QR NATIONAL – TRAIN SUPPORT FACILITY, HEXHAM

Ecological Investigations

Report Prepared for
QR National

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QR NATIONAL
TRAIN SUPPORT FACILITY

Ecological Investigations

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1 Introduction

Eco Logical Australia was commissioned by QR National to prepare an ecological assessment for the Train Support Facility at Hexham, NSW. The ecological assessment is to be submitted as supporting information for a major project application under Part 3A of the Environmental Planning and Assessment Act 1979. The Minister for Planning and Infrastructure is the consent authority for the Application.

1.1 PROJECT DESCRIPTION

The proposal involves the establishment of a Train Support Facility (TSF) (Figure 1) that will provision trains with fuel, sand, water and oil and enable cab cleaning, routine inspection of trains, planned service and maintenance and emergency repairs, and will incorporate two provisioning tracks and two storage tracks. Two temporary construction compounds will be used, one in the north of the site and another in the south, both on cleared agricultural land.

Figure 2 shows the area in which these facilities will be constructed. Whilst the facilities themselves will not require this entire area, this report assumes that vegetation and habitat within the nominated area will be disturbed.

The facility will dispose of domestic effluent on-site via a package treatment plant and spray irrigation. Wastewater from the train washdown facilities is to be re-used on site following a separate treatment process to remove oils and sludge, with small amounts (125-250 L/day) of washdown wastewater to be discharged to the spray irrigation area in the southern half of the site.

Stormwater will be directed via grassed swales through gross pollutant traps to water quality controls ponds before being discharged at three locations. Outlet 1 is located at the northern end of the TSF and will discharge to Purgatory Creek and the Hunter estuary. Outlet 2 is also in the north of the TSF site and will discharge to an existing surface drain then to Hexham Swamp. Outlet 3 in the far south of the TSF will discharge to an existing saltmarsh wetland. Stormwater is managed separately from the effluent of washdown wastewater, and will not include effluent or train washdown wastewater.

Fuel storage is to be stored within appropriately bunded areas, with impervious flooring and sufficient capacity to contain 110% of the largest container stored within the bund.

The proposal also includes the establishment of two conservation areas that total approximately 53 hectares in close proximity to Hexham Swamp. These areas are to be managed in accordance with a Conservation Management Plan and are proposed to be subject of a Conservation Agreement under the National Parks and Wildlife Act 1974 to ensure long term management and security of biodiversity.

1.2 STUDY AREA DESCRIPTION

The study area is bound by the Pacific Highway and the industrial area of Hexham to the east, by private rural lands to the southeast, by the Hunter Water Corporation pipeline and Hexham Swamp

Nature Reserve to the south and southwest, by rural grazing lands to the northwest and by the New England Highway and the township of Tarro to the north (Figure 1). The lot and DPs of the property are:

Lot 1 DP 128309
Lot 101 DP 1084709
Lot 102 DP 1084709
Lot 2 DP 735456
Lot 10 DP735235
Lot 104 DP 1084709
Lot 113 DP 755232
Lot 1 DP 155530
Lot 12 DP 1075150
Lot 1 DP1062240
Lot 311 DP 583724

In terms of defining boundaries that are relevant to the project, the following applies:

- The **subject site** represents the proposed development footprint for the project and is approximately 28 ha. This includes the TSF, access roads, drainage basins and temporary construction compound.
- The **study area** includes the subject site and additional lands that have the potential to be affected by the proposal, either directly or indirectly, as well as lands to be considered for ecological offsets. The total area of the study area is approximately 255 ha

The study area comprises disturbed lands, including evidence of widespread soil disturbance (excavation and filling), interspersed with revegetation and depressions. The southern part of the study area has a long history associated with coal stockpiling, loading and unloading and to this day the site contains a significant quantity of coal tailings. Soil landscape mapping of the site (SCS, Newcastle Sheet 9232) classifies this as disturbed terrain. The northern part of the site comprises the Millers Forest landscape which comprise floodplain / delta on recent sediments with elevation below 3-6m AHD. These areas have a permanently high water table, seasonal waterlogging and foundation hazard. These soils have a high probability of containing acid sulphate soils within 1m of the surface (DLWC Acid Sulfate Soil Risk Map). The vegetation on the site contains remnant, albeit highly disturbed, swamp oak forest, salt marsh and freshwater wetland in the south, artificial freshwater wetlands (ie drains and ponds) and open pasture. Much of the site is currently subject to pasture improvement and cattle grazing.

1.3 ADJACENT ARTC DEVELOPMENT

The Australian Rail Track Corporation (ARTC) proposes to develop a project for Relief Roads (train line) adjacent to the QR National Hexham Redevelopment Project. This project is described in Parsons Brinckerhoff (2012) 'Proposed Hexham Relief Roads Ecological Assessment' as:

> *ARTC proposes to develop five Relief Roads (train lines) and associated infrastructure at Hexham in the NSW Hunter Valley (the proposed Project). The proposed Project is located approximately 15 kilometres north west of Newcastle and 176 kilometres north of Sydney by rail.*
>
> *Key components of the proposed Project comprise:*
> - *Five Up Relief Roads (train lines) to the west of the existing Up and Down Mains between the existing Up Coal and a new Down Coal including:*

- *Each Relief Road to accommodate trains generally comprising two or three locomotives and up to 91 wagons (1,543 m long) requiring a minimum standing room of 1,670 m*
    - *New turnouts, return curves and other track changes*
- *Installing new signal infrastructure for the five Relief Roads (including signal location cases, huts and gantries)*
- *Earth and civil works of approximately 265,000 cubic metres, including cut to fill, track formation, drainage and minor structures*
- *Ancillary infrastructure including vehicle access tracks, temporary construction compounds and stockpile sites*
- *Vehicular tracks, land acquisition and upgrading of existing rail infrastructure and public utilities*

The ARTC project is shown on Figure 2 for context, however the ARTC project is a separate proposal.

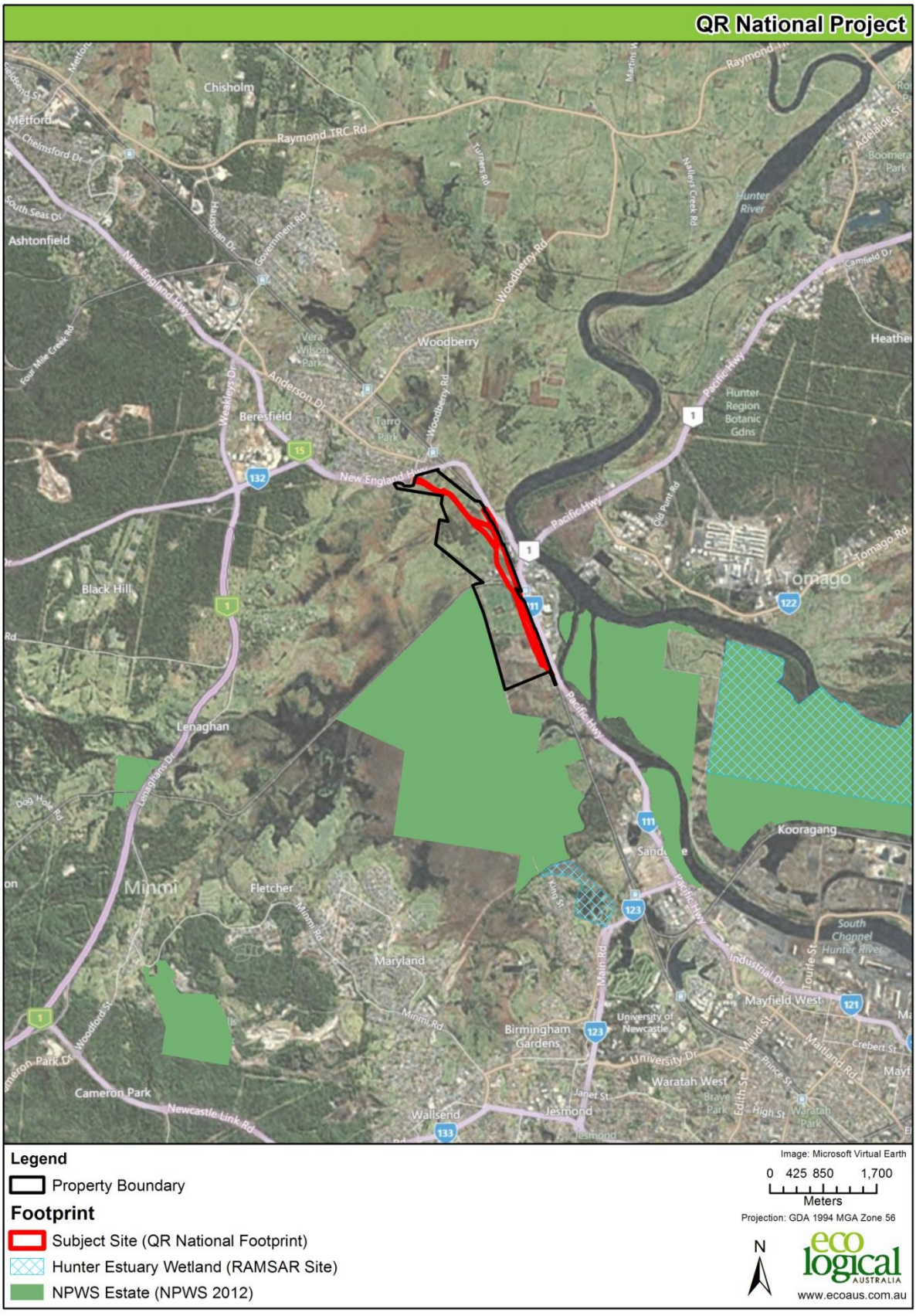

Figure 1: Regional Context

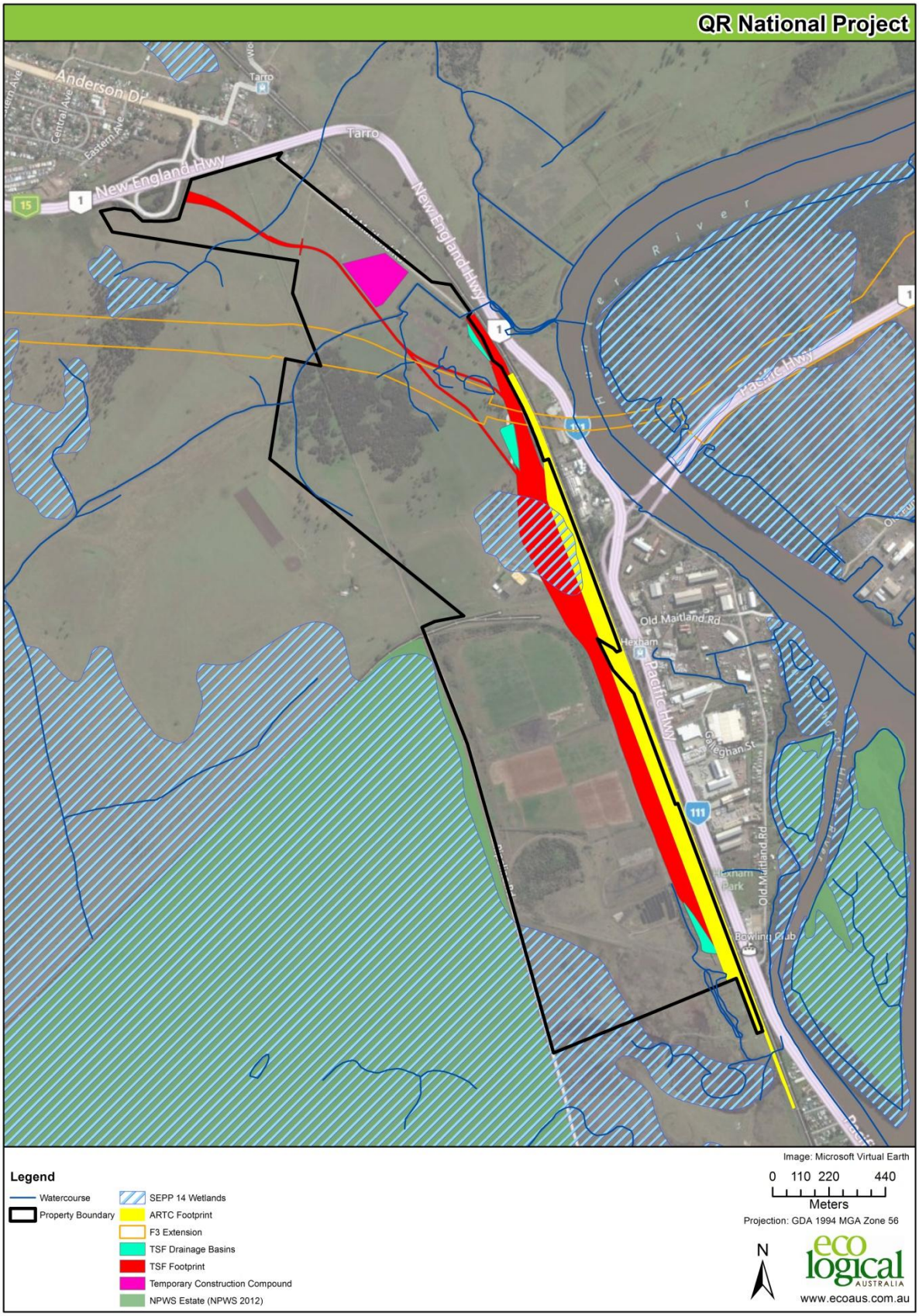

Figure 2: Study area and proposal

2 Planning and Assessment Context

2.1 COMMONWEALTH PLANNING INSTRUMENTS

2.1.1 Environmental Protection and Biodiversity Conservation Act 1999

Approval from the Commonwealth Environment Minister is required under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) if the action (can include a project, development, undertaking or activity) will, or is likely to, have a significant impact on matters considered to be of national environmental significance (NES matters). NES matters relevant to this study include threatened species, ecological communities and migratory (JAMBA/CAMBA) species that are listed under the Act.

The EPBC Act does not define significant impact but identifies matters that are necessary to take into consideration. Additional information is available within EPBC Act Policy Statements that provide background information and guidelines on how to survey for, and assess impacts on, matters of NES. If the matter is referred to the Minister a decision is generally required within 20 days in relation to whether an action requires Commonwealth approval.

So as to seek clarity with regards to EPBC Act approval requirements for NES matters (migratory birds, RAMSAR wetlands, Green and golden bell frog, Grey-headed flying-fox), a referral was submitted to the Commonwealth. The proposed action was deemed to not be a controlled action on 20th March 2012 (EPBC Act referral 2012/6285).

2.2 STATE GOVERNMENT INSTRUMENTS

2.2.1 Environmental Planning and Assessment Act 1979

The proposal is to be assessed under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act). For Part 3A matters, the proponent and consent authority must consider all aspects of the environment, including biological, physical, social and economic factors and the principles of ecologically sustainable development, when assessing the impacts of the project.

The Director-Generals Requirements for this project (issued 22 March 2010) identified ecology as a key issue and required that there be assessment of:

- *Flora, fauna and habitat (including rare, threatened and endangered species populations, ecological communities and SEPP 14 wetlands),*
- *Consideration of local, regional, state and corridor impacts (including consideration of the Hunter Central Rivers Catchment Action Plan and the Watagan Ranges to Port Stephens conservation corridor identified in the Lower Hunter Regional Strategy);*
- *Take into account the Draft Guidelines for Threatened Species Assessment (DEC and DPI); and Threatened Biodiversity Survey and Assessment Guidelines for developments and Activities (DEC);*
- *Offsets for native vegetation clearance consistent with the improve or maintain principle; and*
- *Demonstration that the project can be managed to minimise impacts on the Hexham Swamp Rehabilitation Project*

The Draft Guidelines for Threatened Species Assessment (DEC&DPI, 2005) outline guiding principles for the provision of information to "enable decision makers to ensure that developments deliver the following environmental outcomes:

1. *Maintain or improve biodiversity values (i.e. there is no net impact on threatened species or native vegetation);*
2. *Conserve biological diversity and promote ESD;*
3. *Protect areas of High Conservation Value (including areas of critical habitat);*
4. *Prevent the extinction of threatened species;*
5. *Protect the long-term viability of local populations of a species, population or ecological community; and*
6. *Protect aspects of the environment that are matters of national environmental significance (pursuant to the EPBC Act).*

In order to assess the magnitude of the proposed development and determine whether the above outcomes are achievable, Appendix 3 of the Assessment Guidelines provides guiding assessment questions to identify potential effects of the proposal on threatened species, population or ecological communities or their habitats.

These questions have been addressed in Appendix C of this report for each threatened species, population or ecological community that are known, likely, or potential occurrences within the study area. Where a proposal cannot avoid or mitigate impacts on threatened species, populations and ecological communities, according to key thresholds, other measures, including undertaking a suitable and approved offset action, may need to be taken.

2.2.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The Act is integrated with the NSW Environmental Planning and Assessment Act and requires consideration of whether a development or an activity will affect threatened species, populations and ecological communities or their habitat.

In this study area threatened species and endangered ecological communities that are listed under the Act may be relevant. Section 5 provides a summary of the assessment under TSC Act.

2.2.3 SEPP 14 – Coastal Wetlands

State Environmental Planning Policy 14 - Coastal Wetlands (SEPP 14) was introduced to protect coastal wetlands in New South Wales (outside of the Sydney Metropolitan area). This report assesses the impacts of the project on the SEPP 14 wetlands in section 5.

2.3 NON-STATUTORY PLANS AND PROJECTS

2.3.1 Lower Hunter Regional Strategy

The Lower Hunter Regional Strategy (LHRS) identifies locations for future residential and employment lands for the period 2006-2031. The Strategy also identifies a regional scale 'Green Corridor' between the Watagan Range and Stockton Bight. Most of the subject site is identified as existing employment land with the surrounding Hexham Swamp forming part of the Green Corridor. Within the Green Corridor, the LHRS states that Local Environmental Plans are to provide for the ongoing role of the biodiversity corridor.

2.3.2 Lower Hunter Regional Conservation Plan

The Lower Hunter Regional Conservation Plan (DECCW 2009) sets out a 25-year program to direct and drive conservation efforts in the Lower Hunter Valley. It is a partner document to the Government's Lower Hunter Regional Strategy that sets out the full range of Government planning priorities, and identifies the proposed areas for growth.

The Conservation Plan identifies a 'Green Corridor' stretching from the Watagan Ranges, through Hexham Swamp to Port Stephens (approximately 14,600 hectares). This corridor provides a highly significant link between southern sandstone ranges and the coastal heaths and wetlands of Port Stephens. It will also involve an expansion of the nationally significant freshwater wetlands of Hexham Swamp Nature Reserve (DECCW 2009).

The nominated 'Green Corridor' lies between Hexham Swamp Nature Reserve and the Kooragang Wetland Rehabilitation Project on Ash Island, and thus of relevance to the subject site. Given the study area occurs on highly disturbed land on the peripheral edge of the corridor and adjacent to the rail corridor and Hexham industrial lands, the proposed development is considered unlikely to have any significant effects on habitat connectivity, genetic exchange and dispersal capabilities for threatened species, population and Endangered Ecological Communities considered.

2.3.3 Hunter Central Rivers Catchment Action Plan

The Hunter-Central Rivers Catchment Action Plan (CAP) was adopted in January 2007. Under the heading of Rivers and Freshwater Wetlands, the CAP contains a number of objectives including:

- Maintaining or improving aquatic habitat
- Maintaining and improving riparian vegetation

The CAP identifies principles for the management of wetland areas including the protection of existing wetlands and restoration of degraded areas. The CAP is not a regulatory document, rather it guides investment of funds towards the management of key natural resources in the catchment. The Hunter Estuary Wetlands which are located adjacent to the site are identified as a high priority wetland in the CAP.

2.3.4 Hexham Swamp Rehabilitation Project

The Hexham Swamp Rehabilitation Project is '*a partnership between private landholders, industry groups, local community and government agencies which aims to restore 1,946 hectares of Hexham Swamp (Hunter Central Rivers CMA website).* Key aspects of the project are the re-opening of floodgates at the mouth of Ironbark Creek in a staged manner to re-introduce tidal waters to Hexham Swamp.

Rehabilitation of the Hexham Swamp area was explored in the Ironbark Creek Total Catchment Management Strategy and has been approved as a Major Project under s75B(2)(b) of the *Environmental Planning and Assessment Act 1979*

3 Methods

Following is a description of methods that were undertaken to identify potential effects of the proposal on threatened species, population or ecological communities or their habitats.

3.1 INFORMATION GATHERING AND REVIEW

3.1.1 Database Review

The data audit was based on analysis of environmental database searches including the Atlas of NSW Wildlife and the EPBC Act. Searches included a 10 km radius around the site, centred on the study area, to determine the local occurrence of threatened flora and fauna in accordance with state and federal statutory requirements. These searches were carried out on 25 February 2011.

An assessment of likelihood of occurrence was made for threatened flora and fauna identified from the database search. This assessment was based on database or other records, presence or absence of suitable habitat within the study area, results of the field investigations and professional judgement.

The results of these searches and the likelihood of occurrence assessment can be found in Appendix A, including maps showing the locations of threatened flora and fauna species within 10km of the study area and the broader region.

3.1.2 Literature Review

Three recent studies have compiled ecological information on the study area, including: EcoBiological (2008), EcoHub Ecological Consultants (2009), and Parsons Brinckerhoff (2012). Whilst the EcoBiological and EcoHub reports were not finalised and published, their data from field work has been obtained and utilised in this report.

3.2 FLORA AND FAUNA SURVEY

The survey methods for this project have been designed to supplement the previous surveys with the intention of meeting survey guidelines as it relates to habitat presence and quality (Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities DEC 2004); DECCW (2010) Field Survey Guidelines; DECC (2009) Threatened species survey and assessment guidelines field survey methods for fauna – Amphibians; and the Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act) survey guidelines for Nationally Threatened Species.

Appendix D provides a table that compiles all survey effort for the study area from this and previous flora and fauna studies and compares this effort with the abovementioned survey guidelines. Survey has met OEH requirements in relation to vegetation community mapping, call playback (owls), bats, birds, nocturnal amphibians (spotlighting and play-back) and di-urnal amphibian and reptiles. With regard to vegetation plots and fauna trapping, the survey effort was appropriate for the site, but does not strictly meet the guidelines. For example, two rather than three plots were undertaken in the Phragmites Australia / typha orientalis wetlands due to the homogeneity of the site. With regard to fauna trapping, the total number of trap nights for the entire site exceeded the survey guidelines, however cage and arboreal trapping was not undertaken in the saltmarsh and Phragmites australis wetlands due

to lack of suitable habitat for ground-dwelling mammals. ELA believes the survey intensity and location was appropriate for the site and indeed exceeds the survey requirements in a number of cases.

The following sections describe the supplementary fieldwork undertaken by Eco Logical Australia in 2011.

3.2.1 Vegetation Community Mapping

Vegetation communities within the study area were mapped and defined based on Biometric Vegetation Types. Field work was carried out in January and February 2011. Random meander traverses were used to validate the vegetation communities, their boundaries and condition classes. There was particular focus on delineating the boundaries of Endangered Ecological Communities (EEC) listed under state or federal legislation and investigating SEPP14 wetland within the study area.

3.2.2 Floristic Surveys

In January and February 2011 a total of 10 20x20m vegetation and biometric plots and five (5) transects were completed. Surveys consisted of recording all flora species present within the plots and encountered along transects.

Vegetation survey proformas were used to collect information, with the data including the date of survey, recorder/s, site number, quadrat size (20 m x 20 m), MGA coordinates (all taken with a GPS using WGS84) and vegetation structure. One or more digital photographs were taken at each site. Within each 0.04 ha floristic plot all vascular plants species were recorded and identified as far as was possible. In some cases a lack of flowering material was a hindrance, with some samples only undergoing identification to the genus level. Samples of unknown species were collected for later identification. Nomenclature followed the Flora of New South Wales (Harden 1992; 1993; 2000; 2002) except where more recent taxonomic changes have taken place.

Biometric data were gathered concurrently with the flora survey quadrats, in accordance with the Biobanking Methodology (DECC 2008a) and Biobanking Assessment Methodology and Credit Calculator Operation Manual (DECC 2009). This involved gathering data within a 20mx50m plot/transect on native species richness, over-storey cover, mid-storey cover, native ground cover, exotic cover, number of trees with hollows, over-storey regeneration and length of logs.

The locations of the vegetation plots and transects are shown in

Figure 3.

3.2.3 Targeted Threatened Flora Surveys

Targeted threatened flora searches were undertaken for those species considered to potentially occur on the site based on database searches in the locality and habitat on site. In terms of seasonally cryptic species, only species whose optimal period of detection corresponded with the survey timing (ie January to February) were adequately surveyed for. The following threatened flora species were targeted:

- *Callistemon linearifolius* (Netted Bottlebrush)
- *Melaleuca biconvexa* (Biconvex Paperbark)
- *Persicaria elatior* (Tall Knotweed)

- *Zannichellia palustris*

The Office of Environment and Heritage (OE&H) have indicated that the following additional species should be considered and justification on the adequacy of survey for these species should be provided

- A*sperula asthenes* (Trailing Woodruff)
- *Lindernia alsenoides* (Noah's False Chick Weed)
- *Maundia triglochinoides*

Asperula asthenes grows in damp sites along river banks from Taree to Bulahdelah. This species is best to be surveyed for during spring, which is outside of the survey season applied to this study. However, survey for the ARTC project (Parsons Brinkerhoff, 2012) which included the majority of the TSF subject site and was undertaken in the appropriate season did not identify this species and concluded that the likelihood of it being present on site was low. ELA concurs with this assessment.

Lindernia alsinoides also grows in swampy sites in sclerophyll forest and coastal heath north from Bulahdelah, and is most detectable when flowering in November, which is outside of this study's survey period. Survey of the subject site was undertaken by Parsons Brinkerhoff (2012) during the appropriate season for the ARTC project, however the species was not observed. Given the disturbance history of the study area and the nearest record of these species is over 14km and 66km respectively from the site, these species are not considered potential occurrences. Parsons Brinkerhoff concluded that the likelihood was low and habitat not present.

Maundia triglochinoides has been recorded approximately 3km from the study area and grows in swamps and shallow fresh water on heavy clay and is detectable for most of the year, with distinct leaf form and venation. The species flowers in November – January and would therefore have been flowering during field survey by ELA in 2011. This species was not detected during surveys, nor was it observed by Parsons Brinkerhoff (2012) in their surveys for the ARTC project on the same land. It is therefore highly unlikely that the species is present on this site.

3.2.4 Fauna Surveys

Given the detailed surveys that were undertaken as part of EcoBiological (2008) and EcoHub (2009) fauna surveys by ELA were limited to targeted amphibian surveys in suitable habitat (refer to Appendix D for total survey effort). Survey timing was preferentially aligned with periods following rainfall, during periods of moderate to high humidity and low wind speed, with weather conditions around the survey periods provided in Table 1 below. Surveys were completed on the days and evenings of the 11th, 12th of January 2011 and the 16th, 17th and 18th of February 2011.

Table 1: Weather conditions during the fauna survey (BOM Newcastle University Weather station).

Date	Rainfall (mm)	Temperature (Max daily C°)
7 Jan	18.2	
8 Jan	0	28.8
9 Jan	3	29

10 Jan	3.6	29.5
11 Jan	2	27.8
12 Jan	0.4	30
15 Feb	11.6	25.7
16 Feb	1.4	27.2
17 Feb	0	32.2
18 Feb	41.8	

Nocturnal surveys

Nocturnal amphibian surveys involved 24 person hours searching suitable wetland habitats using 50 watt handheld spotlights. Traverses were generally undertaken on foot, though fauna were opportunistically encountered during vehicular movements.

At several locations call playback surveys were undertaken, consisting of Green and Golden Bell Frog (*Litoria aurea*), Grass Owl (*Tyto capensis*) and Masked Owl (*Tyto novaehollandiae*) call broadcasting for approximately 5 minutes followed by a 5 minute listening period for each call. Spotlights were then used to detect any cryptic species following each call being played. All fauna species encountered or heard calling were recorded. Traverses and call playback locations are shown in **Figure 4**.

Diurnal surveys

Diurnal amphibian surveys involved traverses in areas of suitable habitat for searching for basking individuals. Traverses are shown in **Figure 4**.

Opportunistic Observations

Opportunistic observations of species were recorded at all times, including reptiles, frogs, mammals and birds. Opportunistic observations included identification of indirect evidence such as scats and tracks.

