

APPENDIX 3

Ecological Assessment

Mackas Sand

**Ecological Assessment of
Alternate Haul Route to
Lot 218 DP 1044608, Salt Ash**

November 2011

Ecological Assessment of Alternate Haul Route to Lot 218 DP 1044608, Salt Ash

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Mackas Sand

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1.0 Introduction

In 2009, Mackas Sand was granted development consent (Major Project Approval 08_0142) to extract industrial grade and construction sand resources from Lot 218 and Lot 220, Salt Ash, NSW (**Figure 1.1**). The Approval includes provision for Mackas Sand to access Lot 218 via an existing public road off Lavis Lane and then via a private haul route through the Quality Sands and Ceramics sand quarry and Lot 227 DP 1097995. The Ecological Assessment for that development application was prepared by Umwelt (2009a).

Mackas Sand is seeking approval for modification of Major Project Approval 08_0142 to establish an alternate haul route to Lot 218 around the Quality Sands and Ceramics sand quarry site, as shown in **Figure 1.2**. Umwelt (Australia) Pty Limited (Umwelt) has been engaged by Mackas Sand to prepare the necessary environmental assessments for the proposed modification (the 'proposed alternate haul route'), including this Ecological Assessment. The modification proposal is being assessed under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 Description of the Proposed Development

The modification sought is to construct and utilise an alternate route to access the approved sand extraction area on Lot 218 in DP 1044608 (Lot 218), Salt Ash. Two alignments (Route A and Route B as shown on **Figure 1.2**) have been identified for the eastern section of the haul route with Route A alignment being the preferred alignment of the eastern section of the alternate haul route. The preferred haul route would utilise approximately 1560 metres of public road known as Stockton Bight Track and approximately 610 metres of private haul road.

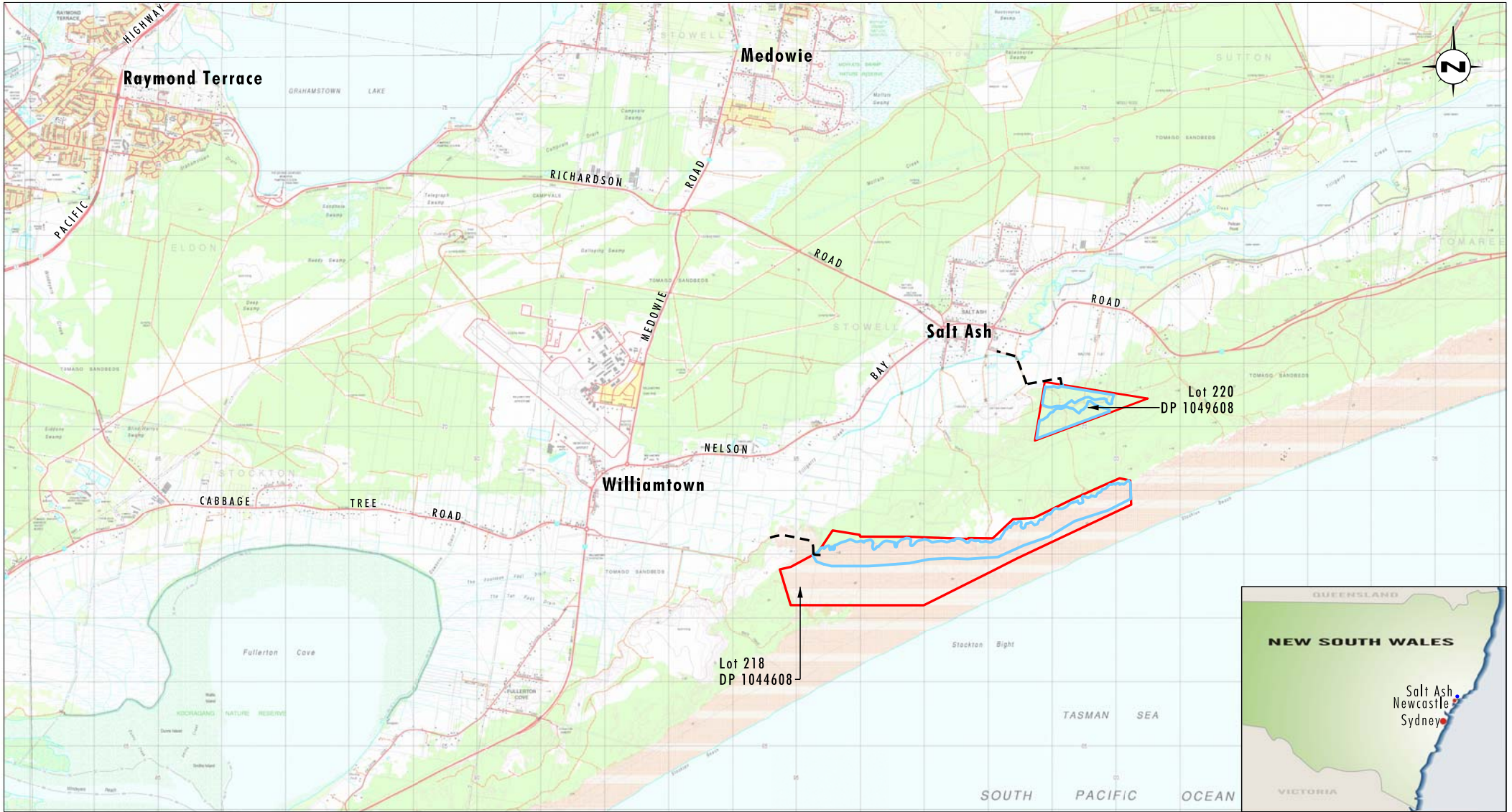
Approximately 1250 metres of the Stockton Bight Track alignment follows an existing track, and powerline easement and traverses bare earth with the remaining 310 metres of Stockton Bight Track alignment being over disturbed grassland.

Approximately 190 metres of the alignment of the private haul road is to be constructed over disturbed grassland, approximately 270 metres will follow the alignment of an existing sand track through Coastal Sand Apple – Blackbutt Forest with the remaining 150 metres to be constructed through approximately 90 metres of Swamp Mahogany – Paperbark Forest and approximately 60 metres of Coastal Sand Apple – Blackbutt Forest.

In total the preferred alternate haul route would disturb an area of approximately 2.26 hectares of which approximately 1.25 hectares is unvegetated (existing track/bare earth/power easement), 0.50 hectares is disturbed grassland, 0.42 hectares is Coastal Sand Apple – Blackbutt Forest (consisting of haul route and small turning circle) and 0.09 hectares is Swamp Mahogany – Paperbark Forest.

The approved access to Lot 218 extraction area is via a public road reserve (Stockton Bight Track) that passes through Pt 76 and part of Pt 101 from where it leaves Stockton Bight Track and traverses across Pt 101 and Pt 13 of DP 753192 to Lot 227 DP 1097995 (Lot 227) which provides access to Lot 218. Pt 101 and Pt 13 in DP 753192 are owned by members of the Towers family and Lot 227 is owned by Worimi Local Aboriginal Land Council (LALC).

The alternate access to the Lot 218 extraction area is via Stockton Bight Track which was realigned (as shown on **Figure 1.2**) by Port Stephens Council to provide physical access to Lot 2 DP 916061 and Lot 122 DP 753192. The realignment of Stockton Bight Track was



