonable diversity of native fauna in addition to those species recorded during field surveys, potentially including threatened species.

The Hinchinbrook Creek riparian strip forms a continuous habitat corridor for species which favours tall forest, dense undergrowth and riparian habitats. It would comprise an important refuge and wildlife corridor for many fauna species, including the regionally significant Eastern Grey Kangaroo and, potentially, the Powerful Owl (*Ninox strenua*).

Other woodland patches at 'the site' are relatively small and are surrounded by extensive cleared areas. Fragmented woodlands typically have a lower diversity as cleared agricultural land and roads constitute a barrier to many native fauna species. Smaller patches of woodland at 'the site' are only likely to support more mobile and adaptable woodland species able to traverse cleared areas and tolerate disturbance. These include species like the Eastern Rosella, Australian Raven and Noisy Miner, which were abundant during field surveys and are widespread and abundant in the Sydney region. Woodland patches outside of the riparian corridor are probably too small and fragmented to support local populations of threatened

woodland bird species known to require large tracts of intact habitat such as the Speckled Warbler (*Pyrrholaemus saggitatus*) and Black-chinned Honeyeater (*Melithreptus gularis gularis*). These species are grassy-woodland specialists and so the denser vegetation along Hinchinbrook Creek would probably have limited value as a habitat corridor.

Tree hollows are important for native fauna as diurnal or nocturnal shelter sites, for rearing young, for feeding, for thermoregulation, and to facilitate ranging behaviour and dispersal. An estimated 15% of all terrestrial vertebrate fauna in Australia are dependent upon tree hollows and for many of these species the relationship is obligate i.e. no other habitat resource represents an adequate substitute (Gibbons and Lindenmayer, 2002).

'The site' contains relatively few pre-European age trees and limited numbers of hollow bearing habitat trees and stags (refer Figure 4). The majority of the woodland and forest within proposed development footprints is sub-mature regrowth. The riparian strip immediately adjoining Hinchinbrook Creek contains a number of very large Cabbage Gums, Spotted Gums and Swamp Oaks. Habitat trees were not counted outside of immediate development footprints however based on the age and structure of the riparian strip it is likely to contain good numbers of tree hollows. Overall the broader study area is likely to contain sufficient quantities of these resources to support local populations of hollow-dependant fauna, providing potential roosting habitat for hollow-dependant threatened species, such as the Powerful Owl (*Ninox strenua*) and Gang Gang Cockatoo (*Callocephalon fimbriatum*). Only one species of hollow-dependant arboreal mammal was recorded at 'the site': the Sugar Glider. 'The site' is also likely to support the Common Brushtail Possum and Common Ringtail Possum as these species are common in urban bushland remnants. Forest and woodland at 'the site' may also support a range of threatened arboreal mammals, potentially including the Squirrel Glider (*Petaurus norfolcensis*).The Hinchinbrook Creek corridor would be used by these species as sheltering, travelling and foraging habitat.

There are a number of large, hollow-bearing habitat trees within the footprint of the proposed sediment basin and spillway. Woodland patches within the proposed employment lands and sediment basin footprints would have little value for threatened arboreal mammals and forest owls as they are surrounded by disturbed, cleared land. Habitat trees within the sediment basin are more likely to be occupied by more aggressive and/or generalist native fauna such as Common Brushtail possums, Sulfur-crested Cockatoos or Galahs.

Woodland and forest in 'the study area' would support a range of threatened tree-roosting micro-bats species recorded in the present survey including the Eastern Falsistrelle, Large-footed Myotis and Greater Broad-nosed Bat and may provide diurnal roost sites for the Eastern bent-wing Bat. 'The study area' contains foraging, roosting and breeding resources that would be utilised by local populations of these species. Mature trees within the proposed development footprint may provide suitable diurnal roost sites for tree-roosting micro-bats as these species are less dependant upon large, mature hollow-bearing trees than arboreal mammals and forest owls (Gibbons and Lindenmayer, 2002). 'The site' does not contain any caves or rock outcrops that would support cave-roosting micro-bats, such as the Eastern Bentwing-bat however there are suitable culverts in the broader study area and these species may utilise 'the site' as foraging habitat.

The canopy species Coastal Grey Box and Cabbage Gum are nectar and seed-bearing and would provide a food resource for native fauna, including the Grey-headed Flying Fox (*Neophema pulchella*) and arboreal mammals. *Eucalyptus* species may also provide seasonal nectar resources for migratory species, including the Regent Honeyeater. Eucalypts at 'the site' are summer and autumn-flowering (Brooker and Koenig, 2006) and so would not provide winter foraging resources for the Swift Parrot. The

Hinchinbrook Creek corridor contains large, mature trees in an intact corridor and so would provide good concentrations of these foraging resources in a context that is suitable for migratory use.

'The study area' contains healthy stands of Swamp Oak, which may be exploited by the Glossy Black Cockatoo (*Calyptorhynchus lathami)* on an occasional basis during seasonal movements. Casuarinas at 'the site' would contribute to the overall foraging resource available in 'the locality'but are unlikely to provide sufficient food resources to support local populations of the species since the Glossy Black Cockatoo prefers Forest Oak (*Allocasuarina torulosa*) and Black Sheoak (*Allocasuarina littoralis*). Local populations frequent preferred feed trees, which are mature, healthy, in dense stands and bear good quantities of fruit (DECCW, 2008b).

Woodland and forest in 'the study area' contains relatively small amounts of standing and fallen dead timber, which would limit shelter and foraging resources for reptiles, small terrestrial mammals and native invertebrates, including the Cumberland Plain Land Snail. Nonetheless, the species is very closely associated with intact Cumberland Plain vegetation communities (DECCW, 2010b) and so Shale Plains Woodland at 'the site' would comprise suitable habitat for the species and may support local populations not detected during the current survey.

'The site' is composed of alluvial sediments on lower slopes and flats. There are no rock outcrops and no surface rock fragments in these areas. 'The study area' would not support fauna that rely on rocky substrate for shelter. There are a number of threatened reptile and frog species predicted as occurring in 'the locality' of 'the site' (DEWHA, 2010a), including the Broad-headed Snake (*Hoplocephalus bungaroides*), Giant Burrowing Frog (*Heleioporus australiacus),* and Littlejohns Treefrog (*Litoria littlejohni*). Records of these species within region are from Hawkesbury Sandstone substrates at higher elevations. These species depend on specific habitat resources from these environments and would not occur at 'the site' (DECCW, 2010b; Ehman, 1997).

'The site' contains suitable foraging and breeding habitat for the Green and Golden Bell Frog (*Litoria aurea)* in vegetated pools along the drainage lines through the proposed sediment basin, drains and ponds and adjoining moist grass and sedge land. However this species has experienced a massive decline within its former range due to a complex range of factors including the influence of Plague Minnow (*Gambusia holbrookii*) and the Chytrid fungus (DECCW, 2010b; Ehman, 1997). The locations of remnant populations within the Sydney Basin are relatively well recognised. There area no Wildlife Atlas records of the species in the vicinity of 'the site' (DECCW, 2010a) nor any recognised local populations in the area (DECCW, 2010b; Ehman, 1997). Therefore despite the presence of suitable habitat at 'the site', the Green and Golden Bell Frog is very unlikely to occur or be affected by the development.

Derived Grassland

Derived native grasslands at 'the site' would support open country bird species and a limited suite of native reptiles and mammals. Dust, altered hydrology and increased nutrient loading associated with past livestock grazing are also likely to reduce the value of these areas for native fauna.

Native grasses at 'the site' would provide foraging habitat for many native bird species, particularly finches and parrots. Patches of native, perennial tussock grasses are an important food resource for species such as the Diamond Firetail (*Stagonopleura guttata*). The derived grassland adjoins intact woodland and would provide potential foraging habitat for woodland birds. The value of this habitat is reduced by current land uses, which include periodic mowing and slashing. Given the history of disturbing activities at 'the site' and ongoing mowing it is very likely to be important habitat for any local populations of threatened woodland birds.

Woody debris was completely absent from cleared areas and so these areas would be unlikely to support small, shelter dependant animals.

SEPP 44 Assessment

'The study area' contains at least two Koala Feed Tree species listed on Schedule 2 of SEPP 44: Grey Gum and Forest Red Gum. Grey Gum makes up approximately 75% of the canopy cover in the Shale Plains Woodland and approximately 20% of the canopy cover in the Alluvial Woodland. Therefore the majority of woodland and forest in 'the study area' contains Schedule 2 feed trees comprising over 15% of the total number of trees in the upper or lower strata of the tree component and consequently constitutes 'potential koala habitat' as defined under the SEPP.

No Koalas or Koala scats were observed during field surveys. There are some previous records of the species in the locality, however these are associated with a population around the Georges River, 7-9km to the south-east of 'the site' (refer Figure 6). This population is isolated from 'the site' by the M5 and several kilometres of suburban housing. There are no recent records to the north-west of these barriers. Therefore woodland and forest in 'the study area' does not comprise "core Koala habitat" as defined under SEPP 44.

Aquatic and Wetland Habitats

Hinchinbrook Creek occurs in 'the study area', which forms part of the wider Georges River catchment further east. NPWS (1997) identify the riparian strip as a regionally significant wildlife regional corridor. The riparian corridor extends along Hinchinbrook Creek from Cecil Hills to Cabramatta Creek in Prestons (Biosis, 2006).

An unnamed drainage line runs through the central portion of the sediment basin area, from the M7 underpass in the west to a culvert and drain beneath the former airport and then eastwards to Hinchinbrook Creek. This major drainage line appears to be man-made and supports very little intact riparian vegetation. The Liverpool City Council Biodiversity Strategy, cited by Biosis (2007) identifies this drainage line as a "Riparian Corridor" through the M7 underpass. This corridor has some potential to provide a habitat link from the woodlands along Hinchinbrook Creek to the Spotted Gum Forest west of the M7 Motorway. However, Biosis (2007) notes that this is currently a potential, rather than functional, corridor since the drainage line is piped under the airport runway and would require extensive rehabilitation and revegetation to be effective as a habitat corridor for most species. Some vegetation rehabilitation works are currently taking place in, within and adjacent to the M7 underpass.

There is another, smaller drainage line through the basin footprint which is in near-original condition and supports intact riparian vegetation. It appears to have been isolated by earthworks and construction of the major channel. The main channel of the creek was classified by Biosis (2007) as class 3 (minimal fish habitat) and was in poor condition, with most of the native bank vegetation cleared and impacted by erosion and grazing. The smaller drainage line was classified as class 4 (unlikely fish habitat) and was also in poor condition, although the bank vegetation was considerably better than that of the main channel (Biosis, 2006). There are an additional two artificial ephemeral drainage lines and freshwater wetlands within the footprint for the sediment basin. The artificial drainage lines have evidently been subject to cattle grazing and, as such, are in poor to moderate condition.

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Legend

- Eastern Bent-wing Bat
- Eastern Falsistrelle
- Greater Broad-nosed Bat
- Grey-headed Flying Fox
- Habitat tree
- Large-footed Myotis
- The Site
- Employment Zone Development (the project)
- Cleared under previous approvals (Biosis, 2006)
- Cumberland Plain Woodland (EEC)
- River Flat Eucalypt Forest on Coastal Floodplains (EEC)
- Freshwater Wetlands

1:5,000 (at A3)

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

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Hoxton Park Airport Development-
Ecology Assessments

Job Number	22-14911
Revision	A
Date	23 FEB 2010

Threatened Biota and Habitat Resources

Figure 5

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6. Conservation Significance

6.1 TSC Act Listed Threatened Biota

6.1.1 Threatened Flora Species

The desktop literature review indicates twenty five threatened plant species which have previously been recorded (eighteen recorded), or are predicted (seven predicted) to occur in 'the locality' of 'the site' (DECCW, 2010a). Wildlife Atlas threatened species records from 'the locality' of 'the site' are shown on Figure 6. None of these species were recorded during site surveys. The majority of these species are considered unlikely to occur as they have limited ranges and/or habitat requirements, which are not present at 'the site'. These include species associated with sandstone or shale-gravel transition environments since 'the site' contains only shale-derived and alluvial soils.

There is potentially suitable habitat for a number of TSC Act listed plant species within the broader study area (refer Appendix B). However, given the intensity of targeted surveys for these species in the present survey and by Biosis (2006) they can be reliably excluded from occurring in the footprint for the proposed employment zone development. These species of threatened plants may colonise habitat in the broader study area in the future or may exist in the soil seed bank or as dormant individuals. Therefore they should be considered in future assessments for the proposed sediment basin and access road.

The full list of threatened plant species considered in this assessment, including their habitat requirements and conservation status is presented in Appendix B.

6.1.2 Endangered Flora Populations

The desktop literature review indicated known records for *Marsdenia viridiflora* subsp. *viridiflora* within 10km of the study site. This species is listed as an endangered population within the Hawkesbury/Nepean CMA (DECCW, 2010b). This species was not recorded during site surveys.