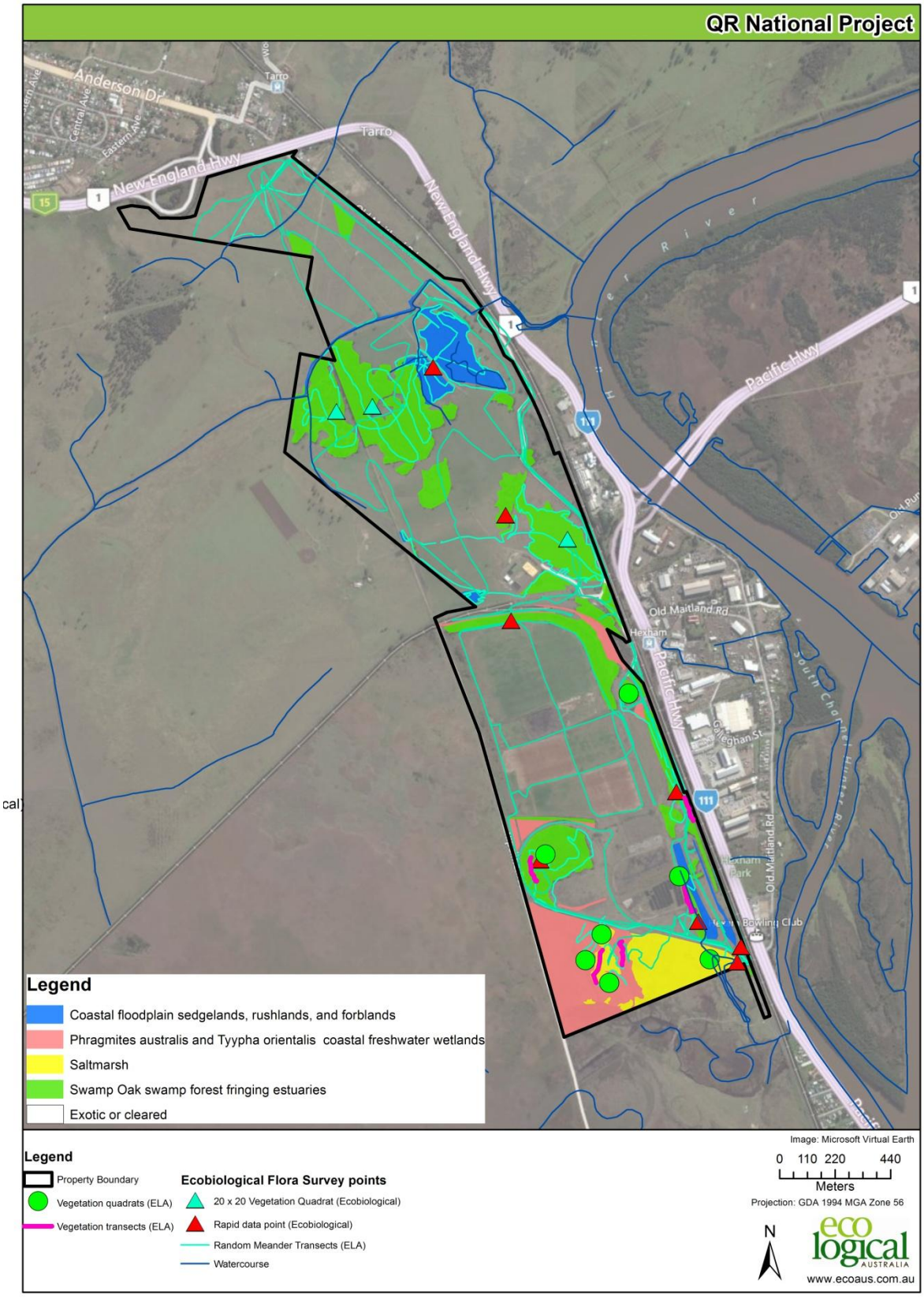

Figure 3: Flora Survey methods.

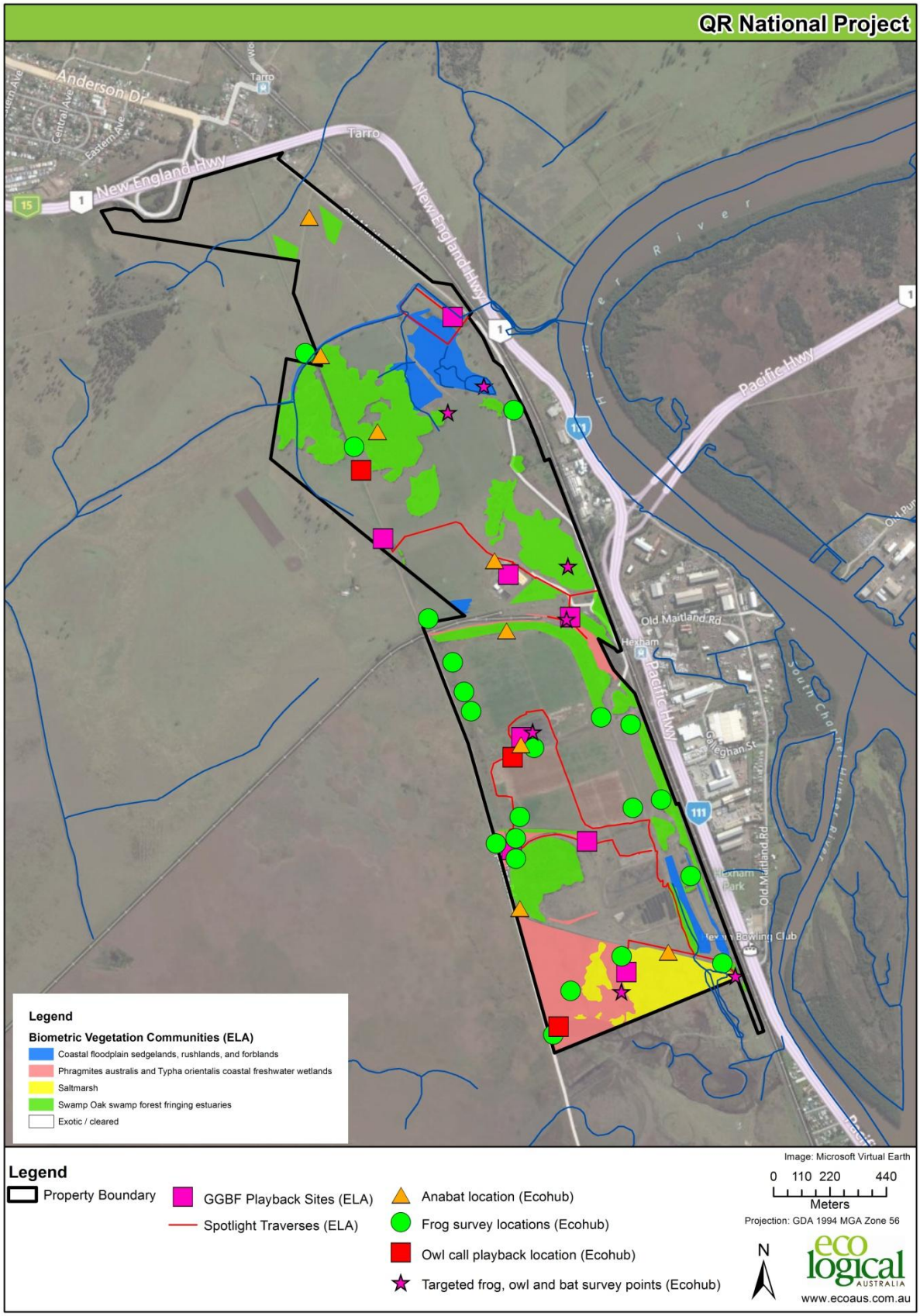

Figure 4 Fauna Survey Methods

4 Results

4.1 INFORMATION GATHERING AND REVIEW

4.1.1 Database Review

Appendix A provides a list of the threatened flora and fauna species that have been recorded within 10km of the study area, and maps have also been produced showing the spatial configuration of the threatened species assessed in the likelihood of occurrence table. Those species in Appendix A that are considered likely to occur within the study area have been assessed pursuant to the DEC DPI (2005) guidelines.

4.1.2 Literature Review

Ecobiological (2008) Draft Ecological Assessment for Proposed Train Support Facility, Maitland Rd, Hexham, NSW

EcoBiological were commissioned by QR National to prepare an assessment of flora, fauna and threatened species for the site of the proposed Hexham Redevelopment Project. Field surveys were conducted between November 2007 and March 2008. Whilst the report was not finalised, the survey methods and results have been utilised for this report.

ECOHUB (2009) Draft Ecological Assessment for QR National – Proposed Industrial subdivision, train support facility and intermodal development

ECOHUB (2009) were engaged by QR National to undertake an Ecological Assessment pursuant to Part 3A of the EP&A Act for the proposed Train Support Facility and Industrial Subdivision at Hexham, NSW (the industrial subdivision is not part of this proposal and assessment). The purpose of this study was to determine the presence or otherwise of significant species and determine possible impacts of the proposed development.

ECOHUB (2009) conducted additional floristic and fauna surveys and analysis to supplement EcoBiological (2008), as detailed below. ECOHUB (2009) appear to use a combination of LHCCREMS and DECC (2004) flora and fauna survey guidelines.

4.2 FLORA AND FAUNA SURVEY

4.2.1 Vegetation Community Validation

Four biometric vegetation communities were identified, described and mapped during the field survey and corresponded to three respective EEC's (Table 2). Vegetation condition varied across the study area. Swamp Oak Swamp Forest had considerable variation in quality due to past disturbance, with some areas being in moderate condition, areas of rehabilitation that contained Swamp Oak (*Casuarina glauca*) and other areas consisting of a predominantly native understorey only and a cleared canopy (Derived Grassland). Areas of Swamp Oak Swamp Forest that comprised rehabilitation were not considered to reflect the description of Swamp Oak Floodplain Forest EEC due to modifications/introduced soil and floristic composition. Table 2 below provides the vegetation types, corresponding EEC's and the area of each type.

All remnant native vegetation on the site (excluding the rehabilitation plantings of Swamp Oak Swamp Forest) is considered to meet the definition of Groundwater Dependence Ecosystems as described in NSW State Groundwater Dependent Ecosystem Policy (DLWC 2002) due to the likely interaction of the vegetation with shallow watertable and periodic inundation of floodwater.

Table 2: Biometric vegetation types and EEC's.

Biometric Vegetation Types	EEC	Area (ha)
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	*Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions* (refer to Figure 3 for actual extent of EEC).	28.65
	Nil (planted and not consistent with the EEC definition).	18.50
Coastal floodplain sedgelands, rushlands and forbs of the North Coast	*Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*	9.69
Phragmites Australia and Typha orientalis coastal freshwater wetlands of the Sydney basin		15.66
Saltmarsh in estuaries of Sydney basin and south east corner	*Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions*	9.24
Disturbed / Cleared Vegetation		172.03
Total		**254**

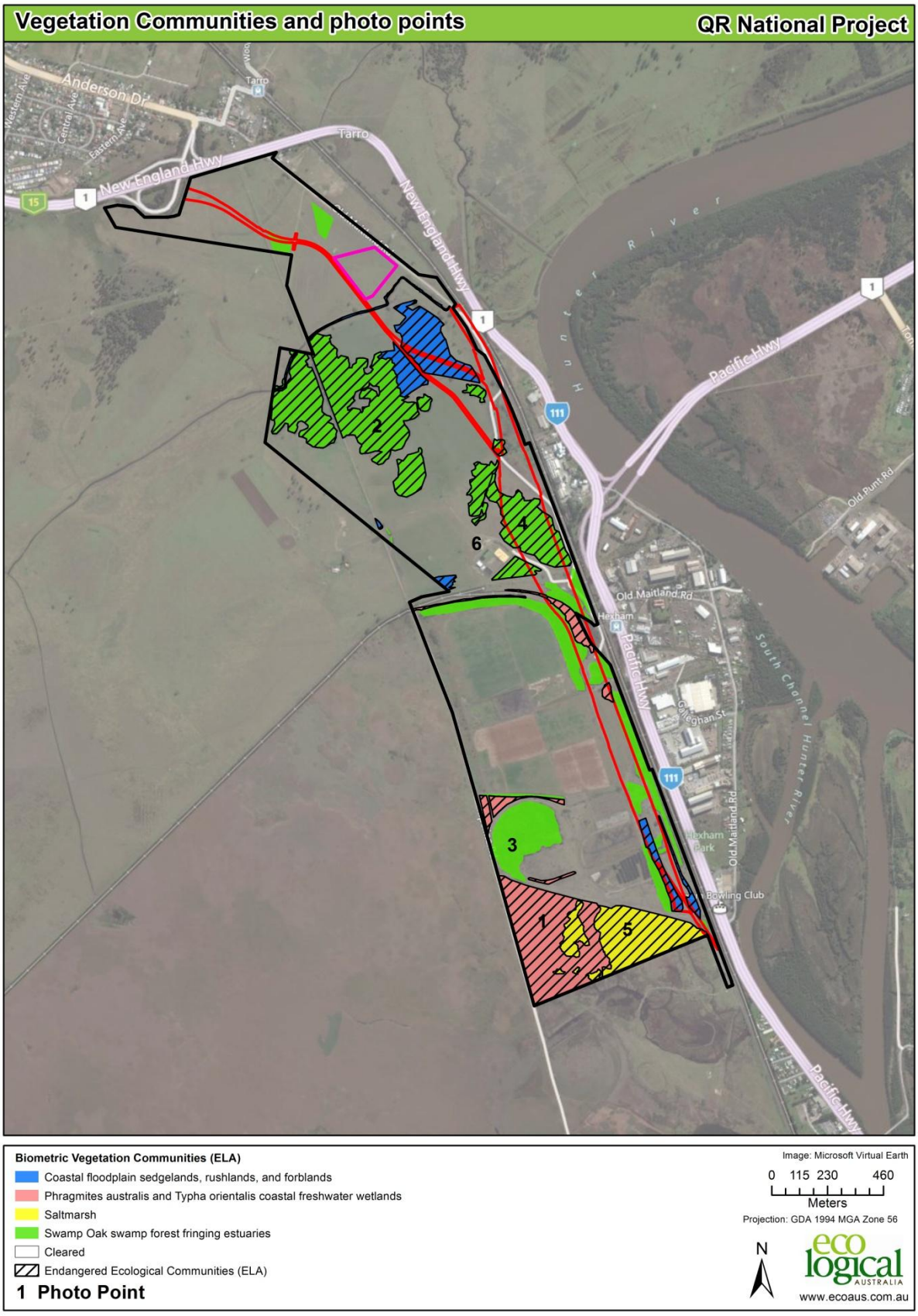

Figure 5: Vegetation communities, Endangered Ecological Communities (EECs) and threatened fauna species encountered during the ELA (2012) surveys.

Coastal floodplain sedgelands, rushlands and forblands of the North Coast - 9.69 ha

This community was scattered throughout the pastures in the northern end of the study area and was also recorded in several constructed drainage lines in the south of the study area (Figure 4). Sections of this community were mapped as Freshwater Wetland Complex (Ephemeral Swamps) by Ecobiological (2008).

The shrub layer was absent, and the ground layer was dominated by a mix of native and exotic species. Common native species included *Bolboschoenus caldwellii, Cynodon dactylon* (Common Couch), *Paspalum distichum* (Water Couch) and *Phragmites australis* (Common Reed), while common exotic species included *Aster subulatus* (Wild Aster) and *Pennisetum clandestinum* (Kikuyu).

This community was in moderate condition, being used to graze cattle, and having modified hydrology and simplified floristics.

The floristic and structural elements of remnant patches of this community were consistent with the NSW Scientific Committee's listing *Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions,* an EEC listed under the TSC Act.

Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin – 15.66 ha

Several remnants of this community were detected throughout the study area (Figure 4; Plate 1). It was also present in a large constructed drainage line in the middle of the study area (Figure 4).

Phragmites australis was the dominant species throughout this community, while *Bolboschoenus caldwellii* and *Typha orientalis* (Broad-leaved Cumbungi) were also present. Saltmarsh species, including *Juncus kraussii* (Sea Rush), *Paspalum vaginatum* (Salt-water Couch) and *Sarcocornia quinqueflora* (Samphire) were present in the ecotone between the saltmarsh and phragmites rushland communities, making it difficult to determine their precise boundaries. This community was in moderate condition throughout the study area. It was subject to stock grazing and was infested with several exotic species, particularly *Juncus acutus* (Sharp Rush).

The floristic and structural elements of this community were consistent with the NSW Scientific Committee's listing *Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*, an Endangered Ecological Community (EEC) listed under the TSC Act.

Plate 1: Phragmites australis and typha orientalis coastal freshwater wetland

Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner – 47 ha
This vegetation community was present in three variations on the site, including remnant forest, areas containing a scattered or absent canopy with native understorey, and rehabilitation areas containing Swamp Oak (Figure 4).

Remnant patches of this community were detected on poorly drained soils scattered throughout the northern portion of the study area (Plate 2). The canopy was dominated by *Casuarina glauca* (Swamp Oak), with occasional *Melaleuca styphelioides* (Prickly-leaved Tea Tree) also observed. The shrub layer was absent and the dense ground layer was dominated by native and exotic grasses and herbs, including *Aster subulatus*, *Atriplex prostrata, Cirsium vulgare* (Spear Thistle), *Cynodon dactylon*, *Pennisetum clandestinum* and *Persicaria lapathifolia* (Pale Knotweed). Areas without the canopy (Plate 4) are considered a derived community.

The rehabilitation area (Plate 3) was dominated by planted *Acacia saligna* (Golden Wreath Wattle), *Melaleuca armillaris* (Bracelet Honey-myrtle) and Swamp Oak, as well as a variety of exotic species such as *Chloris gayana* (Rhodes Grass), *Cirsium vulgare* (Spear Thistle), *Lantana camara* (Lantana) and *Verbena bonariensis* (Purpletop). The rehabilitation variant of Swamp Oak Swamp Forest was in poor condition across its range, due to being planted out with a weedy Western Australian species *(Acacia saligna)* and mismanagement of the area effectively leading colonisation of exotic species.

All variants of this community were subject to stock grazing and infestation of the weeds mentioned above.

Considering the floristic assemblage, position in the landscape and observations of surface soil, two of the variants (Moderate condition and Scattered Swamp Oak) of this community were considered to align with the EEC *Swamp Oak Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner*. The remaining variant were not considered to qualify as the EEC due to modifications to soil and/or floristic composition

Plate 2: Remnant Swamp Oak Swamp Forest in the north of the site

Plate 3: Rehabilitation variant of Swamp Oak Swamp Forest

Plate 4 SEPP 14 Wetland area with derived Swamp Oak Swamp Forest

Saltmarsh in estuaries of the Sydney Basin and South East Corner– 9.24 ha
This community was present in the south of the study area (Figure 4; Plate 5).

Juncus kraussii, Paspalum vaginatum, *Sarcocornia quinqueflora* and *Sporobolus virginicus* were the dominant species throughout this community. *Bolboschoenus caldwellii* and *Phragmites australis* were common in the ecotone between this community and Phragmites australis and Typha orientalis coastal freshwater wetland, making it difficult to determine the precise community boundaries.

This community was in moderate condition throughout its extent. The area was subject to stock grazing and drainage has been modified by a levy. Common exotic species include *Aster prostrata*, *Cotula coronopifolia* (Water Buttons), *Juncus acutus* and Wild Aster.

The floristic and structural elements of this community were consistent with the NSW Scientific Committee's listing *Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions*, an EEC listed under the TSC Act.

Plate 5: Saltmarsh in the southern part of the site

Cleared and exotic

The majority of the study area is comprised of exotic vegetation (Figure 4; Plate 6). The vegetation community was dominated by a range of exotic grasses and herbs, including Lacy Ragweed, *Axonopus fissifolius* (Narrow-leafed Carpet Grass), Spear Thistle, *Eragrostis curvula* (African Lovegrass) and Kikuyu Grass. Large sections of this community were infested with *Alternanthera philoxeroides* (Alligator Weed), a Class 3 noxious weed in the Newcastle LGA.

Plate 6: Exotic / disturbed Vegetation.

4.2.1 Floristic Surveys

A complete species list that resulted from the floristic surveys is provided in Appendix B, including species that have been recorded from the previous studies (Ecobiological 2008; EcoHub 2009), with a total of 256 species recorded, including 187 native species.

No threatened flora species were recorded within the study area.

4.2.2 Fauna Surveys

A complete species list that resulted from the fauna surveys is provided in Appendix B, including species that have been recorded from the previous studies (Ecobiological 2008; EcoHub 2009), with a total of 168 fauna species recorded, including nine amphibians, 128 avian species, 25 mammal species and six reptile species. The following sections provide a summary of the findings from the current surveys. Table 3 below provides a summary of all the threatened and migratory species listed under the EPBC Act and TSC Act that have been recorded in the study area during this and the previous studies. Previous reports do not indicate the location where the individuals were recorded within the study area. Due to the absence of this information, an indication of the likely nature of usage of the study area has been provided, based on available habitats within the study area, the species habitat requirements and movement behaviours.

During field survey undertaken by ELA, the *Pteropus poliocephalus* (Grey-headed Flying-Fox) was the only species recorded, which is listed as Vulnerable under TSC Act and the EPBC Act. This record was made during a nocturnal survey. No other threatened or migratory species were recorded by the ELA survey.

Table 3: List of threatened and migratory species recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	TSC Act	EPBC Act	Study reference	Notes and likely habitat usage in the study area
Tyto capensis	Grass Owl	V	-	Ecobiological (2008); EcoHub (2009)	Responded to call playback and flew in to study area. Thought to be resident pair from Ash Island. Study area provides marginal foraging habitat.
Hieraaetus morphnoides	Little Eagle	V	-	Ecobiological (2008)	No location record available. Assumed to use the site as part of foraging range. No nests observed.
Anseranas semipalmata	Magpie Goose	V	M	EcoHub (2009)	No location record available. Assumed to use the site as part of foraging range. Limited marginal habitat available within the study area.
Botaurus poiciloptilus	Australasian Bittern	V	-	EcoHub (2009)	No location record available. Assumed to use the site as part of foraging range. Limited marginal habitat available within the study area.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	EcoHub (2009); Ecobiological (2008) and Current survey	Recorded flying over the study area. No roost habitat available.
Mormopterus norfolkensis	East Coast Freetail-bat	V	-	Ecobiological (2008); EcoHub (2009)	Recorded through ultrasonic call recording. No location available. Some marginal roost potential in hollow bearing trees within Swamp Oak Forest in the north of the study area (in proposed conservation area).
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Ecobiological (2008)	Recorded through ultrasonic call recording. No location available. Some marginal roost potential in hollow bearing trees within Swamp Oak Forest in the north of the study area (in proposed conservation area).
Miniopterus australis	Little Bentwing-bat	V	-	Ecobiological (2008)	Recorded through ultrasonic call recording. No location available. Study area offers forage habitat only.

Myotis adversus	Large-footed Myotis	V	-	Ecobiological (2008)	Recorded through ultrasonic call recording. No location available. Study area offers forage habitat only.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Ecobiological (2008)	Recorded through ultrasonic call recording. No location available. Some marginal roost potential in hollow bearing trees within Swamp Oak Forest in the north of the study area (in proposed conservation area).
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	EcoHub (2009)	Recorded through ultrasonic call recording. No location available. Study area offers forage habitat only.

4.3 SUMMARY OF BIODIVERSITY VALUES AND CONSTRAINTS TO DEVELOPMENT

The following section presents the biodiversity values present within the study area, including threatened biodiversity (EEC's, threatened species and migratory species) recorded or considered likely occurrences, a summary of general biodiversity, habitat condition and connectivity values.

Table 4: Summary of biodiversity values.

BIODIVERSITY VALUE	**SUMMARY**			
Scientific Name	**Common Name**	**TSC Act**	**EPBC Act**	**Likelihood of Occurrence**
—	*Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions.*	EEC	—	Recorded
—	*Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*	EEC	—	Recorded
—	*Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions*	EEC	—	Recorded
Zannichellia palustris		E	—	Potential
Litoria aurea	Green and Golden Bell Frog	E	V	Potential
Hieraaetus morphnoides	Little Eagle	V	—	Recorded onsite
Anseranas semipalmata	Magpie Goose	V	M	Recorded onsite
Botaurus poiciloptilus	Australasian Bittern	V	—	Recorded onsite
Ephippiorhynchus asiaticus	Black-necked Stork	E	—	Some marginal potential
Rostratula australis	Painted Snipe (Australian subspecies)	E	V	Potential

(a.k.a. R. benghalensis)				
Tyto capensis	Grass Owl	V	—	Recorded onsite
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Potential
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	—	Recorded onsite
Miniopterus australis	Little Bent-wing Bat	V	—	Recorded onsite
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	—	Recorded onsite
Mormopterus norfolkensis	East Coast Freetail Bat	V	—	Recorded onsite
Myotis adversus	Large-footed Myotis	V	—	Recorded onsite
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V	Recorded onsite
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	—	Potential
Scoteanax rueppellii	Greater Broad-nosed Bat	V	—	Recorded onsite
Apus pacificus	Fork-tailed Swift	—	M	Potential
Haliaeetus leucogaster	White-bellied Sea-Eagle	—	M	Recorded onsite
Hirundapus caudacutus	White-throated Needletail	—	M	Potential
Ardea alba	Great Egret	—	M	Potential
Ardea ibis	Cattle Egret	—	M	Potential
Biodiversity	Overall a total of 168 fauna species were recorded, including 9 Amphibian species, 128 Avian species, 25 Mammal species and 6 reptile species. 21 threatened or migratory fauna species have either been recorded or are considered potential occurrences (see above) 268 flora species were recorded across each of the three different studies. Of these 86 were introduced species with additional species considered to have been introduced to the study area through vegetation rehabilitation works. One threatened flora species, *Zannichellia palustris*, listed as endangered is considered a potential occurrence on the site but has not been recorded within the study area . The study area contains five broad vegetation types, with four of these considered to be native vegetation communities in variable condition and			

	covering approximately 32% or 81ha of the study area. Each of these vegetation types are considered to represent three respective EEC's listed under the TSC Act (see above). The remaining study area is classed as either disturbed or a vegetation rehabilitation area.
Habitat condition	The site evidences a long history of industrial and agricultural disturbances, with the spatial representation of the rehabilitation area and disturbed vegetation in Figure 3 depicting the worst affected areas (75% of the site). The central portion of the study area has been subject to coal stockpiling, excavation works and is essentially an artificial landscape. Much of this area is subject to pasture improvement and cattle grazing, with grazing also extending to the north and into areas mapped as having the native vegetation. Despite this level of disturbance, the site does still contain some ecological values, in the form of the three endangered ecological communities associated with wetlands and habitat for threatened species. With the exception of the Green and Golden Bell Frog and hollow roosting bats, the study area generally constitutes foraging or intermittent refuge habitat. Several surveys for Green and Golden Bell Frog have been conducted within the study area over a three year period, with no results indicating the presence of the species. At best, wetland habitats within the study area (ie Coastal floodplain sedgelands, rushlands, and forbs; Phragmites australis and Typha orientalis coastal; and the edges of Coastal Saltmarsh in estuaries of the Sydney Basin) potentially support very occasional and intermittent movements and foraging by Green and Golden Bell Frog, although this has not been confirmed with any sightings. In terms of habitat for hollow obligate Microchiropteran bats (eg. East Coast Freetail Bat, Large-footed Myotis and Greater Broad-nosed Bat), the area of remnant Swamp Oak swamp forest fringing estuaries in the north of the study area contains 682 hollow bearing trees, with the majority of hollows being in the small (<8cm class) (EcoBiological 2008). None of these hollow bearing trees will be affected by the proposed development.
Connectivity	The study area is positioned in a highly fragmented landscape, which has developed through historic agricultural, infrastructure and industrial land uses. The study area itself is highly fragmented, with small patches of isolated remnant vegetation such as the Swamp Oak Forest and areas of wetland occurring within a mostly disturbed/cleared area. The northern railway line, New England Highway, pacific Highway and Hexham industrial area form barriers to movement to the east and north. Cleared pasture interspersed with lowlying wetland areas occurs to the west. The primary habitat connection to the study area occurs to the southwest, whereby the study area is connected to wetland habitats within Hexham Swamp Nature Reserve. Habitat within the reserve is generally non-woody freshwater or estuarine wetland and is therefore only suitable for a restricted fauna assemblage (ie not suitable for forest/woodland dependant species).

4.4 STUDY LIMITATIONS

The floristic audit undertaken recorded as many species as possible and provides a comprehensive but not definitive species list. More species may be recorded during a longer survey over various seasons, however the site has been studied in at least four reports spanning various seasons and three years. The floristic and fauna surveys completed for this study are therefore considered sufficient. For species that were not detectable during the survey period by ELA, results from survey for the ARTC project by Parsons Brinkerhoff 2012 have been considered.