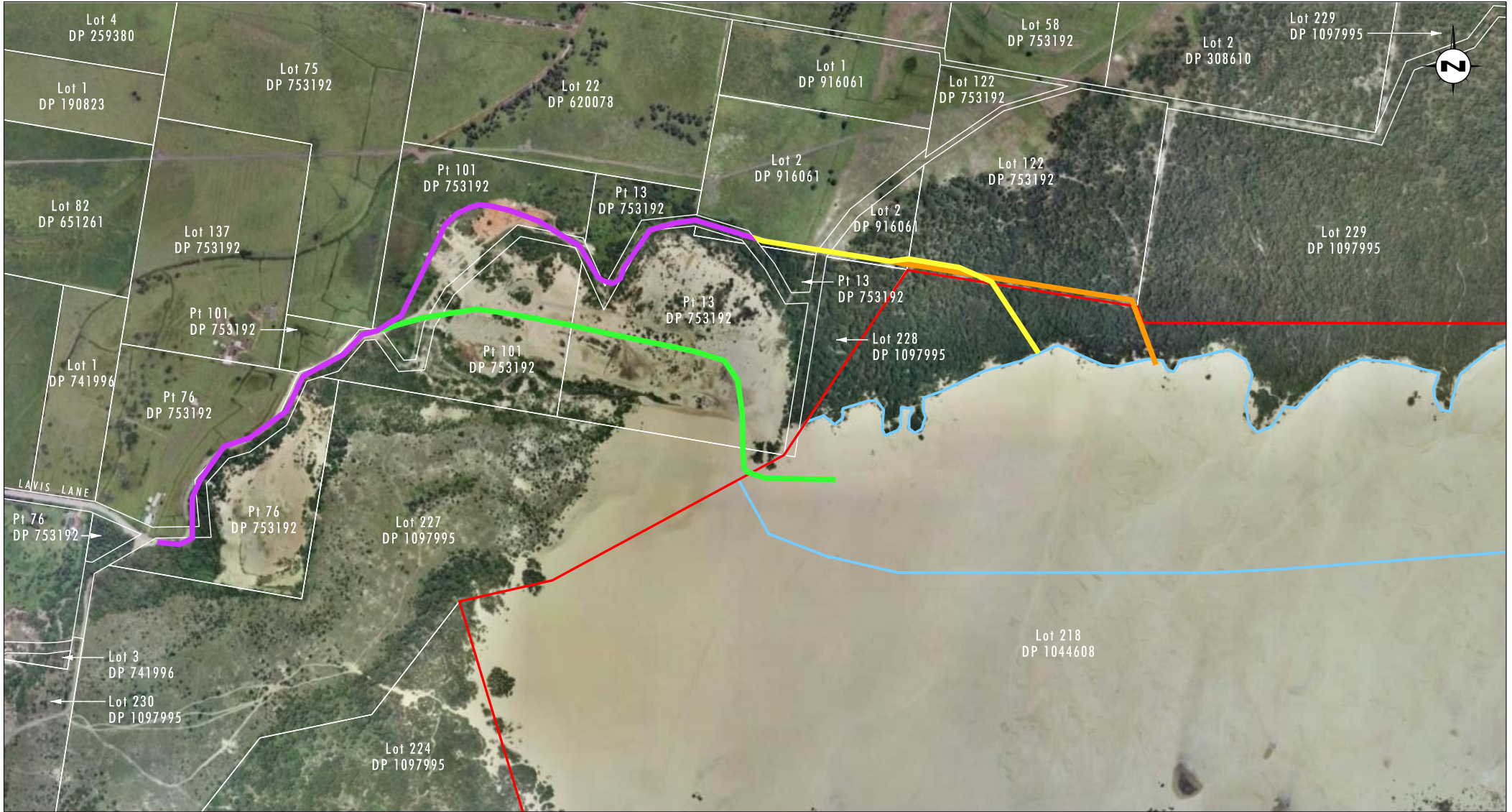
Source: Department of Lands, 2006

Legend

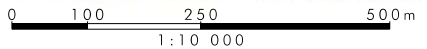
- ▭ Lot Boundaries
- ▭ Approval Areas
- Approved Access Roads

FIGURE 1.1

Location of Approval Areas



Source: Aerial: Google Earth, 2008



- Legend**
- Lot 218 Boundary
 - Lot 218 Approval Extraction Area
 - Stockton Bight Track
 - Previously Approved Access Route
 - Alternate Route A
 - Alternate Route B

FIGURE 1.2
Study Area

gazetted on 1 September 2011. Lot 2 DP 916061 and Lot 122 DP 753192 are owned by B & R B Mackenzie FT Pty Ltd.

Two possible alignments (Route A and Route B as shown on **Figure 1.2**) for the alternate access between Lot 122 and the approved extraction area on Lot 218 have been identified and assessed. Each route follows along the southern boundary of Lot 2 and Lot 122 and predominantly follows the alignment of an existing sand track. The entire southern boundary of Lot 122 has been identified as a Potential Archaeological Deposit (PAD).

Route A deviates approximately 10 metres northward of the existing sand track near the western boundary of Lot 122 as shown on **Figure 1.2** and then crosses into Lot 218 approximately one third the way along the southern boundary of Lot 122. The route deviates to the north along the western third of Lot 122 to avoid identified individuals of ground orchids rough doubletail (*Diuris praecox* (see **Plate 1**)) and sand doubletail (*Diuris arenaria* (see **Plate 2**)) which are listed as vulnerable under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Threatened Species Conservation Act 1995* (TSC Act) respectively. From Lot 122, Route A then traverses across approximately 150 metres of Coastal Sand Apple – Blackbutt Forest and Swamp Mahogany – Paperbark Forest on Lot 218 to the approved extraction area. Construction of this section of the route will result in the removal of approximately 0.24 hectares of vegetation to provide for the access route and a small turning circle for trucks adjacent to the mobile dune field. No *Diuris praecox* or *Diuris arenaria* were identified along or adjacent to Route A within Lot 218. Trees and understorey along this alignment would be cleared and windrowed along the edge of the alignment. Route A is the preferred route.

Route B follows the alignment of the existing track along the full length of the southern boundary of Lot 2 and Lot 122 and will require limited clearing of trees along the route. Field surveys undertaken during the September 2011 flowering period indicate that there are in excess of 250 *Diuris praecox* and approximately 50 *Diuris arenaria* located on the verges of existing sand track and adjacent cleared land with the orchids showing a preference for the cleared areas along and adjacent to existing tracks. Approximately 30 to 50 of these plants would be removed if Route B was constructed.

As can be seen from **Figure 1.3**, Lot 218 adjoins the 4438 hectares of Worimi Conservation Lands to the south, east and north and is located adjacent to a significant tract of Coastal Sand Apple – Blackbutt Forest which includes pockets of Swamp Mahogany – Paperbark Forest. In total, construction of the preferred alignment of the alternate haul route would disturb approximately 0.51 hectares of these forest communities.

Modification is also sought in regard to minor changes to permissible maximum extraction depths on Lot 218 and Lot 220 however this change will not have an ecological impact beyond that already approved.

1.2 Objectives

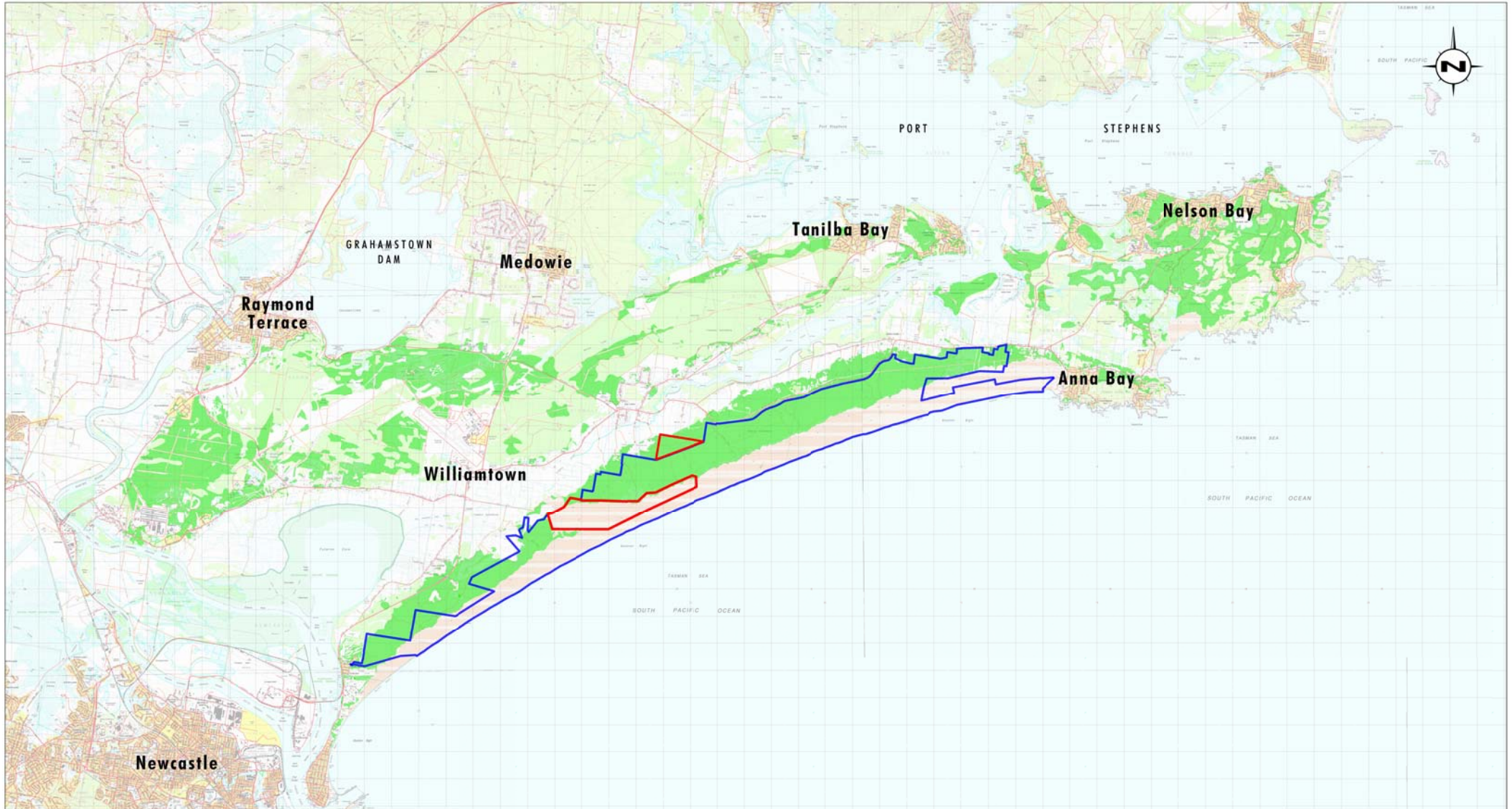
This Ecological Assessment was prepared by Umwelt to assess the potential impact of the proposed development on native flora and fauna species, populations and ecological communities occurring along the alternate haul route alignment including Route A and Route B (hereafter referred to as Project Area). The total footprint of the Project Area including Route A and Route B alignments is 2.63 hectares.