6.1.3 Endangered Ecological Communities

The desktop literature review indicates thirteen EECs listed under the TSC/EPBC Acts which are known or predicted to occur in 'the locality' of 'the site'. The full list of EECs known from the region, including their habitat requirements and conservation status, is presented in Appendix B.

Of these communities two are present within 'the study area':

- River-Flat Eucalypt Forest on Coastal Floodplains (RFEF); and
- Cumberland Plain Woodland (CPW).

All intact native vegetation at 'the site' qualifies as either of these two EECs and those there is no potential for any other EECs to occur.

'The project' would involve the clearing of portions of these EECs at 'the site' (refer Section 8).

6.1.4 Threatened Fauna Species

Threatened species recorded during the current site surveys are shown on Figure 5.

The desktop review indicates the potential presence of additional threatened fauna species which are known or predicted to occur in ‘the locality’ of ‘the site’. DECCW (2010a) Wildlife Atlas threatened species records from ‘the locality’ of ‘the site’ are shown on Figure 6. The full list of threatened fauna, including their conservation status, habitat requirements, the nature of previous records and likelihood of occurrence is presented in Appendix B. A review of the nature of specific habitat requirements of these species, and the habitat present within ‘the study area’ allowed a number of these species to be eliminated as having a low likelihood of occurrence at ‘the site’.

A total of six threatened fauna species are known, or are highly likely to occur at ‘the site’ based on field surveys, habitat assessments and/or recent observations of the species in the locality. Threatened fauna species which are known, or are highly likely to occur at ‘the site’ are presented in Table 6 along with their conservation status, the nature of their previous occurrence in ‘the study area’, the habitats in which they are likely to occur and the potential for impacts arising from the proposed employment zone development.

Table 6 Threatened Fauna Species and their Habitats Likely to Occur at 'the Site'

Scientific Name	Common Name	TSC Act	EPBC Act	Record Type	Habitat within Employment Zone Development Footprint	Likelihood of Impacts
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Present. Recorded in Hinchinbrook Creek riparian corridor.	Potential foraging habitat across the entire site. No suitable roosting habitat within footprint.	Low. Woodland patches and isolated trees in the disturbance footprint would have little value for the species.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	High. 'Possible' Anabat recording.	Potential foraging habitat across the entire site. No suitable roosting habitat within footprint.	Low. Limited areas of important habitat resources within construction footprint (<2 ha) occurring as small, isolated patches.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	High. 'Probable' Anabat recording.	Potential foraging habitat across the entire site. No suitable roosting habitat within footprint.	Low. Limited areas of important habitat resources within construction footprint (<2 ha) occurring as small, isolated patches.
Myotis adversus	Large-footed Myotis	V		High. 'Probable' Anabat recording.	Potential foraging habitat across the entire site. No suitable roosting habitat within footprint.	Low. Limited areas of important habitat resources within construction footprint (<2 ha) occurring as small, isolated patches.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	High. 'Probable' Anabat recording.	Potential foraging habitat across the entire site. No suitable roosting habitat within footprint.	Low. Limited areas of important habitat resources within construction footprint (<2 ha) occurring as small, isolated patches.
Meridolum corneovirens	Cumberland Land Snail	E	-	High. Suitable habitat in Shale Plains Woodland in 'the site'.	Potential habitat within Shale Plains Woodland within footprint.	Medium. Limited areas of important habitat resources within construction footprint (<2 ha) occurring as small, isolated patches. Potential for mortality of individuals if they are sheltering within the disturbance area.

A further 17 threatened fauna species may possibly occur at 'the site' based on the presence of suitable foraging and roosting habitat. There is no evidence, such as recent records in 'the locality' or specific important habitat resources that suggests 'the site' regularly supports local populations of any of these species, either on a permanent or seasonal basis. However these fauna species may occur in habitat at

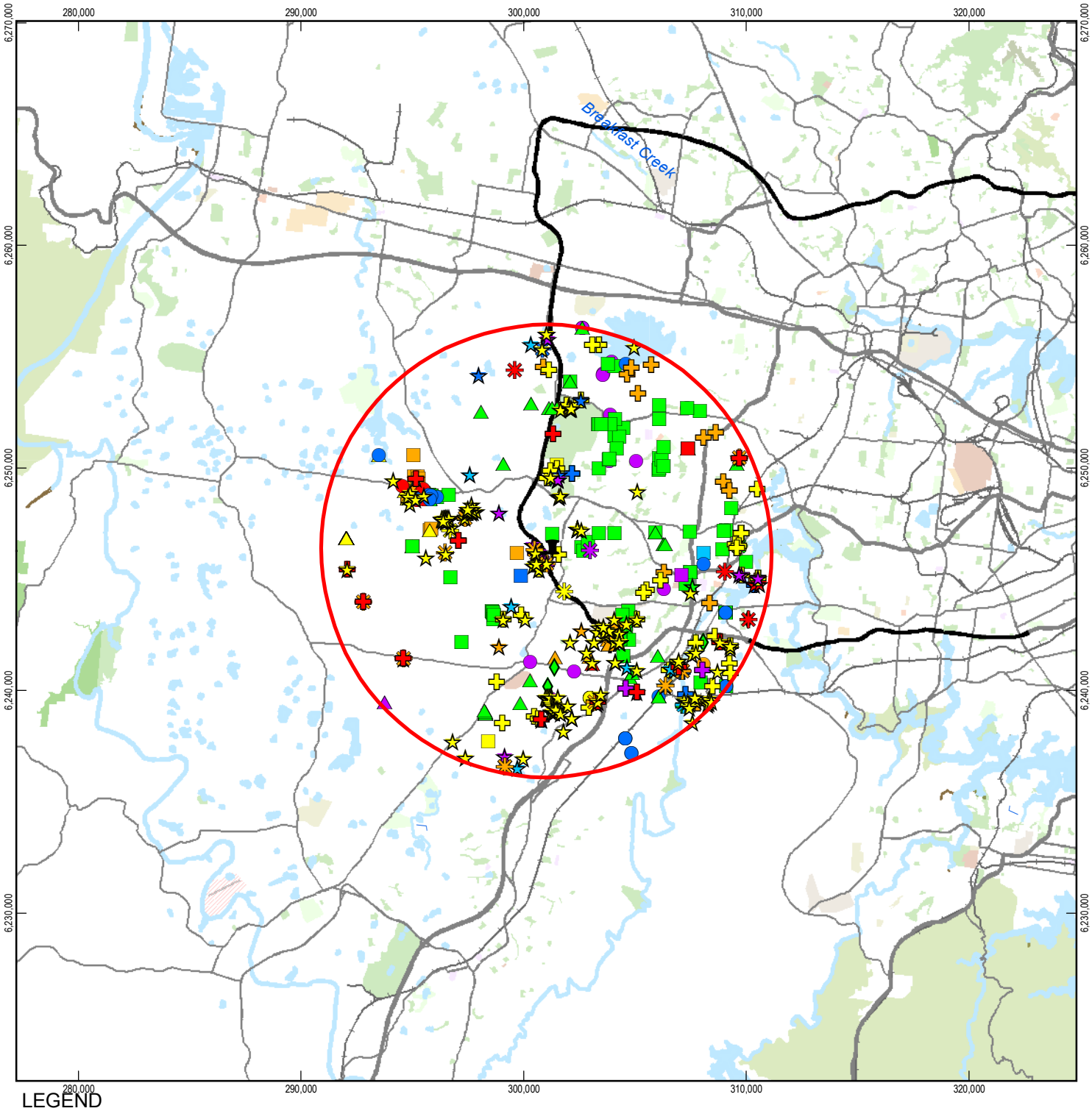
'the site' on an occasional or opportunistic basis. Threatened fauna species that may potentially utilise habitat at 'the site' are presented below:

- *Callocephalon fimbriatum* Gang-gang Cockatoo;
- *Calyptorhynchus lathami* Glossy Black-Cockatoo;
- *Glossopsitta pusilla* Little Lorikeet;
- *Lathamus discolor* Swift Parrot;
- *Ninox connivens* Barking Owl;
- *Ninox strenua* Powerful Owl;
- *Lophoictinia isura* Square-tailed Kite;
- *Melithreptus gularis gularis*) Black-chinned Honeyeater;
- *Pyrrholaemus saggitatus* Speckled Warbler;
- *Tyto novaehollandiae* Masked Owl;
- *Xanthomyza phrygia* Regent Honeyeater;
- *Chalinolobus dwyeri* Large-eared Pied Bat;
- *Dasyurus maculatus* Spotted-tailed Quoll;
- *Mormopterus norfolkensis* Eastern Freetail-bat;
- *Petaurus norfolcensis* Squirrel Glider;
- *Phascolarctos cinereus* Koala; and
- *Petaurus australis* Yellow-Bellied Glider.

There are very limited areas of potential habitat resources for these species within the proposed employment zone construction ('the project') footprint. Further, this habitat is small and isolated patches and so these species would be unlikely to occur in this habitat during construction. Therefore there is a very low risk of direct displacement or mortality of these species associated with 'the project' and the removal of habitat resources would have a minor effect on the amount of these resources available in 'the locality'.

6.1.5 Endangered Fauna Populations

No endangered fauna populations are known to occur in 'the locality' of 'the site' or in the Cumberland CMA sub-region (DECCW, 2010b).



LEGEND

Legend

- Site location
- 10km radius of site

DECCW threatened fauna

- Barking Owl
- Black-chinned Honeyeater (eastern subspecies)
- Bush Stone-curlew
- Cumberland Plain Land Snail
- Eastern Bentwing-bat
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Gang-gang Cockatoo
- Greater Broad-nosed Bat
- Green and Golden Bell Frog
- Grey-headed Flying-fox
- Koala
- Little Lorikeet
- Masked Owl
- Powerful Owl
- Regent Honeyeater
- Southern Myotis
- Speckled Warbler
- Spotted-tailed Quoll
- Square-tailed Kite
- Squirrel Glider
- Swift Parrot

DECCW threatened flora

- Acacia pubescens
- Callistemon linearifolius
- Cynanchum elegans
- Dillwynia tenuifolia
- Diuris aequalis
- Eucalyptus nicholii
- Eucalyptus scoparia
- Grevillea juniperina subsp. juniperina
- Grevillea parviflora subsp. parviflora
- Gyrostemon thesioides
- Leucopogon exolasius
- Marsdenia viridiflora subsp. viridiflora
- Persoonia hirsuta
- Persoonia nutans
- Pimelea spicata
- Pterostylis nigricans
- Pultenaea parviflora
- Pultenaea pedunculata
- Syzygium paniculatum

1:250,000(at A4)

0 2.5 5 10

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

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Mirvac Group Pty Ltd
Hoxton Park Airport Development - Ecology Assessment

DECCW threatened species recorded in the locality

Job Number	21-14911
Revision	A
Date	04 FEB 2010

Figure 6

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z006_Threatend_Species.mxd

Data source: Wildlife Atlas, DECC. Created by: Cwilson, cwilson, qjchung, bahambly

6.2 Matters of National Environmental Significance

6.2.1 Approach

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where 'matters of national environmental significance' (MNES) may be affected. Under the EPBC Act any action, which "has, will have, or is likely to have a significant impact on a matter of national environmental significance" is defined as a "controlled action", and requires approval from the Minister for the Environment, Water, Heritage and the Arts.

A Protected Matters Search (DEWHA, 2010) was performed for 'the project'. A number of EPBC Act listed threatened species have previously been recorded or are predicted to occur in 'the locality'The NSW Wildlife Atlas (DECCW, 2010a) also revealed records of EPBC Act listed threatened species previously recorded in 'the study area' (refer Appendix A). MNES listed under the EPBC Act of potential relevance to 'the study area' include:

- Threatened species (e.g. Swift Parrot *Lathamus discolor*);
- Threatened Ecological Communities (e.g. Cumberland Plain Woodland);
- Migratory species (e.g. waterfowl); and
- Ramsar sites within the same catchments as 'the study area'.

EPBC Act listed biota known from 'the study area' are presented in Appendix B along with an assessment of their habitat requirements, likelihood of occurring in 'the study area' and potential for impacts arising from 'the project'. A number of the EPBC Act listed biota may potentially occur at 'the site' and be affected by 'the project'. Potential impacts on these biota, or their habitats, comprise an impact on a MNES. Potentially affected MNES are discussed below.

6.2.2 Threatened Flora Species

There is potentially suitable habitat for a number of EPBC Act listed plant species within the broader study area (refer Appendix B). However, given the intensity of targeted surveys for these species in the present survey and by Biosis (2006) they can be reliably excluded from occurring in the footprint for the proposed employment zone development. These species of threatened plants may colonise habitat in the broader study area in the future or may exist in the soil seed bank or as dormant individuals. Therefore they should be considered in future assessments for the proposed sediment basin and access road.

6.2.3 Endangered Ecological Communities

The DEWHA (2010b) search engine predicts that four threatened EECs listed under the EPBC Act may occur at 'the site' (refer Appendix B). One of these EECs is present at 'the site': Cumberland Plain Woodland (CPW), which is listed as a Critically Endangered Ecological Community under the EPBC Act. 'The project' would involve the clearing of CPW (refer Section 8).