5 IMPACT ASSESSMENT

The TSF has the potential to have the following impacts on biodiversity:

- Clearing and fragmentation of endangered ecological communities and habitat for threatened species, and
- Changes to hydrology and water quality for groundwater dependent ecosystems

5.1 CLEARING AND FRAGMENTATION OF NATIVE VEGETATION

5.1.1 Clearing of Endangered Ecological Communities

The subject site is highly disturbed, having had a long history of industrial and agricultural land use. Vegetation communities on the site are therefore in a somewhat degraded state. Approximately 10.64 ha of native vegetation will be impacted, of which 7.48 ha met the definition of an Endangered Ecological Community (Table 5 and Figure 5). In addition to the impact on 7.48 hectares of EEC, the adjoining ARTC development will impact on approximately 9.1 ha of EEC, giving a total impact of 16.58 hectares.

The Part 3A *Draft Guidelines for Threatened Species Assessment* (DECC and DPI 2005) identifies matters which are relevant to the assessment of impacts to endangered ecological communities, endangered populations and threatened species. Appendix 3 of DECC and DPI (2005) guidelines lists six questions and associated sub-questions that address the impacts of proposed developments on threatened species, populations, or ecological communities. Appendix C of this report provides detailed assessment accounting for the ecological impacts associated with the proposed Train Support Facility for ecological communities recorded or considered likely to occur in the study area (see species and EEC's in Table 4). The assessment concludes that due to the degraded nature of the EECs and their distribution in the locality and region, the proposed development will not have a significant impact on these EECs.

Table 5: Extent of impact of TSF (proposed development footprint) on biometric vegetation types and their corresponding EEC

Biometric Vegetation Type	Area Vegetation Community Impacted (ha)	Corresponding EEC	Area EEC impacted (ha)
Coastal floodplain sedgelands, rushlands, and forbs	1.49	Freshwater wetland on coastal floodplain	1.49
Phragmites australis and Typha orientalis coastal	1.23	Freshwater wetland on coastal floodplain	1.23
Saltmarsh in estuaries of the Sydney Basin	0	Coastal saltmarsh	0
Swamp Oak swamp forest fringing estuaries, Sydney * appprox half this biometric vegetation type meets definition of the EEC	7.7	Swamp oak forest on coastal floodplain	4.76
Total to be impacted	**10.64**		**7.48**

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5.1.2 Threatened species

In terms of impacts to threatened flora species, *Zannichellia palustris* was the only threatened flora species considered a potential occurrence within the study area. The impact assessment provided in Appendix C concludes that, whilst there is some possibility of the species occurring within the study area, the impacts of the proposal are limited to a relatively small area of potential habitat (1.23ha of *Phragmites australis and typha orientalis* wetland) in which the species has not been observed. The remainder of the *Phragmites australis and Typha orientalis* wetland (approximately 12.8 hectares) on the site will be managed for long term conservation purposes under a Conservation Agreement.

With regard to threatened fauna species and their habitats, **Table 4** provides a list of those species considered at least potential occurrences within the study area. The study area generally constitutes foraging or intermittent refuge habitat. Several surveys for Green and Golden Bell Frog have been conducted within the study area over a three year period, with no results indicating the presence of the species. At best, wetland habitats within the study area (ie Coastal floodplain sedgelands, rushlands, and forbs; Phragmites australis and Typha orientalis coastal; and the edges of Coastal Saltmarsh in estuaries of the Sydney Basin) potentially support very occasional and intermittent movements and foraging by Green and Golden Bell Frog. With the proposal impacting upon 2.72 ha of this marginal habitat for the species and the retention and conservation management of up to 13.41ha (see section 6.3.3), habitat provision will continue and will be improved for the species within the study area, therefore avoiding a significant impact on the species.

In terms of habitat for hollow obligate Microchiropteran bats (eg. East Coast Freetail Bat, Large-footed Myotis and Greater Broad-nosed Bat), the area of remnant Swamp Oak Swamp Forest Fringing Estuaries in the north of the study area contains 682 hollow bearing trees, with the majority of hollows being in the small (<8cm class) (EcoBiological 2008). None of these hollow bearing trees will be affected by the proposed development (refer to Appendix E) and therefore a significant impact on these species is not likely to occur. Whilst there will be loss of native vegetation and habitat, no threatened species or communities are considered likely to be significantly affected by the proposal.

5.1.3 SEPP 14 wetlands

The study area contains approximately 18.88ha of SEPP14 Coastal Wetland as shown in Figure 2 and adjoins Hexham Swamp Nature Reserve (Hunter Wetlands National Park). Wetland number 833 is approximately 10.6 hectares and will have direct impacts of 5.71 hectares. The remainder of wetland 833 is likely to be affected by changes in hydrology. Due to historic disturbance regimes, this wetland is considered to be of very low value as a coastal wetland. The other area of SEPP 14 wetland on the site is in the southern portion where no direct or indirect impacts are expected to occur and indeed this area is proposed for protection via a Conservation Agreement as described in section 6.3.3. Given the large extent of wetland in the area and the mitigation measures described in Section 6 of this document, the development of this site is not considered to have a significant impact on the broader wetland complex of the Lower Hunter.

5.1.4 Connectivity

The proposal is located within the Watagan to Stockton Corridor identified in the Lower Hunter Regional Strategy. The corridor represents a broad strategic corridor rather than one designed for a particular species. The proposal will remove disturbed vegetation within the corridor, in a location where the corridor is already significantly broken for terrestrial species by the railway line, Pacific Highway and the Hunter River. An Offset Strategy will be implemented that will seek to improve approximately 53 hectares of habitat on site and therefore improve the 'stepping stone' connectivity for birds and bats.

5.2 CHANGES TO HYDROLOGICAL ENVIRONMENT

As discussed in Chapter 4, native vegetation communities on site are considered to be groundwater dependent ecosystems. These occur not only as terrestrial communities, but also within the two main agricultural drains that flow to Hexham Swamp. The drains contain wetland species such as *Phragmites australis (*dominant*),*

Bolboschoenus caldwellii and *Typha orientalis* (Broad-leaved Cumbungi). No threatened species listed under the *Fisheries Management Act 1994* or *Threatened Species Conservation Act 1995* have been recorded in the drains, nor are they considered likely due to poor habitat condition and the presence of *Gambusia sp.*

Changes to the hydrological and aquatic environment can occur due to:

- Increased rate and volume of run-off from hardstand areas leading to changes in water quality and salinity in estuarine environments
- Ponding or retention of storm/flood water due to construction of buildings or roads.
- Changes to ground water levels due to filling.

Each of these are discussed below.

5.2.1 Stormwater run-off quantity and quality

An increase in stormwater discharge from the site is anticipated and has been modelled by WorleyParsons (2012). The Stormwater Management Plan (SMP) by WorleyParsons (2012) describes the current site hydrology, water quality and changes to these as a result of the development. Run-off from minor rainfall events will be channelled through vegetated swales, gross pollutant traps and water quality control ponds shown in Figure 6. There are three outlets from the water quality control ponds:

1. Hunter River via culverts to the north of the site below the existing Great Northern railway line
2. Hunter River via culverts to the south of the site below the existing Great Northern railway line
3. To the west to Hexham Swamp via pipe culverts above Hunter Water watermain.

Modelling was undertaken by WorleyParsons (2012) for the annual and the 1 in 10 year storm event. The modelling shows that in major storms, the there will be stormwater discharge to five sensitive locations as described in Table 6 and Figure 6. The northern pond will discharge to the outlet to the Hunter River (sensitive location 1). The central pond will discharge to the cleared area to the west and then towards the Swamp Oak Forest (sensitive location 2) and the southern pond will discharge to the saltmarsh (sensitive location 5). The two other discharge points (sensitive locations 3 and 4) are parts of the site which will not be developed, but were modelled as they flow towards Hexham Swamp.

By implementing the SMP, the WorleyParsons (2012) report concludes that there will be a minor change in the catchment area draining to the Swamp Oak Forest on Coastal Floodplain EEC. The report states that '*following development, Location 2 (Swamp Oak Forest) would overflow on a yearly basis whereas in the natural state this would occur on average once every two years. Ponded depths do not change*.' This change in frequency does not pose a risk to the ecology of the Swamp Oak Forest. With regard to the Coastal Saltmarsh, there is an increase in the volume of fresh water discharged to this location, which Worley Parsons conclude *"to be negligible in comparison to the overall size and quantity of water within the estuarine environment*". Again, this effect is unlikely to be significant on the ecology of the saltmarsh.

Table 6 Modelling stormwater changes to receiving areas

	Sensitive Location	1 year event	1 in 10 year event
1	Culvert to Hunter River	Increase is considered negligible and is within culvert capacity	Negligible change
2	Swamp Oak Forest	Overflows from shallow depression now occur in 1 year ARI event rather than 2 year event	Negligible change
3	SEPP 14 North (ie, to the west of the site)	Culverts under HWC main restrict flows causing slight increase into overflows into Location 2 (Swamp Oak Forest area)	Negligible change
4	SEPP 14 South (ie, to the west of the site)		Decrease
5	Coastal saltmarsh / wetlands	Slight decrease to the saltmarsh complex Increase from 0.12m3/s to 0.33m3/s to the to the phragmites complex	Flows to eastern outlet (saltmarsh) increase from 1.64m3/s to 2.35m3/s Flows to western outlet (phragmites) increase from 1.14m3/s to 2.12m3/s

5.2.2 Retention and dissipation of flood waters

As all ecosystems on the site are groundwater dependent, proposed changes to flooding regimes as a result of the development need to be assessed. The effect of the proposal has been modelled by WBM (2012) to determine its impact on flood levels and velocity for the 1%, 2%, 5% and 10% events. This modelling assumes that the access road between Tarro interchange and the TSF has flood relief culverts as follow (WBM, 2012, page 16):

> *For the assessment of flood mitigation options, a 9m by 1.5m crossing was provided at the two channel crossings, which is similar to the width of the channels. An additional 150m$_2$ of flow area was provided in the form of 300m width of flood relief culverts with a 0.5m height. The culverts were distributed across a 600m length of the access road, in the vicinity of Purgatory Creek*.

The effect of these culverts is to minimise the effect that the road has on retention and dissipation of flood waters. WBM (2012) then describe the changes to flood behaviour under the different flood events:

> *The greatest impact on modelled flood behaviour is for the 2% AEP event, for which the peak flood level upstream of the road alignment is increased by just under 0.1m (typical flood depths increasing from approximately 1.5m to 1.6m). The floodplain flow peaks at around 560m$_3$/s, with 250m$_3$/s being conveyed through the cross drainage structures and the remainder flowing across the road embankment.*
>
> *For the 1% AEP event the impacts are less than those of the 2% AEP event. The peak flood level impact upstream of the access road is reduced to around 0.05m (with typical flood depths being approximately 3m), as substantial overtopping of the road crest occurs. The road embankment becomes effectively drowned out, thereby limiting adverse flood impact.*
>
> *For the 5% AEP and 10% AEP events the flood impacts are relatively minor. Peak flood levels upstream of the access road are typically increased by around 0.04m, with some localised increase of up to 0.06m at the 10% AEP event. The impact at the 10% AEP event would be mitigated by the provision of stormwater cross drainage through the proposed access road.*

The impacts on peak flood velocity for the 2% AEP event are of a similar order to those experienced at the 1% AEP event. The impact on peak velocity is minimal for both the 5% AEP and 10% AEP events.

As shown in Table 7, which draws information from Figures 4-2 to 4-9 in WBM (2012), the changes at the Swamp Oak Forest are negligible for all of these flood events, as they are for the saltmarsh in the smaller flood events. The changes of +0.02 to -0.02 for afflux and +0.05 to -0.05 for velocity essentially represent the minimum level of detectable change. Only in larger flood events (1% and 2%) is there a significant increase in flood velocity in the saltmarsh area. These figures show that in all of these events, the Swamp Oak Forest and the saltmarsh areas are inundated, regardless of the TSF. The development including the access road therefore has a negligible effect on the retention or dissipation of floodwaters and will therefore not have a significant impact on the current hydrological regime of the Swamp Oak Forest.

Table 7: Change in flood level and velocity.

Design flood magnitude	**Swamp Oak Forest**		**Saltmarsh**	
	Flood level Afflux (m)	Change in peak velocity (m/s)	Flood level Afflux (m)	Change in peak velocity (m/s)
10% AEP	+0.02 to -0.02	-0.05 to +0.05	+0.02 to -0.02	-0.05 to +0.05
5% AEP	+0.02 to -0.02	-0.05 to +0.05	+0.02 to -0.02	-0.05 to +0.05
2% AEP	+0.02 to -0.02	-0.05 to +0.05	+0.02 to -0.02	+0.2 to +0.5 at point of discharge, but -0.05 to +0.05 for most of saltmarsh
1% AEP	+0.02 to -0.02	-0.05 to +0.05	+0.02 to -0.02	>+0.5 at point of discharge, but -0.05 to +0.05 for most of saltmarsh

5.2.3 Groundwater

Douglas Partners (2012b) have undertaken an investigation (as part of their contamination assessment) into the effects of the proposed development on the groundwater within and adjacent to the subject site. Whilst groundwater is significantly mounded beneath the coal stockpiles, in areas without stockpiling or fill it is either at or near the surface. DP (2012b) (chapter 6) describe the likely changes to groundwater in the vicinity of groundwater dependent ecosystems in as follows:

The proposed development will be constructed partly over several areas of groundwater dependant ecosystems, some of which are classified as Endangered Ecological Community, and as a consequence the remnant EEC will be left in immediate proximity on one or both sides of the development. Remnant areas on the eastern side of the proposed TSF area (i.e. between TSF and the Great Northern Railway) are likely to be directly affected by the proposed ARTC development.

> *As discussed in the sections above, impacts to water levels due to the development are generally expected to be localised and in the case of construction activities only temporary and recoverable.*
>
> *During construction there is some risk of lowering of the water table due to localised dewatering estimates, however such drawdowns are not expected to have significant impacts on water levels outside of the development footprint.*
>
> *Groundwater levels on the majority of the site are at or near the surface and typically controlled by surface water drainage features. The majority of site changes have potential for slightly changed groundwater levels within filled areas (probably slightly higher), increased run-off, and in places increased seepage, to the ground surfaces adjacent to the development. The increased run-off will have little effect on groundwater levels during wet times as the water levels are controlled by surface water controls. In times of dryer weather the increased run-off is likely lead to certain areas staying wetter for longer than they may have prior to development. There would be some risk of localised pockets receiving less run-off than previously, however the risk of this is limited as the ground is generally low lying with limited fall, encouraging spreading of the run-off.*
>
> *Impacts to groundwater levels from the development are expected to be limited to close proximity to the TSF development footprint. Impacts on water levels on the western parts of the site in Hexham Swamp to the West and the Hunter River to the east, are expected to be negligible.*

The DP (2012b) Report therefore indicates that whilst there will be slight changes to groundwater levels, these will be in the areas being filled and capped (ie, the actual development footprint including the access road). These loses have already been described in previous sections, with impacts to EECs contained in Appendix C. The loss of this vegetation is inconsistent with the NSW Groundwater Dependant Ecosystem Policy which provides five policies for the protection and management of GDEs. However the GDEs on site are highly disturbed through previous land uses and remain in relatively poor condition through weed invasion. Given the improvement of GDEs within the proposed offset areas, this loss is not significant for GDEs in the Hunter estuary.

DP (2012b) also states that

> *Impacts on the groundwater outside of the footprint of filling would be very limited, as the groundwater levels here are generally controlled by existing surface levels and drainage controls (p18).*

This includes the proposed conservation areas containing the saltmarsh, *Phragmites australis* and *Typha orientalis* freshwater wetland in the south and the Swamp Oak Swamp Forest EEC in the north. The development is therefore not expected to cause changes to the remaining GDEs / EECs as a result of groundwater changes.

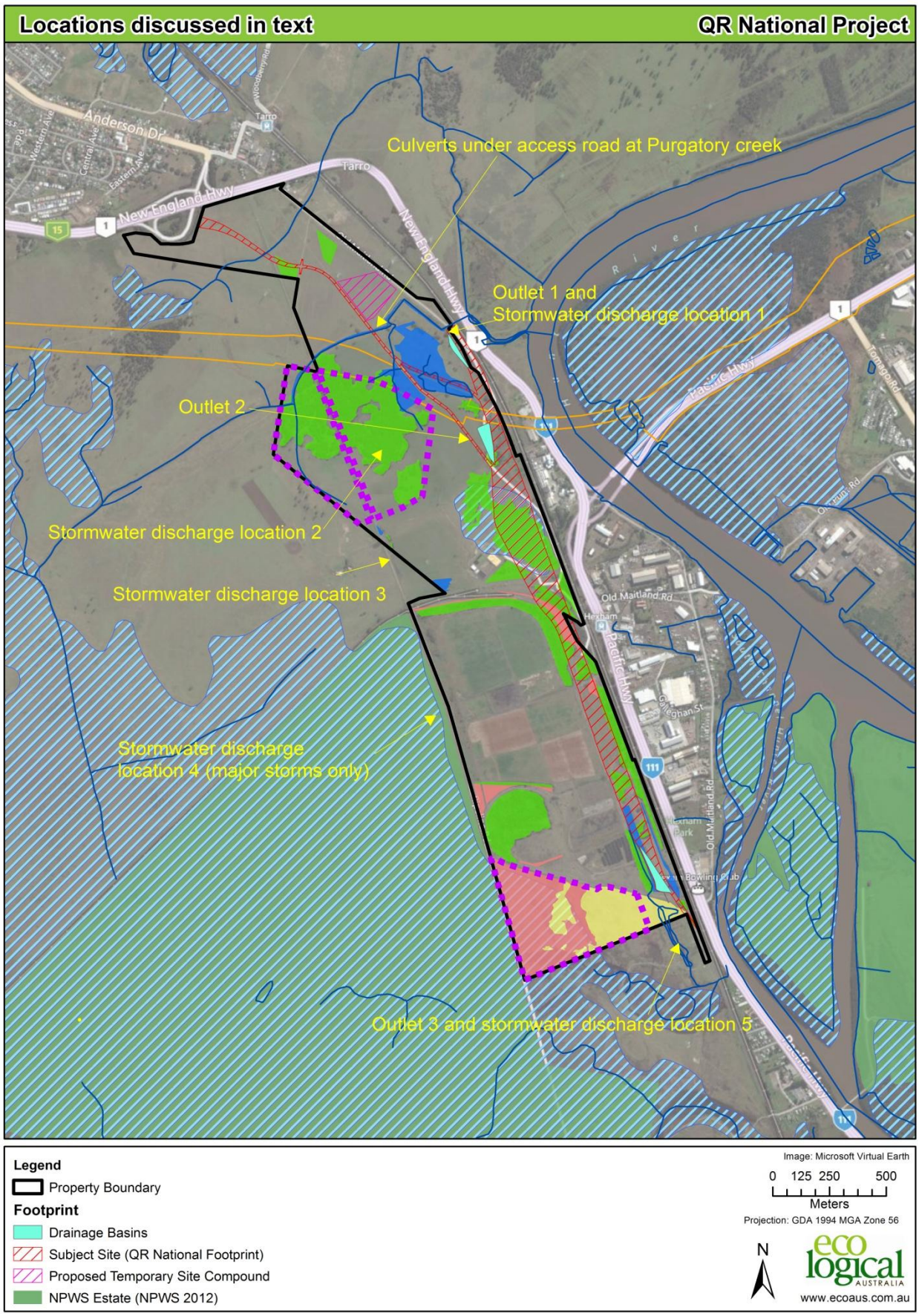

Figure 6 Locations discussed in hydrological assessment

6 Avoidance, Mitigation and Offsets

6.1 MEASURES TO AVOID IMPACT

Ecological survey was used to understand the environmental sensitivities of the site prior to design of the TSF and industrial estate. As a result, the TSF is located primarily on the disturbed part of the site and avoids the southern area which contains saltmarsh.

6.2 MITIGATIVE MEASURES

The following on-site practices are to be undertaken during the construction phase and will be contained within a Construction Environment Management Plan.

Table 8: Mitigation measures during the pre-construction, construction and operational phases of the Project

ITEM	MITIGATION MEASURE / ECOLOGICAL MANAGEMENT PROCEDURE	TIMING
1. Site-specific environmental induction	Ensure that all staff working on the Project undertake a site-specific environmental induction. The induction should include items such as: • Sensitivity of wetlands, particularly saltmarsh • Site environmental procedures (vegetation management, sediment and erosion control, protective fencing, noxious weeds) • What to do in case of emergency (sediment fence failure, injured fauna) • Key contacts in case of environmental emergency e.g. WIRES, Sydney Wildlife Rescue	Pre-construction and during construction for new staff
2. Identification of clearing limits	Accurately and clearly mark out the limits of clearing and trees/vegetation to be retained. Identify trees close to work areas which are at risk during construction and install protective fencing (temporary fluoro orange 'para-web' fencing or similar) to reduce risk of damage during the construction phases of the development. Do not store materials/vehicles under the drip-line (canopy) of retained vegetation.	Pre-construction
3. Pre clearing survey	Qualified ecologist to conduct pre-clearing surveys of: • hollow bearing trees • freshwater wetlands. Fauna at risk of injury are to be relocated to suitable habitat a safe distance from the proposed works by a qualified ecologist.	Pre and during construction
4. Clearing of vegetation	Where trees require felling, retain the timber, particularly sections with hollows - as Coarse Woody Debris for enhancement of the Northern Offset area Cease work immediately if any previously unknown threatened flora or fauna species are encountered. WIRES should be consulted if any injured fauna are encountered.	Construction
5. Management of erosion and	Provide appropriate controls to manage exposed soil surfaces and stockpiles to prevent erosion and subsequent sediment discharge into	Pre and during

ITEM	MITIGATION MEASURE / ECOLOGICAL MANAGEMENT PROCEDURE	TIMING
sediment control	surrounding wetlands. Clearly identify stockpile and storage locations and provide erosion and sediment controls around stockpiles. Stockpiles of topsoil to be stored in windrows no higher than 2m and be maintained free of weeds. Undertake dust suppression where required in accordance with the *Protection of the Environment Operations Act 1997* (POEO Act) where there is a risk of increased dust outside of acceptable levels	construction
6. Site office and plant storage	Ensure these areas are located in the nominated compound.	During construction
7. Weed Management	Establish and implement a Hygiene Protocol for vehicles entering and leaving the site to minimise spread of weeds and other biological risks such as alligator weed.	Pre, post and during construction
8. Monitoring	Develop a monitoring program during construction (including a weekly checklist) to ensure that all mitigation measures proposed have been undertaken. The checklist should include items such as fencing and sediment and erosion control.	Pre, during and post construction

6.3 OFFSET STRATEGY

The Director-General Requirements for this project required the ecological assessment to include consideration of o*ffsets for native vegetation clearance consistent with the improve or maintain principle.* This section describes the policy framework for offsets, the offset strategy proposed and an assessment of how the offset is consistent with the policy framework.

6.3.1 Policy framework

The NSW OEH have adopted *Principles for the use of Biodiversity Offsets in NSW*. A full list of the principles is provided in Appendix D.

OEH have also adopted the *Interim Policy on Assessing and Offsetting Biodiversity Impacts of Part 3A Developments* (DECCW 2010). The policy is designed to assist OEH in assessing the adequacy of an offset. To do so, the policy requires the use of the Biobanking Assessment Methodology to calculate the credits required to offset an impact and the credits generated by a proposed offset. The outcome of this assessment is described as meeting one of three outcomes (Table 9), with a Tier 1 being the preferred outcome. The policy notes that proposals assessed as State Significant projects do not have to meet the “improve or maintain” standard which is required under the Biobanking scheme as some projects will not be able to achieve “improve or maintain” but, due to their social or economic benefits, should proceed. The term ‘red flag’ in the table relates to certain communities or species that are ‘red flagged’ under the Biobanking Assessment Methodology. This means that the loss and

offset of this community or species cannot achieve an improve or maintain outcome. The term 'impacts fully offset' refers to an offset where the credit requirements are fully met.

Table 9: Interim Policy on Biodiversity Offsets for Part 3A

Tier 1 Outcome	No variation to offset type Red flags fully protected Impacts fully offset	Maintain or Improve
Tier 2 Outcome	No variation to offset type Red flags partially protected Impacts fully offset	No net loss
Tier 3 outcome	Variation applied to offset type Red flags partially protected Impacts partially offset	Mitigated net loss

6.3.2 Offset required

As described in Table 5, the project will impact on 10.64 hectares of native vegetation. The credits required to offset the impacts are described in Table 10, with the full Credit Report provided in Appendix F. The credits required are based on the biometric vegetation type being impacted and the habitat for threatened species that uses these communities.

Table 10 Credits required

Biometric Vegetation Type	Hectares of impact	Credits required to offset impacts of clearing
Coastal floodplain sedgelands, rushlands, and forblands of the North Coast	1.49	13
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	1.23	17
Saltmarsh in estuaries of the Sydney Basin and South East Corner	0	0
Swamp Oak swamp forest fringing estuaries, Sydney Basin	7.92	231
Total	**10.64**	**261**

6.3.3 Proposed Offset

QR National have committed to the protection and management of 53.63 hectares of native vegetation and habitat on-site. Figure 7 and Figure 8 indicates the lands proposed for offset.

Description of vegetation communities

The Northern Offset (Figure 7) is dominated by *Casuarina glauca* (Swamp Oak), with occasional *Melaleuca styphelioides* (Prickly-leaved Tea Tree) also observed. The vegetation contains over 600 hollow-bearing trees, although most of these hollows are less than 8cm. The shrub layer is absent and the dense ground layer is dominated by native and exotic grasses and herbs, including *Aster subulatus* (Wild Aster), *Atriplex prostrata, Cirsium vulgare* (Spear Thistle), *Cynodon dactylon* (Common Couch), *Pennisetum clandestinum* (Kikuyu) and *Persicaria lapathifolia* (Pale Knotweed). The area is also heavily grazed. Weed treatment and stock management will therefore be an important management requirement. The Northern offset also contains an area that is currently clear and will require re-establishment of native vegetation to return it to swamp oak swamp forest.

The southern offset area (Figure 8) is a combination of saltmarsh and *Phragmites australis* and *Typha orientalis* coastal freshwater wetland. These communities were also subject to stock grazing and weed infestation and will therefore require management actions addressing these issues in particular.

Management

Management of the offset sites will be undertaken in accordance with a Conservation Management Plan that will address standard management actions such as weed management, feral animal control, management of retained vegetation, fire management, buffer zones, management of edge effects, management of hydrological changes, habitat enhancement (eg; for green and golden bell frog) rehabilitation measures, and monitoring. Of particular relevance for these two sites will be weed management and stock management.

The Conservation Management Plan is to be prepared following confirmation with OEH that the site is suitable for a Conservation Agreement (discussed below). The Northern Offset area will not include the Hunter Water pipeline that runs north-south through the site. The pipeline is on land owned by Hunter Water and is a separate lot to the offset. Access to maintain the pipeline or any other infrastructure will not be inhibited by the Conservation Management Plan.

Security

To meet the NSW Principles for Offsetting, the mechanism or instrument should provide certainty in the long term – ie, it should 'run with the land' regardless of ownership and should require management in accordance with pre-determined actions. It is also important however to recognise the circumstances of the site and the flexibility that may be required for future state infrastructure such as the proposed extension to the F3. The RMS has released a concept design for the F3 extension which indicates a preferred route passing through the QR National site. The proposed offset area avoids the land required for the route.

There are several options available for long term security of offsets:

- Property Vegetation Plans under the NSW Native Vegetation Act 2003
- Biobanking Agreements under the NSW Threatened Species Conservation Act 1995
- Covenants under the NSW Conveyancing Act 1919

- Conservation Agreements under the NSW National Parks and Wildlife Act 1974
- Trust Agreements under the NSW Nature Conservation Trust Act 2001
- Planning Agreement under the NSW EP&A Act 1979

QR National propose to utilise a Conservation Agreement (NP&W Act 1974). Preliminary discussions with the Office of Environment and Heritage have occurred, with OEH advising that a Conservation Agreement under the NPW Act 1974 is considered an appropriate mechanism for conserving land in perpetuity and is one of OEHs preferred methods (see Appendix G for correspondence). Conservation Agreements are legally binding and are specifically designed for conservation management. Conservation Agreements typically take 6-12 months to establish. During this time the Conservation Management Plan will be prepared. If a Conservation Agreement is not deemed a suitable approach, QR National will discuss alternative arrangements with the consent authority.

Credits generated

The Biobanking Assessment Methodology has been used to calculate the credits generated by the proposal. These are contained in the Table 11.