PLATE 1
Diuris praecox (Rough Doubletail)



PLATE 2
Diuris Arenaria (Sand Doubletail)



Source: Department of Lands (2006), Hunter Councils (2003)

0 2.5 5 10km
1:200 000

Legend

- ▭ Lot Boundaries (218 & 220)
- ▭ Worimi Conservation Lands
- ▭ Coastal Sand Apple Blackbutt Forest

FIGURE 1.3

Coastal Sand Apple
Blackbutt Forest

The objectives of the Ecological Assessment were to:

- record the flora and fauna species/communities present in the habitats of the Project Area;
- identify any threatened or migratory species, endangered populations, threatened ecological communities (TECs), or their habitats, listed under the TSC Act, the *Fisheries Management Act 1994* (FM Act) or the EPBC Act;
- assess the impact that the proposed development would have on any threatened flora and fauna species, endangered populations, TECs, or their habitats, recorded, or with the potential to occur within the Project Area; and
- provide management recommendations to mitigate ecological impacts associated with the proposed development.

2.0 Methods

2.1 Literature Review

A review of previous documents and reports relevant to the project was undertaken. This included regional and sub-regional vegetation mapping reports, site-specific surveys completed within the Project Area, ecological surveys undertaken in the vicinity of the Project Area and also relevant ecological database searches. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring threatened and migratory species, endangered populations and TECs. Relevant documents are discussed below, focussing on the key findings of each assessment.

2.1.1 Vegetation of the Tomago and Tomaree Sandbeds, Port Stephens NSW (Driscoll and Bell 2006)

Vegetation of the Tomago and Tomaree Sandbeds, Port Stephens, New South Wales (Driscoll and Bell 2006) was commissioned by the Hunter Water Corporation. The aim of the report was to identify and map groundwater-dependent ecosystems (GDEs) on the Tomago and Tomaree sandbeds to assist in the management of water extraction from aquifers.

Driscoll and Bell 2006 provides the most comprehensive vegetation mapping in the local area. The Project Area is located to the south-east of the Driscoll and Bell (2006) study area, however some mapped vegetation communities extend as far south as the Project Area as shown on **Figure 1.3**. The characteristics of the vegetation communities in the Project Area were compared to vegetation community descriptions from Driscoll and Bell (2006). Based on this, the vegetation communities along the forested section of the Project Area broadly align with two community descriptions, being Tomago Blackbutt – Apple – Bloodwood Forest and Anna Bay Blackbutt – Apple – Bloodwood Forest.

2.1.2 Lower Hunter and Central Coast Regional Environmental Management Strategy Vegetation Mapping

Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) Vegetation Mapping (NPWS 2000 and House 2003) is a broad-based vegetation mapping system for the Lower Hunter and Central Coast regions incorporating seven local government areas (LGAs), from Port Stephens to Gosford and west to

Cessnock. The aim of this report was to provide cross tenure maps of the distribution of vascular plant communities in the Lower Hunter and Central Coast regions.

Characteristics of the vegetation communities along the alternate haul route were compared to the LHCCREMS vegetation map units and where appropriate, were mapped using the same map unit names.

2.1.3 Draft Flora and Fauna Assessment for Proposed Rezoning of Lot 218, Stockton Bight (Umwelt 2004)

The Draft Flora and Fauna Assessment for Proposed Rezoning of Lot 218 at Stockton Bight report (Umwelt 2004) was prepared to meet the flora and fauna assessment requirements for Port Stephens Council as a component of a rezoning application of the site.

Surveys identified 39 fauna species, including the koala (*Phascolarctos cinereus*), squirrel glider (*Petaurus norfolcensis*), eastern pygmy possum (*Cercartetus nanus*), powerful owl (*Ninox strenua*), Goulds wattled bat (*Chalinolobus gouldii*) and little forest bat (*Vespadelus vulturnus*). A total of 25 flora species were recorded within the Coastal Sands Apple – Blackbutt Forest and Swamp Mahogany Paperbark Forest communities which were mapped within Lot 218, outside the approved sand extraction area.

2.1.4 Ecological Assessment of Sand Extraction Operations from Lot 218 and Lot 220, Salt Ash (Umwelt 2009a)

Umwelt was engaged by Mackas Sand to undertake the environmental assessments associated with sand extraction on Lots 218 and 220 at Salt Ash. The vegetated disturbance area for the sand extraction development on Lot 220 was 48 hectares. The approved Lot 218 extraction area comprises unvegetated mobile sand dune. The 2009 survey area overlapped the Project Area and included similar vegetation communities.

The report drew on the previous ecological surveys undertaken in 2003 and 2004 (for Umwelt 2004) with additional ecological surveys including targeted flora and fauna surveys, ground-truthing the vegetation community mapping, threatened flora species survey, an assessment of the current condition of the Project Area and an updated fauna survey and habitat assessment.

No threatened flora species, endangered populations or TECs were recorded in the approved Lot 218 extraction area. Four threatened fauna species were recorded during surveys specifically for this project, being the squirrel glider (*Petaurus norfolcensis*), grey-headed flying-fox (*Pteropus poliocephalus*), greater broad-nosed bat (*Scoteanax rueppellii*) and the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*). Four other threatened fauna species were recorded in the surrounding area during surveys by Umwelt (2004): powerful owl (*Ninox strenua*), koala (*Phascolarctos cinereus*), eastern pygmy possum (*Cercartetus nanus*) and the masked owl (*Tyto novaehollandiae*).

2.1.5 Ecological Database Searches

A search of the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife database was undertaken to identify threatened species, endangered populations and TECs that have been previously recorded within a 10 kilometre radius of the Project Area. Similarly, the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) Protected Matters database was searched to identify Commonwealth listed threatened and migratory flora and fauna species and ecological communities whose range falls within the Project Area, and/or have been previously recorded within a 10 kilometre radius. The data

obtained from these two database searches were used to compile a list of threatened species, populations and TECs potentially occurring within the Project Area. A comparison between habitat requirements for each of these species and the habitat types present within the Project Area was undertaken to determine the likelihood of TSC and EPBC listed flora and fauna species occurring.

2.2 Field Surveys

Ecological surveys undertaken as part of this assessment were conducted by Umwelt on 3 and 11 March 2010, 30 April 2010, and 2 and 14 September 2011. The survey effort is described in **Sections 2.2.1** and **2.2.2** below. The aims of the field surveys were to:

- describe the vegetation communities and fauna habitat types present within the Project Area;
- describe the health and condition of the vegetation and habitats of the Project Area;
- obtain information on the general floristics and fauna species diversity of the Project Area;
- identify threatened flora and fauna species, migratory species and populations or TECs or their habitats occurring within or having potential to occur within the Project Area; and
- collate sufficient information to enable an accurate assessment of the impacts of the proposed development on the ecological values of the Project Area.