6.2.4 Threatened fauna Species

One EPBC Act listed fauna species was recorded during site surveys – the Grey-headed Flying Fox. There is no evidence such as recent records or important habitat resources to suggest that permanent local populations of any other EPBC Act listed fauna occur at 'the site'.

Based on desktop and habitat assessments four EPBC Act listed fauna species are likely to occur at 'the site' on an occasional or opportunistic basis:

- *Lathamus discolor* Swift Parrot;
- *Xanthomyza phrygia* Regent Honeyeater;
- *Chalinolobus dwyeri* Large-eared Pied Bat; and
- *Dasyurus maculatus* Spotted-tailed Quoll.

There are very limited areas of potential habitat resources for these species within the proposed employment zone construction footprint (<2 ha). Further, this habitat is small and isolated patches and so these species would be unlikely to occur in this habitat during construction. Therefore there is a very low risk of direct displacement or mortality of these species and the removal of habitat resources would have a minor effect on the amount of these resources available in the locality.

6.2.5 Migratory Species

'The site' provides potential for habitat migratory bird species protected under the provisions of International treaties and/or the EPBC Act. These include the Wood Duck, White faced Heron and Masked Lapwing, which were observed during field surveys. Native vegetation and wetlands at 'the site' are likely to be used by a range of these migratory species on a periodic basis. This would potentially include use of foraging resources by threatened migratory species, including the Swift Parrot and Regent Honeyeater.

'The project' would remove habitat for these migratory species within construction footprints.

6.2.6 Threatened Aquatic Species

The desktop review indicates an additional two threatened fish species which are predicted to occur in 'the locality'of 'the site' (Australian Grayling and Macquarie Perch) however a review of the distribution, specific habitat requirements of these species, and the habitat present led to the conclusion that these three fish species have a low likelihood of occurrence at 'the site' (Appendix B).

6.2.7 Wetlands of International Importance (Ramsar Wetlands)

'The site' is within the same broad catchment as the Towra Point Nature Reserve Ramsar Site. 'The site' is within the same catchment as the Towra Point Nature Reserve Ramsar Site. The Ramsar site is located many tens of kilometres downstream of 'the site' and is separated by the expanse of Botany Bay. Provided standard environmental management measures are adopted at 'the site' the proposal would be very unlikely to result in any surface water contamination. Even if any such contamination did occur the proposal site is so far removed from the Ramsar site that any such contamination would be diluted and would have no discernible effect. The proposal would not result in any other impacts on the natural environment beyond the immediate construction footprint. Therefore the proposed works would not impose "a significant effect" on the Towra Point Nature Reserve Ramsar Site.

6.3 Key Threatening Processes

A ‘key threatening process’ is ‘a threatening process specified in Schedule 3’ of the TSC Act. A ‘threatening process’ is ’a process that threatens, or may have the capability to threaten the survival or evolutionary development of species, populations or ecological communities’.

There is direct evidence of the following key threatening processes (KTPs) currently operating on site:

- Invasion of native plant communities by exotic perennial grasses;
- Predation by the European Red Fox; and
- Invasion and establishment of exotic vines and scramblers.

The following four KTPs would have operated previously, given the modified landscape and vegetation communities present at ‘the site’:

- Clearing of native vegetation;
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands;
- Loss of Hollow-bearing Trees; and
- Removal of dead wood and dead trees.

The development will directly contribute to the operation of these KTPs by affecting remnant native vegetation, drainage lines and wetlands at ‘the site’. The extent and severity of the operation of these processes is described in Section 8.

7. Constraints & Opportunities Assessment

7.1 Approach

Four levels of constraint were identified as occurring on 'the site' based on the results of field surveys and desktop assessments and the conservation significance included above. The following broad ecological constraints classes were identified at 'the site':

- Very High Constraint – EECs in good condition or occurring as large patches and/or large patches of habitat for threatened fauna. Future development should avoid construction in these areas as far as is practicable. Impacts within these areas would need to be assessed in detail, mitigated as far as is practicable and offset.
- High Constraint – areas comprising small or degraded patches of EECs, and/or containing threatened species habitat. Future development may include construction in these areas, but would also consider retaining and improving some areas as part of an overall land use strategy. Impacts within these areas would need to be assessed in detail, mitigated as far as is practicable and offset.
- Medium Constraint – includes small or degraded areas of native vegetation, derived native grasslands, artificial features with some fauna habitat value. Future development may include construction in these areas, but would also consider retaining and improving some areas as part of an overall land use strategy. Impacts within these areas would need to be assessed in detail and mitigated as far as is practicable and offset.
- Low Constraint – areas comprising predominately cleared and disturbed grasslands with minimal native plant species and fauna habitat value. Future development plans should aim to place construction in these areas, in preference to other areas, as far as is practicable. Impacts within these areas would need to be assessed but would not require specific mitigation measures nor biodiversity offsets.

Ecological constraints classes identified and mapped at 'the site' are shown on Figure 7.

301,000

302,000

6,246,000

6,245,000

Legend

- Employment Zone Development (the project)
- Cleared under previous approvals (Biosis, 2006)
- The Site

EcologicalConstraints

- Very high Constraint
- High Constraint
- Medium Constraint
- Low Constraint

1:5,000 (at A3)

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

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Mirvac Group Pty Ltd
Hoxton Park Airport Development - Ecology Assessments

Job Number	22 - 14911
Revision	A
Date	23 FEB 2010

Ecological Constraints

Figure 7

G:\22\14911\GIS\ESRI\Map_Documents\22.14911.Z007_Ecological_Constraints.mxd

10 Bond Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: DCDB, NSW Dept. of Lands: Cadastre - 19/01/2010; Imagery: Nearmap - 19/01/2010. Created by: qjchung, bahambly

8. Preliminary Impact Assessment

8.1 Approach

This Section assesses the potential impacts of 'the project' on the flora and fauna of ''the study area''. This impact assessment applies only the employment zone development ('the project'), which is currently subject to a detailed Project Application. The future sedimentation basin and future access road will each be subject to final ecological impact assessments as part of separate Project Applications under Part 3a of the EP&A Act once the final project design for these components has been completed.

The impact assessment provided below is based on indicative infrastructure locations and construction footprints supplied by the proponent. The employment zone development would involve the following:

- The design, construction and operation of warehouse buildings;
- Fit out and use of warehousing and distribution businesses, including 24/7 operational hours;
- Construction of the required site infrastructure including:
  - Roads;
  - Parking;
  - Drainage; and
  - Services and Utilities; and
- Earthworks including excavation and fill.

Impacts within the employment zone development footprint have previously been assessed by Biosis (2007) and GHD (2007a). The extent, condition and conservation significance of native vegetation and habitats at 'the site' is equivalent that described in the Biosis (2007) assessment and subsequent GHD (2007a) site surveys in the preparation of the VMP for 'the site'. The impact assessments and assessments of significance provided by Biosis (2007) and offsets strategy presented by GHD (2007b) are appropriate to conditions observed in the current assessment. Therefore the impact assessment provided below is based on quantitative assessments provided in these reports

8.2 Vegetation Clearing and Construction Impacts

8.2.1 Vegetation Communities

Construction for 'the project' would require the clearing or modification of native vegetation within the surface disturbance area. The proposed employment zone development will completely remove three small patches of Shale Plains Woodland vegetation totalling 1.475 ha in area (GHD, 2007b). This clearing is permitted and can commence upon approval of the Part 3a application. The Biosis (2006) Report completed assessments of significance under the EPBC and TSC Acts respectively and concluded that, 'on the basis of the small size, fragmentation and degraded state of the community within 'the study area', the proposed development was not likely to result in a significant impact on the EEC'. Notwithstanding this determination, the development will seek to mitigate this impact through appropriate 'offsetting' mechanisms' implemented within the subject site, which are in place via the VPA with LCC.

The remainder of the employment zone development footprint is exotic grassland or disturbed cleared land with little conservation value.

8.2.2 Flora Species

'The project' would not remove any known populations of threatened plants. Vegetation clearing for 'the project' would remove a number of mature *Eucalyptus* and *Melaleuca*. Mature trees have value within plant populations as sources of seed. There are extensive areas of these species at 'the site' and the removal of a small proportion of mature individuals would not threaten the persistence of local populations.

Construction for 'the project' would damage or remove understorey plants that are within the surface disturbance area at the time of the operations. Any vegetation clearing required in these areas would remove non-threatened native plants and noxious and environmental weeds. The majority of this area is disturbed, cleared, subject to severe weed infestation and has little habitat value for native plants.

It is likely that flora populations would persist in the soil seed bank and in alternative habitat outside the surface disturbance area. Reproduction at the population scale is unlikely to be disadvantaged by damage to individual plants. Populations of extremely rare plants, or those with restricted distributions would be more vulnerable to negative effects arising from direct removal. The proposed construction is highly unlikely to remove a significant proportion of any threatened plant populations and is unlikely to remove any adult/above-ground individuals because targeted surveys did not record any threatened plants or populations within construction footprint areas.

The proposed construction may remove habitat for threatened plant species likely to occur at 'the site' and potentially dormant individuals or seeds (refer Appendix B).

8.2.3 Fauna

The proposed employment zone development ('the project') would remove limited areas of habitat resources within the construction footprint (<2 ha) occurring as small, isolated patches. Based on these considerations Biosis (2006) considered that the proposed development is likely to have a nil or negligible impact on threatened fauna species. Accordingly, no further assessment was carried out for threatened fauna under the EPBC and TSC Acts or is considered necessary (Biosis, 2006).

'The project' would cause displacement or mortality of fauna that are within the surface disturbance area at the time of construction activities. These impacts are only likely to affect generalist species able to occupy isolated and degraded habitat. These species are widespread and common and unlikely to be significantly affected at the population scale by these effects. 'The project' may also interrupt or prevent breeding for one season if species are breeding within or near disturbance footprints during construction. Given the extent of native vegetation in the broader study area it is likely that fauna populations would be able to seek refuge and persist in alternative habitat outside the surface disturbance area. The magnitude of likely impacts would vary between types of fauna.

Birds are relatively mobile and so most individuals would be able to avoid vegetation clearing (which is minimal) or construction operations. Most individuals directly affected by 'the project' would be displaced rather than killed. Some mortality of less mobile individuals, such as nestlings, old or sick birds may occur. Birds breeding in, or in the vicinity of the surface disturbance area may have breeding disrupted for one season. These direct impacts would affect limited numbers of individuals and would be isolated in time and space and so would be unlikely to threaten the survival of any local populations of any bird species. Appropriate mitigation measures (described in Section 9) would limit these impacts.

Macropods and other large terrestrial mammals are likely to readily avoid vegetation clearing or construction operations and so individuals directly affected by 'the project' would be displaced rather than

killed. There may be some mortality of mammals less able to avoid the disturbance. These may include smaller terrestrial mammals, nocturnal species and especially arboreal mammals and microbats which may be sheltering in felled trees. There may be mortality of individuals sheltering in woody debris, tree hollows, crevices or under bark. Displaced individuals would be vulnerable to predation since they would be disturbed in daylight hours and would experience energy costs, increased risk of predation and increased competition for resources (especially for alternative hollows). This may result in impacts beyond the disturbance area by favouring aggressive or generalist species. It should be noted these potential impacts would be minimal due to there being minimal suitable habitat for these species throughout the employment zone development.

The mobility of microbats and low energy cost of flight would facilitate successful dispersal after disturbance and recolonisation of regenerating areas. Therefore, although individual bats would be susceptible to short term impacts from vegetation clearing and especially removal of roost sites, bat populations would probably be resilient to these effects.

Displacement or mortality due to construction impacts would affect limited numbers of individuals and would be unlikely to threaten the survival of any local populations of any fauna species.

More significant negative effects on fauna populations may arise from removal of habitat for permanent project infrastructure and changes to vegetation structure and the quality of habitat in regenerating vegetation. Impacts on habitats are discussed below.

There is likely to be ongoing impacts on fauna utilising adjacent areas of habitat during construction associated with noise and other disturbances. There are already disruptive human activities in ‘the study area’ associated with the M7, Cowpasture Road and ongoing road upgrades and warehouse construction. The majority of fauna currently occupying ‘the study area’ are likely to be adapted to these disturbances. There is likely to be minimal impacts upon smaller, less mobile fauna in the immediate vicinity of the proposed works.

8.2.4 Terrestrial Habitats

The development will have an impact on habitat for native flora and fauna through vegetation clearing as described above. This clearing will have additional negative effects on the quality of habitats in the broader locality through edge effects, fragmentation of habitat and the temporary disruption of fauna movement corridors. These impacts are permitted as described in Sections 8.2.1 and 9.4.