Table 11 Credits generated by Offsets

	Northern Offset		Southern Offset		Combined	
Vegetation Type	**Ha**	**Credits generated**	**Ha**	**Credits generated**	**Ha**	**Credits generated**
Coastal floodplain sedgelands, rushlands, and forbs	0.61	4	-	-	0.61	4
Swamp Oak swamp forest fringing estuaries, Sydney	18.1	139	-	-	18.1	139
Swamp Oak swamp forest fringing estuaries, Sydney – to be rehabilitated	14.6	97	-	-	14.6	97
Phragmites australis and Typha orientalis coastal			12.8	119	12.8	119
Saltmarsh in estuaries of the Sydney Basin			7.52	72	7.52	72
Total	**33.31**	240	20.32	191	**53.63**	**431**

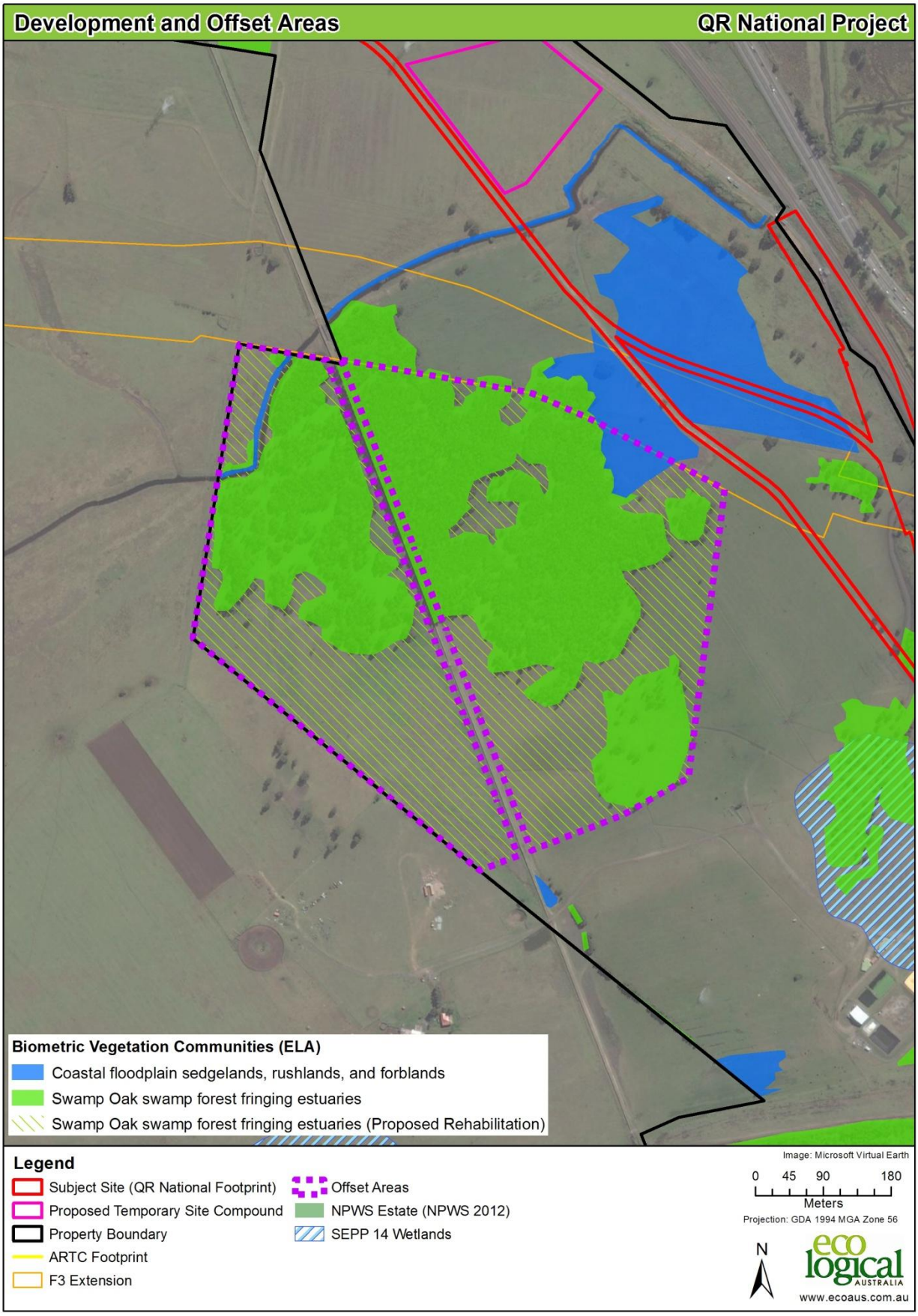

Figure 7: Northern Offset Area

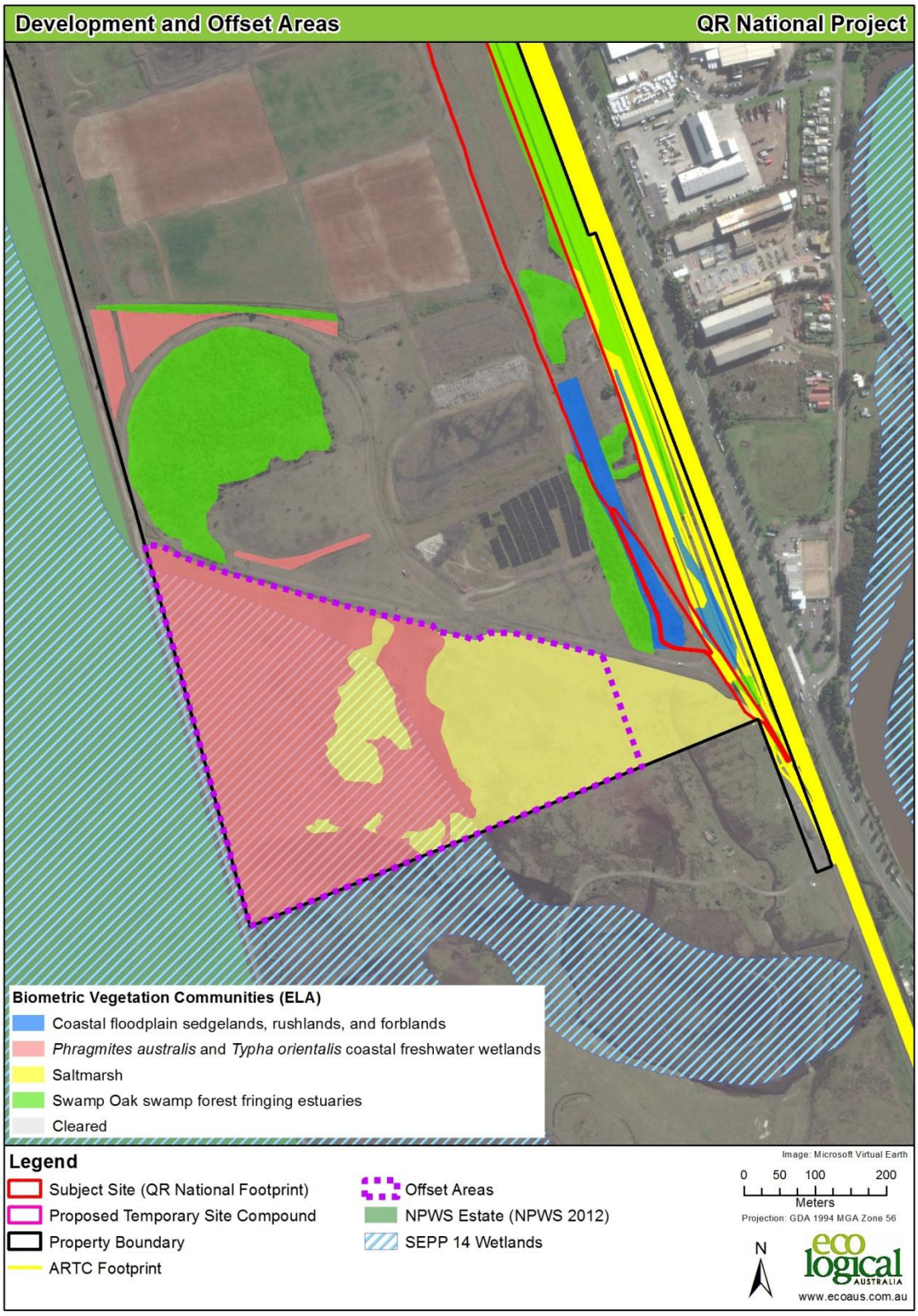

Figure 8 Southern Offset Area

6.3.4 Evaluation of Offset Strategy

An evaluation of the impacts and offsets has been undertaken using the Biobanking Assessment Methodology (DECC 2008). Table 12 provides a summary of credits required to offset the loss of native vegetation as well as the number of credits generated by the proposed offsets. The outcome is that credit requirements are met for three out of the four biometric vegetation communities, with an over-all credit surplus of 170. The only community to be in deficit is the Coastal floodplain sedgelands, rushlands and forblands, which is 9 credits short. In terms of the *OEH Interim Policy on Assessing Impacts and Offsets of Part 3A Development*, achieving an "improve or maintain" outcome by the project is not possible as red-flagged EECs are being impacted. A Tier 2 outcome for three out of four communities is achieved and a Tier 3 outcome is achieved for the Coastal floodplain sedgelands community.

The offsets are also consistent with the OEH Principles for Offsetting as described in Table 13. In conclusion the Offset Strategy represents a very positive outcome.

Table 12: Credit Balance

Vegetation type	Credits required to offset impacts of clearing	Credits created by on-site conservation management	Balance
Coastal floodplain sedgelands, rushlands, and forblands of the North Coast	13	4	Deficit of 9
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	17	119	Surplus of 102
Saltmarsh in estuaries of the Sydney Basin and South East Corner	0	72	Surplus of 72
Swamp Oak swamp forest fringing estuaries, Sydney Basin	231	236	Surplus of 5
Total	**261**	**431**	**Surplus of 170**

Table 13 Comparison to OEH Offsetting Principles

Impacts must avoided first by using prevention and mitigation measures	The TSF project undertook avoidance where possible and has proposed mitigation measures.
All regulatory requirements must be met	The project is to be assessed under Part 3A of the EP&A Act and will therefore meet regulatory requirements.
Offsets must never reward ongoing poor performance	QR National does not have a record of poor performance.

Offsets should complement other government programs	The two offset sites are within the Hexham Swamp area which has been subject to significant rehabilitation funding over the past decade. The protection and management of 50 hectares will complement this program.
Offsets must be underpinned by sound ecological principles	The offsets will provide for in-situ conservation and will be undertaken in accordance with a Conservation Management Plan
Offsets should aim to result in a net improvement in biodiversity over time	Offsets will deliver an over-all credit surplus and will be managed in accordance with a management plan so that biodiversity values are improved over time.
Offsets must be enduring and they must offset the impact of the development for the period that the impact occurs	Offsets will be secured via a Conservation Agreement under the NP&W Act or similar.
Offsets should be agreed prior to the impact occurring	Offsets are proposed as part of the Environmental Assessment.
Offsets must be quantifiable and the benefits reliably estimated	The offsets have been calculated in line with the Biobanking assessment method.
Offsets must be targeted	Offsets targeted Swamp Oak Forest and Phragmites Australis communities to the maximum extent possible on the site.
Offsets must be appropriately located	Offsets are located on the same site as the development.
Offsets must be supplementary	No management obligations for these communities currently exist on the site.
Offsets and their actions must be enforceable through development consent conditions, license conditions, conservation agreements or a contract.	A Conservation Agreement under the NP&W Act is proposed.

7 Conclusion

This report documents the results of flora and fauna surveys, including previous investigations that have been completed for the QR National Train Support Facility at Hexham, NSW. Surveys were completed in 2007 and 2008 by EcoBiological (2008) and EcoHub (2009), with Eco Logical Australia undertaking supplementary surveys in January and February 2011. The combined efforts of survey are considered adequate and have been adapted from the Threatened Biodiversity and Assessment Guidelines (DEC 2004).

Three EEC's occur in the study area: *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions; Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*; and *Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions.*

No threatened flora species were recorded within the study area, though *Zannichellia palustris* was considered a potential occurrence.

Eleven threatened fauna species were recorded within the study area and an additional 4 threatened fauna species were considered likely to occur. Six Migratory species listed under the EPBC Act are also considered likely to occur.

The majority of the area proposed to be affected on the site comprises cleared/disturbed land or rehabilitation, containing both native and non-endemic species. However, there will be an impact to approximately 10.48 hectares of native vegetation, 7.45 hectares of which is considered to be endangered ecological community. These losses are caused by direct impact of clearing. The magnitude of this impact on has been assessed in Appendix C, with the result being that no threatened species or communities are considered likely to be significantly affected by the proposal.

Indirect impacts such as changes to hydrological regimes were also assessed, however surface and groundwater analysis indicates that there will be only very minor changes away from the areas being filled for development and therefore it is not expected that there will be changes to the remaining GDEs.

A Biobanking Assessment on the proposed development and proposed offset lands was completed to determine if sufficient credits would be generated on the offset lands to achieve the 'improve or maintain' outcome according to the Methodology. The proposal will achieve a *no net loss* outcome for three of the four communities, with a mitigated loss for Coastal floodplain sedgelands, rushlands, and forblands of the North Coast. Overall, the offset will deliver a surplus of 170 credits.

Statutory considerations that have been addressed include impacts on SEPP14 Coastal Wetland with approximately 5.71 ha of degraded SEPP14 wetland being directly affected.

A referral of the project under the EPBC Act has been made, and has been determined by SEWPaC to not be a controlled action.

In conclusion, whilst the project will have ecological impacts, those impacts are to disturbed vegetation and habitat. The provision of an on-site conservation outcome more than adequately mitigates this impact.

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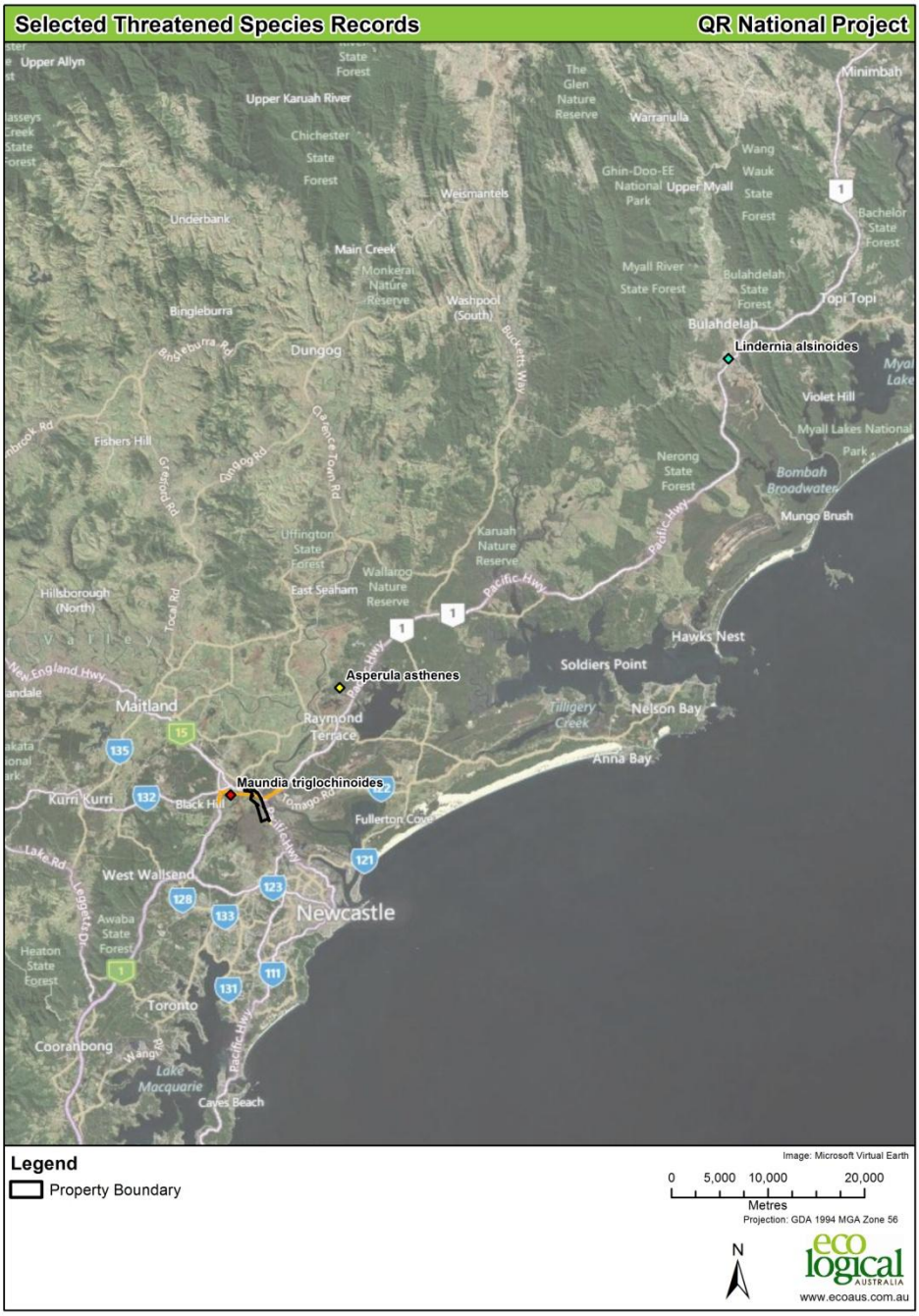
Appendix A: Threatened Flora and Fauna Likelihood of Occurrence



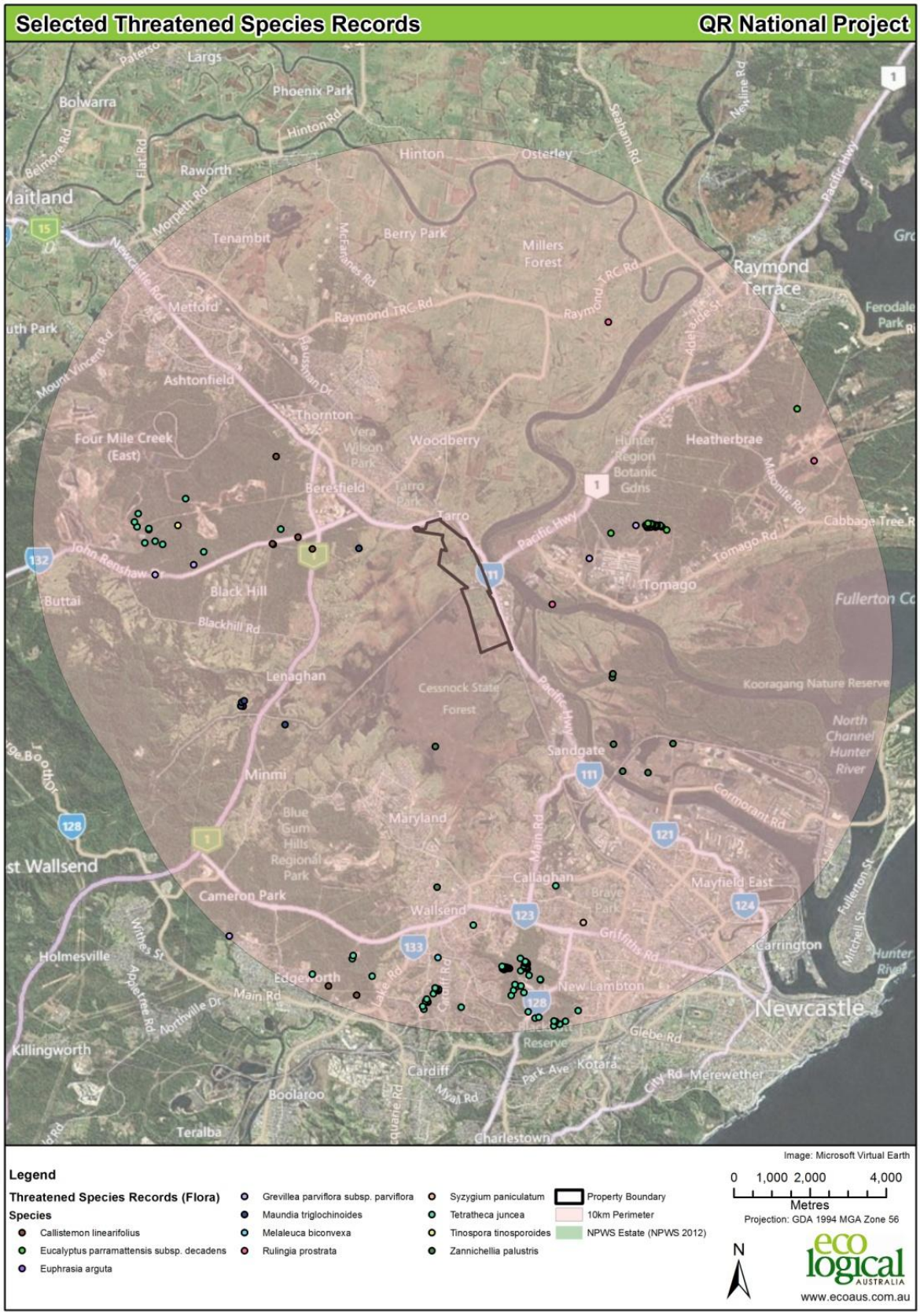


Figure 9: Threatened flora species recorded within 10km of the study area and a figure showing the nearest records of *Lindernia alsinoides* and *Asperula asthenes*.

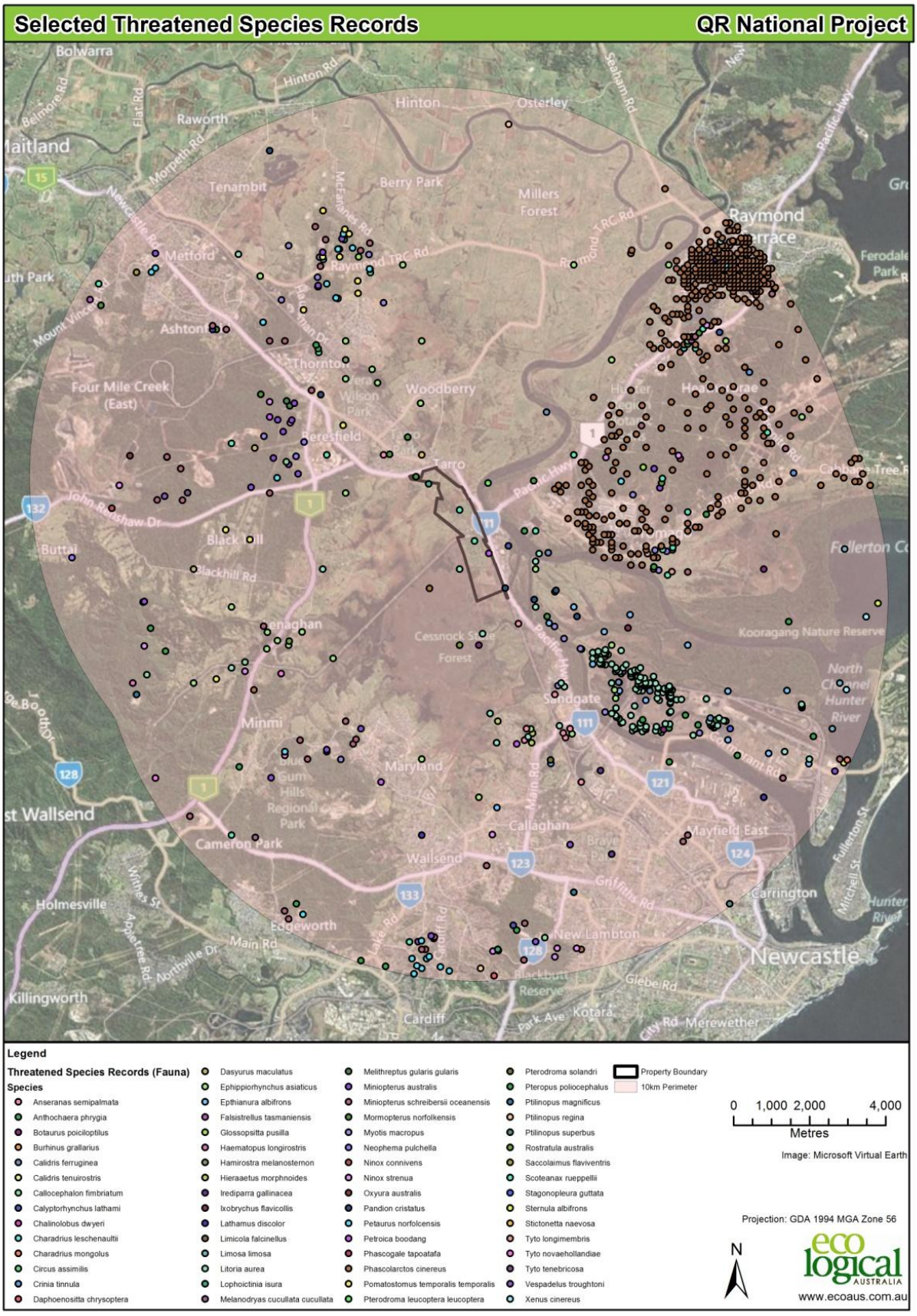


Figure 10: Threatened fauna species recorded within 10kmof the study area.