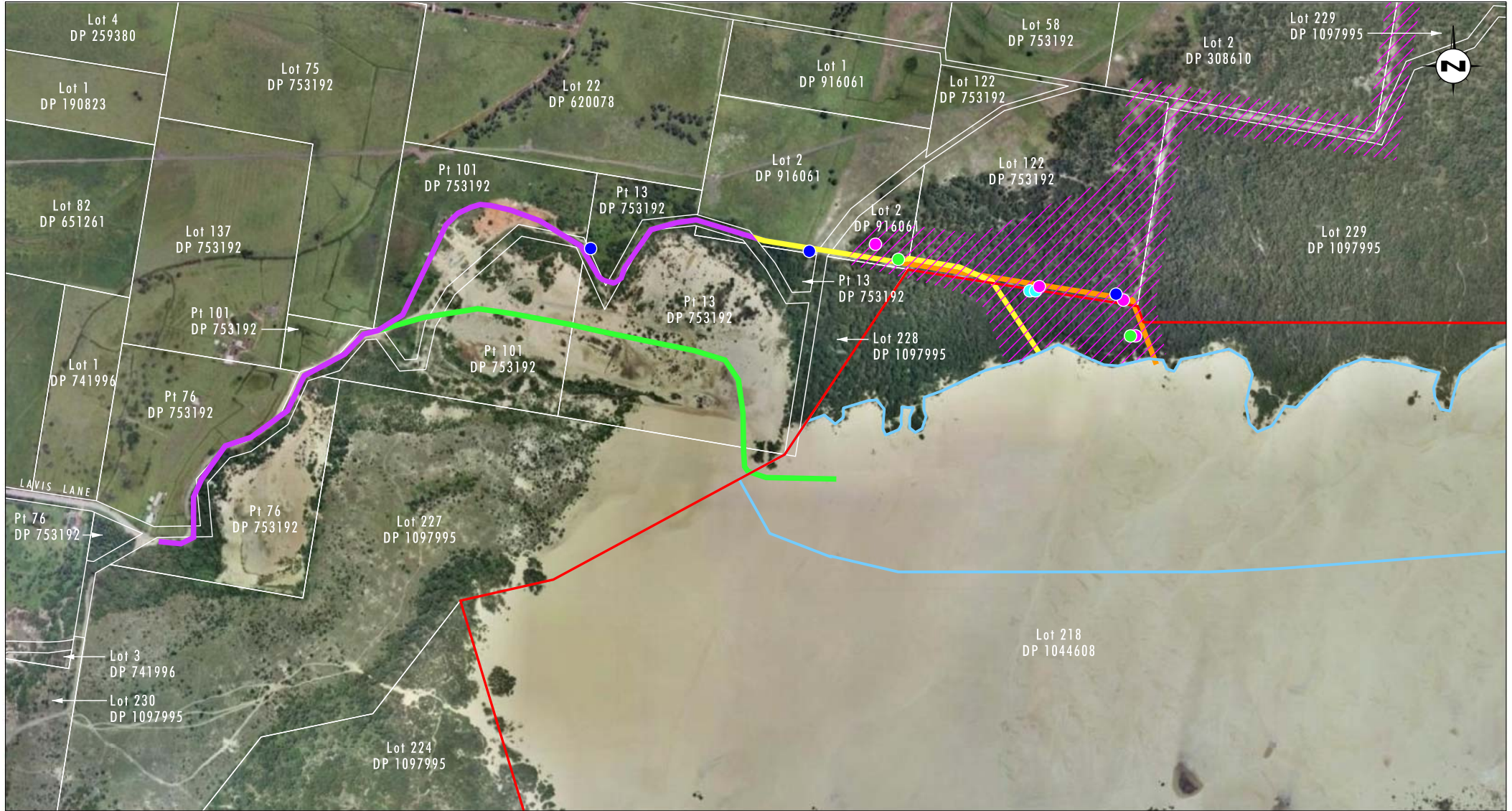
2.2.1 Flora Survey

Four 20 metre x 20 metre quadrats and seven rapid assessment plots were sampled in selected areas within the Project Area (see **Figure 2.1**). At each quadrat, a period of 45 to 60 minutes was spent searching for all vascular flora species present within the quadrat. At each rapid assessment plot, a period of 15 to 20 minutes was spent searching for the dominant vascular flora species present within the plot. Species within the quadrat and plot were assigned a cover-abundance value to reflect their relative cover and abundance. A modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with selected modifications sourced from Poore 1955 and Austin *et al.* 2000) was used to estimate cover-abundances of all plant species recorded within each quadrat and plot. **Table 2.1** shows the cover-abundance categories used.

Table 2.1 - Modified Braun-Blanquet Crown Cover-Abundance Scale

Class	Cover-abundance*	Notes
1	Few individuals (less than 5% cover)	Herbs, sedges and grasses: <5 individuals Shrubs and small trees: <5 individuals
2	Many individuals (less than 5% cover)	Herbs, sedges and grasses: 5 or more individuals Shrubs and small trees: 5 or more individuals Medium-large overhanging tree
3	5 – less than 20% cover	-
4	20 – less than 50% cover	-
5	50 – less than 75% cover	-
6	75 – 100% cover	-

Note: * Modified Braun-Blanquet scale (Poore 1955; Austin *et al.* 2000)



Source: Aerial: Google Earth, 2008

0 100 250 500m
1:10 000

Legend

- Lot 218 Boundary
- Lot 218 Approval Extraction Area
- Stockton Bight Track
- Previously Approved Access Route
- Alternate Route A
- Alternate Route B
- Call-playback
- Flora Quadrat
- Habitat Assessment
- Micro-bat Echolocation Survey
- ▨ Targeted Orchid Survey Area

FIGURE 2.1

Location of Survey Sites

At each of the quadrats and rapid assessment plots, information was gathered on the condition of remnant vegetation. Additionally, features indicating general health of the vegetation remnant at each quadrat were recorded, including: evidence of natural regeneration; occurrence and abundance of weeds; and evidence of disturbance and feral animals.

In addition to plot-based sampling, ground-truthing of vegetation mapping was undertaken along the length of the Project Area, and all species observed opportunistically were recorded.

2.2.1.1 Plant Identification and Taxonomic Review

All vascular plants recorded or collected were identified using keys and nomenclature from Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Recent changes to nomenclature and classification were incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2011), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide common names. Where the identity of a specimen was unknown or uncertain, it was lodged with the National Herbarium of New South Wales at the Royal Botanic Gardens Sydney.

2.2.1.2 Targeted Orchid Surveys

In addition to the quadrat and rapid assessment plots that were completed, targeted orchid surveys were undertaken on 2 and 14 September 2011. These surveys consisted of meander transects undertaken on-foot targeting the threatened orchid species rough doubletail (*Diuris praecox* (see **Plate 1**)) sand doubletail (*Diuris arenaria* (see **Plate 2**)). Any of these threatened orchid species identified in the field were way-pointed with a GPS in order to identify locations to be avoided and for mapping purposes.

The initial targeted orchid survey carried out on 2 September 2011 was undertaken along the alternate haul route including Route B within suitable habitat on Lot 2 DP 916061 and Lot 122 DP 753192 by an ecologist for an approximate two hour period (equating to two person hours of survey). This survey identified the presence of numerous threatened orchids that would be disturbed or removed by construction of the alternate haul route if Route B was used to access Lot 218 from the south-eastern corner of Lot 122 DP 753192 (referred to **Figure 2.1**).

Following this survey, Route A (see **Figure 2.1**) which avoids disturbance of the majority of the identified orchids was identified. A further survey of Route A alignment was carried out on 14 September 2011 by two ecologists (equating to a total of four person hours).

2.2.2 Fauna Survey

The following sections document the methods employed for the fauna survey components of the project.

2.2.2.1 Diurnal Bird Survey

Approximately two person hours over two separate days were spent searching for diurnal bird species along the alignment of the alternate haul route during the surveys. Each survey

consisted of a slow walking transect within targeted habitat types. Species were identified from characteristic calls and by observation, using 10 x 42 binoculars.

2.2.2.2 Herpetofauna Survey

Approximately two person hours over two separate days were spent searching for herpetofauna (reptile and amphibian species) along the alignment of the alternate haul route during the survey. Searches were conducted in likely microhabitats, including beneath rocks and logs, in tree bark, in ground litter and in wet soak areas.

2.2.2.3 Hair Funnel Sampling

One line of arboreal and terrestrial hair tube funnels were sampled along the alignment of the alternate haul route. Funnels were baited with a peanut butter, honey and oat bait mix, or meat, and were sprayed (on the tree trunk in the case of arboreal funnels) with a concentrated honey water solution. Funnels were set at intervals of 10 to 20 metres.

Hair samples were analysed by Barbara Triggs, a recognised expert in hair analysis.

2.2.2.4 Spotlighting Survey

Two nocturnal spotlighting surveys, each of two person hours on two separate nights, were undertaken within the Project Area. Spotlighting surveys targeted nocturnal birds, mammals and herpetofauna. Spotlighting was conducted on foot using 30 watt Lightforce hand-held spotlights. Spotlighting was undertaken generally between 8.00 pm and 10.00 pm, concentrating efforts within areas of most suitable habitat. Opportunistic spotlighting was also undertaken from a slow-moving vehicle while travelling throughout the Project Area.