Edge effects refer to the impact of clearing on the surrounding areas of remnant vegetation. Negative impacts may include an increase in incursion of weeds, sedimentation or access for predators. Patchy, disturbed environments may also disrupt native bird communities by favouring aggressive edge-specialists like the Noisy Miner, which can displace other small native birds. Disturbance may also favour predatory species such as the Australian Raven and Pied Currawong, which can affect breeding success of smaller birds. Edge effects are already having pronounced negative effects on habitat in ‘the study area’. Existing disturbance associated with the former airport site has resulted in clearly visible edge effects in native vegetation such as infestation with exotic species around the margins of the Hinchinbrook Creek riparian corridor. The employment zone development would create new edges along areas of retained vegetation, which would be exposed to additional edge effects. Measures recommended in Section 9 should be implemented to minimise the potential for these impacts. The overall effect would be minor as the vegetation to be removed is limited in extent (under 2 ha), occurs as very small isolated patches and is at the margins of remnant patches.

The employment zone development will contribute to a barrier to movement of fauna in 'the locality'by creating additional obstacles between the Hinchinbrook Creek riparian corridor and woodland to the west of the M7. The vegetation to be directly removed would have little value for fauna species as the habitat to be removed is a 'dead end' terminating in the former airport site. Fauna movement to the west is already limited by the M7 and to the south by Cowpasture Road. The Hinchinbrook Creek riparian corridor riparian corridor is significant at a local and regional scale, connecting woodland and forest to the south of 'the site' with other remnant vegetation to the north. The existing riparian corridor is 50-100m wide and provides foraging, shelter and travelling habitat. This area of intact vegetation is likely to be sufficient to maintain ecological functions such as pollination of plants, seed fall from mature trees, maintenance of soil mycorrhizal associations and movement of the majority of fauna that contribute to the community. 'The project' would have a very minor effect on the integrity of this habitat corridor.

8.2.5 Aquatic Habitat

Aquatic habitats within the development footprint are all artificial drainage features and have little conservation value. They are unlikely to support any threatened biota or be important to the maintenance of any local populations of aquatic biota.

Hinchinbrook Creek provides greater habitat value including good habitat opportunities for aquatic species. 'The project' would not directly affect Hinchinbrook Creek and is unlikely to result in significant indirect impacts as described below.

8.3 Indirect Impacts

8.3.1 Degradation of surface waters

Potential sources of impacts to surface water within the study area include:

- Runoff from areas stripped of vegetation;
- Runoff from soil stockpiles;
- Runoff from hardstand areas, including roads, processing areas and site facilities;
- Leakage or spillage of hydrocarbon products from vehicles, wash down areas and workshops,
- Refuelling bays and fuel, oil and grease storages.

There are a number of sensitive aquatic habitats within close proximity of project infrastructure, including Hinchinbrook Creek, smaller drainage lines and intermittent marshes. These areas are all sensitive receptors for adverse impacts on water quality potentially arising from 'the project'.

Potential water quality impacts of 'the project' may be associated with runoff from disturbed areas, including vegetation clearing areas, construction laydown areas and access roads if risks are not effectively managed and appropriate mitigation measures implemented. Concentrated and/or altered water movement within the construction corridor could increase the potential for sediment mobilisation and transport. Negative effects on aquatic habitats may include increases in stream sediment load, changes in channel form, changes in stream hydrology and a variety of changes in stream faunal populations and communities. Infrastructure that impinge on the stream channel may also cause increases in sediment input and consequent declines in water quality and stream habitat integrity, leading to declines in abundance of invertebrates and fish (Davies and Nelson, 1994).

The overall risk of significant soil erosion and water pollution arising from the proposed construction is considered to be low because of the following factors:

- 'The site' is very flat;
- The local topography of 'the site' has been extensively modified and existing roads and hardstand areas are isolated from natural environments by drainage diversion and sediment control works;
- The Hinchinbrook Riparian corridor contains intact native vegetation environment and would have a substantially lower erosion hazard than, for example, cleared agricultural landscapes. Any localised increases in erosion hazard as a result of construction would be limited to the immediate construction footprint and there would be buffers of intact vegetation between the disturbance footprint and aquatic habitats;
- Within 'the site', a network of access roads and cleared areas is already established and any additional access roads would principally be short, temporary tracks. Erosion hazard would only increase significantly within limited areas of native vegetation removal (< 2 ha); and
- Soil protection measures and techniques would be implemented during and following construction.

8.3.2 Sediments dust and runoff

There are sensitive environmental receptors adjacent to the development footprint including the Hinchinbrook Creek and associated native vegetation.

Potential indirect impacts to terrestrial flora and fauna from extraction activities would include dust and vehicle exhaust emissions generated from construction vehicles and equipment.

8.3.3 Roads and access

Collisions with wildlife (such as macropods and arboreal mammals) within 'the site' are possible, particularly during dusk and dawn when macropods are active. The development would represent a relatively minor increase in traffic volumes at 'the site', which currently experiences traffic from ongoing construction activities, particularly in the context of very heavy traffic on the M7 and Cowpasture Road. Vehicle movements would be low-speed, since roads on site would be temporary gravel access tracks and subject to speed restrictions. Therefore the increase in traffic is unlikely to significantly increase the risk of vehicle collisions with fauna utilising habitats in the local area.

8.4 Duration of Impacts

'The project' would result in permanent removal of native vegetation and habitats within the entire construction footprint. There would also be continuous and permanent indirect impacts, such as noise, light, dust and traffic.

The development would result in some positive long term impacts within 'the study area' through the approved offset strategy (refer Section 9).

9. Recommended Mitigation Measures

9.1 General

The mitigation of adverse effects arising from 'the project' has been presented according to the hierarchy of avoidance; mitigation and offsetting of impacts.

9.2 Avoidance of Impacts

9.2.1 Project Location & Scope

The majority of the development area falls within land which is extensively modified by historical disturbance. Impacts on native flora and fauna are substantially less than would be associated with an undisturbed 'green field' site. Remnant vegetation and habitats that will be removed occur as isolated patches within the development footprint. These patches could not be practically avoided without substantial changes to the proposed development. The conservation significance of the vegetation and habitats to be removed would not justify such a change to 'the project' scope.

9.3 Mitigation of Impacts

9.3.1 Construction Planning

It is recommended that the Construction Environmental Management Plan (CEMP) be developed for 'the project' and include the mitigation measures outlined below.

Soil and surface water management

The CEMP 'will include a 'Soil and Water Management Plan' for 'the site'. Specific surface water management measures will be outlined in this plan, which would include as a minimum the following principles to manage surface water:

- Minimise the area of disturbance, thus minimising the volume of 'dirty' surface water runoff. The clearing and construction method should ensure that soils are only exposed immediately prior to construction, with the remainder of 'the site' covered by retained or replanted vegetation;
- Minimise handling of soils through direct replacement onto landscaped open space areas and careful selection of soil stockpile locations;
- Ensure the fullest separation possible of 'clean' and 'dirty' surface water runoff;
- Install appropriate surface water and erosion control devices (i.e. silt fences or equivalent) around the disturbance footprint;
- Runoff from disturbed and rehabilitated areas will be diverted into sediment ponds and not discharged into the natural system;
- Soil and water management practices outlined in the 'Blue Book' are to be employed onsite in line with standard industry practices.
- Ensure water management systems adopted on site do not adversely affect water quantity or quality in downstream water courses.

Dust

Appropriate construction measures must be incorporated to minimise the generation of dust and associated impacts on adjacent natural environments. These are likely to include:

- Setting appropriate speed limits for construction traffic to limit dust generation; and
- Applying water to internal haul roads during construction, where required.

Fauna Management

Mitigation measures for fauna are required as the proposed works involve the removal of habitat in native vegetation. Due care during clearing is recommended to reduce direct impacts to any fauna species which may be utilising the disturbance area. A pre-clearance survey by 'the site' Environmental Management Representative (EMR) will be required prior to clearing of any native vegetation within the proposed construction area. This should involve:

- Searches for birds, nests and roosts;
- Active searches for micro bats, including checking under exfoliating bark;
- Identification and marking of habitat trees during pre-clearing surveys (habitat trees include: trees with a DBH > 70cm; trees with resident fauna or associated signs of occupation; and/or any trees with hollows);
- Habitat trees should be avoided as far as is practicable by postponing clearing through these areas as long as is practicable;
- Habitat trees should be monitored for fauna by 'the site' EMR during clearing operations and sensitive construction techniques used to minimise the risk of mortality of resident fauna; and
- During clearing operations, all habitat trees should be retained as intact as practicable and placed on the surface of nearby revegetation areas. Where it is practical to separate any leaves, branches and seeds from native species, these items should used for brush mulching in re-vegetation areas. Where practical, hollow-bearing habitat trees should be felled in such a way that hollow limbs are retained intact and should be placed in nearby revegetation areas. The transfer of seeds from non-native species through contaminated soil and vegetative material to revegetation areas should be avoided.

The proposed construction would progress in stages. This approach would maintain vegetated corridors as long as possible, maximising opportunities for fauna to escape into remnant vegetation outside 'the site'.

The 'project area' contains very limited habitat resources. The above listed survey/search activities would require the EMR (or an experienced ecologist) to be active on site for approximately four hours due to the small amount of clearing required within the proposed employment zone development.

Groundcover Clearance Protocol

Groundcover substrate, especially large woody debris, provides important habitat for native fauna, including threatened species. It is recommended that the following protocol be included in the CEMP:

- 'The site' EMR is to perform a pre-clearing survey for Cumberland Land Snails and if any individuals are found relocate them, along with relevant shelter substrate, to the nearest area of intact habitat outside the disturbance footprint;
- As part of the pre-clearing survey, 'the site' EMR will identify large woody debris with habitat value (excluding exotic weed material) that warrants relocation;

- During construction, remove identified large woody debris using excavator grabs, where practicable; and
- Place intact large woody debris within nearby revegetation areas.

Again, this would require the services of the EMR (or and experienced ecologist) for approximately four hours due to the small amount of clearing required by 'the project'

Site Management

The following mitigation measures are recommended in order to minimise construction impacts of 'the site':

- Set appropriate speed limits for construction traffic to reduce the risk of fauna road fatalities; and
- Restrict access into adjacent remnant vegetation during construction by appropriate marking / fencing of surface disturbance footprint.

Weed and Pest Management

It is recommended that the following measures be adopted to manage environmental weeds during construction:

- Stockpiles of fill or vegetation should not be placed in areas of adjoining remnant vegetation but instead within existing cleared areas;
- To limit the spread of weeds into adjoining remnant vegetation the surface disturbance footprint existing fencing around the Hinchinbrook Creek riparian corridor should be maintained and construction activities completely excluded from this area;
- Incorporate control measures in the design of the proposed works to limit the spread of weed propagules downstream of 'the site';
- Progressive rehabilitation of disturbed vegetation to limit the potential for colonisation by weeds;
- Monitor and control Noxious Weed species in line with legislative obligations; and
- Perform ongoing monitoring of weed infestation on and adjoining 'the site'.

Implementation of the above listed mitigation measure will further minimise impacts to native biota at the site, noting that identified impacts are not considered significant and are already permitted under previous agreements.

9.4 Offsetting

'The site' forms part of the Hoxton Park Airport Redevelopment and is influenced by previous development approvals. The entire area of the proposed employment zone development ('the project') falls within the area already rezoned by Liverpool City Council (LCC) for development. This rezoning included an appropriate Offset Strategy and associated 7-part test, approved by LCC as suitable for mitigating known impacts within the development footprint and, therefore, not considered to be a 'significant' impact as defined by the Section 5 of the EP & A Act (GHD, 2007a; 2007b).

Construction of 'the project' will impact on 1.475 ha of Shale Plains Woodland (SPW) vegetation (low condition and 'paddock trees'). The offset strategy is to be read in conjunction with the VMP, namely, HPAL Freehold Report for Hoxton Park Airport Development Vegetation Management Plan, October 2007 (GHD, 2007a)'. The Offset Strategy describes the impact of the proposed development on native

vegetation, proposed offsetting actions and justification and the VMP provides details of the implementation works.

The ecological assessment conducted by Biosis (2006) concluded that, 'on the basis of the small size, fragmentation and degraded state of the community within 'the study area', the proposed development was not likely to result in a significant impact on the EEC'. In line with the 'improve or maintain' principal presented in the DEC/DPI (2005) guidelines the development will seek to compensate for this impact through appropriate 'offsetting' mechanisms. The Offset Strategy will be implemented in the Hinchinbrook Creek Corridor over a five-year period. The principle goals of the strategy are to improve the condition and conservation of existing vegetation and promote a net increase in vegetation cover across 'the site'. The Offset Strategy includes three distinct management actions to mitigate vegetation clearing for the development, being:

- Conservation of existing remnant vegetation outside the RFI Zone;
- Rehabilitation of 4.06 ha existing vegetation; and
- Revegetation activities based on a compensation ratio of 1:2.85 (GHD, 2007b).

The layout of the development site and offset site is shown on Figure 8. This figure has been taken directly from the offset strategy (GHD 2007b).

Implementation of the proposed Offset Strategy will allow 'the project' to satisfy the 'improve or maintain' test. Impacts to existing vegetation will be minimal with only 1.475 ha of low condition vegetation disturbed. To compensate for this a total of 4.05 ha of remnant vegetation will be conserved and rehabilitated on site and an additional 4.2 ha replanted. This will provide a net increase in vegetation cover across the broader study area in addition to the conservation and management of approximately 16 ha of land included in riparian buffers required under the WMA Act. Implementation of the Offset Strategy will adequately compensate for the impact on existing vegetation during construction of the development (GHD, 2007b).