An assessment of likelihood of occurrence was made for threatened flora species identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- "yes" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the site
- "no" = habitat on site and in the vicinity is unsuitable for the species.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Allocasuarina defungens	Dwarf Heath She-oak	E	E	Found only in NSW from the Nabiac area, north-west of Forster, to Byron Bay on the NSW north coast (DECC 2007). *A. defungens* is a straggly oak about 2m high with blue-green foliage found in heath on sand (sometimes clay and sandstone soils), and swamp sclerophyll forest margins (DECC 2007). The species also extends onto exposed nearby-coastal hills or headlands adjacent to sandplains (DECC 2007).	No
Asperula asthenes	Trailing Woodruff	V	V	Asperula asthenes occurs only in NSW, in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens/Wallis Lakes area (DEC 2005). It grows in damp sites often along river banks (Harden 1993).	Unlikely. The site has had a long history of disturbance and there are no nearby records.
Callistemon linearifolius	Netted Bottlebrush	V	-	Grows in dry sclerophyll forest on the coast and adjacent ranges (DECC 2007). *C. linearifolius* has been recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River (DECC 2007).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Cryptostylis hunteriana	*Leafless Tongue Orchid*	V	V	It is known from a range of vegetation communities including swamp-heath and woodland (DECC 2007). The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); where it appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*) (DECC 2007). Bell (2001) has identified Coastal Plains Scribbly Gum Woodland and Coastal Plains Smoothed-barked Apple Woodland as potential habitat on the Central Coast. Flowers between November and February, although may not flower regularly (DECC 2007; Bell 2001).	Unlikely
Eucalyptus parramattensis spp. decadens	Drooping Red Gum	V	V	There are two separate meta-populations of Drooping Red Gum. The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Abedare in the south (DECC 2007). Large aggregations of the sub-species are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south (DECC 2007). Drooping Red Gum generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high (DECC 2007). It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland (DECC 2007). Often where this species occurs, it is a community dominant. Flowers from November to January.(DECC 2007).	No
Grevillea parviflora subsp. parviflora	Small Flower Grevillea	V	V	Occurs on sandy clay loam soils, often with lateritic ironstone gravels (DECC 2007). Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine-grained sandstones. Soil landscapes include Lucas Heights and Berkshire Park (DECC 2007). Often occurs in open, slightly disturbed sites such as along tracks. Flowering has been recorded between July to December as well as April-May (DECC 2007).	No
Lindernia alsinoides	Noah's False Chickweed	E	-	Lindernia alsinoides occurs north from Bulahdelah, including Shannon Creek, near Grafton, where it grows in damp paperbark swamp with Melaleuca alternifolia and Melaleuca quinquenervia (DEC 2005).	Unlikely. The site has had a long history of disturbance and there are no nearby records

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Maundia triglochinoides	*Maundia triglochinoides*	V	-	Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct (DEC 2005). Maundia triglochinoides is an aquatic herbaceous plant found in swamps or shallow fresh water on heavy clay on the north and central NSW coast.	Unlikely and not found despite searches at the appropriate time of year.
Melaleuca biconvexa	Biconvex Paperbark	V	V	Associated with damp habitats, such as Coastal Narrabeen Moist Forest, Riparian Melaleuca Swamp Woodland (LMCC 2001). This species may occur in dense stands forming a narrow strip adjacent to watercourses, in association with other *Melaleuca* species or as an understorey species in wet forest (NSW Scientific Committee 1998). Flowering occurs over just 3-4 weeks in September and October (DECC 2007).	No
Persicaria elatior	Tall Knotweed	V	V	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance (DECC 2007).	No
Pterostylis gibbosa	Illawarra Greenhood	E	E	Associated with seasonally hard setting clay soils with approximately 1000mm of rainfall (NPWS 1997). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum *Eucalyptus tereticornis*, Wollybutt *E. longifolia* and White Feather Honey-myrtle *Melaleuca decora*. Near Nowra, the species grows in an open forest of Spotted Gum *Corymbia maculata*, Forest Red Gum and Grey Ironbark *E. paniculata*. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark *E. crebra*, Forest Red Gum and Black Cypress Pine *Callitris endlicheri.* The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber in late summer, followed by the flower stem in winter and flowers in spring.	Unlikely
Rulingia prostrata	Dwarf Kerrawang	E	E	Occurs on sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum (*Eucalyptus pauciflora*) Woodland at Rose Lagoon; Blue leaved Stringybark (*E. agglomerata*) Open Forest at Tallong; and in Brittle Gum (*E. mannifera*) Low Open Woodland at Penrose; Scribbly Gum (*E. haemostoma*)/ Swamp Mahogany (*E. robusta*) Ecotonal Forest at Tomago (DECC 2007). Associated native species may include *Imperata cylindrica*, *Empodisma minus* and *Leptospermum continentale* (*ibid*). Appears to respond positively to some forms of disturbance (eg. some Victorian records are from gravel road surfaces and the Tomago population is on an area previously subject to sandmining); however, there are conflicting reports about the response of the species to fire (*ibid*).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Tetratheca juncea	Black-eyed Susan	V	V	Occurs on predominantly low nutrient soils with a dense grassy understorey of grasses although it has been recorded in heathland and moist forest (DECC 2007). It is associated with dry open forest or woodland habitats dominated by Corymbia gummifera, E. capitellata, E. haemastoma and Angophora costata (Payne 1993). Themeda australis is generally the dominant ground cover (Payne 1993). T. juncea also displays a preference for southern aspect slopes, although is slopes with different aspects (DECC 2007). Flowers July to December.	Unlikely
Zannichellia palustris		E	—	*Zannichellia palustris* inhabits shallow, still to slowly moving, waterbodies which contain either fresh or brackish waters (NSW Fisheries 2002, Greenwood 2001). The species appears to prefer ephemeral habitats which dry out completely. Winning (1992) suggests the species prefers fresh to brackish water adjacent to tidal estuaries, as both known populations occurred in previously estuarine areas which had been separated from tidal flows by control structures.	Potential
FROGS					
Litoria aurea	Green and Golden Bell Frog	E	V	This species has been observed utilising a variety of natural and man-made waterbodies (Pyke & White 1996) such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water (DECC 2007). Fast flowing streams are not utilised for breeding purposes by this species (Mahony 1999). Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading (DECC 2007). Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–Typha sp. and spikerushes–Eleocharis sp.) adjacent to open grassland areas for foraging are preferable (Ehmann 1997; Robinson 1993). Ponds that are typically inhabited tend to be free from predatory fish such as Mosquito Fish *(Gambusia holbrooki)* (DECC 2007).	Potential

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Litoria littlejohni	Littlejohn's Tree Frog, Heath Frog	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 (DECC 2007). It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. I t appears to be restricted to sandstone woodland and heath communities at mid to high altitude (NSW Scientific Committee 2000). It forages both in the tree canopy and on the ground, and it has been observed sheltering under rocks on high exposed ridges during summer (NSW Scientific Committee 2000). It hunts 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. Eggs and tadpoles are mostly found in slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools (DECC 2007).	Unlikely
Mixophyes balbus	Stuttering Frog	E	V	A variety of forest habitats from rainforest through wet and moist sclerophyll forest to riparian habitat in dry sclerophyll forest (DECC 2007) that are generally characterised by deep leaf litter or thick cover from understorey vegetation (Ehmann 1997). Breeding habitats are streams and occasionally springs. Not known from streams disturbed by humans (Ehmann 1997) or still water environments (NSW Scientific Committee 2002).	Unlikely
Mixophyes iteratus	Giant Barred Frog	E	E	Found on forested slopes of the escarpment and adjacent ranges in riparian vegetation, subtropical and dry rainforest, wet sclerophyll forests and swamp sclerophyll forest (DECC 2007; Ehmann 1997). This species is associated with flowing streams with high water quality, though habitats may contain weed species (Ehmann 1997). This species is not known from riparian vegetation disturbed by humans (NSW Scientific Committee 1999). During breeding eggs are kicked up onto an overhanging bank or the streams edge (DECC 2007).	Unlikely
DIURNAL BIRDS					
Anthochaera Phrygia (aka Xanthomyza phrygia)	Regent Honeyeater	E	E & M	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*) (Garnett 1993). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised (NPWS 1997). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Anseranas semipalmata	Magpie Goose	V	M	Activities centred on terrestrial sedge-dominated wetlands; mainly those on floodplains of rivers (Marchant & Higgins 1993; Simpson & Day 1999).	Yes. Recorded on site by EcoHub(2009)
Botaurus poiciloptilus	Australasian Bittern	V	-	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats (Marchant & Higgins 1993). Reedbeds, swamps, streams, estuaries (Simpson & Day 1999).	Yes. Recorded on site by EcoHub(2009)
Calidris ternuirostris	Great Knot	V	-	Sheltered coastal habitats containing large intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons (DECC 2007). Often recorded on sandy beaches with mudflats nearby, sandy spits and inlets, or exposed reefs or rock platforms (Morris 1989; Higgins & Davies 1996).	Unlikely
Callocephalon fimbriatum	Gang-gang Cockatoo	V-E2	-	During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands (Morcombe 2004). In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages (Shields & Chrome 1992). They sometimes inhabit woodland, farms and suburbs in autumn/winter (Simpson & Day 2004).	Unlikely
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils (Environment Australia 2000; NPWS 1997; DECC 2007). Intact drier forest types with less rugged landscapes are preferred (DECC 2007). Nests in large trees with large hollows (Environment Australia 2000).	Unlikely
Charadrius leschenaultii	Greater Sand Plover	V	-	Entirely coastal in NSW, foraging on intertidal sand and mudflats in estuaries, roosting during high tide on sandy beaches or rocky shores (DECC 2007)	Unlikely
Charadrius mongolus	Lesser Sand Plover	V	M	Favours coastal areas including beaches, mudflats and mangroves where they forage (DECC 2007). They may be seen roosting during high tide on sandy beaches or rocky shores (DECC 2007).	Unlikely
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands floodplains (Marchant & Higgins 1993). Forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland, mangroves, mudflats, shallow swamps with short emergent vegetation and permanent billabongs and pools on floodplains (Marchant & Higgins 1993; DECC 2007).	Some marginal potential

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Haematopus longirostris	Pied Oystercatcher	V	-	Roosts and forages on sandy beaches, sand banks, mudflats and estuaries (Marchant & Higgins 1993, Simpson & Day 1999).	Unlikely
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Open forests, riverine woodlands, scrubs and heathlands (Simpson and Day 1999).	Unlikely
Irediparra gallinacea	Comb-crested Jacana	V	-	Freshwater wetlands, such as lagoons, billabongs, swamps, lakes and reservoirs, generally with abundant floating aquatic vegetation (Marchant and Higgins 1999).	Unlikely
Ixobrychus flavicollis	Black Bittern	V	-	Occurs in both terrestrial and estuarine wetlands generally in areas of permanent water and dense vegetation (DECC 2007). In areas with permanent water it may occur in flooded grassland, forest, woodland, rainforest and mangroves (DECC 2007).	Unlikely
Lathamus discolor	Swift Parrot	E	E	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts (Blakers et al. 1984; Schodde and Tidemann 1986; Forshaw and Cooper 1981). Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (DECC 2007).	Unlikely
Limicola falcinellus	Broad-billed Sandpiper	V	M	The eastern form of the Broad-billed Sandpiper breeds in northern Siberia before migrating southwards in winter to Australia (DECC 2007). In Australia, Broad-billed Sandpipers over-winter on the northern coast, particularly in the north-west, with birds located occasionally on the southern coast (DECC 2007). In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary (DECC 2007). There are few records for inland NSW (DECC 2007). Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat (DECC 2007). Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons (DECC 2007). Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches.	Unlikely
Limosa limosa	Black-tailed Godwit	V	-	Primarily found along the coast on sandspits, lagoons and mudflats (DECC 2007). The species has also been found to occur inland on mudflats or shallow receding waters of portions of large muddy swamps or lakes (Pizzey and Knight 1997; Higgins & Davies 1996).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Hieraaetus morphnoides	Little Eagle	V	-	The Little Eagle is widespread in mainland Australia, central and eastern New Guinea. The Little Eagle is seen over woodland and forested lands and open country, extending into the arid zone. It tends to avoid rainforest and heavy forest (BIB, 2006).	Yes. Recorded on site.
Lophoictinia isura	Square-tailed Kite	V	-	In coastal areas associated tropical and temperate forests and woodlands on fertile soils with an abundance of passerine birds (Marchant & Higgins 1993, DECC 2007). May be recorded inland along timbered watercourses (DECC 2007). In NSW it is commonly associated with ridge or gully forests dominated by Woollybutt (*Eucalyptus logifloria*), Spotted Gum (*E. maculata*), or Peppermint Gum (*E. elata, E. smithii*) (DECC 2007).	Unlikely
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Predominantly associated with box-ironbark association woodlands and River Red Gum (NSW Scientific Committee, 2001). Also associated with drier coastal woodlands of the Cumberland Plain and the Hunter, Richmond and Clarence Valleys (NSW Scientific Committee, 2001).	Unlikely
Neophema pulchella	Turquoise Parrot	V	-	Steep rocky ridges and gullies, rolling hills, valleys and river flats and the plains of the Great Dividing Range compromise the topography inhabited by this species (Marchant & Higgins 1993). Spends much of the time on the ground foraging on seed and grasses (DECC 2007). It is associated with coastal scrubland, open forest and timbered grassland, especially low shrub ecotones between dry hardwood forests and grasslands with high proportion of native grasses and forbs (Environment Australia 2000).	Unlikely
Oxyura australis	Blue-billed Duck	V	-	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation (DECC 2007). The species is completely aquatic, swimming low in the water along the edge of dense cover (DECC 2007). It will fly if disturbed, but prefers to dive if approached (DECC 2007). Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and over-wintering lakes with some long-distance dispersal to breed during spring and early summer (DECC 2007). Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes (DECC 2007).	Unlikely
Pandion haliaetus	Osprey	V	-	Associated with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Schodde and Tidemann 1986; Clancy 1991; Olsen 1995). Osprey may nest on the ground, on sea cliffs or in trees (Olsen 1995). Osprey generally prefer emergent trees, often dead or partly dead with a broken off crown (Olsen 1995).	Unlikely
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Open woodlands dominated by mature eucalypts with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs (NSW Scientific Committee 2001). This species avoids very wet areas (Blakers et al. 1984).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Pterodroma leucoptera leucoptera	Gould's Petrel	V	-	Marine	Unlikely
Pterodroma solandri	Providence Petrel	V	-	Marine	Unlikely
Ptilinopus magnificus	Wompoo Fruit-Dove	V	-	Associated with large, undisturbed patches of tall tropical or subtropical rainforest, at all altitudes, preferably with a diversity of fruit (Marchant and Higgins 1999; DECC 2007). Occasionally located in patches of monsoon rainforest, closed gallery forest, wet sclerophyll forest, tall open forest, open woodland or vine thickets near rainforest (Marchant and Higgins 1999; DECC 2007).	Unlikely
Ptilinopus superbus	Superb Fruit-Dove	V	-	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms (DECC 2007). It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees (ibid.). Part of the population is migratory or nomadic (ibid.). At least some of the population, particularly young birds, moves south through Sydney, especially in autumn (ibid.). Breeding takes place from September to January (ibid.). Will feed in adjacent mangroves or eucalypt forests (Blakers et al. 1984).	Unlikely
Rostratula australis (a.k.a. R. benghalensis)	Painted Snipe (Australian subspecies)	E	V	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DECC 2007). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (ibid.). Breeding is often in response to local conditions; generally occurs from September to December (DECC 2007). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (DECC 2007). Feeds on worms, molluscs, insects and some plant-matter (ibid.).	Potential
Stagonopleura guttata	Diamond Firetail	V	-	Typically found in grassy eucalypt woodlands, but also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities (DECC 2007). It is often found in riparian areas and sometimes in lightly wooded farmland (DECC 2007). Appears to be sedentary, though some populations move locally, especially those in the south (DECC 2007).	Unlikely
Sterna albifrons	Little Tern	E	-	Almost exclusively coastal, preferring sheltered areas (DECC 2007), however may occur several kilometres inland in harbours, inlets and rivers (Smith 1990). Australian birds breed on sandy beaches and sand spits (Simpson & Day 1999).	Unlikely
Stictonetta naevosa	Freckled Duck	V	-	Associated with a variety of plankton-rich wetlands, such as heavily vegetated, large open lakes and their shores, creeks, farm dams, sewerage ponds and floodwaters (DECC 2007).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Xanthomyza phrygia	Regent Honeyeater	E	E, M	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*) (Garnett 1993). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised (NPWS 1997). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000).	Unlikely
Xenus cinereus	Terek Sandpiper	V	M	A rare migrant to the eastern and southern Australian coasts, being most common in northern Australia, and extending its distribution south to the NSW coast in the east (DECC 2007). The two main sites for the species in NSW are the Richmond River estuary and the Hunter River estuary (DECC 2007). In Australia, has been recorded on coastal mudflats, lagoons, creeks and estuaries (DECC 2007). Favours mudbanks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs, and occasionally up to 10 km inland around brackish pools (DECC 2007). Generally roosts communally amongst mangroves on dead trees, often with related wader species (DECC 2007).	Unlikely
NOCTURNAL BIRDS					
Ninox connivens	Barking Owl	V	-	Associated with a variety of habitats such as savanna woodland, open eucalypt forests, wetland and riverine forest. The habitat is typically dominated by Eucalypts (often Redgum species), however often dominated by Melaleuca species in the tropics (DECC 2007). It usually roosts in dense foliage in large trees such as River She-oak (*Allocasuarina cunninghamiana*), other Casuarina and Allocasuarina, eucalypts, Angophora, Acacia and rainforest species from streamside gallery forests (NPWS 2003). It usually nests near watercourses or wetlands (NPWS 2003) in large tree hollows with entrances averaging 2-29 metres above ground, depending on the forest or woodland structure and the canopy height (Debus 1997).	Unlikely
Ninox strenua	Powerful Owl	V	-	Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Tyto novaehollandiae	Masked Owl	V	-	Associated with forest with sparse, open, understorey, typically dry sclerophyll forest and woodland (DECC 2007) and especially the ecotone between wet and dry forest, and non forest habitat (Environment Australia 2000). Known to utilise forest margins and isolated stands of trees within agricultural land (Hyem 1979) and heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained (Kavanagh & Peake 1993).	Unlikely
Tyto capensis	Grass Owl	V	—	Reported habitats include tall grass, swampy, sometimes tidal areas, mangrove fringes, grassy plains, coastal heaths, grassy woodland, cane grass, lignum, sedges, cumbungi, cane fields and grain stubble (Pizzey and Knight, 1997). The Grass Owl nests on the ground within dense tall grass, sedges, reeds and even sugarcane plantations (Pizzey and Knight, 1997). The Grass Owl primarily feeds on rodents, hunting on the wing over heathland, grassland and sedgeland, as well as along the edge of sugar cane, crops and pastureland (Pizzey and Knight, 1997).	Yes. Recorded on site.
Tyto tenebricosa	Sooty Owl	V	-	Sooty Owls are associated with tall wet old growth forest on fertile soil with a dense understorey and emergent tall Eucalyptus species (Environment Australia 2000, Debus 1994). Pairs roost in the daytime amongst dense vegetation, in tree hollows and sometimes in caves. The Sooty Owl is typically associated with an abundant and diverse supply of prey items and a selection of large tree hollows (Debus 1994, Garnett 1993, Hyem 1979).	Unlikely
MAMMALS (EXCLUDING BATS)					
Dasyurus maculatus *Dasyurus maculatus maculatus*	Spotted-tailed Quoll Spotted-tailed Quoll (SE Mainland Population)	V -	- E	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests (Mansergh 1984; DECC 2007j), more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in (DECC 2007). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (Environment Australia 2000).	Unlikely
Petaurus norfolcensis	Squirrel Glider	V	-	Associated with dry hardwood forest and woodlands (Menkhorst et al. 1988; Quin 1995). Habitats typically include gum barked and high nectar producing species, including winter flower species (Menkhorst et al. 1988). The presence of hollow bearing eucalypts is a critical habitat value (Quin 1995).	Unlikely
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (Strahan 1995).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	Preferred habitat is Dry Open forest with a sparse open understorey, however, has been located in heath, swamps and rainforest and wet sclerophyll forest (DECC 2007).	Unlikely
Phascolarctos cinereus	Koala	V	V	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70% (Reed et al. 1990), with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis	Unlikely
Potorous tridactylus *Potorous tridactylus tridactylus*	Long-nosed Potoroo Long-nosed Potoroo (SE Mainland Population)	V -	- V	Associated with dry coastal heath and dry and wet sclerophyll forests (Strahan 1998) with dense cover for shelter and adjacent more open areas for foraging (Menkhorst & Knight 2004).	Unlikely
Pseudomys novaehollandiae	New Holland Mouse	-	V	Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. The home range of the New Holland Mouse can range from 0.44 ha to 1.4 ha (TSSC, 2010).	Unlikely
MAMMALS (BATS)					
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (Churchill 1998; DECC 2007). This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; DECC 2007).	Potential
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Prefers moist habitats with trees taller than 20m (DECC 2007). Roosts in tree hollows but has also been found roosting in buildings or under loose bark (DECC 2007).	Yes. Recorded on site.
Miniopterus australis	Little Bent-wing Bat	V	-	Prefers well-timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests (Churchill 1998). This species shelter in a range of structures including culverts, drains, mines and caves (Environment Australia 2000). Relatively large areas of dense vegetation of either wet sclerophyll forest, rainforest or dense coastal banksia scrub are usually found adjacent to caves in which this species is found (DECC 2007). Breeding occurs in caves, usually in association with M. schreibersii (Environment Australia 2000, DECC 2007).	Yes. Recorded on site.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (AMBS 1995, Dwyer 1995, Dwyer 1981). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995).	Potential
Mormopterus norfolkensis	East Coast Freetail Bat	V	-	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range (Churchill 1998). Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges (Environment Australia 2000; Allison & Hoye 1998). Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (Environment Australia 2000; Allison & Hoye 1998).	Yes. Recorded on site.
Myotis adversus	Large-footed Myotis	V	-	Will occupy most habitat types such as mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River Red Gum woodland, as long as they are close to water (Churchill 1998). While roosting is most commonly associated with caves, this species has been observed to roost in tree hollows, amongst vegetation, in clumps of Pandanus, under bridges, in mines, tunnels and stormwater drains (Churchill 1998). However the species apparently has specific roost requirements, and only a small percentage of available caves, mines, tunnels and culverts are used (Richards 1998).	Yes. Recorded on site.
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998).	Yes. Recorded on site.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Found in almost all habitats, from wet and dry sclerophyll forest, open woodland (Churchill 1998), open country, mallee, rainforests, heathland and waterbodies (SFNSW 1995). Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock (Environment Australia 2000) and in abandoned sugar glider nests (Churchill 1998). The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (Environment Australia 2000).	Potential

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests (Hoye & Richards 1998). Within denser vegetation types use is made of natural and man made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1998).	Yes. Recorded on site.
Vespadelus troughtoni	Eastern Cave Bat	V	-	Inhabit tropical mixed woodland and wet sclerophyll forest on the coast and the dividing range but extend into the drier forest of the western slopes and inland areas (Churchill 1998). Has been found roosting in sandstone overhand caves, boulder piles, mine tunnels and occasionally in buildings (Churchill 1998).	Unlikely
MIGRATORY TERRESTRIAL SPECIES LISTED UNDER EPBC ACT					
Apus pacificus	Fork-tailed Swift	-	M	Sometimes travels with Needletails. Varied habitat with a possible tendency to more arid areas but also over coasts and urban areas (Simpson & Day 1999).	Potential
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Marchant & Higgins 1993, Simpson & Day 1999). Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away (Marchant & Higgins 1993).	Potential
Hirundapus caudacutus	White-throated Needletail	-	M	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant & Higgins 1993; Simpson & Day 1999). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant & Higgins 1993).	Potential
Merops ornatus	Rainbow Bee-eater	-	M	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May (Pizzey and Doyle 1988). Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs (ibid). Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting (*ibid*).	Unlikely
Monarcha melanopsis	Black-faced Monarch	-	M	Rainforest and eucalypt forests, feeding in tangled understorey (Blakers et al. 1984).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Myiagra cyanoleuca	Satin Flycatcher	-	M	Wetter, denser forest, often at high elevations (Simpson & Day 2004).	Unlikely
Rhipidura rufifrons	Rufous Fantail	-	M	The Rufous Fantail is a summer breeding migrant to southeastern Australia (Morcombe, 2004). The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation (Morcombe, 2004). Open country may be used by the Rufous Fantail during migration (Morcombe, 2004).	Unlikely
Xanthomyza phrygia	Regent Honeyeater	E	E, M	SEE DIURNAL BIRDS ABOVE	SEE DIURNAL BIRDS ABOVE
MIGRATORY WETLAND SPECIES LISTED UNDER EPBC ACT					
Actitis hypoleucos	Common Sandpiper	—	M	In Australia, the Common Sandpiper is found in coastal or inland wetlands, both saline and fresh. It is found mainly on muddy edges or rocky shores. During the breeding season in the northern hemisphere, it prefers freshwater lakes and shallow rivers. (BIB, 2006)	Unlikely
Ardea alba	Great Egret	-	M	The Great Egret is common and widespread in Australia (McKilligan, 2005). It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats (McKilligan, 2005).	Yes. Recorded on site.
Ardea ibis	Cattle Egret	-	M	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005).	Yes. Recorded on site.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Anseranas semipalmata	Magpie Goose	V	M	Now confined to northern Australia, principally the Fitzroy River and east Kimberley, WA, northern Northern Territory, coastal Cape York Peninsula and patchily through eastern Queensland. Small numbers have returned to north-east New South Wales, and re-introduced successfully to Victoria, where populations expanding in south-west and on the Gippsland Plain, and South Australia (Marchant and Higgins, 1990, P. Menkhorst). Magpie Geese live in shallow swamps and associated grassland, feeding on seeds or tubers and green grass (Frith and Davies, 1961, Whitehead and Tschirner, 1992, Wilson, 1997). During the wet season, the geese usually nest in extensive colonies. They move hundreds of kilometres to perennial swamps in the dry season (Frith and Davies, 1961, Bayliss, 1989, Bayliss and Yeomans, 1990).	Yes. Recorded by EcoHub (2009).
Arenaria interpres	Ruddy Turnstone	-	M	Frequents beaches along the coast of NSW (DNR 2000). Flies from Siberia or Alaska to Australia in August - September each year (*ibid*).	Unlikely
Calidris acuminata	Sharp-tailed Sandpiper	-	M	It prefers the grassy edges of shallow inland freshwater wetlands. It is also found around sewerage treatment ponds, flooded grasslands, mudflats, mangroves, rocky shores and beaches.	Unlikely
Calidris canutus	Red Knot	—	M	Red Knots are widespread around the Australian coast, less in the south and with few inland records. Small numbers visit Tasmania and off-shore islands. It is widespread but scattered in New Zealand. They breed in North America, Russia, Greenland and Spitsbergen. Red Knots are a non-breeding visitor to most continents. (BIB, 2006)	Unlikely
Calidris ferruginea	Curlew Sandpiper	-	M	Intertidal mudflats of estuaries, lagoons, mangrove channels; around lakes, dams, floodwaters, flooded saltbush surrounds of inland lakes (Morcombe, 2004).	Unlikely
Calidris ruficollis	Red-necked Stint	—	M	The Red-necked Stint breeds in north-eastern Siberia and northern and western Alaska. It follows the the East Asian-Australasian Flyway to spend the southern summer months in Australia. It is found widely in Australia, except in the arid inland. In Australia, Red-necked Stints are found on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They may also be seen in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands. They are often in dense flocks, feeding or roosting. (BIB, 2006)	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Charadrius bicinctus	Double-banded Plover	—	M	In Australia, the Double-banded Plover is found mainly on the east coast and Tasmania and is a regular visitor to Norfolk and Lord Howe Islands. It has been recorded occasionaly in Western Australia. It is widespread throughout New Zealand. The Double-banded Plover is found on coastal beaches, mudflats, sewage farms, river banks, fields, dunes, upland tussock grasses and shingle. (BIB, 2006)	Unlikely
Charadrius mongolus	Lesser Sand Plover	V	M	SEE DIURNAL BIRDS ABOVE	Unlikely
Gallinago hardwickii	Latham's Snipe	-	M	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover (Marchant and Higgins 1999). Occupies a variety of vegetation around wetlands (Marchant and Higgins 1999) including wetland grasses and open wooded swamps (Simpson and Day 1999).	Unlikely
Heteroscelus brevipes	Grey-tailed Tattler	–	M	Grey-tailed Tattlers breed in Siberia and on passage are seen along the East Asian-Australasian Flyway (the migration route to Australia). When non-breeding they are found in China, Philipines, Taiwan, Vietnam, Malay Peninsula, Indonesia, New Guinea, Micronesia, Fiji, New Zealand and Australia. They are more commonly seen in the north of Australia. Grey-tailed Tattlers are usually seen in small flocks on sheltered coasts with reefs and rock platforms or with intertidal mudflats. They are also found in intertidal rocky, coral or stony reefs, platforms and islets that are exposed at high tide, also shores of rock, shingle, gravel and shells and on intertidal mudflats in embayments, estuaries and coastal lagoons, especially those fringed with mangroves. (BIB, 2006)	Unlikely
Limicola falcinellus	Broad-billed Sandpiper	V	M	SEE DIURNAL BIRDS ABOVE	Unlikely
Limosa lapponica	Bar-tailed Godwit	-	M	Mainly coastal, usually sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats. Breeds in Northern Russia, Scandinavia, NW Alaska (DEH 2005a).	Unlikely
Limosa limosa	Black-tailed Godwit	-	M	Mainly coastal, usually sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats (DEH 2005a). Often found inland in small numbers (ibid). Breeds in Iceland, Nth Atlantic, Europe, Russian and China (*ibid*).	Unlikely
Numenius madagascariensis	Eastern Curlew	-	M	Intertidal coastal mudflats, coastal lagoons, sandy spits (DEH 2005a). Breeds in Russia, NE China (*ibid*).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Numenius minutus	Little Curlew, Little Whimbrel	-	M	The Little Curlew is known to breed in Siberia, with migrants arriving after early April. Southern migration begins in September following the Chinese coast and, after a staging in Mongolia, continues to Northern Australia and New Guinea (Barter 2002). Outside of the breeding season, the species inhabits grasslands, open plains, parklands and mud-flats of Northern Australia (Simpson and Day 1999).	Unlikely
Numenius phaeopus	Whimbrel	-	M	Intertidal coastal mudflats, river deltas and mangroves, occasionally sandy beaches (DEH 2005a). Breeds Siberia and Alaska (*ibid*.).	Unlikely
Pluvialis fulva	Pacific Golden Plover	-	M	Breeds North Siberia, Alaska (DEH 2005a). Mainly coastal, beaches, mudflats and sandflats and other open areas such as recreational playing fields in Australia (*ibid*.).	Unlikely
Pluvialis squatarola	Grey Plover	—	M	The Grey Plover breeds around the Arctic regions and migrates to the southern hemisphere, being a regular summer migrant to Australia, mostly to the west and south coasts. It is generally sparse but not uncommon in some areas. It is occasionally found inland. The Grey Plover is almost entirely coastal, being found mainly on marine shores, inlets, estuaries and lagoons with large tidal mudflats or sandflats for feeding, sandy beaches for roosting, and also on rocky coasts. (BIB, 2006)	Unlikely
Rostratula benghalensis (a.k.a. R. Australis)	Painted Snipe	-	M	See: *Rostratula australis*	Unlikely
Xenus cinereus	Terek Sandpiper	V	M	SEE DIURNAL BIRDS ABOVE	Unlikely

Disclaimer: Data extracted from the Atlas of NSW Wildlife and EPBC Protected Matters Report are only indicative and cannot be considered a comprehensive inventory. 'Migratory marine species' and 'listed marine species' listed on the EPBC Act (and listed on the SEWPaC protected matters report) have not been included in this table, since they are considered unlikely to occur within the study area due to the absence of marine habitat.

E = Endangered; E2 = Endangered Population; V = Vulnerable; M = Migratory.