2.2.2.5 Call Playback Survey

Nocturnal call playback sessions were undertaken on two separate nights within the first four hours after dusk. Calls were broadcast using a 10 watt directional loud hailer. Call playback sessions commenced with a quiet listening period of approximately five minutes. Each species' call was played for a minimum period of four minutes followed by a listening period of two minutes before the beginning of the next species' call. Call playback sessions included the calls of:

- squirrel glider (*Petaurus norfolcensis*);
- koala (*Phascolarctos cinereus*);
- masked owl (*Tyto novaehollandiae*);
- sooty owl (*Ninox connivens*);
- powerful owl (*Ninox strenua*); and
- grass owl (*Tyto longimembris*) at the site adjacent to grassland habitat.

2.2.2.6 Micro-bat Survey

Three micro-bat echolocation recordings were made using an 'Anabat II Bat Detector' and an 'Anabat CF Storage ZCAIM', hereafter referred to as an 'Anabat detector'. At each site the

Anabat detector was placed on the ground angled up at 45 degrees, from before sunset to two hours after sunset. Each detector was positioned within potential micro-bat flight paths.

Recorded bat calls were analysed by Glenn Hoye of Fly By Night Bat Surveys Pty Ltd. The echolocation calls of species were identified to one of three levels of confidence:

- definite;
- probable; and
- possible.

All three levels of identification confidence were treated as positive identifications for the purposes of this Ecological Assessment.

2.2.2.7 Habitat Assessment

Habitat assessments were undertaken at two locations throughout the Project Area during the survey. The assessments targeted the identification of potential habitat and resources for threatened fauna species. Observations of the following habitat features were made throughout the Project Area:

- evidence of fire;
- nature of and extent of erosion;
- extent of weed species;
- presence of feral animals;
- type of ground cover (e.g. litter, rock, soil);
- ground fauna resources;
- wet soaks/drainage lines;
- degree of dieback;
- presence of mistletoe;
- structure and floristics of vegetation cover; and
- number of habitat trees.

As part of the habitat assessment, all habitat trees (those with hollows, nests or dreys) were marked and recorded using a GPS. Habitat trees were marked with pink spray paint and each were given an individual number.

2.2.2.8 Koala Survey and Assessment

Port Stephens Council has prepared a Comprehensive Koala Plan of Management (2002). This plan covers the Project Area. The Spot Assessment Technique (Phillips and Callaghan 1995) was used to assess koala activity within the Project Area. Searches were made to identify preferred koala food trees and evidence of koala faecal pellets during walking

transects and at the four vegetation quadrats (refer to **Figure 2.1**) where preferred koala feed trees were identified.

The project is subject to assessment under State Environmental Planning Policy (SEPP) No. 44 (Koala Habitat Protection) as it lies in an LGA listed in Schedule 1 of the policy. SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas (*Phascolarctos cinereus*), to ensure permanent free-living populations over their present range and to reverse the current trend of population decline. Any development application in an identified LGA, affecting an area of land of one hectare or greater, including adjoining lands on the same holding, must be assessed under the policy.

Assessment under SEPP 44 is based on an initial determination of whether the land constitutes potential koala habitat. This is determined by assessing whether the eucalypt species present in Schedule 2 constitutes 15% or more of the total number of trees in the upper or lower strata of the tree component. If potential koala habitat is present, the area must be further assessed to determine if the land is core koala habitat.

The species listed in Schedule 2 of the policy are identified in **Table 2.2**.

Table 2.2 – Species Listed in Schedule 2 of SEPP 44

Scientific Name	Common Name
<i>Eucalyptus tereticornis</i>	forest red gum
<i>Eucalyptus microcorys</i>	tallowwood
<i>Eucalyptus punctata</i>	grey gum
<i>Eucalyptus viminalis</i>	ribbon or manna gum
<i>Eucalyptus camaldulensis</i>	river red gum
<i>Eucalyptus haemastoma</i>	broad-leaved scribbly gum
<i>Eucalyptus signata</i>	scribbly gum
<i>Eucalyptus albens</i>	white box
<i>Eucalyptus populnea</i>	bimble box or poplar box
<i>Eucalyptus robusta</i>	swamp mahogany

Four 20 metre by 20 metre vegetation quadrats were sampled and four walking transects were undertaken during the field surveys of the Project Area targeting the species listed in Schedule 2, and searching for faecal pellets.

2.2.2.9 Indirect Evidence of Faunal Presence Opportunistic Observations

Indirect evidence of faunal presence was recorded when detected. Evidence included tracks, scats, scratches, burrows, bones, nests and drays. Scats were sent away for expert analysis by Barbara Triggs. All opportunistic fauna observations were recorded during all aspects of the field surveys.

3.0 Flora Survey Results

3.1 Floristics

In total, 136 flora species within 49 families were recorded within the Project Area. Poaceae (grasses) was the most speciose family with 18 species recorded, followed by Asteraceae (daisies) and Fabaceae (Fabaceae), both with 10 species recorded. A list of all flora species recorded in the Project Area is provided in **Appendix A**.

Of the 136 flora species recorded, 26 (19%) were introduced species. Introduced pasture species dominate the grassland areas and include broad-leaved carpet grass (*Axonopus compressus*), African lovegrass (*Eragrostis curvula*), paspalum (*Paspalum dilatatum*) and kikuyu grass (*Pennisetum clandestinum*). Other dominant introduced species include bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*), lantana (*Lantana camara*) and golden wreath wattle (*Acacia saligna*). These understorey species occur in dense patches through the Project Area.

A hybrid of one threatened flora species Charmhaven apple (*Angophora inopina*) was recorded in the central section of the Project Area (see **Section 3.3**). Samples of the trees were taken and identified as hybrids between Charmhaven apple (*Angophora inopina*) and its relative rough-barked apple (*Angophora floribunda*) however, for the purpose of this report it has been assessed as the threatened Charmhaven apple (*Angophora inopina*). There is currently no guideline that indicates how a hybrid should be treated under the EPBC Act or TSC Act, therefore the Precautionary Principle has been applied and it is considered to be the listed threatened species.