The developer will need to provide investment into the rehabilitation program as described by the VMP (GHD 2007a) as per the contributions outlined in the VPA.

LEGEND

- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- LOCAL CENTRE
- GENERAL INDUSTRIAL
- PROPOSED BIO RETENTION BASIN
- EXISTING VEGETATION TO BE RETAINED-ZONE 1
- OPEN SPACE TO BE REVEGETATED-ZONE 2
- 40M RFI ZONE
- CENTRE LINE OF CREEK
- SITE BOUNDARY

N

0 100 200 300m
SCALE 1:10000 AT ORIGINAL SIZE

* Base plan and land use information provided by Urbis JHD, plan dated February 2007

CLIENTS | PEOPLE | PERFORMANCE

Mirvac Group Pty Ltd
Hoxton Park Airport Development - Ecology Assessment

Job Number 22 - 14911
Revision A
Date 04 FEB 2010

Offset Strategy

Figure 8

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10. Conclusions

This ecological assessment noted a mix of ecological constraints at 'the site', reflecting the extent of previous disturbance. The extent, condition and conservation significance of native vegetation and habitats at 'the site' is equivalent to that described in the Biosis (2006) assessment and subsequent GHD (2007a) site surveys in the preparation of the VMP for 'the site'. Some relatively intact habitats have very high conservation significance including intact patches of the TSC Act listed EEC River Flat Eucalypt Forest and TSC/EPBC Act listed EEC Cumberland Plain Woodland. Native vegetation at 'the site' is likely to support local populations of six threatened fauna species based on 'the site' surveys, habitat assessments and/or recent observations of the species in the locality.

There are very limited areas of potential habitat resources for threatened biota within the proposed employment zone ('the project') construction footprint (<2 ha). The removal of these habitat resources would have a minor effect on local populations of EECs and threatened fauna. The impact assessments and assessments of significance provided by Biosis (2006) and offsets strategy presented by GHD (2007b) are appropriate to conditions observed in the current assessment. No additional surveys, modifications to the development design, mitigation or offsets are required to accompany 'the project' Application for the proposed employment zone development with development able to proceed without delay.

Based on the findings of this assessment, the proposed sediment basin and access road is likely to result in impacts on native vegetation and threatened biota in addition to the impacts identified by Biosis (2006) and GHD (2007a) and compensated for by the existing offsets strategy (GHD, 2007b). The following recommendations are made to inform the development design process for the proposed future sediment basin and future access road. This advice is provided to avoid or reduce the potential for adverse impacts on threatened biota and their habitats and hence facilitate the development approval process:

- Retain as much of the remnant native vegetation comprising EECs and containing habitat trees as possible;
- Retain and rehabilitate riparian corridors and drainage channels where possible;
- Enhance connectivity values and habitat linkages through 'the study area' via retained and rehabilitated watercourses. Incorporate existing remnant trees into these where possible and use appropriate local native species in rehabilitation and landscaping areas; and
- Develop a biodiversity offset strategy to offset any residual impacts or impacts not previously covered by the offset strategy (GHD 2007b), on biodiversity of future development on site that cannot be avoided or mitigated through development design and/or implementation of impact amelioration measures.

The detail of these impacts and recommended mitigation and offsetting actions will be included in future Project Applications for the future sediment basin and future access road.

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Appendix A

Species Lists

Table A.1. Flora Species List

Plants	Scientific Name	Common Name	NSW Status	Commonwealth Status	Employemnt zone	Sediment basin	Hinchinbrook creek corridor
Acanthaceae							
	Brunoniella australis	Blue Trumpet	U				x
	Pseuderanthemum variabile	Pastel Flower	U				x
Adiantaceae							
	Adiantum aethiopicum	Common Maidenhair	P13			x	x
	Cheilanthes sieberi	Rock Fern	U		x	x	x
Amaranthaceae							
	Alternanthera denticulata	Lesser Joyweed	U		x	x	
Amygdalaceae							
	*Prunus spp.**		U		x		
Anthericaceae							
	Tricoryne simplex		U		x	x	
Apiaceae							
	Centella asiatica	Indian Pennywort	U		x	x	
	Daucus glochidiatus	Native Carrot	U		x		
Apocynaceae							
	*Araujia sericifera**	Moth Vine	U		x	x	x
	*Gomphocarpus fruticosus**	Narrow-leaved Cotton Bush	U			x	
	Parsonsia straminea	Common Silkpod	U				x
Asparagaceae							
	*Asparagus asparagoides**	Bridal Creeper	U		x		
Asteraceae							
	*Ageratina adenophora**	Crofton Weed	U			x	
	*Bidens pilosa**	Cobbler's Pegs	U				x
	Cassinia aculeata	Dolly Bush	U				x
	*Cirsium vulgare**	Spear Thistle	U		x	x	x
	*Conyza bonariensis**	Flaxleaf Fleabane	U		x	x	x
	Euchiton gymnocephalus	Creeping Cudweed	U		x		
	Euchiton nitidulus	Shining Cudweed	V				x
	Euchiton sphaericus	Star Cudweed	U		x		
	*Gamochaeta americana**	Cudweed	U			x	
	Gnaphalium sphaericum				x		
	*Senecio madagascariensis**	Fireweed	U		x	x	x
	Senecio quadridentatus	Cotton Fireweed	U		x		
	*Sonchus oleraceus**	Common Sowthistle	U			x	x
	*Taraxacum officinale**	Dandelion	U		x	x	x
Cactaceae							
	*Opuntia stricta**	Common Prickly Pear, Smooth Pest Pear	U		x	x	x
Campanulaceae							
	Wahlenbergia gracilis	Sprawling Bluebell	U		x		
	Wahlenbergia littoricola		U		x		
Caryophyllaceae							
	*Stellaria media**	Common Chickweed	U		x	x	
Casuarinaceae							
	Casuarina glauca	Swamp Oak	U		x		x
Chenopodiaceae							
	Einadia hastata	Berry Saltbush	U			x	x
	Einadia nutans	Climbing Saltbush	U		x	x	
	Einadia trigonos	Fishweed	U			x	
Clusiaceae							
	Hypericum gramineum	Small St John's Wort	U		x		x
	*Hypericum perforatum**	St. Johns Wort	U		x		
Commelinaceae							
	Commelina cyanea	Native Wandering Jew	U				x
	*Tradescantia fluminensis**	Wandering Jew	U			x	x
Convolvulaceae							
	Dichondra repens	Kidney Weed	U		x	x	x
Cyperaceae							
	Bolboschoenus caldwellii		U		x		
	Carex appressa	Tall Sedge	U		x	x	
	Carex spp.		U			x	
	*Cyperus brevifolius**		U		x		
	*Cyperus eragrostis**	Umbrella Sedge	U		x	x	x
	Cyperus gracilis	Slender Flat-sedge	U		x		
	Cyperus polystachyos		U		x		
	*Cyperus rotundus**	nutgrass	U			x	
	Cyperus spp.		U		x		
	Eleocharis cylindrostachys		U		x		
	*Isolepis prolifera**		U		x		
Ericaceae							
	Astroloma humifusum	Native Cranberry	U		x		
	Leucopogon juniperinus	Prickly Beard-heath	U		x	x	
Fabaceae (Faboideae)							

	Daviesia genistifolia	Broom Bitter Pea	U		x	x	x
	Daviesia ulicifolia	Gorse Bitter Pea	U		x	x	
	Dillwynia acicularis		U			x	
	Dillwynia sieberi		U		x		x
	Glycine microphylla	Small-leaf Glycine	U		x		x
	Glycine tabacina	Variable Glycine	U			x	x
	Hardenbergia violacea	False Sarsaparilla	U		x		
	Pultenaea villosa	Hairy Bush-pea	U		x		
	*Trifolium arvense**	Haresfoot Clover	U				x
Fabaceae (Mimosoideae)							
	Acacia parramattensis	Parramatta Wattle	U		x	x	x
	Acacia longifolia		U		x		x
	Acacia falciformis	Broad-leaved Hickory	U		x		
	Acacia fimbriata	Fringed Wattle	U			x	
	Acacia floribunda	White Sally	U		x		
	Acacia parvipinnula	Silver-stemmed Wattle	U		x		
	Acacia ulicifolia	Prickly Moses	U				x
Geraniaceae							
	Geranium homeanum		U				x
Goodeniaceae							
	Goodenia hederacea	Ivy Goodenia	U		x		
Haloragaceae							
	Haloragis heterophylla	Variable Raspwort	U			x	
	*Myriophyllum aquaticum**	Parrots Feather	U				x
	Myriophyllum variifolium		U		x		
Hydrocharitaceae							
	Ottelia ovalifolia subsp. ovalifolia	Swamp Lily	U				x
Juncaceae							
	*Juncus acuminatus**		U				
	*Juncus acutus subsp. acutus**	Sharp Rush	U		x	x	
	Juncus continuus		U		x		
	Juncus usitatus		U		x	x	
Lamiaceae							
	Clerodendrum tomentosum	Hairy Clerodendrum	U		x		
Lemnaceae							
	Lemna disperma		U				x
Lobeliaceae							
	Pratia purpurascens	Whiteroot	U				x
Loganiaceae							
Lomandraceae							
	Lomandra filiformis subsp. filiformis		U				x
	Lomandra longifolia	Spiny-headed Mat-rush	U		x	x	
	Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush	U			x	x
Luzuriagaceae							
	Geitonoplesium cymosum	Scrambling Lily	U				x
Malaceae							
	*Pyracantha angustifolia**	Orange Firethorn	U				x
Malvaceae							
	Lagunaria patersonia	Norfolk Island Hibiscus	U			x	
	*Sida rhombifolia**	Paddy's Lucerne	U		x	x	x
Myrsinaceae							
	*Anagallis arvensis**	Scarlet Pimpernel	U			x	
Myrtaceae							
	Angophora subvelutina	Broad-leaved Apple	U		x	x	x
	Angophora floribunda	Rough-barked Apple	U				x
	Corymbia maculata	Spotted Gum	U		x	x	x
	Eucalyptus eugenioides	Thin-leaved Stringybark	U		x		
	Eucalyptus moluccana	Grey Box	U		x	x	x
	Eucalyptus tereticornis	Forest Red Gum	U		x	x	
	Melaleuca decora		U		x	x	
	Melaleuca linariifolia	Flax-leaved Paperbark	U		x		
	Melaleuca styphelioides	Prickly-leaved Tea Tree	U		x	x	
Oleaceae							
	*Ligustrum sinense**	Small-leaved Privet	U			x	
	Notelaea longifolia	Large Mock-olive	U			x	x
	*Olea europaea subsp. cuspidata**	African Olive	U			x	x
Oxalidaceae							
	*Oxalis corniculata**	Creeping Oxalis	U		x		
Phormiaceae							
	Dianella longifolia	A Blue Flax Lily	U			x	x

	Dianella revoluta	Blueberry Lily, Blue Flax Lily	U		x		x
Phyllanthaceae							
	Breynia oblongifolia	Coffee Bush	U		x	x	
	Phyllanthus virgatus	Wiry Spurge	U		x	x	
Phytolaccaceae							
	*Phytolacca octandra**	Inkweed	U			x	
Pittosporaceae							
	Bursaria spinosa	Native Blackthorn	U		x	x	x
	Pittosporum revolutum	Rough Fruit Pittosporum	U				x
Plantaginaceae							
	*Plantago lanceolata**	Lamb's Tongues	U		x	x	x
Poaceae							
	Aristida ramosa	Purple Wiregrass	U		x	x	x
	Austrodanthonia spp.	A Wallaby Grass	U		x	x	
	*Avena fatua**	Wild Oats	U		x		
	*Avena spp.**	Oats	U			x	
	Bothriochloa macra	Red Grass	U		x		
	*Briza maxima**	Quaking Grass	U		x		
	*Briza minor**	Shivery Grass	U		x	x	x
	*Briza subaristata**		U		x		
	*Bromus diandrus**	Great Brome	U		x		
	*Chloris gayana**	Rhodes Grass	U		x	x	
	Chloris truncata	Windmill Grass	U		x		
	Cymbopogon refractus	Barbed Wire Grass	U		x		x
	Cynodon dactylon	Common Couch	U		x	x	x
	Echinopogon caespitosus	Bushy Hedgehog-grass	U			x	
	*Ehrharta erecta**	Panic Veldtgrass	U		x		x
	*Eleusine tristachya**	Goose Grass	U		x		
	Entolasia marginata	Bordered Panic	U		x		
	Entolasia stricta	Wiry Panic	U				x
	Eragrostis brownii	Brown's Lovegrass	U		x		
	*Eragrostis curvula**	African Lovegrass	U		x	x	
	Imperata cylindrica var. major	Blady Grass	U			x	
	Microlaena stipoides	Weeping Grass	U		x	x	x
	Oplismenus aemulus		U		x	x	x
	Panicum simile	Two-colour Panic	U			x	
	*Paspalum dilatatum**	Paspalum	U		x	x	x
	*Pennisetum clandestinum**	Kikuyu Grass	U		x		
	*Phalaris aquatica**	Phalaris	U			x	
	Phragmites australis	Common Reed	U			x	x
	Poa spp.		U			x	
	Setaria spp.		U			x	
	Setaria viridus		U		x		
	*Sporobolus africanus**	Parramatta Grass	U		x		
	Themeda australis	Kangaroo Grass	U		x	x	x
Polygonaceae							
	Persicaria decipiens	Slender Knotweed	U		x		
	Persicaria spp.	Knotweed	U		x		
	*Rumex crispus**	Curled Dock	U		x		x
Proteaceae							
	Grevillea robusta	Silky Oak	U		x		
Ranunculaceae							
	Clematis aristata	Old Man's Beard	U			x	x
Rosaceae							
	*Rubus fruticosus sp. agg.**	Blackberry complex	U		x	x	x
Solanaceae							
	*Cestrum parqui**	Green Cestrum	U		x	x	
	*Lycium ferocissimum**	African Boxthorn	U			x	
	Solanum campanulatum		U			x	
	*Solanum nigrum**	Black-berry Nightshade	U		x		x
	*Solanum pseudocapsicum**	Madeira Winter Cherry	U			x	
Typhaceae							
	Typha orientalis	Broad-leaved Cumbungi	U		x	x	
Verbenaceae							
	*Lantana camara**	Lantana	U		x		x
	*Lantana montevidensis**	Creeping Lantana	U				
	*Verbena bonariensis**	Purpletop	U		x	x	x
	*Verbena hispida**	Rough Verbena	U		x		
Vitaceae							
	Cayratia clematidea	Slender Grape	U				x