Appendix B: Flora and Fauna Species List

Flora Species List:

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Acanthaceae	*Brunoniella australis*	Blue Trumpet	-	-			**x**
Adiantaceae	*Pellaea falcata*	Sickle Fern	-	-	TR1		
Adiantaceae	*Cheilanthes sieberi*		-	-	TR4		
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair	-	-			x
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach	-	-	oppo	x	
Alismataceae	*Alisma plantago-aquatica*	Water Plantain	-	-	oppo	x	
Amaranthaceae	*Alternanthera philoxeroides**	Alligator Weed	-	-	oppo	x	
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed	-	-	oppo	x	
Anacardiaceae	*Schinus areira**	Pepper Tree	-	-	TR1		
Apiaceae	*Hydrocotyle bonariensis**		-	-	oppo		
Apiaceae	*Apium prostratum*	Sea Celery	-	-	oppo		
Apiaceae	*Daucus glochidiatus*	Native Carrot	-	-		x	
Apiaceae	*Centella asiatica*	Pennywort	-	-			x
Apiaceae	*Actinotus minor*	Lesser Flannel Flower	-	-			x

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Apiaceae	*Hydrocotyle peduncularis*		-	-			x
Apiaceae	*Hydrocotyle laxiflora*	Stinking Pennywort	-	-			x
Apiaceae	*Xanthosia tridentata*	Rock Xanthosia	-	-			x
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax	-	-			x
Arecaceae	*Phoenix dactylifera**	Date Palm	-	-	oppo		
Asclepiadaceae	*Araujia sericifera**	Moth Vine	-	-	Q6		
Asclepiadaceae	*Gomphocarpus fruticosus**	Narrow-leaved Cotton Bush	-	-		x	
Asteraceae	*Erechtites valerianifolia**	Brazilian Fireweed	-	-	oppo		
Asteraceae	*Euchiton sp.**		-	-	Q7		
Asteraceae	*Senecio madagascariensis**	Fireweed	-	-	TR1, TR2, TR4, TR5, Q1, Q2, Q5, Q6, Q7	x	
Asteraceae	*Cirsium vulgare**	Spear Thistle	-	-	TR1, TR2, TR4, TR5, Q1, Q5, Q6, Q7	x	x
Asteraceae	*Tagetes minuta**	Stinking Roger	-	-	TR1, TR4	x	
Asteraceae	*Hypochaeris radicata**	Catsear	-	-	TR1, TR4		x
Asteraceae	*Conyza sp.**		-	-	TR1, TR4, TR5, Q1, Q5, Q6, Q7		
Asteraceae	*Bidens pilosa**	Cobbler's Pegs	-	-	TR1, TR5, Q6, Q7	x	
Asteraceae	*Aster subulatus**	Wild Aster	-	-	TR2, Q1, Q2, Q5, Q6		x
Asteraceae	*Cotula coronopifolia**	Water Buttons	-	-	TR3, Q2	x	

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Asteraceae	*Ambrosia tenuifolia**	Lacy Ragweed	-	-	TR4, TR5, Q1, Q2	x	
Asteraceae	*Ageratina adenophora**	Crofton Weed	-	-		x	
Asteraceae	*Ambrosia psilostachya**	Perennial Ragweed	-	-		x	
Asteraceae	*Cassinia arcuata*	Sifton Bush	-	-		x	
Asteraceae	*Conyza albida**	Tall Fleabane	-	-		x	
Asteraceae	*Conyza bonariensis**	Flaxleaf Fleabane	-	-		x	
Asteraceae	*Galinsoga parviflora**		-	-		x	
Asteraceae	*Heterotheca grandiflora**	Telegraph Weed	-	-		x	
Asteraceae	*Senecio linearifolius*		-	-		x	
Asteraceae	*Taraxacum officinale**	Dandelion	-	-		x	
Asteraceae	*Eclipta platyglossa*		-	-		x	
Asteraceae	*Hypochaeris radicata**	Catsear	-	-		x	
Asteraceae	*Lagenifera stipitata*	Blue Bottle-daisy	-	-			x
Azollaceae	*Azolla pinnata*		-	-		x	
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine	-	-	oppo		
Brassicaceae	*Capsella bursa-pastoris**	Shepherd's Purse	-	-		x	
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell	-	-	TR1	x	
Casuarinaceae	*Casuarina glauca*	Swamp Oak	-	-	TR1, TR4, Q5, Q6	x	
Casuarinaceae	*Allocasuarina littoralis*	Black Sheoak	-	-			x

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Ceratophyllaceae	*Ceratophyllum demersum*	Hornwort	-	-		x	
Chenopodiaceae	*Sarcocornia quinqueflora*		-	-	TR2, Q1, Q2		
Chenopodiaceae	*Atriplex prostrata**		-	-	TR2, Q2	x	
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	-	-	TR5, Q5		
Chenopodiaceae	*Einadia trigonos*	Fishweed	-	-		x	
Clusiaceae	*Hypericum gramineum*	Small St John's Wort	-	-		x	x
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	-	-	oppo		
Convolvulaceae	*Ipomoea purpurea**	Common Morning Glory	-	-		x	
Crassulaceae	*Bryophyllum delagoense **	Mother of millions	-	-	oppo	x	
Cunoniaceae	*Ceratopetalum gummiferum*	Christmas Bush	-	-			x
Cyperaceae	*Bolboschoenus caldwellii*		-	-	TR2, TR3, Q1, Q2, Q3, Q4	x	
Cyperaceae	*Cyperus polystachyos*		-	-	TR4	x	x
Cyperaceae	*Isolepis inundata*		-	-		x	x
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	-	-		x	x
Cyperaceae	*Eleocharis minuta*		-	-		x	
Cyperaceae	*Cyperus congestus**		-	-		x	
Cyperaceae	*Baumea articulata*	Jointed Twig-rush	-	-			x
Cyperaceae	*Cyperus sesquiflorus*		-	-			x
Cyperaceae	*Baumea rubiginosa*		-	-			x
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge	-	-			x

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Cyperaceae	*Lepidosperma laterale*		-	-			x
Cyperaceae	*Schoenoplectus mucronatus*		-	-			x
Cyperaceae	*Ptilothrix deusta*		-	-			x
Dennstaedtiaceae	*Hypolepis glandulifera*		-	-		x	
Dennstaedtiaceae	*Pteridium esculentum*	Bracken	-	-			x
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern	-	-			x
Dicksoniaceae	*Calochlaena dubia*	Common Ground Fern	-	-	TR3		x
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower	-	-			x
Droseraceae	*Drosera peltata*		-	-			x
Epacridaceae	*Astroloma humifusum*	Native Cranberry	-	-			x
Epacridaceae	*Epacris pulchella*		-	-			x
Euphorbiaceae	*Homalanthus populifolius*		-	-		x	
Euphorbiaceae	*Euphorbia peplus**	Petty Spurge	-	-		x	
Euphorbiaceae	*Ricinus communis**	Castor Oil Plant	-	-		x	
Euphorbiaceae	*Chamaesyce drummondii*	Caustic Weed	-	-		x	
Euphorbiaceae	*Amperea xiphoclada*		-	-			x
Fabaceae (Faboideae)	*Trifolium repens**	White Clover	-	-	TR4, TR5, Q6	x	
Fabaceae (Faboideae)	*Trifolium fragiferum**	Strawberry Clover	-	-		x	
Fabaceae (Faboideae)	*Gompholobium latifolium*	Golden Glory Pea	-	-			x

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Fabaceae (Faboideae)	*Pultenaea paleacea*		-	-			x
Fabaceae (Faboideae)	*Bossiaea obcordata*	Spiny Bossiaea	-	-			x
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla	-	-			x
Fabaceae (Faboideae)	*Glycine microphylla*		-	-			x
Fabaceae (Mimosoideae)	*Acacia saligna*	Golden Wreath Wattle	-	-	TR1, TR4, TR5, Q6, Q7	x	
Fabaceae (Mimosoideae)	*Acacia longifolia subsp. longifolia*	Sydney Golden Wattle	-	-		x	
Fabaceae (Mimosoideae)	*Acacia baileyana*	Cootamundra Wattle	-	-		x	
Fabaceae (Mimosoideae)	*Acacia longifolia*		-	-			x
Fabaceae (Mimosoideae)	*Acacia suaveolens*	Sweet Wattle	-	-			x
Fabaceae (Mimosoideae)	*Acacia terminalis*	Sunshine Wattle	-	-			x
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses	-	-			x
Gentianaceae	*Centaurium erythraea**	Common Centaury	-	-	TR5, Q1, Q5	x	
Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern, Tangle Fern	-	-			x
Goodeniaceae	*Goodenia heterophylla*		-	-			x
Goodeniaceae	*Goodenia paniculata*		-	-			x

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Haloragaceae	*Gonocarpus tetragynus*		-	-			x
Haloragaceae	*Gonocarpus teucrioides*	Raspwort	-	-			x
Haloragaceae	*Gonocarpus micranthus subsp. micranthus*		-	-			x
Iridaceae	*Patersonia sericea var. sericea*		-	-			x
Iridaceae	*Romulea rosea var. australis**	Onion Grass	-	-		x	
Juncaceae	*Juncus kraussii*		-	-	TR2, TR3, Q1		
Juncaceae	*Juncus acutus**		-	-	TR2, TR3, Q1, Q2, Q3, Q4	x	
Juncaceae	*Juncus subsecundus*		-	-	TR4, Q5		x
Juncaceae	*Juncus continuus*		-	-		x	
Juncaceae	*Juncus planifolius*		-	-			x
Juncaceae	*Juncus prismatocarpus*		-	-			x
Juncaginaceae	*Triglochin striatum*	Streaked Arrowgrass	-	-	oppo		
Juncaginaceae	*Triglochin microtuberosum*		-	-		x	
Lauraceae	*Cinnamomum camphora**	Camphor Laurel	-	-	TR5		
Lauraceae	*Cassytha glabella*		-	-			x
Lemnaceae	*Lemna sp.*		-	-	oppo		
Lemnaceae	*Spirodela punctata*		-	-		x	
Liliaceae	*Lilium formosanum**	Tiger Lily	-	-		x	

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Lindsaeaceae	*Lindsaea linearis*	Screw Fern	-	-			x
Lobeliaceae	*Pratia purpurascens*	Whiteroot	-	-			x
Lomandraceae	*Lomandra glauca subsp. glauca*		-	-			x
Lomandraceae	*Lomandra obliqua*		-	-			x
Lomandraceae	*Lomandra confertifolia subsp. rubiginosa*		-	-			x
Lomandraceae	*Lomandra filiformis subsp. filiformis*		-	-			x
Lomandraceae	*Lomandra longifolia var. longifolia*		-	-			x
Malaceae	*Cotoneaster sp.**		-	-	oppo		
Malvaceae	*Malva sp.**		-	-	TR1, TR4		
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	-	-	TR4, TR5, Q7	x	
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow	-	-		x	
Malvaceae	*Hibiscus sp.**		-	-		x	
Marsileaceae	*Marsilea hirsuta*		-	-	oppo	x	
Meliaceae	*Melia azedarach*	White Cedar	-	-	Q7	x	
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark	-	-	oppo	x	x
Myrtaceae	*Corymbia maculata*	Spotted Gum	-	-	oppo	x	x
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	-	-	oppo	x	
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark	-	-	oppo	x	
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree	-	-	oppo	x	

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Myrtaceae	*Eucalyptus acmenoides*		-	-	oppo		
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	-	-	TR1	x	
Myrtaceae	*Angophora costata*	Sydney Red/Rusty Gum	-	-	TR1		x
Myrtaceae	*Melaleuca armillaris*	Bracelet Honey-myrtle	-	-	TR1, TR4, Q5, Q6, Q7		
Myrtaceae	*Kunzea ambigua*	Tick Bush	-	-		x	x
Myrtaceae	*Eucalyptus botryoides*	Bangalay	-	-		x	
Myrtaceae	*Eucalyptus viminalis*	Ribbon Gum	-	-		x	
Myrtaceae	*Leptospermum laevigatum*	Coast Teatree	-	-		x	
Myrtaceae	*Lophostemon confertus*	Brush Box	-	-		x	
Myrtaceae	*Melaleuca hypericifolia*	Hillock bush	-	-		x	
Myrtaceae	*Callistemon citrinus*	Crimson Bottlebrush	-	-		x	
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany	-	-		x	
Myrtaceae	*Melaleuca sp.*		-	-		x	
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush	-	-			x
Myrtaceae	*Eucalyptus capitellata*	Brown Stringybark	-	-			x
Myrtaceae	*Melaleuca decora*		-	-			x
Myrtaceae	*Eucalyptus haemastoma*	Broad-leaved Scribbly Gum	-	-			x

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Myrtaceae	*Eucalyptus pilularis*	Blackbutt	-	-			x
Myrtaceae	*Melaleuca nodosa*	Ball Honeymyrtle	-	-			x
Myrtaceae	*Melaleuca sieberi*		-	-			x
Myrtaceae	*Melaleuca thymifolia*		-	-			x
Myrtaceae	*Corymbia gummifera*	Red Bloodwood	-	-			x
Myrtaceae	*Syncarpia glomulifera*	Turpentine	-	-			x
Myrtaceae	*Leptospermum polygalifolium subsp. cismontanum*		-	-			x
Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree	-	-			x
Myrtaceae	*Angophora inopina*	Charmhaven Apple	V	V			x (unsubstantiated record – considered a typo. error)
Najadaceae	*Najas browniana*	Waternymph	-	-		x	
Oleaceae	*Ligustrum sinense**	Small-leaved Privet	-	-		x	x
Onagraceae	*Ludwigia peploides subsp. montevidensis*	Water Primrose	-	-	oppo		
Orchidaceae	*Cryptostylis subulata*	Large Tongue Orchid	-	-			?
Osmundaceae	*Todea barbara*	King Fern	-	-			x
Oxalidaceae	*Oxalis exilis*		-	-			x
Phormiaceae	*Dianella caerulea var. caerulea*		-	-			x
Phytolaccaceae	*Phytolacca octandra**	Inkweed	-	-	TR4	x	
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	-	-	oppo		
Pittosporaceae	*Billardiera scandens*	Appleberry	-	-			x
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues	-	-	Q7TR1, TR5, Q1, Q6	x	

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Poaceae	*Lachnagrostis filiformis*		-	-	oppo	x	
Poaceae	*Hordeum leporinum**	Barley Grass	-	-	oppo	x	
Poaceae	*Lolium perenne**	Perennial Ryegrass	-	-	oppo	x	
Poaceae	*Pennisetum clandestinum**	Kikuyu Grass	-	-	oppo	x	
Poaceae	*Echinochloa crus-galli**	Barnyard Grass	-	-	oppo		
Poaceae	*Eragrostis curvula**	African Lovegrass	-	-	oppo		
Poaceae	*Paspalum distichum*	Water Couch	-	-	oppo		
Poaceae	*Sporobolus virginicus*		-	-	Q2		
Poaceae	*Setaria gracilis**	Slender Pigeon Grass	-	-	Q7		
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	-	-	TR1		x
Poaceae	*Melinis repens**	Red Natal Grass	-	-	TR1, Q7	x	
Poaceae	*Cynodon dactylon*	Common Couch	-	-	TR1, TR2, TR4, TR5, Q1, Q2, Q5, Q7	x	
Poaceae	*Chloris gayana**	Rhodes Grass	-	-	TR1, TR4, TR5, Q6, Q7	x	
Poaceae	*Phragmites australis*	Common Reed	-	-	TR2, TR3, TR5, Q1, Q2, Q3, Q4	x	
Poaceae	*Paspalum vaginatum*	Salt-water Couch	-	-	TR3		
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass	-	-	TR4		
Poaceae	*Axonopus fissifolius**	Narrow-leafed Carpet Grass	-	-	TR4, Q5		
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass	-	-	TR4, Q5		

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Poaceae	*Ehrharta erecta**	Panic Veldtgrass*	-	-	TR4, TR5, Q5		
Poaceae	*Paspalum dilatatum**	Paspalum	-	-	TR5, Q1	x	x
Poaceae	*Andropogon virginicus**	Whisky Grass	-	-		x	x
Poaceae	*Briza maxima**	Quaking Grass	-	-		x	
Poaceae	*Chloris truncata*	Windmill Grass	-	-		x	
Poaceae	*Deyeuxia quadriseta*		-	-		x	
Poaceae	*Holcus lanatus**	Yorkshire Fog	-	-		x	
Poaceae	*Isachne globosa*	Swamp Millet	-	-		x	
Poaceae	*Poa labillardieri*	Tussock	-	-		x	
Poaceae	*Setaria verticillata**	Whorled Pigeon Grass	-	-		x	
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	-	-		x	
Poaceae	*Sporobolus africanus**	Parramatta Grass	-	-		x	
Poaceae	*Chloris virgata**	Feathertop Rhodes Grass	-	-		x	
Poaceae	*Panicum effusum*	Poison or Hairy Panic	-	-			x
Poaceae	*Axonopus affinis**	Narrow-leaved Carpet Grass*	-	-			x
Poaceae	*Entolasia stricta*	Wiry Panic	-	-			x
Poaceae	*Panicum simile*	Two-colour Panic	-	-			x
Poaceae	*Themeda australis*	Kangaroo Grass	-	-			x
Poaceae	*Imperata cylindrica*	Blady grass	-	-			x
Poaceae	*Microlaena stipoides var. stipoides*		-	-			x
Poaceae	*Austrostipa pubescens*		-	-			x

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Polygonaceae	*Persicaria decipiens*	Spotted Knotweed	-	-	oppo	x	x
Polygonaceae	*Persicaria lapathifolia*	Pale Knotweed	-	-	oppo	x	
Polygonaceae	*Persicaria orientalis**	Princes Feathers	-	-	oppo		
Polygonaceae	*Rumex crispus**	Curled Dock	-	-	TR2	x	
Polygonaceae	*Persicaria hydropiper*	Water Pepper	-	-		x	
Portulacaceae	*Portulaca sp.**		-	-	TR4, Q7		
Portulacaceae	*Portulaca pilosa**		-	-		x	
Primulaceae	*Anagallis arvensis**	Scarlet/Blue Pimpernel	-	-	TR5		
Proteaceae	*Grevillea robusta*	Silky Oak	-	-	TR5	x	
Proteaceae	*Banksia integrifolia subsp. integrifolia*	Coastal Banksia	-	-		x	
Proteaceae	*Grevillea sp.*		-	-		x	
Proteaceae	*Grevillea sericea*		-	-			x
Proteaceae	*Hakea dactyloides*	Finger Hakea, Broad-leaved Hakea	-	-			x
Proteaceae	*Lambertia formosa*	Mountain Devil	-	-			x
Proteaceae	*Lomatia silaifolia*	Crinkle Bush	-	-			x
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung	-	-			x
Proteaceae	*Petrophile pulchella*	Conesticks	-	-			x
Proteaceae	*Banksia oblongifolia*	Fern-leaved Banksia	-	-			x
Proteaceae	*Banksia serrata*	Old-man Banksia	-	-			x
Proteaceae	*Isopogon anethifolius*		-	-			x
Proteaceae	*Persoonia levis*	Broad-leaved Geebung	-	-			x

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
Proteaceae	*Banksia spinulosa var. collina*		-	-			x
Ranunculaceae	*Ranunculus inundatus*	River Buttercup	-	-	oppo	x	
Ranunculaceae	*Clematis aristata*	Old Man's Beard	-	-	oppo		x
Ranunculaceae	*Ranunculus plebeius*		-	-		x	
Ranunculaceae	*Clematis glycinoides*	Headache Vine	-	-		x	
Restionaceae	*Lepyrodia scariosa*		-	-			x
Rosaceae	*Rubus fruticosus sp. agg.**	Blackberry complex	-	-	oppo	x	x
Rubiaceae	*Opercularia varia*	Variable Stinkweed	-	-			x
Rubiaceae	*Pomax umbellata*		-	-			x
Rutaceae	*Boronia polygalifolia*		-	-			x
Rutaceae	*Zieria smithii*	Sandfly Zieria	-	-			x
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo	-	-	TR1	x	
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush	-	-			x
Scrophulariaceae	*Mimulus repens*	Creeping Monkey-flower	-	-	oppo	x	
Scrophulariaceae	*Verbascum virgatum**	Green Mullein	-	-		x	
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsparilla	-	-			x
Solanaceae	*Solanum nigrum**	Black-berry Nightshade	-	-	TR4	x	
Solanaceae	*Solanum mauritianum**	Wild Tobacco Bush	-	-	TR4, TR5, Q6	x	
Sterculiaceae	*Lasiopetalum ferrugineum var.*		-	-			x

Family	Scientific Name	Common Name	TSC Act/ NPWS Act	EPBC Act	ELA 2011	Ecobiological	Eco Hub
	ferrugineum						
Thymelaeaceae	*Pimelea linifolia subsp. linifolia*		-	-			x
Tremandraceae	*Tetratheca ericifolia*		-	-			x
Typhaceae	*Typha orientalis*	Broad-leaved Cumbungi	-	-	oppo	x	
Verbenaceae	*Lantana camara**	Lantana	-	-	TR1, TR4, TR5, Q5, Q6, Q7	x	
Verbenaceae	*Verbena bonariensis**	Purpletop	-	-	TR1, TR5, Q5, Q6, Q7	x	
Verbenaceae	*Phyla nodiflora**	Carpet Weed	-	-		x	
Verbenaceae	*Verbena rigida**	Veined Verbena	-	-		x	
Violaceae	*Viola hederacea*		-	-			x
Vitaceae	*Cissus antarctica*	Water Vine	-	-			x
Xanthorrhoeaceae	*Xanthorrhoea latifolia subsp. latifolia*		-	-			x

* denotes exotic species

Fauna Species List derived from the current survey ELA (2011), EcoBiological (2008) and EcoHub (2009)

CLASS NAME	SCIENTIFIC NAME	COMMON NAME	TSC Act	EPBC Act	ELA (2011)	EcoBiological (2008)	EcoHub (2009)
Amphibia	*Limnodynastes peronii*	Brown-striped Frog	-	-	cp5	x	x
Amphibia	*Litoria peronii*	Peron's Tree Frog	-	-	CP5, CP6,	x	x
Amphibia	*Limnodynastes tasmaniensis*	Spotted Grass Frog	-	-	cp5, cp9	x	x
Amphibia	*Litoria dentata*	Bleating Tree Frog	-	-	cp5, cp9, cp11	x	x
Amphibia	*Litoria fallax*	Eastern Dwarf Tree Frog	-	-	CP6, CP7, CP11	x	x
Amphibia	*Litoria caerulea*	Green Tree Frog	-	-		x	x
Amphibia	*Crinia signifera*	Common Eastern Froglet	-	-			x
Amphibia	*Litoria latopalmata*	Broad-palmed Frog	-	-			x
Amphibia	*Litoria tyleri*	Tyler's Tree Frog	-	-			x
Aves	*Anas castanea*	Chestnut Teal	-	-	opp	x	x
Aves	*Anas superciliosa*	Pacific Black Duck*	-	-	opp	x	x
Aves	*Grallina cyanoleuca*	Magpie-lark	-	-	opp	x	x
Aves	*Hirundo neoxena*	Welcome Swallow	-	-	opp	x	x
Aves	*Vanellus miles*	Masked Lapwing	-	-	opp	x	x
Aves	*Elseyornis melanops*	Black-fronted Dotterel	-	-	opp		x
Aves	*Acrocephalus australis*	Australian Reed-Warbler	-	-	opp		
Aves	*Anthus australis*	Australian Pipit (Richard's - novaeseelandiae)	-	-	opp		
Aves	*Acanthiza nana*	Yellow Thornbill	-	-		x	x
Aves	*Acridotheres tristis*	Common Myna*	-	-		x	x
Aves	*Acrocephalus stentoreus*	Clamorous Reed-Warbler	-	-		x	x
Aves	*Anas gracilis*	Grey Teal	-	-		x	x
Aves	*Anthus novaeseelandiae*	Richard's Pipit	-	-		x	x
Aves	*Ardea alba*	Great Egret	-	-		x	x

CLASS NAME	SCIENTIFIC NAME	COMMON NAME	TSC Act	EPBC Act	ELA (2011)	EcoBiological (2008)	EcoHub (2009)
Aves	*Ardea intermedia*	Intermediate Egret	-	-		x	x
Aves	*Ardea pacifica*	White-necked Heron	-	-		x	x
Aves	*Calidris acuminata*	Sharp-tailed Sandpiper	-	-		x	x
Aves	*Cisticola exilis*	Golden-headed Cisticola	-	-		x	x
Aves	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	-	-		x	x
Aves	*Corvus coronoides*	Australian Raven	-	-		x	x
Aves	*Cracticus nigrogularis*	Pied Butcherbird	-	-		x	x
Aves	*Cracticus torquatus*	Grey Butcherbird	-	-		x	x
Aves	*Cygnus atratus*	Black Swan	-	-		x	x
Aves	*Elanus axillaris*	Black-shouldered Kite	-	-		x	x
Aves	*Circus aeruginosus*	Marsh Harrier	-	-			x
Aves	*Eolophus roseicapillus*	Galah	-	-		x	x
Aves	*Falco berigora*	Brown Falcon	-	-		x	x
Aves	*Gallinula tenebrosa*	Dusky Moorhen	-	-		x	x
Aves	*Gymnorhina tibicen*	Australian Magpie	-	-		x	x
Aves	*Haliaeetus leucogaster*	Sea Eagle	-	M		x	x
Aves	*Himantopus himantopus*	Black-winged Stilt	-	-		x	x
Aves	*Malurus cyaneus*	Superb Fairy-wren	-	-		x	x
Aves	*Megalurus gramineus*	Little Grassbird	-	-		x	x
Aves	*Megalurus timoriensis*	Tawny Grassbird	-	-		x	x
Aves	*Neochmia temporalis*	Red-browed Finch	-	-		x	x
Aves	*Ocyphaps lophotes*	Crested Pigeon	-	-		x	x
Aves	*Pachycephala pectoralis*	Golden Whistler	-	-		x	x
Aves	*Phalacrocorax melanoleucos*	Little Pied Cormorant	-	-		x	x
Aves	*Phalacrocorax sulcirostris*	Little Black Cormorant	-	-		x	x
Aves	*Platalea regia*	Royal Spoonbill	-	-		x	x
AVes	*Platycercus eximus*	Eastern Rosella	-	-		x	x
Aves	*Porphyrio porphyrio*	Purple Swamphen	-	-		x	x

CLASS NAME	SCIENTIFIC NAME	COMMON NAME	TSC Act	EPBC Act	ELA (2011)	EcoBiological (2008)	EcoHub (2009)
Aves	*Rhipidura leucophrys*	Willie Wagtail	-	-		x	x
Aves	*Scythrops novaehollandiae*	Channel-billed Cuckoo	-	-		x	x
Aves	*Sturnus vulgaris*	Common Starling	-	-		x	x
Aves	*Threskiornis molucca*	Australian White Ibis	-	-		x	x
Aves	*Threskiornis spinicollis*	Straw-necked Ibis	-	-		x	x
Aves	*Tyto capensis*	Grass Owl	V	-		x	x
Aves	*Accipiter novaehollandiae*	Grey Goshawk	-	-		x	
Aves	*Ardea ibis*	Cattle Egret	-	-		x	
Aves	*Cacatua sanguinea*	Little Corella	-	-		x	
Aves	*Chenonetta jubata*	Australian Wood Duck	-	-		x	
Aves	*Chrysococcyx basalis*	Horsfield's Bronze-Cuckoo	-	-		x	
Aves	*Circus approximans*	Swamp Harrier	-	-		x	
Aves	*Egretta garzetta*	Little Egret	-	-		x	
Aves	*Epthianura albifrons*	White-fronted Chat	-	-		x	
Aves	*Falco longipennis*	Australian Hobby	-	-		x	
Aves	*Hieraaetus morphnoides*	Little Eagle	V	-		x	
Aves	*Hirundo ariel*	Fairy Martin	-	-		x	
Aves	*Malurus lamberti*	Variegated Fairy-wren	-	-		x	
Aves	*Motacilla flava*	Yellow Wagtail	-	-		x	
Aves	*Pelecanus conspicillatus*	Australian Pelican	-	-		x	
Aves	*Plectorhyncha lanceolata*	Striped Honeyeater	-	-		x	
Aves	*Rhipidura fuliginosa*	New Zealand Fantail	-	-		x	
Aves	*Sericornis frontalis*	White-browed Scrubwren	-	-		x	
Aves	*Tregellasia leucops*	White-faced Robin	-	-		x	
Aves	*Zosterops lateralis*	Silvereye	-	-		x	
Aves	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	-	-			x
Aves	*Actitis hypoleucos*	Common Sandpiper	-	-			x
Aves	*Alcedo azurea*	Azure Kingfisher	-	-			x
Aves	*Anhinga melanogaster*	Darter	-	-			x