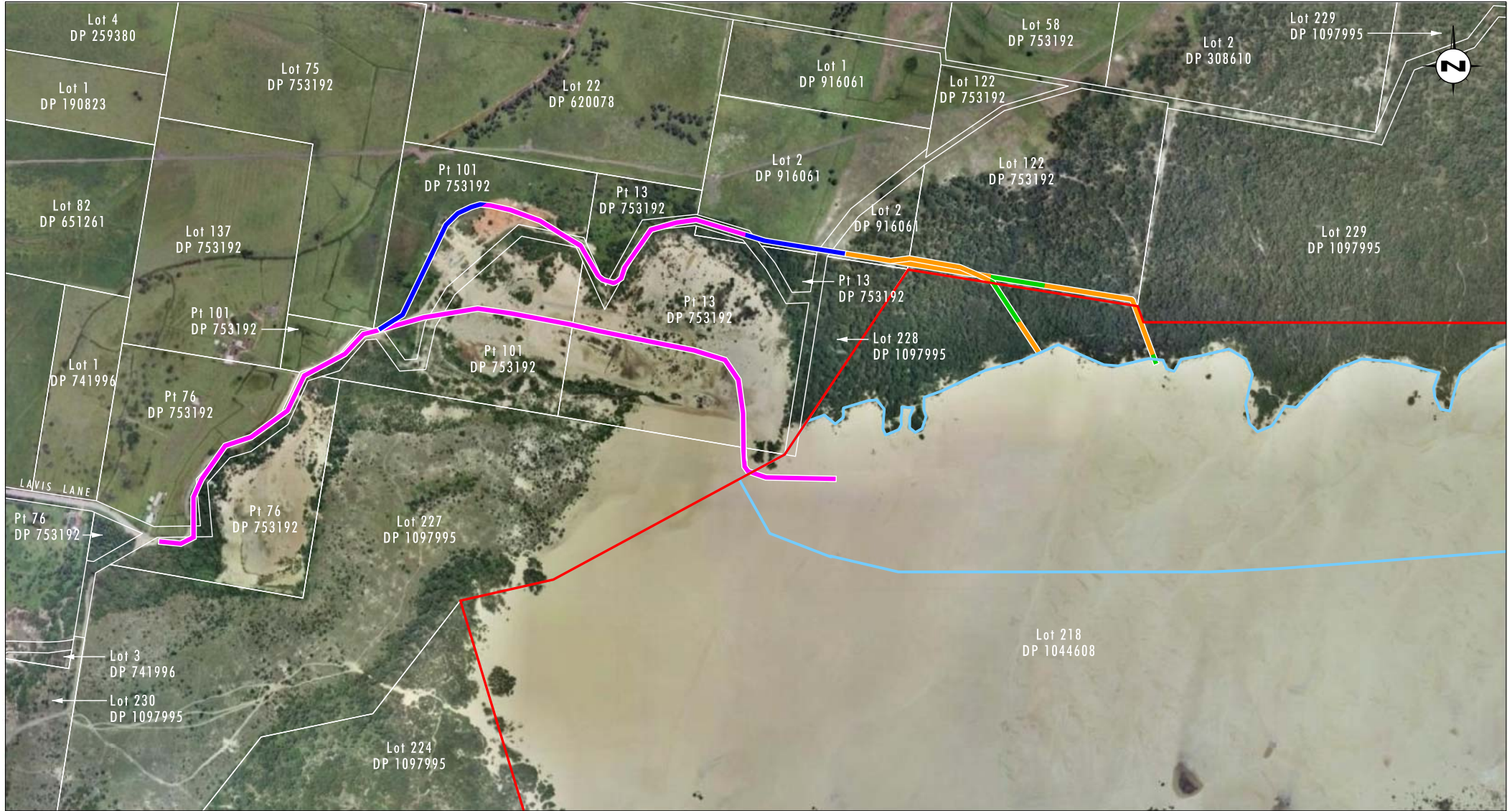
3.2 Vegetation Communities

Three vegetation communities were recorded within the Project Area, being: Coastal Sand Apple – Blackbutt Forest, Swamp Mahogany – Paperbark Forest and Previously Disturbed Grassland. The distribution of these communities within the Project Area is shown in **Figure 3.1**, and each is discussed in more detail in the following sections. As shown on **Figure 1.3**, these vegetation communities extend well beyond the Project Area into the adjoining Worimi Conservation Lands.

3.2.1 Coastal Sand Apple – Blackbutt Forest

The Coastal Sand Apple – Blackbutt Forest (nomenclature following LHCCREMS vegetation classification (NPWS 2000)), occurs in the eastern parts of the Project Area with approximately 0.42 hectares being within the preferred alternate haul route alignment. This community is characterised by a canopy stratum to 30% cover, up to 16 metres in height, dominated by blackbutt (*Eucalyptus pilularis*) and smooth-barked apple (*Angophora costata*). A sub-canopy layer is present and is dominated by old man banksia (*Banksia serrata*) and broom-heath (*Monotoca elliptica*). The sub-canopy typically has a canopy cover of 10% and a height of up to 10 metres.

The understorey stratum is mostly open (5% canopy cover) and dominated by Sydney golden wattle (*Acacia longifolia*), prickly Moses (*Acacia ulicifolia*), bossiaea (*Bossiaea rhombifolia*) and *Platysace lanceolata*. The ground cover is generally dense (to 50% canopy cover) consisting of common bracken fern (*Pteridium esculentum*), kangaroo grass (*Themeda australis*), blady grass (*Imperata cylindrica* var. *major*), raspwort (*Gonocarpus*



Source: Aerial: Google Earth, 2008

0 100 250 500m
1:10 000

Legend

- Lot 218 Boundary
- Lot 218 Approval Extraction Area
- Coastal Sand Apple-Blackbutt Forest
- Swamp Mahogany-Paperbark Forest
- Previously Disturbed (Existing Track and Power Easement)
- Previously Disturbed (Grassland)

FIGURE 3.1

Vegetation Communities

teucroides) and flax lily (*Dianella caerulea* var. *producta*). This community generally consists of a good succession of species in all strata.

The introduced species lantana (*Lantana camara*) and bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*) were the only dominant introduced species to occur in this community. Dense stands of both occur along the existing access track and at the base of the dunal system.

The vegetation community within the Project Area broadly aligns with two vegetation communities described in the Vegetation of the Tomago and Tomaree Sandbeds (Driscoll and Bell 2006): being Tomago Blackbutt – Apple – Bloodwood Forest and Anna Bay Blackbutt – Apple – Bloodwood Forest.

LHCCREMS Vegetation Survey, Classification and Mapping (NPWS 2000 and House 2003) maps the majority of the Project Area as Coastal Sand Apple – Blackbutt Forest (MU33). The community as described above is consistent with the MU33 description by NPWS (2000).

3.2.2 Swamp Mahogany – Paperbark Forest

Swamp Mahogany – Paperbark Forest (nomenclature following LHCCREMS vegetation classification), occurs in a moist depression in the east of the Project Area, adjacent to Coastal Sand Apple – Blackbutt Forest, with less than 0.09 hectares being within the preferred alternate haul route alignment. This community occurs in the lowest point of the Project Area between Lot 122 and Lot 218 in a location where the water table is high.

This vegetation community is characterised by a canopy stratum to 30% canopy cover, 15 metres in height, dominated by swamp mahogany (*Eucalyptus robusta*), broad-leaved paperbark (*Melaleuca quinquenervia*) and blackbutt (*Eucalyptus pilularis*).

The understorey is open (10-15% cover), to 8 metres in height, consisting of prickly tea-tree (*Leptospermum juniperinum*) and lemon-scented tea-tree (*Leptospermum polygalifolium*). The groundcover stratum is typically dense (60% canopy cover), and is dominated by *Juncus* spp., saw-sedge (*Gahnia clarkei*) and swamp water fern (*Blechnum indicum*).

The vegetation community within the Project Area is broadly consistent with the Paperbark Swamp Forest map units described in the Vegetation of the Tomago and Tomaree Sandbeds (Driscoll and Bell 2006).

3.2.3 Previously Disturbed Grassland

A significant proportion of the western section of the Project Area comprises previously disturbed areas such as existing bitumen or dirt roads, as well as 0.5 hectares of previously disturbed grassland. In the disturbed grassland, vegetation has been cleared for agricultural purposes, leaving only ground cover vegetation, typically less than 0.5 metres in height.

The derived grassland in most cases is dominated by introduced grasses such as paspalum (*Paspalum dilatatum*), kikuyu (*Pennisetum clandestinum*) and red Natal grass (*Melinis repens*). Introduced herbs were also common, including fireweed (*Senecio madagascariensis*), white clover (*Trifolium repens*), Paddy's lucerne (*Sida rhombifolia*) and cobbler's pegs (*Bidens pilosa*).

Native species were also recorded in the grassland, including common couch (*Cynodon dactylon*) and slender rat's tail grass (*Sporobolus creber*). In areas subject to inundation

native species included *Juncus* sp., common reed (*Phragmites australis*) and broadleaf cumbungi (*Typha orientalis*).