Table A.2. Fauna Species List

Scientific Name	Common Name	NSW Status	Federal Status	Observation Type
BIRDS				
Cactua sanguinea	Little Corella	P		Heard
Cormobates leucophaea	White-throated Treecreeper	P		Heard
Eudynamys orientalis	Pacific Koel	P		Heard
Gerygone albogularis	White-throated Gerygone	P		Heard
Grallina cyanoleuca	Australian Magpie-lark	P		Heard
Myzomela sanguinolenta	Scarlet Honeyeater	P		Heard
Psephotus haematonotus	Red-rumped Parrot	P		Heard
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	P		Seen
Acanthiza lineata	Striated Thornbill	P		Seen
Acanthiza nana	Yellow Thornbill	P		Seen
Acanthiza pusilla	Brown Thornbill	P		Seen
Acanthiza reguloides	Buff-rumped Thornbill	P		Seen
Accipiter fasciatus	Brown Goshawk	P		Seen
Acrocephalus australis	Australian Reed Warbler	P		Seen
Anthochaera carunculata	Red Wattlebird	P		Seen
Ardea novaehollandiae	White-faced Heron	P		Seen
Cacatua galerita	Sulphur-crested Cockatoo	P		Seen
Cacatua roseicapilla	Galah	P		Seen
Chenonetta jubata	Wood Duck	P		Seen
Cisticola exilis	Golden-headed Cisticola	P		Seen
Cocomantis flabelliforms	Fan-tailed Cuckoo	P		Seen
*Columba livia**	Rock Dove	U		Seen
Coracina novaehollandiae	Black-faced Cuckoo-shrike	P		Seen
Corvus coronoides	Australian Raven	P		Seen
Corvus mellori	Little Raven	P		Seen
Coturnix sp.	Unidentified Quail	P		Seen
Cracticus nigrogularis	Pied Butcherbird	P		Seen
Cracticus tibicen	Australian Magpie	P		Seen
Cracticus torquatus	Grey Butcherbird	P		Seen
Dacelo novaeguineae	Laughing Kookaburra	P		Seen
Dicaeum hirundinaceum	Mistletoebird	P		Seen
Elanus axillaris	Black-shouldered Kite	P		Seen
Eopsaltria australis	Eastern Yellow Robin	P		Seen
Eurystomus orientalis	Dollarbird	P		Seen
Falco cenchroides	Australian Kestrel	P		Seen
Hirundo neoxena	Welcome Swallow	P		Seen
Malurus cyaneus	Superb Fairy-wren	P		Seen
Manorina melanocephala	Noisy Miner	P		Seen
Neochima temporalis	Red-browed Finch	P		Seen
Ocyphaps lophotes	Crested Pigeon	P		Seen
Oriolus sagittatus	Olive-backed Oriole	P		Seen
Pachycephala rufiventris	Rufous Whistler	P		Seen
Pardalotus punctatus	Spotted Pardalote	P		Seen
Pardalotus striatus	Striated Pardalote	P		Seen
Phalacrocorax melanoleucos	Little Pied Cormorant	P		Seen
Platycercus eximius	Eastern Rosella	P		Seen
*Pycnonotus jocosus**	Red-whiskered Bulbul	U		Seen
Rhipidura fuliginosa	Grey Fantail	P		Seen
Rhipidura leucophrys	Willy Wagtail	P		Seen
Scythrops novaehollandiae	Channel-billed Cuckoo	P		Seen

Sericornis frontalis	White-browed Scrubwren	P		Seen
Smicrornis brevirostris	Weebill	P		Seen
Strepera graculina	Pied Currawong	P		Seen
*Sturnus tristis**	Common Myna	U		Seen
Threskiornis Aethiopica	Australian White Ibis	P		Seen
Todiramphus sanctus	Sacred Kingfisher	P		Seen
Trichoglossus haematodus	Rainbow Lorikeet	P		Seen
Vanellus miles	Masked Lapwing	P		Seen
Zosterops lateralis	Silvereye	P		Seen
MAMMALS				
Terrestrial mammals				
**Bos taurus*	Domestic Cow	U		Scat (old)
**Canis vulpes*	Red Fox	U		Scat, Seen
**Oryctolagus cuniculus*	European Rabbit	U		Seen
Macropus giganteus	Eastern Grey Kangaroo	P		Seen
**Canis familiaris*	Domestic Dog	U		Scat, skull
**Felis catus*	Domestic Cat	U		Seen
Arboreal mammals				
Petaurus breviceps	Sugar Glider	P		Seen
Microbats				
Chalinolobus gouldi	Gould's Wattled Bat	P		Anabat (confident)
Mormopterus species 2	Unidentified Mormopterus 2	P		Anabat (confident)
Nyctophilus sp.	Unidentified Longeared Bat	P		Anabat (confident)
Tadarida australis	White-striped Freetail Bat	P		Anabat (confident)
Vespadelus vulturnus	Little Forest Bat	P		Anabat (confident)
Falsistrellus tasmaniensis	Eastern Falsistrelle#	P		Anabat (Possible)
Chalinolobus morio	Chocolate Wattled Bat	P		Anabat (probable)
Miniopterus schreibersii oce	Eastern Bentwing Bat#	P		Anabat (probable)
Myotis macropus	Southern Myotis#	V		Anabat (probable)
Scoteanax ruepelli	Greater Broad-nosed Bat#	P		Anabat (probable)
Scotorepens orion	Eastern Broad-nosed Bat	P		Anabat (probable)
Vespadelus sp.	Unidentified Forest Bat	P		Anabat (probable)
Flying-Fox				
Pteropus poliocephalus	Grey-headed Flying-fox	V		Heard
FROGS				
Limnodynastes tasmaniensis	Spotted Marsh Frog	P		Heard
Crinia signifera	Common Eastern Froglet	P		Heard, seen
Litoria fallax	Eastern Dwarf Tree Frog	P		Heard
Litoria peronii	Peron's Tree Frog	P		Heard
REPTILES				
Lampropholis guichenotti	Pale-flecked Garden Sun-skink	P		Seen
Chelodina longicollis	Eastern Long-necked Tortoise	P		Seen
Eulamprus quoyii	Eastern Water-skink	P		Seen
Lampropholis delicata	Dark-flecked Garden Sunskin	P		Seen
Fish				
Gambusia holbrookii	Plague minnow			Seen
Cyprinus carpio	Common carp			Seen
Anguilla reinhardtii	Long-finned eel			Seen

Status Codes

V	Vulnerable
P	Protected
U	Unprotected

Appendix B

Threatened Biota Assessment

Table B.1. Threatened biota known or predicted from the locality, habitat association and likelihood of occurring at the site