CLASS NAME	SCIENTIFIC NAME	COMMON NAME	TSC Act	EPBC Act	ELA (2011)	EcoBiological (2008)	EcoHub (2009)
Aves	*Anseranas semipalmata*	Magpie Goose	V	M			x
Aves	*Anthochaera chrysoptera*	Little Wattlebird	-	-			x
Aves	*Aphelocephala leucopsis*	Southern Whiteface	-	-			x
Aves	*Apus pacificus*	Fork-tailed Swift	-	-			x
Aves	*Aquila audax*	Wedge-tailed Eagle	-	-			x
Aves	*Artamus leucorynchus*	White-breasted Woodswallow	-	-			x
Aves	*Aviceda subcristata*	Pacific Baza	-	-			x
Aves	*Botaurus poiciloptilus*	Australasian Bittern	V	-			x
Aves	*Bubulcus ibis*	Cattle Egret	-	-			x
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	-	-			x
Aves	*Calidris ferruginea*	Curlew Sandpiper	-	-			x
Aves	*Chlidonias hybridus*	Whiskered Tern	-	-			x
Aves	*Colluricincla harmonica*	Grey Shrike-thrush	-	-			x
Aves	*Columba livia*	Rock Dove	-	-			x
Aves	*Coturnix ypsilophora*	Brown Quail	-	-			x
Aves	*Cuculus pallidus*	Pallid Cuckoo	-	-			x
Aves	*Dacelo novaeguineae*	Laughing Kookaburra	-	-			x
Aves	*Dendrocygna eytoni*	Plumed Whistling-Duck	-	-			x
Aves	*Dicrurus bracteatus*	Spangled Drongo	-	-			x
Aves	*Egretta novaehollandiae*	White-faced Heron	-	-			x
Aves	*Eopsaltria australis*	Eastern Yellow Robin	-	-			x
Aves	*Eudynamys scolopacea*	Common Koel	-	-			x
Aves	*Eurystomus orientalis*	Dollarbird	-	-			x
Aves	*Falco cenchroides*	Nankeen Kestrel	-	-			x
Aves	*Fulica atra*	Eurasian Coot	-	-			x
Aves	*Gallinago hardwickii*	Latham's Snipe	-	M			x
Aves	*Geopelia humeralis*	Bar-shouldered Dove	-	-			x
Aves	*Gerygone levigaster*	Mangrove Gerygone	-	-			x
Aves	*Haliastur sphenurus*	Whistling Kite	-	-			x
Aves	*Hirundapus caudacutus*	White-throated Needletail	-	M			x

CLASS NAME	SCIENTIFIC NAME	COMMON NAME	TSC Act	EPBC Act	ELA (2011)	EcoBiological (2008)	EcoHub (2009)
Aves	*Lalage tricolor*	White-winged Triller	-	-			x
Aves	*Larus novaehollandiae*	Silver Gull	-	-			x
Aves	*Lichenostomus chrysops*	Yellow-faced Honeyeater	-	-			x
Aves	*Lonchura castaneothorax*	Chestnut-breasted Mannikin	-	-			x
Aves	*Manorina melanocephala*	Noisy Miner	-	-			x
Aves	*Manorina melanophrys*	Bell Miner	-	-			x
Aves	*Meliphaga lewinii*	Lewin's Honeyeater	-	-			x
Aves	*Merops ornatus*	Rainbow Bee-eater	-	M			x
Aves	*Microeca fascinans*	Jacky Winter	-	-			x
Aves	*Monarcha melanopsis*	Black-faced Monarch	-	-			x
Aves	*Ninox boobook*	Southern Boobook	-	-			x
Aves	*Numenius phaeopus*	Whimbrel	-	-			x
Aves	*Pardalotus punctatus*	Spotted Pardalote	-	-			x
Aves	*Passer domesticus*	House Sparrow	-	-			x
Aves	*Petroica rosea*	Rose Robin	-	-			x
Aves	*Phaps chalcoptera*	Common Bronzewing	-	-			x
Aves	*Philemon corniculatus*	Noisy Friarbird	-	-			x
Aves	*Plegadis falcinellus*	Glossy Ibis	-	-			x
Aves	*Podargus strigoides*	Tawny Frogmouth	-	-			x
Aves	*Psephotus haematonotus*	Red-rumped Parrot	-	-			x
Aves	*Rhipidura albiscapa*	Grey Fantail	-	-			x
Aves	*Sphecotheres viridis*	Figbird	-	-			x
Aves	*Stipiturus malachurus*	Southern Emu-wren	-	-			x
Aves	*Strepera graculina*	Pied Currawong	-	-			x
Aves	*Streptopelia chinensis*	Spotted Turtle-Dove	-	-			x
Aves	*Tringa stagnatilis*	Marsh Sandpiper	-	-			x
Aves	*Turdus merula*	Eurasian Blackbird	-	-			x
Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	-	cp5	x	x
Mammalia	*Lepus capensis*	Brown Hare	-	-	opp	x	x
Mammalia	*Oryctolagus cuniculus*	Rabbit	-	-	opp	x	x

CLASS NAME	SCIENTIFIC NAME	COMMON NAME	TSC Act	EPBC Act	ELA (2011)	EcoBiological (2008)	EcoHub (2009)
Mammalia	*Vulpes vulpes*	Fox	-	-	opp	x	x
Mammalia	*Vespadelus vulturnus*	Little Forest Bat	-	-		x	probable
Mammalia	*Chalinolobus gouldii*	Gould's Wattled Bat	-	-		x	x
Mammalia	*Mormopterus "Species 2"*	Undescribed Freetail Bat	-	-		x	x
Mammalia	*Mormopterus norfolkensis*	Eastern Freetail-bat	V	-		x	x
Mammalia	*Tadarida australis*	White-striped Freetail-bat	-	-		x	x
Mammalia	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	-		x	
Mammalia	*Isoodon macrourus*	Northern Brown Bandicoot	-	-		x	
Mammalia	*Miniopterus australis*	Little Bentwing-bat	V	-		x	
Mammalia	*Myotis adversus*	Large-footed Myotis	V	-		x	
Mammalia	*Nyctophilus sp.*	long-eared bat	-	-		x	
Mammalia	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	-		x	
Mammalia	*Vespadelus pumilus*	Eastern Forest Bat	-	-		x	
Mammalia	*Nyctophilus gouldi*	Gould's Long-eared Bat	-	-			possible
Mammalia	*Bos taurus*	European cattle	-	-			x
Mammalia	*Chalinolobus morio*	Chocolate Wattled Bat	-	-			x
Mammalia	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V	-			x
Mammalia	*Mus musculus*	House Mouse	-	-			x
Mammalia	*Rattus fuscipes*	Bush Rat	-	-			x
Mammalia	*Rattus rattus*	Black Rat	-	-			x
Mammalia	*Sus scrofa*	Pig	-	-			x
Mammalia	*Vespadelus darlingtoni*	Large Forest Bat	-	-			x
Reptilia	*Chelodina longicollis*	Eastern Snake-necked Turtle	-	-	cp5		x
Reptilia	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink	-	-		x	
Reptilia	*Demansia psammophis*	Yellow-faced Whip Snake	-	-		x	
Reptilia	*Eulamprus tenuis\martini*	Barred-sided Skink	-	-		x	
Reptilia	*Pogona barbata*	Bearded Dragon	-	-		x	
Reptilia	*Pseudechis porphyriacus*	Red-bellied Black Snake	-	-		x	

Appendix C: Statutory Assessment

The likelihood of occurrence table identifies the following species as likely to occur within the study area, based on previous records, local records and suitable habitat. For each species or endangered ecological community, an assessment has been carried out in accordance with *Draft Guidelines for Threatened Species Assessment (DEC and DPI).*

Table 14: Threatened biodiversity requiring assessment

Scientific Name	Common Name	TSC Act	EPBC Act	Likelihood of Occurrence
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions.		EEC	—	Recorded
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions		EEC	—	Recorded
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions		EEC	—	Recorded
Zannichellia palustris		E	—	Potential
Litoria aurea	Green and Golden Bell Frog	E	V	Potential
Hieraaetus morphnoides	Little Eagle	V	—	Recorded
Anseranas semipalmata	Magpie Goose	V	M	Recorded
Botaurus poiciloptilus	Australasian Bittern	V	—	Recorded
Ephippiorhynchus asiaticus	Black-necked Stork	E	—	Potential
Rostratula australis (a.k.a. R. benghalensis)	Painted Snipe (Australian subspecies)	E	V	Potential
Tyto capensis	Grass Owl	V	—	Recorded
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Potential
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	—	Recorded
Miniopterus australis	Little Bent-wing Bat	V	—	Recorded
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	—	Recorded
Mormopterus norfolkensis	East Coast Freetail Bat	V	—	Recorded
Myotis adversus	Large-footed Myotis	V	—	Recorded
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V	Recorded
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	—	Potential
Scoteanax rueppellii	Greater Broad-nosed Bat	V	—	Recorded

Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable for an EEC.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Whilst 47 hectares of the biometric vegetation type "Swamp oak swamp forest fringing estuaries, Sydney basin", only 28 ha of this matched the definition of the Swamp Oak Floodplain Forest Endangered Ecological Community. Of that, 4.76 ha will be cleared for construction of the TSF. This loss is not expected to have a significant impact on the extent of this community in the Lower Hunter.

This community can also be susceptible to changes in hydrological environment. The impacts from the proposal on stormwater, flooding and groundwater have been assessed in several reports (Douglas Partners 2012b; BMTWBM 2012: Worley Parsons 2012). The proposed development is not considered likely to impact upon this EEC due to stormwater changes, as the proposed development will not significantly change the hydrological regime. Where structures could change the hydrology (such as the access road), culverts and/or a bridge will be designed thaa the road allows a larger conyenance of flood water that the existing control at the Pacific Highway. The groundwater report prepared by Douglas Partners (2012), indicates that there will be minor increases in the level of groundwater directly adjacent to the proposed development; however, these impacts are not considered likely to occur at the Swamp Oak Forest area.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The occurrence of this EEC on the subject site is not at the limit of its known distribution.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The proposed development will require removal of all vegetation within the subject site. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

The Swamp Oak Floodplain Forest within the study area is fragmented and is isolated from other remnant patches of this EEC and other vegetation occurring in the locality. This community will not be affected as part of the proposal. Accordingly, the proposal is unlikely to affect the habitat connectivity.

6. How is the proposal likely to affect critical habitat?

No critical habitat occurs within the study area.

Conclusion:

The proposed development is not likely to have a significant impact on this EEC in the locality or in the region.

Coastal Saltmarsh in the NSW North Coast, Sydney Basin and Southeast Corner bioregions

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable for an EEC.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Approximately 9.24 ha of Saltmarsh is mapped within the study area. The proposal will not remove any of this EEC from within the subject site. All of the saltmarsh within the study area is proposed to be set aside as a conservation offset and managed via a CMP.

Impacts from the proposal on stormwater, flooding and groundwater have been assessed in several reports (Douglas Partners 2012b; BMTWBM 2012: Worley Parsons 2012). Although Worley Parsons (2012) indicates that there will be some increase in the amount of freshwater entering the Saltmarsh from stormwater discharge, impacts on the EEC are likely to be negligable due to regular tidal flushing from the south.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The occurrence of this EEC on the subject site is not at the limit of its known distribution.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

As this community is not being cleared, no loss of connectivity will occur.

6. How is the proposal likely to affect critical habitat?

No critical habitat occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on this Endangered Ecological Community in the locality or in the region.

Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Not applicable for EEC.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Approximately 25.7ha of Freshwater Wetlands on Coastal Floodplains were mapped within the study area. The proposal will remove approximately 2.72 ha of this EEC. The area of Freshwater Wetlands on Coastal Floodplains proposed to be removed has been subject to past disturbance, in some cases complete clearing followed by re-colonization.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The occurrence of this EEC on the subject site is not at the limit of its known distribution.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The proposed development will require removal of 2.72ha of this EEC. Approximately 12.8 ha will be protected in an offset area that will be managed for long-term conservation outcomes. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

The removal of approximately 2.72ha of Freshwater Wetlands on Coastal Floodplains EEC will not significantly affect habitat connectivity, because the areas to be removed either occur on the edge of a larger remanent or are already isolated from other patches of this EEC occurring in the locality. Accordingly, the proposal is unlikely to affect the habitat connectivity of this community but may impact its ability to recover into the future.

6. How is the proposal likely to affect critical habitat?

No critical habitat occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on this Endangered Ecological Community in the locality or in the region.

Zannichellia palustris

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Zannichellia palustris is considered to have potential to occur within the study area, as it occurs in fresh to brackish, still or slowly moving waters and has previously been recorded locally, at Cessnock, Kooragang, Shortland and Wallsend. Targeted searches conducted within the study did not detect any individuals of this species.

The proposal may involve modification of and indirect impacts on potential *Zannichellia palustris* habitat within the study area, particularly due to the creation of train tracks and access roads. It is unlikely that the proposed action would have an adverse effect on the life cycle of this species, if it does in fact occur within the study area, as long as potential disturbances are managed appropriately, as detailed in Section 6.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposed development may remove approximately 1.23 hectares of potential habitat for this species, located in the Phragmites australis and typha orientalis freshwater wetland. Other indirect impacts, including sedimentation, weed invasion, hydrological change and nutrient input will need to be mitigated as recommended in Section 6.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

This species has only been recorded in the Murray River estuary in South Australia and the lower Hunter region in NSW. Given the proposal does not affect known occurrences of the species, an impact at the limit of the species known distribution or otherwise will not occur.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The proposed development will affect 1.23 hectares of potential habitat for the species. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a Conservation Management Plan that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

The study area is situated in an already fragmented landscape with limited connectivity, therefore the proposal does not cause the severance of connectivity. The proposed management of the conservation offset area, in time, will improve connectivity through the subject site.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on this species in the locality or the region.

Green and Golden Bell Frog *(Litoria aurea)*

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The habitat preference and requirements of the Green and Golden Bell Frog (GGBF) are not well understood and difficult to define (Mahony 1999), particularly in recent years where threats have to some degree altered habitat preferences. Although the site has a long history of industrial and agricultural disturbance, the species has the propensity to turn up in highly disturbed sites. Generally large, permanent water bodies containing high levels of emergent vegetation such as *Typha*, *Baumea* and the introduced *Juncus acutus* appears to be favourable for species, however it has been observed utilising a wide range of natural and man-made water bodies including coastal swamps, marshes, dune swales, lagoons, lakes, estuary wetlands, riverine floodplain wetlands, billabongs, storm water retention basins, farm dams, bunded areas, storage tanks, water troughs, drains, ditches and other excavation areas capable of capturing water such as quarries and brick pits (DEC, 2005). Terrestrial habitat attributes that appear to favour the species include large grassy areas associated with adjacent cover from logs, holes and burrows, rocks or tussock forming vegetation that provide shelter.

The subject site contains many of the above mentioned habitat characteristics and closely resembles habitat present within nearby areas of known habitat for the species, namely the Sandgate/Hexham Swamp key population and the nearby Kooragang/Ash Island key population which is less than 4km away. It is considered, therefore, that the subject site contains potential habitat for the Green and Golden Bell Frog and, due to these nearby populations, has a greater likelihood of supporting the species.

Surveys for the GGBF have been conducted by EcoBiological (2008) on three occasions from November 2007 to January 2008 with one survey undertaken during heavy rain. EcoHub (2009) undertook additional surveys on five evenings following rainfall in November 2008. Supplementary surveys have been completed as part of this study on four nights in January and February 2011 following rainfall. No GGBFs were detected on the subject site during any survey event.

Despite this lack of detection from several survey events over three different seasons, failure to detect the species does not necessarily preclude it from occurring in the study area. Long-term monitoring of the Sandgate/Hexham Swamp population of GGBF has shown that significant decline has occurred in recent years and that it appears to be under imminent threat of extinction. While the Kooragang/Ash Island population is believed to be relatively secure, there can be long periods where the GGBF cannot be found in places that it is commonly found in at other times, and there are areas of habitat where detection only occurs on a very infrequent basis.

There are numerous records of the GGBF from the area surrounding the subject site with the closest of these being less than 350m away (NSW NPWS Wildlife Atlas; DECC, 2007) and it is well accepted that the Green and Golden Bell Frog once occurred in and along the northern boundary of Hexham Swamp (Mahony, 2003). Additionally there are anecdotal records of the frog nearby to the 'coal washery' that forms part of the subject site (EcoBiological 2008). More importantly a significant breeding population occurs less than 3km to the south east of subject site, listed as the Sandgate/Hexham Swamp key population in both the Green and Golden Bell Frog Draft Recovery Plan and the Green and Golden Bell Frog Lower Hunter Key Population Management Plan (DEC, 2005; DECC, 2007). The subject site lies within the historical distribution of the Sandgate/Hexham Swamp population as mapped by the Management Plan. The GGBF is known to be capable of moving considerable distances in relatively short periods and has been noted moving distances of greater than 1km in a single day/night (Pyke & White, 2001; DEC, 2005). Considering that the subject site is within dispersal capabilities of the frog to a known population and that the subject site is directly linked to that population it is reasonable to assume that the frogs could use the subject site from time to time.

With respect to whether the proposal is likely to affect the lifecycle of the GGBF, no individuals have been recorded on the site, despite survey events spread of three different breeding seasons. Therefore, no known breeding, refuge or forage habitat is present within the site. It is considered that while the habitat removal and modification on the subject site due to the proposed development is not considered likely to impact on the lifecycle of the GGBF. Despite this, the proposal includes securing a conservation offset which contains less disturbed potential habitat.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The proposed development will result in the removal of approximately 38ha of vegetated and disturbed land that offers variously suitable potential habitat, including 2.72 ha of freshwater wetland.

It is difficult to quantify the level of this impact on the species, given the GGBF has not been recorded on the site and the site is considered to represent potential habitat that may be used at some point. However, provided recommendations are implemented including pre-clearing and clearing surveys, the securing of the conservation offset lands in perpetuity, the proposal is unlikely to constitute a significant impact on the species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Green and Golden Bell Frog is not at the known limit of its distribution at this location.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

The GGBF can reportedly capable of moving considerable distances in relatively short periods and has been noted moving distances of greater than 1km in a single day/night (Pyke & White, 2001; DEC,

2005). The proposed development will result in clearing and development of 28ha of disturbed land that the GGBF is capable of traversing. The project will however be aligned in a north-south direction. To the east is the Pacific Highway which already acts as a barrier to east-west movement. The project would not disrupt north-south movement. The reduction in connectivity is considered to be offset by the securing of with the conservation offset lands within the study area which, via a small parcel of private land, is contiguous with Hunter Wetlands National Park directly to the west of the subject site. Therefore, connectivity across the landscape would be maintained and further secured.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposal will remove potential habitat for the GGBF. However, given the species has not been recorded within the study area, despite surveys over three seasons, and the proposal involves securing 53ha of conservation offset, the proposal is not considered to represent a significant impact on the species.

Magpie Goose *(Anseranas semipalmata)*

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Magpie Goose is known to inhabit terrestrial sedge-dominated wetlands, particularly those on floodplains of rivers (Marchant & Higgins 1993; Simpson & Day 1999). Phragmites Rushland vegetation in the south of the study area provides habitat foraging and roosting for the Magpie Goose, and the species was recorded onsite by EcoHub (2009).

The proposal involves the removal of 2.72 ha of freshwater wetland habitats. No breeding habitat is available within the study area. As long as potential disturbances are managed appropriately, as detailed in Section 6, it is unlikely that the proposal will have a significant impact on the life cycle of the Magpie Goose.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Magpie Goose was recorded within the study area by EcoHub (2009) and the subject site is considered to contain some marginal foraging habitat for the species. The proposal involves removal of 2.72 ha of freshwater wetland and areas of open grassland from subject site. Provided appropriate management strategies are implemented to minimise disturbance, it is unlikely that the proposal will have a significant impact on the habitat of the Magpie Goose.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The study area is not at the limit of the known distribution of the Magpie Goose.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

The proposal would not isolate or fragment any areas of habitat for the species.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on this species in the locality or the region.

Australasian Bittern *(Botaurus poiciloptilus)*

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Australasian Bittern inhabits terrestrial wetlands, reedbeds, swamps, streams and estuaries, (Marchant & Higgins 1993; Simpson & Day 1999). Phragmites Rushland and Saltmarsh vegetation in the south of the study area provides some marginal foraging habitat for this species, and it was recorded onsite by EcoHub (2009). No breeding habitat was observed or is considered likely to occur on the site.

The proposal involves the removal of 2.72ha of freshwater wetland habitat. As long as potential disturbances are managed appropriately, as detailed in Section 6, it is unlikely that the proposal will have a significant impact on the life cycle of the Australasian Bittern.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Australasian Bittern foraging habitat occurs in the Phragmites Rushland and Saltmarsh vegetation in south of the study area. The proposal involves removal of approximately 2.72ha of freshwater wetland that represents potential forage habitat for the species. Provided appropriate management strategies are implemented to minimise disturbance, it is unlikely that the proposal will have a significant impact on the habitat of the Australasian Bittern.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The study area is not at the limit of the known distribution of the Australasian Bittern.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

The Australasian Bittern is a mobile species capable of traversing open areas where it is necessary. The proposal is not considered likely to cause barriers to the movement of the species and therefore will not affect habitat connectivity.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on this species.

Black-necked Stork *(Ephippiorhynchus asiaticus)*

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Black-necked Stork is associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands floodplains (Marchant & Higgins 1993). The species forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland, mangroves, mudflats, shallow swamps with short emergent vegetation and permanent billabongs and pools on floodplains (Marchant & Higgins 1993; DECC 2007). The NPWS Atlas of NSW Wildlife contains numerous local Black-necked Stork records in the locality, including within Hexham Swamp. The subject site contains some potential foraging habitat for the Black-necked Stork, particularly in the freshwater wetland and Saltmarsh vegetation in the south of the study area.

The proposal involves the removal of 2.72ha of freshwater wetland vegetation which represents marginal potential forage habitat for the species. No breeding habitat is present on the site. If disturbances are managed appropriately, as detailed in Section 6, it is unlikely that the proposal will have a significant impact on the life cycle of the Black-necked Stork.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Marginal potential Black-necked Stork foraging habitat occurs in the freshwater wetland vegetation, open grassy areas and Saltmarsh vegetation in south of the study area. The proposal involves removal of 2.72ha of freshwater wetland. The subject site comprises mostly disturbed lands and therefore of marginal habitat quality for the species. Provided appropriate management strategies are implemented to minimise disturbance, it is unlikely that the proposal will have a significant impact on the habitat of the Black-necked Stork.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The study area is not at the known limit of the distribution of the Black-necked Stork.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

Proposed vegetation removal would not lead to the further fragmentation or isolation of vegetated areas, and would not threaten the long-term survival of the Black-necked Stork in the locality as the species is considered to be highly mobile.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on the Black-necked Stork.

Painted Snipe (Australian subspecies) *(Rostratula australis)*

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Australian Painted Snipe prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DECC 2007). It nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds, and breeding is often in response to local conditions and generally occurs from September to December (DECC 2007). The species in known to roost during the day in dense vegetation (NSW Scientific Committee 2004) and forages nocturnally on mud-flats and in shallow water, feeding on worms, molluscs, insects and some plant-matter (DECC 2007). The NPWS Atlas of NSW Wildlife contains a 2004 record of the Australian Painted Snipe at Ash Island in 2004. The freshwater wetland vegetation types withn the subject site provides potential foraging habitat for this species.

The proposal involves the removal of approximately 2.72ha of freshwater wetland habitat constituting highly disturbed marginal foraging habitat. As long as potential disturbances are managed appropriately, as detailed in Section 5, it is unlikely that the proposal will have a significant impact on the life cycle of the Australian Painted Snipe.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Potential foraging habitat for the Australian Painted Snipe occurs in the freshwater wetland vegetation types within the subject site. Approximately 2.72ha of highly disturbed marginal potential habitat is proposed to be removed as part of the proposal. Provided appropriate management strategies are implemented to minimise disturbance, it is unlikely that the proposal will have a significant impact on the habitat of the Australian Painted Snipe.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The study area is not at the known limit of the distribution of the Australian Painted Snipe.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

Proposed vegetation removal would not lead to the further fragmentation or isolation of vegetated areas, and would not threaten the long-term survival of the Australian Painted Snipe in the locality, as the species is capable of traversing open areas of land.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on the Australian Painted Snipe in the locality or the region.

Little Eagle (*Hieraetus morphnoides*)

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Reported habitats of the Grass Owl include tall grass, swampy, sometimes tidal areas, mangrove fringes, grassy plains, coastal heaths, grassy woodland, cane grass, lignum, sedges, cumbungi, cane fields and grain stubble (Pizzey and Knight, 1997). The Grass Owl nests on the ground within dense tall grass, sedges, reeds and even sugarcane plantations (Pizzey and Knight, 1997). The Grass Owl primarily feeds on rodents, hunting on the wing over heathland, grassland and sedgeland, as well as along the edge of sugar cane, crops and pastureland (Pizzey and Knight, 1997). This species was recorded onsite by both Ecobiological (2008) and EcoHub (2009), however no evidence of roosting owls or regurgitated owl pellets was detected. It is considered unlikely that habitat within the the subject site supports breeding, as extensive areas of dense rushland or sedgeland is not present. Therefore the site is considered to contain marginal foraging habitat only.

The proposal involves the removal of vegetation and modification of 38ha of a mosaic of cleared and disturbed vegetation and what is considered to be marginal foraging habitat. No nests were observed within the study area and no suitable nest trees are present within the subject site. The proposal includes the securing of approximately 53 ha of habitat within a conservation offset. Given no breeding habitat will be affected by the proposal, the level of this impact (ie removal of marginal foraging habitat) is not considered likely to have an affect on the lifecycle of the species or the local breeding pair.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

A mosaic of 38 ha of variously suitable foraging habitat for the Little Eagle is proposed to be removed as part of the proposal. This is considered to be a small portion of available foraging habitat for a local breeding pair. The retention of 53.ha of more intact habitat that will be managed via a CMP within an offset area is considered on balance to offset any impact on the species.

Provided appropriate management strategies are implemented to minimise disturbance, it is unlikely that the proposal will have a significant impact on the habitat of the Little Eagle.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The subject site is not at the limits of the known distribution for the species.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

The Little Eagle was recorded flying above the site by EcoBiological (2008). The species is considered highly mobile and is therefore capable of traversing areas of open ground. The proposed development is therefore not considered likely to result in the severing of habitat for this species.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on the Little Eagle in the locality or the region.

Grass Owl (*Tyto capensis)*

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Reported habitats of the Grass Owl include tall grass, swampy, sometimes tidal areas, mangrove fringes, grassy plains, coastal heaths, grassy woodland, cane grass, lignum, sedges, cumbungi, cane fields and grain stubble (Pizzey and Knight, 1997). The Grass Owl nests on the ground within dense tall grass, sedges, reeds and even sugarcane plantations (Pizzey and Knight, 1997). The Grass Owl primarily feeds on rodents, hunting on the wing over heathland, grassland and sedgeland, as well as along the edge of sugar cane, crops and pastureland (Pizzey and Knight, 1997). This species was recorded onsite by both Ecobiological (2008) and EcoHub (2009), however no evidence of roosting owls or regurgitated owl pellets was detected. It is considered unlikely that habitat within the the subject site supports breeding, as extensive areas of dense rushland or sedgeland is not present. Therefore the site is considered to contain marginal foraging habitat only.

The proposal involves the removal of vegetation and modification of 38ha of a mosaic of cleared and disturbed vegetation and what is considered to be marginal foraging habitat. The proposal includes the securing of approximately 53 ha of more intact habitat within a conservation offset. Given no breeding habitat will be affected by the proposal, the level of this impact (ie removal of marginal foraging habitat) is not considered likely to have an affect on the lifecycle of the species or the local breeding pair.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

A mosaic of 38ha of variously suitable foraging habitat for the Grass Owl is proposed to be removed as part of the proposal. This is considered to be a small portion of available foraging habitat for a local breeding pair. An offset of 53 ha of more intact habitat that will be managed via a CMP within an offset area is considered on balance to offset any impact on the species.

Provided appropriate management strategies are implemented to minimise disturbance, it is unlikely that the proposal will have a significant impact on the habitat of the Grass Owl.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The subject site is not at the limits of the known distribution for the species.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

The Grass Owl was recorded flying into the site from the adjacent nearby habitats present on Ash Island to the southeast (EcoHub 2009) and southwest (EcoBiological 2008) and is therefore capable of traversing areas of open ground. The proposed development is therefore not considered likely to result in the severing of habitat for this species.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on the Grass Owl in the locality or the region.