3.3 Threatened Flora Species and Endangered Populations

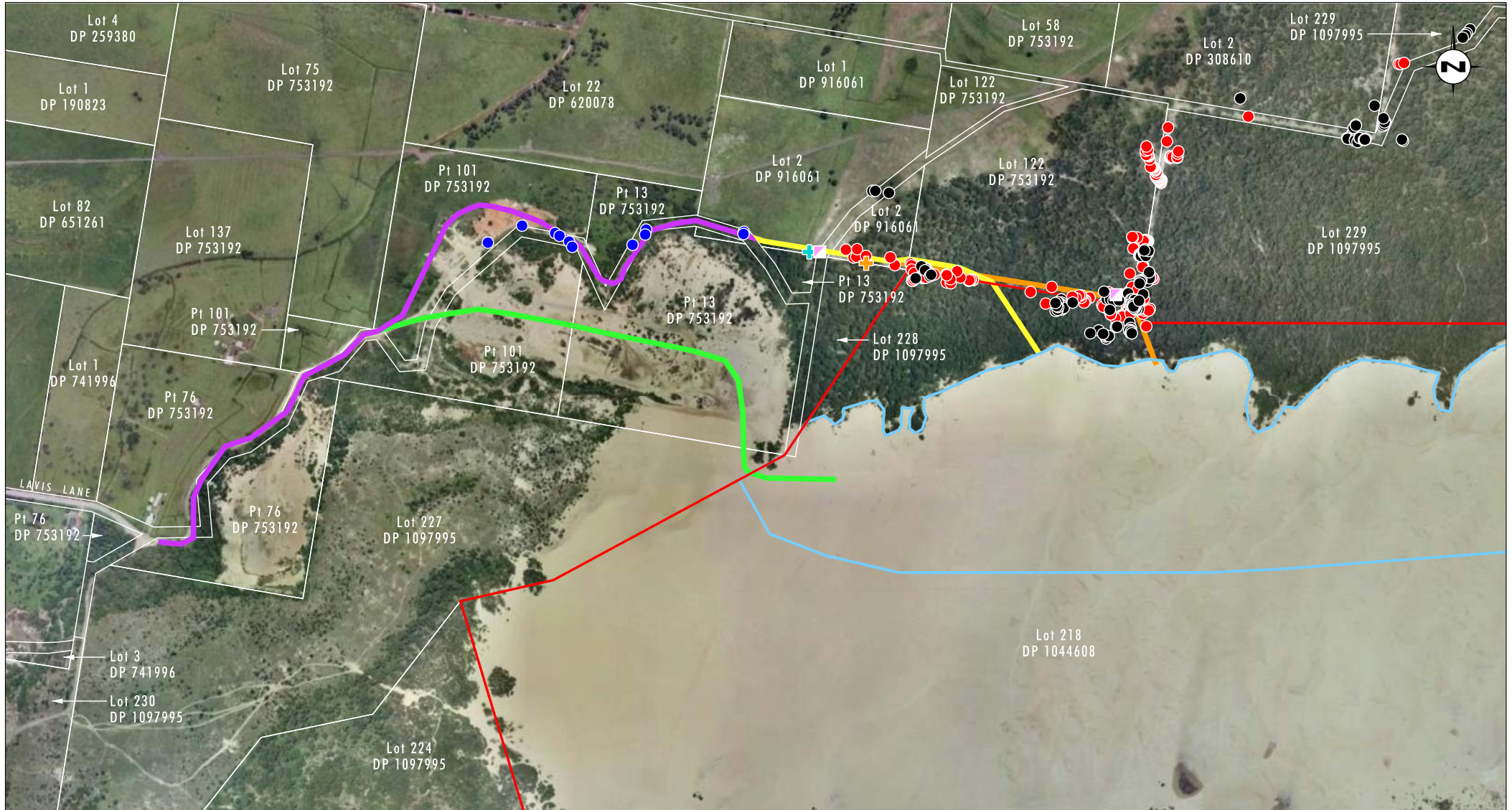
As described in **Section 3.1**, a stand of trees occurring along the central section of the alternate haul route has been determined to comprise trees being intergrades of *Angophora floribunda* and *Angophora inopina*, the latter being a threatened species listed as vulnerable under the TSC Act. This was confirmed by the Royal Botanic Gardens Sydney. Such hybrids are not technically required to be treated as the threatened species. However, for the purposes of this assessment, using the Precautionary Principle, the hybrid is treated as the threatened species, *Angophora inopina*. The locations of the *Angophora inopina* hybrids within or close to the Project Area are shown on **Figure 3.2**. The trees were found in or adjacent to the central area of the alternate haul route, where approximately 11 individuals were recorded. Given that the trees are hybrids, and the true species *A. floribunda* and *A. inopina* both are likely to occur in the stand, it is difficult to estimate exact numbers present.

Additionally, the sand doubletail (*Diuris arenaria*) which is listed under TSC Act and rough doubletail (*Diuris praecox*) which is listed under TSC and EPBC Acts were both identified during targeted field surveys of the eastern section of the Project Area. Approximately 250 individuals of *Diuris praecox* were identified with approximately 30 to 50 individuals within or immediately adjacent to Route B alignment of the alternate haul route. In addition, approximately 50 individuals of sand doubletail (*Diuris arenaria*) were identified along or adjacent to Route B alignment of the alternate haul route. Only 8 to 10 individuals of *Diuris praecox* were identified along the section of the alternate haul route west of where Route A crosses into Lot 218. No *Diuris praecox* or *Diuris arenaria* were identified along the alignment of Route A between Lot 122 and Lot 218 extraction area. As a result utilisation of Route A would avoid disturbing 20 to 40 individual of *Diuris praecox* that would be disturbed if Route B was utilised.

Although it was not identified during surveys of the Project Area, potential habitat was identified for the threatened leafless tongue-orchid (*Cryptostylis hunteriana*). Despite the absence of records, it should be noted that surveys were not undertaken during the flowering season of this orchid and that despite the rarity of this species there was considered to be potential for this species to occur. The leafless tongue orchid (*Cryptostylis hunteriana*) is listed as a vulnerable species under the TSC Act and the EPBC Act.

No other threatened flora species or endangered flora populations were recorded along the alternate haul route.

A list of all threatened flora species recorded or regarded to have potential to occur within a 10 kilometre radius of the Project Area (based on database searches and literature review) is presented in **Appendix B**. Of these, only Charmhaven apple (*Angophora inopina*), sand doubletail (*Diuris arenaria*), rough double-tail (*Diuris praecox*) and leafless tongue orchid (*Cryptostylis hunteriana*) were known to occur or found to have potential to occur in the Project Area.



Source: Aerial: Google Earth, 2008

0 100 250 500m
1:10 000

Legend

- ▭ Lot 218 Boundary
- ▭ Lot 218 Approval Extraction Area
- ▭ Stockton Bight Track
- ▭ Previously Approved Access Route
- ▭ Alternate Route A
- ▭ Alternate Route B
- + Grey-headed Flying-fox
- + Little Bentwing-bat
- Greater Broad-nosed Bat
- *Angophora floribunda/inopina*
- *Diuris arenaria*
- *Diuris praecox*

FIGURE 3.2

Threatened Species

3.4 Threatened Ecological Communities

All TECs occurring in the Sydney Basin Bioregion were considered for their potential to occur in the Project Area, and this list was narrowed down to the following TECs that were considered to have potential to occur:

- Swamp Sclerophyll Forest in the NSW North Coast, Sydney Basin and South-East Corner Bioregions;
- Littoral Rainforest in the NSW North Coast, Sydney Basin and South-East Corner Bioregions;
- Freshwater Wetlands in the NSW North Coast, Sydney Basin and South-East Corner Bioregions; and
- Swamp Oak Floodplain Forest in the NSW North Coast, Sydney Basin and South-East Corner Bioregions.

The characteristics of the vegetation communities recorded along the alternate haul route were compared with the characteristics of the above TECs. No TECs were found to be consistent with the vegetation communities of the Project Area.

While the Swamp Mahogany – Paperbark Forest recorded in the Project Area shares some floristic and structural characteristics with the Swamp Sclerophyll Forest TEC, it does not occur on a floodplain and is not associated with any floodplain, and therefore is not consistent with the TEC.

3.5 EPBC Act Threatened Flora Species

EPBC Act listed threatened flora species, Charmhaven apple (*Angophora inopina*), and one vulnerable flora species, rough doubletail (*Diuris praecox*), were recorded in the Project Area. Both these species are listed as vulnerable under the EPBC Act. Refer to **Section 3.3** for more detail on this species.

The nine EPBC Act listed threatened flora species that were returned from a 10 kilometre radius search of the DSEWPC Protected Matters Database, are listed in **Table 3.1**. The far right column of **Table 3.1** indicates whether each species is known to occur, has potential to occur or no potential to occur in the Project Area.

Table 3.1 – EPBC Act Listed Threatened Flora Species

Species	EPBC Act Status	Recorded/Potential to Occur
Charmhaven apple <i>Angophora inopina</i>	vulnerable	recorded
Leafless tongue orchid <i>Cryptostylis hunteriana</i>	vulnerable	potential
rough doubletail <i>Diuris praecox</i>	vulnerable	recorded
dwarf heath casuarina <i>Allocasuarina defungens</i>	endangered	no potential

Table 3.1 – EPBC Act Listed Threatened Flora Species (cont)

Species	EPBC Act Status	Recorded/Potential to Occur
Parramatta red gum <i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	vulnerable	no potential
Camfield's stringybark <i>Eucalyptus camfieldii</i>	vulnerable	no potential
biconvex paperbark <i>Melaleuca biconvexa</i>	vulnerable	no potential
Knotweed <i>Persicaria elatior</i>	vulnerable	no potential
dwarf kerrawang <i>Rulingia prostrata</i>	endangered	no potential

3.6 Regionally Significant Flora Species

The Project Area occurs within the Hunter Region, within which there are numerous flora species considered to have conservation significance (Peake et al. 2003). The criteria used to list regionally significant species include:

- endemic taxa – known distribution restricted to this region;
- uncommon taxa – less than 50 known populations;
- records close to the limit of the species' geographical range; and
- significant reductions in population size or area occupied.

The Hunter Rare Plants Database (Peake et al. 2003) provides an extensive list of flora species within the Hunter Region that are considered to be regionally significant. Only one regionally significant flora species from this list occurs in the Project Area, blady grass (*Imperata cylindrica* var. *major*). This species is relatively widespread throughout the region and is considered significant due to the Hunter Region being the limit of its distribution.