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
EECs						
Blue Gum High Forest (EC of the Cumberland Plain)	Blue Gum High Forest (EC of the Cumberland Plain)	EEC	CE	Blue Gum High Forest is a moist, tall open forest community characterised by the canopy species Sydney Blue Gum (*Eucalyptus saligna*) and Blackbutt (*E. pilularis*). Forest Oak (*Allocasuarina torulosa*) and Sydney Red Gum (*Angophora costata*) also often occur. Moisture preferring species such as Lilly pilly (*Acmena smithii*), Sandpaper Fig (*Ficus coronata*), Soft Bracken (*Calochleana dubia*) and Maiden Hair (*Adiantum aethiopicum*) may also occur. Historically restricted to the ridgelines in Sydney's north from Crows Nest to Hornsby, extending west along the ridges between Castle Hill and Eastwood, remaining remnant patches mainly occur in the Hornsby, Ku-ring-gai, and Baulkham Hills LGA's and represent only 4.5% of the original extent of this community (DEC 2007).	Nil. No suitable ridgeline habitat at the site.	Nil.
Cumberland Plain Woodland (EC of the Cumberland Plain)	Cumberland Plain Woodland	EEC	CEEC	Characterised by canopy species Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*E. tereticornis*), with Narrow-leaved Ironbark (*E. crebra*), Spotted Gum (*Corymbia maculata*) and Thin-leaved Stringybark (*E. eugenoides*) occurring less frequently. The shrub layer is dominated by Blackthorn (*Bursaria spinosa*), and grasses such as Kangaroo Grass (*Themeda australis*) and Weeping Meadow Grass (*Microlaena stipoides var stipoides*). Only 9 percent of the original extent remains intact, with remnants scattered widely across the Cumberland Plain (DECCW, 2010b).	**Present.**	Certain. Proposed development will clear portions of this EEC at the site.
Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	Freshwater wetlands on coastal floodplains	EEC		Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Generally occur below 20 m elevation on level areas. They are dominated by herbaceous plants and have very few woody species. The structure and composition of the community varies both spatially and temporally depending on the water regime.	Low. Wetlands at the site are artificial features. Suitable habitat is extensively modified and/or supports other native vegetation types.	Nil.
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	River-Flat Eucalypt Forest on Coastal Floodplains	EEC		Occurs on the flats, drainage lines and river terraces of coastal floodplains where flooding is periodic and where soils are generally rich in silt, lack deep humic layers and have little or no saline (salt) influence. It occurs south from Port Stephens in the NSW North Coast, Sydney Basin and South East Corner bioregions.	**Present.**	Certain. Proposed development will clear portions of this EEC at the site.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Shale/Sandstone Transition Forest in the Sydney Basin Bioregion	Shale/Sandstone Transition Forest	EEC	EEC	Shale/Sandstone Transitional forest occurs on the edges of the Cumberland Plain Western Sydney NSW, where clay soils from the shale rock intergrade with soils from sandstone, or where shale caps overlay sandstone. The boundaries are indistinct, with species composition variable depending on the soil influences. Dominant tree species include Forest Red Gum (*Eucalyptus tereticornis)*, Grey Gum (*E. punctata)*, stringybarks (*E. globoidea*, *E. eugenioides*) and ironbarks (*E. fibrosa* and *E. crebra*). Areas with a low sandstone influence have an understorey that is closer to Cumberland Plain Woodland. 9,950 ha of this community remain intact with the majority occurring in the Hawkesbury, Baulkham Hills, Liverpool, Parramatta, Penrith, Campbelltown and Wollondilly LGA's.	Low. No suitable habitat within the site.	Nil.
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	Swamp oak floodplain forest	EEC		This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which Casuarina glauca (swamp oak) is the dominant species northwards from Bermagui. Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees.	Low. Suitable habitat is extensively modified and/or supports other native vegetation types.	Nil.
Sydney Turpentine-Ironbark Forest (EC of the Cumberland Plain)	Sydney Turpentine-Ironbark Forest (EC of the Cumberland Plain)	E	CE	Sydney Turpentine - Ironbark Forest is an open forest occurring on the Cumberland Plain in Western Sydney NSW. Characteristic canopy trees include Turpentine (*Syncarpia glomulifera*), Grey Gum (*Eucalyptus punctata*), Grey Ironbark (*Eucalyptus paniculata*) and Thin-leaved Stringybark (*E. eugenoides*). In areas of high rainfall (over 1050 mm per annum) Sydney Blue Gum (*E. saligna*) is more dominant. The shrub stratum is sparse, containing species such as Sweet Pittosporum (*Pittosporum undulatum*) and Elderberry (*Panax Polyscias sambucifolia*). Remnants mostly occur in the Baulkham Hills, Hawkesbury, Hornsby, Ku-ring-gai, Parramatta, Ryde, Sutherland and Wollondilly LGA's (DEC 2007).	Nil. No suitable ridgeline or sideslope habitat at the site.	Nil.
Flora						
Acacia bynoeana	Bynoe's Wattle	E	V	This species is endemic to central eastern NSW, and is currently known from only 34 locations, many of which are only 1-5 plants. This species occurs mainly in heath and dry sclerophyll forest on sandy soils, seeming to prefer open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches. This species flowers from September to March, and fruit matures in November (DECCW, 2010b)	Low. The species preferred soils and geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Acacia pubescens	Downy Wattle	V	V	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. Occurs in open woodland and forest, in communities including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland. Flowers from August to October (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Allocasuarina glareicola		E	E	Occurs primarily in Castlereagh woodland in the Richmond area of the Cumberland Plain region of western Sydney, on lateritic soil. It grows in open woodland commonly in association with Eucalyptus parramattensis, E. fibrosa, Angophora bakeri, E. sclerophylla and Melaleuca decora, M. nodosa, Hakea dactyloides, Hakea sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownei, Themeda australis and Xanthorrhoea minor (DECCW 2010).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Apatophyllum constablei	*Apatophyllum constablei*		E	This species of shrub grows to 0.4 m and occurs in dry sclerophyll forest on sandy and skeletal soils on slopes with a north to north-westerly aspect near cliff bases or just above. It grows in association with *Eucalyptus piperita, E. punctata, E. sparsifolia, Banksia serrata, Acacia linifolia, Cleistochloa rigida,* and *Lomandra obliqua*. This species is only known from four sites, three within Wollemi National Park near Gospers Mountain and Coorongooba Creek, and the other about 2 km from Glen Davis. Flowering occurs from August to January (DECC 2007).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Caladenia tessellata	Thick Lip Spider Orchid or Tessellated Spider Orchid	E	V	Inhabits grassy sclerophyll woodland on clay loam or sandy soils, and low woodland with stony soil. Flowering generally occurs between September and November, however late flowering in September or early October has been recorded in southern populations. This species is known from Sydney (historic records), Wyong, Ulladulla and Braidwood regions in NSW. Kiama and Queanbeyan populations are presumed extinct. Records from the 1930's occur within the Huskisson area (DEC 2010).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Callistemon linearifolius	Netted Bottle Brush	V	-	This species of shrub grows in dry sclerophyll forest on the coast and adjacent ranges of NSW and flowers in spring and summer (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Cynanchum elegans	White-flowering Wax Plant	E	E	This species is a climber or twiner with a highly variable form. It usually occurs on the edge of dry rainforest or littoral rainforest, but also occurs in Coastal Banksia Scrub, open forest and woodland, and Melaleuca scrub (DECCW, 2010b).	Low. The species preferred soils and geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Dillwynia tenuifolia		V	V	This species of shrub occurs within scrubby/dry heath areas of Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays, and associated transitional communities including Castlereagh Scribbly Gum Woodland within the western regions of Sydney, predominately the Cumberland Plain as well as the Lower Blue Mountains and north to Yengo. Flowering occurs from August to March, responding to environmental conditions. (DECCW 2010).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Diuris aequalis	Buttercup Doubletail	E	V	Has been recorded in forest, low open woodland with grassy understorey and secondary grasslands on the higher parts of the central and southern tablelands (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Eucalyptus benthamii	Camden White Gum	V	V	This species of tree grows to 40 m and occurs in open forest with deep alluvial sands and a flooding regime that permits seedling establishment on the alluvial flats of the Nepean River and its tributaries including in the Kedumba Valley in the Blue Mountains National Park and Bents Basin State Recreation Area in NSW. It grows in association with *E. crebra, Eucalyptus elata, E. bauerina, E. amplifolia, E. punctata, E. deanei, Angophora subvelutina, Bursaria spinosa, Leptospermum flavescens, Acacia filicifolia* and *Pteridium esculentum* (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V		Occurs only within Western Sydney of NSW in an area bounded by Blacktown, Erskine Park, Londonderry and Windsor. Outlier populations also occur at Kemps Creek and Pitt Town. This species is found growing on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium, typically containing lateritic gravels in association with Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forests. Flowering occurs between July and October, however may occur at other times throughout the year. Birds and bees are thought to pollinate this species. It regenerates solely from seed, and responds well to soils that have been mechanically disturbed (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	The habitat for this species are broad, and are known to occur in areas supporting heath, shrubby woodland and forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks. It has been known to flower over two periods throughout the year, July to December and April to May (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Gyrostemon thesioides		E		Within NSW, has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. The species has not been recorded from the Nepean and Georges Rivers for 90 and 30 years respectively, despite searches. Grows on hillsides and riverbanks and may be restricted to fine sandy soils (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Leucopogon exolasius	Woronora Beard-heath	V	V	Woronora Beard-heath is found along the upper Georges River area and in Heathcote National Park. The plant occurs in woodland on sandstone. Flowering occurs in August and September (DECCW 2010).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Marsdenia viridiflora subsp. viridiflora		EP		A climber with stems to 4m high that grows in vine thickets and open shale woodland. Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Melaleuca biconvexa	Biconvex Paperbark	V	V	This species occurs in damps areas often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. The flowering period for this species is short with flowering taking place over a 3 - 4 week period during September and October. This species is conspicuous and could be easily identified outside the flowering period. M. biconvexa populations are threatened by land clearing, too frequent fire, alteration to drainage hydrology, increased pollution, and disturbance by stock (DEC 2007).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Melaleuca deanei	Deane's Paperbark	V	V	This species occurs in two distinct areas, in the Ku-ring-gai / Berowra and Holsworthy/Wedderburn areas. There are also more isolated occurrences at Springwood in the Blue Mountains, Wollemi National Park, Yalwal (west of Nowra), and Central Coast (Hawkesbury River) areas. It grows on sandstone and flowers in summer (DECCW, 2010b).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Persoonia bargoensis	Bargo Geebung	E	V	This species of shrub occurs in woodland and dry sclerophyll forest on sandstone and well drained, loamy, gravely soils in the south-west of Sydney. It seems to prefer disturbance areas such as roadsides where more light is available (DECC 2008).	Low. The species preferred soils and geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Persoonia hirsuta	Hairy Geebung	E	E	This species is found on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone in the Blue Mountains, Southern Highlands, and Sydney Coastal regions of NSW (DECCW, 2010b).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Persoonia nutans	Nodding Geebung	E	E	Occurs only on aeolian and alluvial sediments in sclerophyll forest and woodland vegetation communities. It is restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south with the largest populations occur in Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland. Flowering occurs Decenber to January, though may flower at any time of the year (DECCW 2010).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Pimelea curviflora var. curviflora	Pimelea curviflora var. curviflora	V	V	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots. Flowers October to May. Seedlings have been observed following fire (DECC 2008).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Pimelea spicata	Spiked Rice Flower	E	E	This species occurs within undulating substrates derived from Wianamatta Shale on well-structured clay soils, within the Cumberland Plain and Illawarra regions. It is associated with Grey Box (*Eucalyptus moluccana*) and Ironbark (*E. crebra, E. fibrosa*) within the Cumberland Plain, and in Coast Banksia open woodland within the Illawarra regions (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
Pomaderris brunnea	Rufous Pomaderris / Brown Pomaderris	V	V	This species of shrub grows in moist woodland and forest communities on clay and alluvial soils of flood plains and creek lines. It occurs in a restricted area near the Nepean and Hawkesbury Rivers in NSW, Walcha on the New England tablelands and in far eastern Gippsland in Victoria. Flowering occurs from September to October (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Pterostylis nigricans	Dark Greenhood	V		Occurs in north-east NSW north from Evans Head. Its preferred habitat is on coastal heathland with *Banksia ericifolia*, and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils (DECC 2008).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Pterostylis saxicola	Sydney Plains Greenhood	E	E	This species of terrestrial orchid occurs in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines within sclerophyll forest or woodland on shale or shale/sandstone transition soils in small isolated pockets from Freemans Reach to Picton in Western Sydney (DECCW, 2010b).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Pultenaea parviflora		E	V	Endemic to the Cumberland Plain, with the core distribution from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. *Eucalyptus fibrosa* is usually the dominant canopy species. *Eucalyptus globoidea*, *E. longifolia, E. parramattensis, E. sclerophylla and E. sideroxylon* may also be present or co-dominant, with Melaleuca decora frequently forming a secondary canopy layer. Associated species may include *Allocasuarina littoralis, Angophora bakeri, Aristida spp. Banksia spinulosa, Cryptandra spp., Daviesia ulicifolia, Entolasia stricta, Hakea sericea, Lissanthe strigosa, Melaleuca nodosa, Ozothamnus diosmifolius* and *Themeda australis*. The species is often found in association with other threatened species such as *Dillwynia tenuifolia, Dodonaea falcata, Grevillea juniperina, Micromyrtus minutiflora, Persoonia nutans* and *Styphelia laeta*. Pollinators are unknown, and flowering may occur between August and November depending on environmental conditions (DECCW 2010).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Pultenaea pedunculata	Matted Pea Bush	E	-	This species of prostrate shrub is found on clay or sandy clay soils on Wianamatta Shale, close to localised patches of tertiary alluvium, or on the shale / sandstone interface. In NSW it is represented by three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn (where it is locally abundant). The species occurs in a range of habitats including woodland vegetation, road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Syzygium paniculatum	Magenta Lilly Pilly	V	V	This species is a small to medium rainforest tree, found only in NSW in a narrow linear coast strip from Bulahdelah to Conjola State Forest (DECCW, 2010b).	Low. The species preferred soils and geomorphic settings are not present.	Nil.
Thesium australe	Austral Toadflax	V	V	This species is a small straggling herb found in very small populations scattered across eastern NSW. It occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass (*Themeda australis*) (DECCW, 2010b).	Low. Potentially suitable habitat but not detected in targeted surveys.	Low.
FAUNA						
Birds						