Tree Roosting Microchiropteran Bats: Eastern False Pipistrelle *(Falsistrellus tasmaniensis),* East Coast Freetail Bat *(Mormopterus norfolkensis),* Yellow-bellied Sheathtail-bat *(Saccolaimus flaviventris),* Large-footed Myotis *(Myotis adversus)* and Greater Broad-nosed Bat *(Scoteanax rueppellii)*

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

These four species of bat all inhabit woodlands and forests, and their preferred roost sites are in tree hollows and under loose bark on trees (Churchill 1998). Suitable habitat within the subject site for these species occurs as a mosaic of variously structured foraging habitat. A number of hollow bearing trees have been recorded and mapped (EcoBiological 2008) in the remnant patch of Swamp Oak Forest in the north of the study area, though none of these are to be affected by the proposal. Eastern False Pipistrelle, East Coast Freetail Bat and Greater Broad-nosed Bat have previously been recorded within the study area (Ecobiological 2008; EcoHub 2009), while the Yellow-bellied Sheathtail-bat is considered to have potential to inhabit the study area.

The subject site contains potential forage habitat only for these species and the proposal does not require removal of any hollow bearing trees (refer to Appendix E), therefore there will be no impact on critical lifecycle phases for these species.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The subject site contains a mosaic of 38ha of variously suitable foraging habitat for these species, which will be cleared and modified as part of the proposal. No roosting habitat will be affected by the proposal. This impact is considered to be a small portion of available foraging habitat in the local area. The retention of 51 ha of more intact habitat that will be managed via a CMP within an offset area is considered on balance to offset any impact on these species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The study area is not at the limit of the known distribution of these species.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

Foraging habitat for these species is currently heavily fragmented in the locality by agricultural, residential and industrial development. Whilst the proposal will to some degree cause additional fragmentation of habitat, a critical corridor will not be severed and these species are all considered capable of traversing the open areas. Therefore the affect on habitat connectivity for these species is not considered significant.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on these microchiropteran bat species in the locality or the region.

Cave Roosting Microchiropteran Bats including Large-eared Pied Bat *(Chalinolobus dwyeri),* Little Bent-wing Bat *(Miniopterus australis),* Eastern Bent-wing Bat *(Miniopterus schreibersii oceanensis)*

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

These four species of bat roost in caves, and inhabit woodlands and forests (Churchill 1998). Suitable habitat within the subject site for these species occurs as a mosaic of variously structured foraging habitat. Little Bentwing-bat, Eastern Bent-wing Bat and Large-footed Myotis have previously been recorded within the study area (Ecobiological 2008; EcoHub 2009), while the Large-eared Pied Bat is considered to have potential to inhabit the study area. No suitable roost habitat for these species is available within the study area, therefore impacts on the lifecycles of these species will not result.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The subject site contains a mosaic of 38ha of variously suitable foraging habitat for these species, which will be cleared and modified as part of the proposal. No roosting habitat for these species will be affected by the proposal. This impact is considered to be a small portion of available foraging habitat in the local area. The retention of 53 ha of more intact habitat that will be managed via a CMP within an offset area is considered on balance to offset any impact on these species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The study area is not at the limit of the known distribution of these species.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on these microchiropteran bat species in the locality or the region.

Grey-headed Flying-Fox *(Pteropus poliocephalus)*

1. How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Grey-headed Flying-Fox inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Their camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998). The Grey-headed Flying-fox was recorded flying over the study area during field investigations as part of this study and has also previously been recorded onsite (EcoHub 2009; Ecobiological 2008). There is extremely limited potential foraging habit within the study area, with the occasional planted Eucalypt occurring within rehabilitation areas of the subject site and Melaleuca species north of the subject site providing seasonal and intermittent inflorescence. No roost habitat is present within the study area.

Due to highly mobile nature of the species, the clearing of the subject site and small isolates of potential forage habitat and given there will be no impact on roost habitat the proposal will not have a significant impact on the life cycle of the Grey-headed Flying-Fox.

2. How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

There is extremely limited potential foraging habit within the study area, with the occasional planted Eucalypt occurring within rehabilitation areas of the subject site offering seasonal and intermittent forage. The proposal will result in the removal of this small area of potential habitat, which is not considered to represent a significant impact. Additionally, the retention of 53 ha of more intact habitat that will be managed via a CMP within an offset area is considered on balance to offset any impact on these species.

3. Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The study area is not at the limit of the known distribution of the Grey-headed Flying.

4. How is the proposal likely to affect current disturbance regimes?

The majority of the subject site has been historically cleared for industrial and subsequent agricultural land use. Although some areas within this site have been rehabilitated using both endemic and non-endemic species, the majority still remains cleared. The remaining areas of the study area (ie outside of the subject site) are proposed to be used as a conservation offset managed under a CMP that will control and manage current disturbances. This will include removal of stock, control of weeds and feral pests and the restoration of both cleared and native vegetation within the offset area.

5. How is the proposal likely to affect habitat connectivity?

Proposed vegetation removal would not lead to the further fragmentation or isolation of vegetated areas, and would not threaten the long-term survival of the Grey-headed Flying Fox in the locality.

6. How is the proposal likely to affect critical habitat?

No critical habitat for this species occurs at this location.

Conclusion:

The proposed development is not likely to have a significant impact on Grey-headed Flying Fox in the locality or the region.

Appendix D: Consolidated survey effort for all flora and fauna studies and comparison to guidelines.

Survey method	Survey Guidelines (DEC 2004; OE&H 2010)	Survey	Timing	Stratification type, area and survey effort per type					Compliance with OE&H Guidelines
				Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Coastal floodplain sedgelands, rushlands and forbs of the North Coast	Phragmites Australia and Typha orientalis coastal freshwater wetlands of the Sydney basin	Saltmarsh in estuaries of Sydney basin and south east corner	Disturbed / Cleared Vegetation	
				47.15	**9.69**	**15.66**	**9.24**	**172.26**	
Rapid Data Points (RDP)	N/A	EcoBiological (2008)	3/12/207 and 9/1/2008	4 points	3 points		1 point		N/A
		ECOHUB (2008) (descriptive quadrats)	December 2007	7 points in total (locations unknown)					
Floristic quadrats	Swamp Oak Forest - 4 quadrats; Coastal floodplain sedgelands - 3 quadrats; Phragmites australis and Typha orientalis freshwater wetlands - 3 quadrats; Saltmarsh - 3 quadrats; Distrubed/cleared - 0 quadrats	EcoBiological (2008)	3/12/207 and 9/1/2008	3 plots					Not all stratification units have been sampled as per the guidelines; however given the homogeneity of stratification units as found during extensive random meanders, the site is considered to have been adequately surveyed.
		ECOHUB (2008)	11-16 June 2008	4 quadrats in total (locations unknown					
		Eco Logical Australia (2011)	January - February 2011	4 quadrats	2 quadrats	2 quadrats	2 quadrats		
Wetland survey	N/A	EcoBiological (2008)	11/1/2008 and 31/3/2008		1 survey				N/A
Floristic searches	N/A	EcoBiological (2008)	3/12/207 and 9/1/2008	1 transect	1 transect			1 transect	N/A
		ECOHUB (2008)	11-16th June 2008	3 transects	1 transects	2 transects	1 transects	1 transects	

		Eco Logical Australia (2011)	January - February 2011	2 transects plus random meandre accross study area (Figure 3)	1 plus random meandre accross study area (Figure 3)	1 plus random meandre accross study area (Figure 3)	1 plus random meandre accross study area (Figure 3)	random meandre accross study area (Figure 3)	
Vegetation community mapping	Stratify the site in to Biometric vegetation types	EcoBiological (2008)	3/12/207 and 9/1/2008	Random meandre across the entire site					Yes
		Eco Logical Australia (2011)	January - February 2011	Random meandre across the entire site					
		ECOHUB (2008)	June 2008	Random meandre across the entire site					
Targeted flora and fauna habitat transects	N/A	EcoBiological (2008)	November 2007 to March 2008	1 transect	1 transect			1 transect	N/A
		ECOHUB (2008)	11-16 June 2008	2 transects	1 transect			1 transect	
		Eco Logical Australia (2011	January - February 2011	Random meandre accross the entire site					
Elliot A trapping (terrestrial)	100 trap nights over 3-4 consecutive nights. Effort per stratification unit up to 50ha, plus an additional effort for every additional 100ha	EcoBiological (2008)	19-23/11/2007	72 trap nights					132 trap nights have been sampled on the site. Given the suitability of the habitat on the site (depauperate and long history of disturbance), this level of survey effort is considered adequate.
		ECOHUB (2008)	11th-14th June 2008 and 21-25th June 2008	80 trap nights (western boundary of subject site) plus 80 trap nights (southwest section of subject site). Actual location unknown					
Elliot B trapping (terrestrial)	100 trap nights over 3-4 consecutive nights. Effort per stratification	EcoBiological (2008)	19-23/11/2007	36 trap nights					Due to inadequate location of survey sites, it's difficult to say whether precise guidelines per stratification unit have been met. However, 36 trap nights have been

	unit up to 50ha, plus an additional effort for every additional 100ha								sampled on the site, presumably in more favourable habitats. Given the suitability of the habitat on the site (depauperate and long history of disturbance), this level of survey effort is considered adequate.
Arboreal trapping (ECOHUB arboreal glider traps)	24 trap nights over 3-4 consecutive nights. Effort per stratification unit up to 50ha, plus an additional effort for every additional 100ha	ECOHUB (2008)	11th-14th June 2008 and 21-25th June 2008	72 trap nights plus 36 trap nights (location unknown)					Given arboreal habitat is confined to the swamp oak forest, the combined arboreal trapping and hair tubing effort by EcoBiological (2008) and ECOHUB (2008) is adequate.
Hair tubes (arboreal)		EcoBiological (2008)	19-23/11/2007	96 trap nights					
Cage trapping	24 trap nights over 3-4 consecutive nights. Effort per stratification unit up to 50ha, plus an additional effort for every additional 100ha	ECOHUB (2008)	11th -14th June and 21st -25th June 2008	16 trap nights (location unknown)					No. However, given the available habitat, past disturbance and the likelihood of encountering threatened fauna targeted by this method, this level of effort is considered adequate.
Spotlighting	2x 1 hour up to 200 hectares of stratification unit at 1km per hour on 2 separate nights.	EcoBiological (2008)	22/11/2007;	12.5hrs total effort (location unknown)					It is difficult to accurately calculate effort per stratification unit, due to lacking survey location information. However, given the complexity and habitat suitability of the study area, the effort employed is considered adequate.
		Eco Logical Australia (2011)	January - February 2011	1 x 20min transect 3 repeat visits	1 x 20min transect 3 repeat visits	2 x 20min transects 3 repeat visits	1 x 20min transect 3 repeat visits	meandre transects	
		ECOHUB (2008)	8th June 2008	2 hours (location unknown)					
Call playback	Sites to be separated by 800m-1km. At least 5 visits on separate nights for Powerful Owl, Barking Owl and Grass Owl. 6 visits for Sooty Owl and 8 visits for Masked Owl.	EcoBiological (2008)	22nd November 2007 - 10th January 2008	3 sites over 4 nights					Yes
		ECOHUB (2008)	8th -12th June 2008	1hr each night for 4 nights (unknown locations)					

Anabat II bat call recorder	2 sound activated devices - effort per 100ha of stratification unit targeting preferred habitat.	EcoBiological (2008)	22nd November 2007 - 10th January 2008	4 sites x 12hrs			1 site x 12hrs	3 sites x 12hrs	Yes
		ECOHUB (2008)	11th -14th June and 21st -25th June 2008	2 sites (nights and hours unknown)	2 sites (nights and hours unknown)	2 sites (nights and hours unknown)		1 sites (nights and hours unknown)	
Bird survey	Species time curve is suggested	EcoBiological (2008)	22nd November 2007 - 10th January 2008	4 transects x 30min each	1 transects x 30min each	1 transects x 30min each	1 transects x 30min each	3 transects x 30min each	Yes
		ECOHUB (2008)	11th -14th June and 21st -25th June 2008	3 transects (12 hours total)	1 transect (12 hours total)	1 transect (12 hours total)		1 transect (12 hours total)	
		Eco Logical Australia (2011	January - February 2011	Opportunistic	Opportunistic	Opportunistic	Opportunistic	Opportunistic	
Targeted waterbird survey	A 1 hr census at dawn or duck per wetland	EcoBiological (2008)			2x2hr searches				Yes
Nocturnal amphibian survey (including Green and Golden Bell Frog call playback)	Tadpole surveys, call surveys and active searches (day and night). Small habitat areas 1hr on 3 separate occasions. Large areas 3 separate four-hourly searches. Surveys should be done between Sept - January during wet and humid nights.	EcoBiological (2008)	4 separate days/nights 22nd November 2007 - 10th January 2008	4 survey points (14 hours total effort)	5 survey points x 30min each (14 hours total effort)	4 survey points x 30min each (14 hours total effort)	3 survey points x 30min each (14 hours total effort)	5 survey points x 30min each (14 hours total effort)	Yes
		ECOHUB (2008) (descriptive quadrats)	June 2008; and humid and wet nights 9th, 10th, 14th, 19th and 21st November 2008	5 repeat visits of 2 sites	5 repeat visits of 3 sites	5 repeat visits of 3 sites		5 repeat visits of 1 site (dam)	
		Eco Logical Australia (2011	January - February 2011		1 site 3 repeat visits	4 sites 3 repeat visits	1 site 3 repeat visits	2 sites 3 repeat visits (dam)	
Diurnal reptile and amphibian survey	30-minute search on two separate days targeting specific habitat	EcoBiological (2008)	22nd November 2007 - 10th January 2008	6 person hours within subject site and opportunistic through subject site					Yes
		ECOHUB (2008) (descriptive quadrats)	18th June 2008	2 transects with 5 sub-plots (location unknown)					

Appendix E: Hollow bearing tree survey results from EcoBiological (unpub)

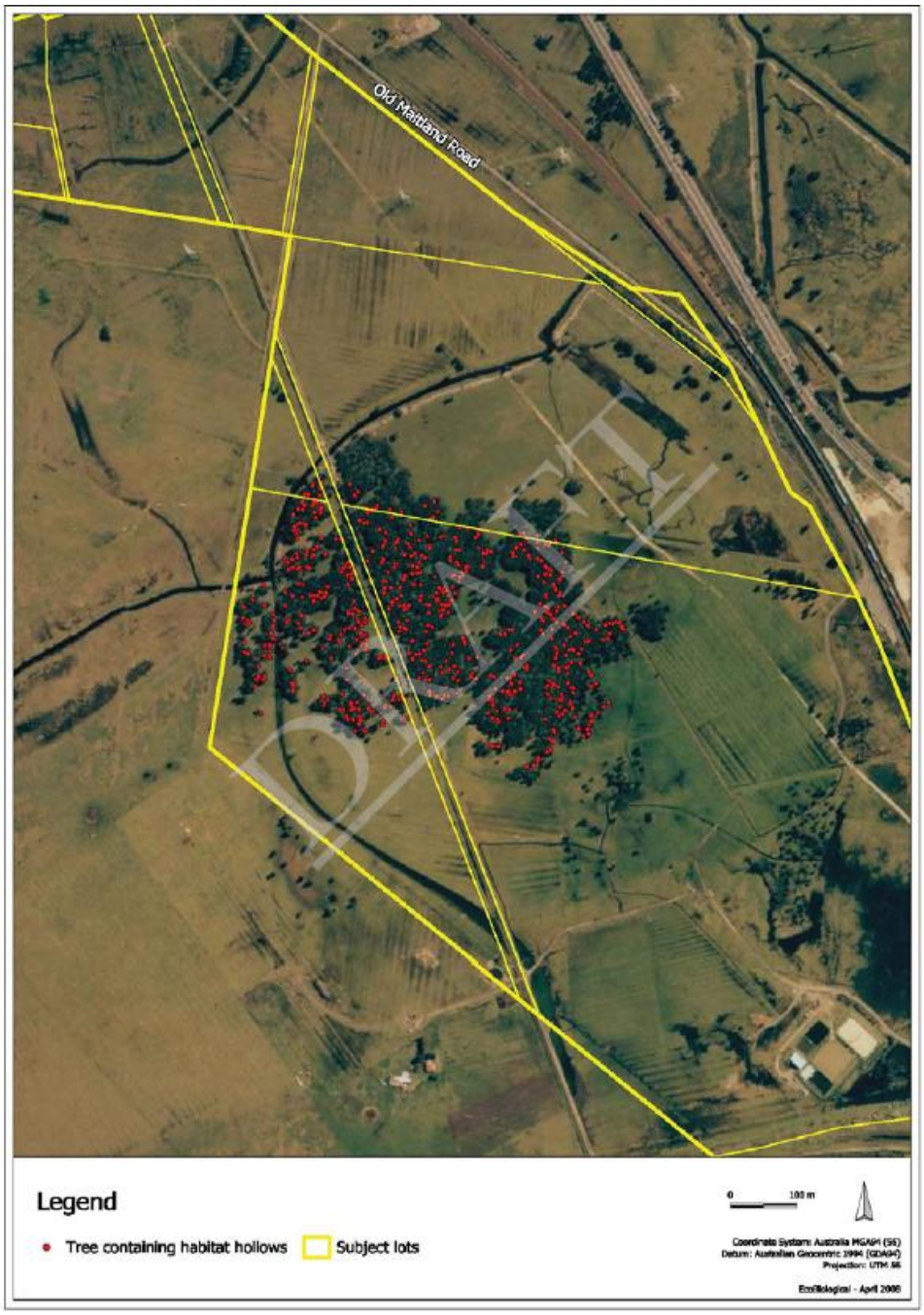


Figure 11: Location of trees containing potential habitat hollows within the study area (From EcoBiological 2008).

A total of 682 trees bearing potential habitat hollows were identified and mapped and the size class of hollows were recorded. The majorit of hollows were small and over 90% of the hollow bearing trees were Swamp Oak (EcoBiological 2008).

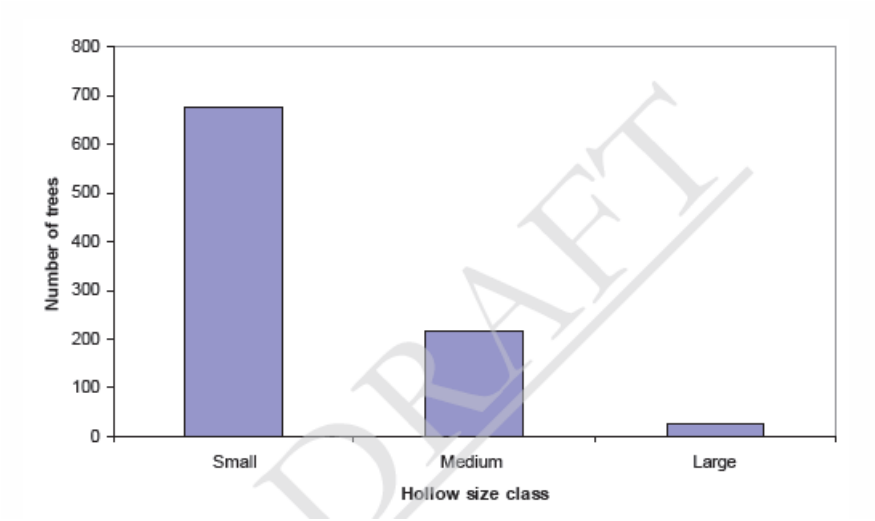


Figure 12: Number of trees with each hollow size class (small <8cm, medium 8-20cm and large >20cm) (From EcoBiological 2008).

DRAFT

Appendix F: Biobanking Credit Reports

BioBanking Credit Calculator

BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 20/08/2012 Time: 12:33:56PM Tool version: 2.0

Development details

Proposal ID: 0032/2012/0223D

Proposal name: QLD Rail Hexham Version 3 - Development

Proposal address: Maitland Road Hexham NSW

Proponent name: QLD rail

Proponent address: Maitland Road Hexham NSW

Proponent phone: 5555-5555

Assessor name: Darren James

Assessor address: PO Box 12 Sutherland NSW 1499

Assessor phone: 8536 8618

Assessor accreditation: 0032

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Coastal floodplain sedgelands, rushlands, and forblands of the North Coast	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site

☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Coastal floodplain sedgelands, rushlands, and forblands of the North Coast	1.49	13	Yes
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	1.23	17	Yes
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	4.54	108	Yes
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	3.01	114	Yes
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	0.22	5	Yes
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	0.15	4	Yes
Total	10.64	261	

Credit profiles

1. Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin, (HU673)

Number of ecosystem credits required	17
CMA sub-region	Hunter
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin, (HU673)	Hunter Clarence Lowlands Richmond - Tweed (Qld - Scenic Rim) (Part A) Orange - Lachlan South Olary Plain, MU Basin Sands (Part A) - Murray South Olary Plain, MU Basin Sands (Part A) - Murrumbidgee Macleay Hastings - Northern Rivers Armidale Plateau Coffs Coast & Escarpment Glen Innes-Guyra Basalts (Part B) Nightcap

	MU Fans LA Plains - Lachlan Upper Slopes - Murray Upper Slopes - Lachlan Lower Slopes - Murray Lower Slopes - Murrumbidgee Lower Slopes - Lachlan MR - Murray MR - Murrumbidgee South Olary Plain, MU Basin Sands (Part B) - Murrumbidgee LA - Lachlan

2. Coastal floodplain sedgelands, rushlands, and forblands of the North Coast, (HU532)

Number of ecosystem credits required	13
CMA sub-region	Hunter
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Coastal floodplain sedgelands, rushlands, and forblands of the North Coast, (HU532)	Hunter

3. Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner, (HU635)

Number of ecosystem credits required	231
CMA sub-region	Hunter
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner, (HU635) Forest Red Gum - Rough-barked Apple open forest on poorly drained lowlands of the Central Coast, Sydney Basin, (HU546) Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin, (HU591) River Oak riparian woodland of the North Coast and northern Sydney Basin, (HU598) Rough-barked Apple - red gum grassy woodland of the MacDonald River Valley on the Central Coast, Sydney Basin, (HN578)	Hunter East Gippsland Lowlands (Part A) South East Coastal Ranges (Part A) Yuraygir Clarence Lowlands Richmond - Tweed (Qld - Scenic Rim) (Part A) Murwillumbah (Qld - Southeast Hills and Ranges)

Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner, (ME023)

Swamp Oak - Prickly Tea-tree - Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin and South East Corner, (ME026)

Paperbark swamp forest of the coastal lowlands of the North Coast and Sydney Basin, (ME050)

River Red Gum - Blakely's Gum grassy woodland of the NSW South Western Slopes Bioregion (Benson 79), (LA188)

River Red Gum - Veined Swamp Wallaby Grass grassy tall woodland of depressions on floodplains and alluvial plains (Benson 249), (LA191)

River Red Gum - wallaby grass tall woodland on the outer River Red Gum zone in the semi-arid (warm) climate zone (Benson 9), (MU584)

River Red Gum very tall open forest of the NSW South Western Slopes Bioregion (Benson 79), (MU586)

Paperbark swamp forest of the coastal lowlands of the North Coast, (NR217)

Swamp Mahogany swamp forest of the coastal lowlands of the North Coast, (NR254)

Forest Red Gum - Woollybutt - Pithy Sword-sedge swamp woodland in dune swales near Pambula, southern South East Corner, (SR546)

East Gippsland Lowlands (Part C)

Wollemi - Hawkesbury/Nepean

Wollemi (Part A)

Wollemi (Part B)

Orange - Lachlan

Karuah Manning

Yengo - Hawkesbury/Nepean

Yengo - Hunter/Central Rivers

Cumberland - Hawkesbury/Nepean

Cumberland - Sydney Metro

Wyong

Walcha Plateau - Northern Rivers

Macleay Hastings - Hunter/Central Rivers

Macleay Hastings - Northern Rivers

Armidale Plateau

Coffs Coast & Escarpment

Clarence Sandstones

Burragorang (Part A)

Moss Vale - Southern Rivers

Jervis

Bungonia - Hawkesbury/Nepean

Pittwater (Part A)

Sydney Cataract - Sydney Metro

Pittwater

Pittwater (Part B)

Bateman

Illawarra

Wongwibinda Plateau

South East Coastal Ranges (Part C)

Monaro - Murrumbidgee

Monaro (Part B)

Monaro (Part C)

MU Fans

Upper Hunter

	Nandewar, Northern Complex
	Upper Slopes - Murray
	Upper Slopes - Murrumbidgee
	Upper Slopes - Lachlan
	Wollemi (Part C)
	Lower Slopes - Murray
	Lower Slopes - Murrumbidgee
	Lower Slopes - Lachlan
	MR - Murray
	Stanthorpe Plateau
	South East Coastal Plains

Species credits

BioBanking Credit Calculator

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE.

Date of report: 24/08/2012 Time: 4:52:00PM Tool version: 2.0

Biobank details

Proposal ID:	0032/2012/0225B
Proposal name:	QLD Rail Hexham Version 3 - Biobank
Proposal address:	Maitland Road Hexham NSW
Proponent name:	QLD rail
Proponent address:	Maitland Road Hexham NSW
Proponent phone:	5555-5555
Assessor name:	Darren James
Assessor address:	PO Box 12 Sutherland NSW 1499
Assessor phone:	8536 8618
Assessor accreditation:	0032

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report
- ☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Coastal floodplain sedgelands, rushlands, and forblands of the North Coast	0.61	4	No
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	18.10	139	No
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	14.60	97	No
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	12.80	119	No
Saltmarsh in estuaries of the Sydney Basin and South East Corner	7.52	72	No
Total	53.63	431	

Credit profiles

1. Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin, (HU673)

Number of ecosystem credits required	119
CMA sub-region	Hunter
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

2. Coastal floodplain sedgelands, rushlands, and forblands of the North Coast, (HU532)

Number of ecosystem credits required	4
CMA sub-region	Hunter
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

3. Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner, (HU635)

Number of ecosystem credits required	97
CMA sub-region	Hunter
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	

4. Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner, (HU635)

Number of ecosystem credits required	139
CMA sub-region	Hunter
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

5. Saltmarsh in estuaries of the Sydney Basin and South East Corner, (HU606)

Number of ecosystem credits required	72
CMA sub-region	Hunter
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	>100 ha

Species credits

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	Cat and/or Fox control
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	Control feral pigs
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin	Maintain or reintroduce flow regimes (aquatic flora)
Saltmarsh in estuaries of the Sydney Basin and South East Corner	Maintain or reintroduce flow regimes (aquatic flora)
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Exclude miscellaneous feral species
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)
Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner	Maintain or reintroduce flow regimes (aquatic flora)

Appendix G: Correspondence with OEH re Offsets

David

From OEH point of you, a Conservation Agreement under the NP&W Act is considered an appropriate mechanism for conserving in perpetuity and is one of OEH preferred methods (providing it is done in accordance with the legislation and supported by Lynn W's group). Cheers Steve

Steve Lewer

Regional Biodiversity Conservation Officer

Planning and Aboriginal Heritage Section

Conservation and Regulation - North East Branch

Office Of Environment and Heritage

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email: steve.lewer@environment.nsw.gov.au

From: David Bonjer [mailto:DavidB@ecoaus.com.au]
Sent: Friday, 24 August 2012 2:13 PM
To: Gibson Robert

Cc: Lewer Steve
Subject: Trani Support facility, Hexham

Hi Robert and Steve

As you may recall we are assisting QR National and their project managers (Engenicom) with the ecological assessment and biodiversity offsets for the Train Support Facility at Hexham (MP 07-0171).

In order to determine what kind of instrument should be used to secure the offsets, I made initial enquires to Lynn Webber and Rebecca Scrivener at OEH, seeking their opinion on whether a Conservation Agreement (CA) under the NP&W Act would be suitable. From both i received a positive verbal response – although it was pointed out that this was not a comment on the adequacy of the offset – as that is assessed under the Part 3A process. However, for the purposes of the part 3A assessment i would like to get a little more certainty that a CA would be supported by OEH as a means of securing the offset. Are you able to respond to this email with some advice on this issue. I understand this could be in-principle only because the CA application would need to be assessed in the usual process – as would the development proposal itself.

For your information, the offset is likely to be about 53 hectares and in two portions. A 20 ha area of freshwater wetland and saltmarsh which adjoins the National Park, and a 33 ha portion of which half is Swamp Oak and half needs rehabilitation of cleared land. Exclusion of stock, fencing and weed management will go a long way to achieving this. A Plan of Management will be prepared and implemented. At this point in time it is not intended to transfer land to NPWS, but the CA would not preclude this from happening in the future if all parties agreed. Also FYI, our Biobanking Credit calculations show that the offsets will generate 431 credits, compared to the 261 required for the project –a surplus of 170 credits. Three out of four biometric veg types are adequately offset, with one falling short by just 9 credits.

QR National intend to lodge the application for the Part 3A project very shortly so a quick response would be appreciated. Please don't hesitate to call if you would like to discuss.

Thanks

David Bonjer

Senior Environmental Planner

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