Burhinus grallarius	Bush Stone-curlew	E	-	This species inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights, it feed on insects and small vertebrates, such as frogs, lizards and snakes. Nests are on the ground in a scrape or small bare patch (DECCW, 2010b).	Low. Potentially suitable habitat at the site but probably limited by feral predators.	Low.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	This species is nomadic, spending summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests and winter at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	E	This species is highly specialised, feeding almost exclusively on the seeds extracted from the wooden cones of Allocasuarina species including Black She-oak (Allocasuarina littoralis), Forest She-oak (Allocasuarina torulosa) or Drooping She-oak (Allocasuarina verticilliata). It is uncommon although widespread throughout suitable forest and woodland habitats, from central QLD to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW. This species needs suitable hollows in living and dead trees for nesting and breeds between March and August (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Glossopsitta pusilla	Little Lorikeet	V		Distributed in dry, open eucalypt forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. They feed primarily on nectar and pollen of profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands White Box Eucalyptus albens and Yellow Box E. meliodora are particularly important food sources for pollen and nectar respectively. Nest hollows have small openings (approximately 3cm diameter) and are mostly found in living, smooth-barked eucalypts, especially Manna Gum Eucalyptus viminalis, Blakely's Red Gum E. blakelyi and Tumbledown Gum E. dealbata (DECCW 2010).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Lathamus discolor	Swift Parrot	E	E	This species is migratory, travelling to the mainland from March to October to forage on winter flowering eucalypts and lerps. While on the mainland, it mostly occurs in the southeast, with records of the species spread approximately between Adelaide and Brisbane. Breeding takes place in Tasmania from September to January (DECCW, 2010b)	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Ninox connivens	Barking Owl	V		Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or in dense clumps of canopy leaves in large eucalypts. The Barking owl feeds on a variety of prey, with invertebrates predominant for most pf the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits important during breeding. This species lives alone or in a pair with territories ranging from 30 to 200 hectares. Nests are built in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camandulensis*), White Box (*Eucalyptus albens*), Red Box (*Eucalyptus polyanthemos*), and Blakely's Red Gum (*Eucalyptus blakelyi*)(DECCW 2010).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Ninox strenua	Powerful Owl	V		This species is a nocturnal, solitary and sedentary species. They occur in a number of vegetation types ranging from woodland and open sclerophyll forest to tall open wet forest and rainforest. However, this species does prefer large tracts of vegetation. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old with breeding taking place from late summer to late autumn. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400 - 1,450 ha. It forages within open and closed woodlands as well as open areas (DECCW, 2010b). This Owl has a variety of vocal calls and is known to 'dawn call' when returning from its night hunting activities to mark the position of its daytime roost (Parks Victoria 2003).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Lophoictinia isura	Square-tailed Kite	V		Although this species shows a preference for timbered watercourses, they have been found in a variety of habitats including woodlands and open forests. It appears to occupy large hunting grounds and breeds from July - February with nests generally located along of near watercourses. It is a solitary bird, and a specialised predator, taking small passerines, especially honeyeaters and their eggs and nestlings as well as large insects in the tree canopy. It generally hunts low over open forest, woodlands and mallee communities, heaths, and other low scrubby habitats that are rich in passerines. This species prefers a structurally diverse landscape with a broad range of habitats and appears to utilise a large range greater than 100 km2 (DECCW 2010).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Melithreptus gularis gularis)	Black-chinned Honeyeater	V		Occupies mostly upper levels of drier open forest or woodlands dominated by Box and Ironbark eucalypts, as well as open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. This species usually occurs in pairs or is nomadic. It forages along twigs, branches, and trunks probing for insects. Nectar is taken from flowers and honeydew is gleaned from foliage. The Black-chinned Honeyeater nests high in the crown of a tree in the uppermost lateral branches (DECCW 2010).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Pyrrholaemus saggitatus	Speckled Warbler	V		Occurs in a range of Eucalyptus dominated communities that have a grassy understorey with a sparse shrub layer and open canopy, often in gullies or on rocky ridges. The species requires large, relatively undisturbed remnants in order to persist in an area. Its diet consists mainly of seeds and insects (DECCW 2010).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Rostratula benghalensis	Painted Snipe (was Australian Painted Snipe)	E	V, M	This bird is a wetland species with a scattered distribution in Australia. It occurs primarily along the east coast from north QLD to the Eyre Peninsular in SA excluding the majority of Victoria and NSW. This species is normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. This cryptic species nests on the ground amongst tall reed-like vegetation near water. It emerges from the dense growth at dusk to feed on mudflats and the water's edge taking insects, worm and seeds (DECCW, 2010b). This species prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Low. Wetlands at the site are probably too small and degraded to support the species.	Low.
Tyto novaehollandiae	Masked Owl	V		This species occurs in dry eucalypt woodlands at altitudes from sea level to 1100 m and roosts and breeds in hollows and sometime caves in moist eucalypt forested gullies. It hunts along the edges of forests and roadsides and has a home range covering between 500 ha and 1000 ha. Prey for this species are principally terrestrial mammals but arboreal species may also be taken. Masked Owls are sparsely distributed from southern QLD to SA and WA. It has also been recorded on the Nullarbor plain. The southern subspecies occupies a home range of 5 to 10 square km (DEC 2007).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Xanthomyza phrygia	Regent Honeyeater	E	E	This species is a semi-nomadic species that inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak where there are significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Fish						
Macquaria australasica	Macquarie Perch	V	E	This species of freshwater fish inhabits river and lake habitats, especially the upper reaches of rivers and their tributaries. Spawning occurs in spring and summer in shallow upland streams or flowing sections of river systems. This species is found in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas. Threats include the reduction in water quality through agricultural and forestry practises (siltation), changes to river flows and temperatures due to damming and in-stream modifications, cold water release from dams affecting spawning, predation and competition by introduced fish species, over-fishing, and disease (DECCW, 2010b).	Low. Not known from the Georges River catchment (Biosis, 2006).	Nil.
Prototroctes mairaena	Australian Grayling	-	V, M	This species of migratory fish inhabits estuarine waters and coastal seas as larvae/juveniles, and freshwater rivers and streams as adults. It occurs in coastal rivers and streams in South East New South Wales into Victoria and Tasmania. Most of their lives is spent in freshwater rivers and streams in cool, clear waters with a gravel substrate and alternating pool and riffle zones, however can also occur in turbid water. The species can penetrate well inland, being recorded over 100 km inland from the sea. Larvae and juveniles inhabit estuaries and coastal seas, with an apparent obligatory marine stage. Threats include in-stream modifications such as dams and weirs, changes to river flows, reduction of water quality from agricultural and industrial activities, and predation and competition with introduced fish species (DSE 2007).	Low. Aquatic habitat at the site is clay substrate and remote from the coast.	Nil.
Frogs						
Heleioporus australiacus	Giant Burrowing Frog	V	V	This species of frog ranges from south-eastern NSW through to Victoria and appears to exist as two distinct populations: The Northern population occurs on sandy soils supporting heath, woodland or open forest and has a marked preference for sandstone ridge top habitats and broader upland valleys along slow flowing to intermittent creek lines. It requires creeks and watercourses for breeding but spends drier months buried under deep leaf litter or sandy loose soil within vegetated areas. This species has been found occurring at considerable distance from suitable riparian breeding or other moist habitats, indicating an ability to move about freely. This species calls mainly in spring and autumn with	Low. The species' preferred soils and geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
				calling bouts after rains in late summer (Anstis 2002), although may be sampled at any time of the year providing it is raining (Recsei 1996). Breeding takes place from August to march. It feeds on ground-dwelling invertebrates such as beetles, ants, and spiders (DECCW, 2010b).		
Litoria littlejohni	Littlejohns Treefrog	V	V	Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops, hunting either in shrubs or on the ground. Breeding is triggered by heavy rain and can occur from late winter to autumn, but is most likely to occur in spring when conditions are favourable. Males call from low vegetation close to slow flowing pools and eggs are laid in loose gelatinous masses attached to small submerged twigs. Eggs and tadpoles are mostly found in slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools (DECCW, 2010b).	Low. The species' preferred soils and geomorphic settings are not present.	Nil.
Litoria aurea	Green and Golden Bell Frog	E	V	This species inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. It prefers sites containing cumbungi (Typha spp.) or spike rushes (Eleocharis spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. They are active by day and breed during the summer months (DECCW, 2010b). Plague Minnow (Gambusia holbrooki) is a key threatening process as they feed on green and Golden Bell Frog eggs and tadpoles.	Low-medium. Suitable habitat for the species at the site, however the species is known from a limited number of populations in the Sydney region.	Low.
Mixophyes balbus	Stuttering Barred Frog	E	V	Occurs along the east coast of Australia. They are found in rainforest and wet, tall, open forest. When not breeding, adults live in deep leaf litter and thick understorey vegetation on the forest floor. This species feeds on insects and smaller frogs, breeding in streams during summer after heavy rain (DEC 2007).	Low. The species' preferred vegetation types and geomorphic settings are not present.	Nil.
Mixophyes iteratus	Giant Barred Frog	E	E	This species occurs on the coast and ranges from southeastern QLD to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. They forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. They breed in shallow, flowing rocky streams from late spring to summer, and feed primarily on large insects and spiders (DEC 2007).	Low. The species' preferred vegetation types and geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Mammals						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	This species is distributed between south-eastern QLD to NSW from the coast to the western slopes of the divide. This species roosts in caves and mines and has been most commonly recorded from dry sclerophyll forests and woodlands. C. dwyeri is an insectivorous species that flies relatively slowly over the canopy or along creek beds (Churchill 1998) (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	This species of carnivorous marsupial is largely nocturnal but opportunistically hunts prey during the day. It inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are found in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		This species of bat inhabits moist forest generally with trees larger than 20 m and roosts in eucalypt hollows, underneath bark or in buildings. Diet consists of moths, beetles and other insects, which it collects within or just below the tree canopy. This species hibernates during winter and breeding takes place in late spring (DECCW, 2010b).	**High.** 'Possible' Anabat recording.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		This species has dark reddish-brown to dark brown fur and is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998, DECCW, 2010b). In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within 6 m of the ground. Moths form the major component of their diet and breeding takes place from October to April (Churchill 1998).	**High.** 'Probable' Anabat recording.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches
Mormopterus norfolkensis	Eastern Freetail-bat	V		This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range and roosts primarily in tree hollows but also in man-made structures or under bark. This species is solitary and probably insectivorous (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Myotis adversus	Large-footed Myotis	V		Primarily a coastal species that forages over streams and watercourses feeding on fish and insects, it will occur inland along large river systems. Breeding takes place during November or December, roosting in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage (DECC 2007).	**High.** 'Probable' Anabat recording.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches
Petaurus norfolcensis	Squirrel Glider	V		This species of glider is widely though sparsely distributed throughout eastern Australia. In NSW it inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. This species prefers a diversity of food supplies including acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein, and requires an abundant supply of tree-hollows for nesting and shelter (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Phascolarctos cinereus	Koala	V		The Koala is protected under SEPP 44, which aims to conserve habitat within its current distribution. The Koala has a fragmented distribution throughout eastern Australia. It is limited to areas of preferred feed trees in eucalypt woodlands and forests. Along the coastal fringe these areas are becoming more fragmented and isolated due to urbanisation. Koalas are generally inactive for 20 hours a day, with activity peaking just after sunset when they begin to forage (Martin and Handasyde 1995). The size of their home range varies depending on the quality of habitat, ranging from less than 2 ha to several hundred hectares in size. Females breed at two years of age and produce one young per year (DEC 2005).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	This species roosts in camps generally located within 20 km of a regular food source and are commonly found in gullies, close to water and in vegetation with a dense canopy. This species is known to forage in areas supporting subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps on the nectar and pollen of native trees, in particular eucalypts, melaleucas and banksias. Grey-headed Flying-fox show a regular pattern of seasonal movement with much of the population moving to northern NSW and QLD during May and June where they exploit the winter flowering trees such as Swamp Mahogany, Forest red gum and Paperbark (NSW Scientific Committee 2004). This species will also forage in urban gardens and cultivated fruit crops (DECCW, 2010b).	Present. Recorded in Hinchinbrook Creek riparian corridor.	Low. Woodland patches and isolated trees in the disturbance footprint would have little value for the species.
Petrogale pencillata	Brush-tailed Rock-wallaby	E	V	This species of small wallaby occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. In NSW they occur along the whole Eastern section of the State (DECC 2008).	Low. The species' preferred geomorphic settings are not present.	Nil.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Likelihood of Occurring	Likelihood of Impacts
Petaurus australis	Yellow-Bellied Glider	V		This species of large arboreal mammal occurs in a variety of forest types though prefers tall mature eucalypt forest with high rainfall and rich soils, along the east coast to the western slopes of the Great Divide. This species relies on hollow-bearing trees for shelter and nesting. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Plant and insect exudates provide the bulk of this gliders diet including nectar, sap, honeydew and manna, whilst protein is obtained from arthropods and some pollen. The Yellow-bellied Glider incises tree trunks and branches to obtain phloem sap, often leaving a distinctive 'V'-shaped scar. Tree selection and usage is complex and a large number of tree species are used as sap trees throughout the range of this glider (DECCW, 2010b).	Medium. May occur in suitable woodland and forest habitat at the site on an occasional basis.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches.
Potorous tridactylus	Long-Nosed Potoroo	V	V	This species of small mammal is generally restricted to areas with high annual rainfall, inhabiting coastal heath and dry and wet sclerophyll forests. Its major habitat requirement is relatively thick ground cover with occasional open areas and may consist of grass trees, sedges, ferns or heath, or low shrubs of tea-trees and Melaleucas where soil is light and sandy. It feeds on the fruiting bodies of underground-fruiting fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil. Breeding occurs biannually in late winter / early spring and in late summer, with one young being reared (Johnston 1995). In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with annual rainfall exceeding 760 mm (DECCW, 2010b).	Low. The species' preferred soils, vegetation types and geomorphic settings are not present.	Nil.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	This species is a large and robust bat that feed on slow-flying prey such as large moths and beetles. It hunts from above rows of trees lining creeks and the edges of woodland in otherwise cleared paddocks, roosting in hollow tree trunks and branches as well as the roofs of old buildings (Churchill 1998). It inhabits a variety of habitats ranging from moist and dry eucalypt forest and rainforest to tall wet forest, however tends to prefers moist gullies in mature coastal forest or rainforest from the Atherton Tablelands in north QLD, along the coastal regions to southern NSW. The species is only found at low altitudes (below 500 m) (Churchill 1998; DECCW, 2010b). Reproduction takes place in January at maternal roosting sites (DEC 2005).	**High.** 'Probable' Anabat recording.	Low. Limited areas of suitable habitat within construction footprint (<2 ha) occurring as small, isolated patches
Invertebrates						
Meridolum corneovirens	Cumberland Land Snail	E	-	This species of snail has a 25 - 30 mm diameter shell which may be any shade of brown, is always uniform in colour, and is more flattened and very thin and fragile than the common exotic garden snail. It is found primarily under litter of bark, leaves and logs, or in loose soil around grass clumps within Cumberland Plain Woodland - a grassy, open woodland with occasional dense patches of shrubs. I has also been found under rubbish. It occurs within a small area on the Cumberland Plain, from Richmond and Windsor to Picton and from Liverpool to the Hawkesbury and Nepean Rivers. It feeds on fungus, and does not eat green	**High.** Suitable habitat in Shale Plains Woodland in the site.	Low-medium.

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				plants. During periods of drought this species can burrow into the soil to escape the dry conditions (DECCW, 2010b)		
Reptiles						
Hoplocephalus bungaroides	Broad-Headed Snake	E	V	This species is generally black above with yellow spots forming narrow, irregular cross-bands. The average length is around 60 cm, with a maximum of 150 cm. The Broad-headed snake is nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter, and spring, moving to shelters in hollows of large trees within 200m of escarpments in summer. It feeds mostly on geckos and small skinks, as well as occasionally on frogs and small mammals (DECCW, 2010b).	Low. The species' preferred vegetation types and geomorphic settings are not present.	Nil.

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