4.0 Fauna Survey Results

4.1 Fauna Habitat

The Project Area provides foraging, roosting and nesting habitats for a variety of fauna species. Two broad habitat types were identified along the alternate haul route: open forest and previously disturbed/grassland. While the previously disturbed/grassland areas provide mostly foraging habitat, the open forest areas provide a range of habitat niches for fauna species.

The canopy in the open forest habitat is dominated by smooth-barked apple (*Angophora costata*) and blackbutt (*Eucalyptus pilularis*) which support a moderate abundance of tree hollows providing important habitat for hollow-dependent fauna. A total of 27 habitat trees were recorded and marked within a 20 metre buffer of alternate haul route. Of these it is

estimated that up to 15-20 habitat trees, comprising approximately 50 hollows ranging in size, would occur within the proposed alternate haul route.

The canopy trees also provide foraging resources such as insects, nectar and foliage, for a wide variety of fauna including small and medium sized arboreal mammals, birds and reptiles. Swamp mahogany (*Eucalyptus robusta*) provides an important winter foraging resource for a wide range of species, in particular migratory birds such as swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*).

The open, mid-stratum of the open forest habitat supports tea-trees and paperbarks, providing a good nectar resource for birds and arboreal mammals. These shrubs, combined with the dense ground stratum of grasses and sedges also provide important cover and refuge for reptiles, small mammals and birds.

Narrow artificial drainage channels occur adjacent to the Project Area and provide the only local surface water resources for fauna species, however these are not permanent.

The Regional Biodiversity Conservation Strategy (House 2003) identifies the Coastal Sand Apple – Blackbutt Forest (see **Figure 1.3**) occurring along the Stockton Bight dune system from Stockton to Anna Bay as regionally significant habitat and as a regionally significant habitat linkage. This category includes the best connected bushland in the region and these habitat areas have been identified to ensure that large contiguous and often pristine areas of bushland are protected. Typically these areas represent the most viable and often the most diverse bushland in the region (House 2003). The Project Area occurs in a relatively disturbed area of this large vegetation remnant and as such the habitats are of lower habitat value than other examples contiguous with the Project Area and in the surrounding region. The forest habitats in the eastern half of the alternate haul route are significantly more diverse and important for fauna species than the disturbed grassland habitats of the western half.

4.1.1 Koala Habitat Assessment

The vegetation communities of the alternate haul route were assessed according to Schedule 2 of SEPP 44. Of the listed SEPP 44 trees, only one, swamp mahogany (*Eucalyptus robusta*), was found to occur. This species occurs in moderately high density in the Swamp Mahogany – Paperbark Forest. Based on the formal SEPP 44 assessments undertaken at flora plot sites and habitat assessment sites, there were no sites which supported over 15% of swamp mahogany (*Eucalyptus robusta*) trees (as a percentage of total number of canopy trees).

Surveys in nearby, similar habitats (Umwelt 2004) identified a koala (*Phascolarctos cinereus*) and the Port Stephens Koala Plan of Management (CKPoM) (Phillips and Callagan 1995) identifies the site as providing supplementary koala habitat, which is important to the long-term management of koalas in Port Stephens. The site is located within the Fullerton Cove/Stockton Bight Koala Management Unit (KMU). As such, sections of the alternate haul route, in particular approximately the 0.1 hectares of Swamp Mahogany – Paperbark Forest that would be disturbed by construction of the alternate haul route provides potential habitat for koalas (*Phascolarctos cinereus*).

4.2 Fauna Species Recorded

A total of 53 fauna species were recorded during fauna surveys of the Project Area, including 37 bird species, 14 mammal species, one reptile species and one amphibian species.

A list of all species recorded in the Project Area is provided in **Appendix C** and the locations where threatened species were recorded during the survey effort are shown in **Figure 3.1**.

4.2.1 Birds

Thirty-seven bird species from 21 families were recorded during fauna surveys of the project area. The most common species recorded were yellow-faced honeyeater (*Lichenostomus chrysops*), white-throated treecreeper (*Cormobates leucophaeus*) and superb fairy-wren (*Malurus cyaneus*). Other species recorded include rufous whistler (*Pachycephala rufivenris*), swamp harrier (*Circus approximans*) and yellow-tailed black-cockatoo (*Calyptorhynchus funereus*).

No threatened bird species were recorded during surveys.

4.2.2 Mammals

Fourteen mammal species from seven families were recorded during fauna surveys for the Project Area, five non-flying and nine flying mammal species. The most common species recorded were the common brushtail possum (*Trichosurus vulpecula*) and eastern grey kangaroo (*Macropus giganteus*). A total of eight micro-bats were recorded within the Project Area, including Gould's wattled bat (*Chalinolobus gouldii*) and little forest bat (*Vespadelus vulturinus*).

Three threatened bat species were recorded during the survey, including little bentwing-bat (*Miniopterus australis*) and greater broad-nosed bat (*Scoteanax rueppellii*), both listed as vulnerable under the TSC Act, and grey-headed flying-fox (*Pteropus poliocephalus*), listed as vulnerable under the TSC Act and EPBC Act.

4.2.3 Reptiles

One reptile species was recorded during the survey of the Project Area, being grass skink (*Lampropholis delicata*). The alternate haul route is likely to provide habitat for a variety of reptile species, however habitat for threatened reptile species was not identified.

No threatened reptile species were recorded during surveys.

4.2.4 Amphibians

One amphibian species was recorded during the survey of the proposed alternate haul route, being common eastern froglet (*Crinia signifera*). The Project Area supports limited habitat suitable for amphibian species, however the artificial drainage channels periodically hold water.

No threatened amphibian species were recorded during surveys.

4.3 TSC Act Listed Threatened Fauna Species and Endangered Fauna Populations

The following three threatened fauna species listed under the TSC Act were recorded in the Project Area during surveys for this assessment:

- grey-headed flying-fox (*Pteropus poliocephalus*): one individual of this species was recorded during spotlighting surveys and this species is likely to forage within the Project Area. No roost sites were identified in the Project Area;
- little bentwing-bat (*Miniopterus australis*): this species was recorded by an Anabat located on the existing access track bordering Lot 2 and Lot 122. It is likely that this species would forage throughout the Project Area and adjacent habitats. This species rarely roosts in tree hollows, however there is some potential that there would be a roost of this species in tree hollows of the Project Area; and
- greater broad-nosed bat (*Scoteanax rueppellii*): this species is likely to forage widely throughout the Project Area and adjacent habitats, being recorded by an Anabat in the central and eastern parts of the Project Area. There is potential that this hollow-roosting species would roost in the Project Area in suitable tree hollows.

The results of the Atlas of NSW Wildlife Database and Protected Matters Database searches indicated an additional 19 threatened fauna species that have reasonable potential to occur in the Project Area. These are listed below:

- varied sittella (*Daphoenositta chrysoptera*);
- glossy black-cockatoo (*Calyptorhynchus lathami*);
- swift parrot (*Lathamus discolor*);
- regent honeyeater (*Anthochaera phrygia*);
- masked owl (*Tyto novaehollandiae*);
- powerful owl (*Ninox strenua*);
- spotted-tail quoll (*Dasyurus maculatus*);
- long-nosed potoroo (*Potorous tridactylus*);
- brush-tailed phascogale (*Phascogale tapoatafa*);
- koala (*Phascolarctos cinereus*);
- eastern pygmy possum (*Cercartetus nanus*);
- squirrel glider (*Petaurus norfolcensis*);
- grey-headed flying fox (*Pteropus poliocephalus*);
- eastern freetail-bat (*Mormopterus norfolkensis*);
- little bentwing bat (*Miniopterus australis*);

- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- greater broad-nosed bat (*Scoteanax rueppellii*);
- yellow-bellied sheath-tail-bat (*Saccolaimus flaviventris*); and
- large-eared pied-bat (*Chalinolobus dwyeri*).

A list of all TSC Act listed threatened fauna species recorded or regarded to have potential to occur within a 10 kilometre radius of the Project Area (based on database searches and literature review) is presented in **Appendix B**.

4.4 EPBC Act Listed Threatened and Migratory Fauna Species

All EPBC Act listed threatened and migratory fauna species recorded within the Project Area are listed in **Table 4.1**. This table also includes species that were returned from a 10 kilometre radius search of the DSEWPC Protected Matters Database. The far right column in **Table 4.1** indicates whether each species was recorded in the Project Area, has potential to occur or has no potential to occur.

Table 4.1 – EPBC Act Listed Threatened and Migratory Fauna Species

Species	EPBC Act Status	Recorded/Potential to Occur
Threatened species		
grey-headed flying-fox <i>Pteropus poliocephalus</i>	vulnerable	recorded
swift parrot <i>Lathamus discolor</i>	endangered & marine	potential
regent honeyeater <i>Anthochaera phrygia</i>	endangered & migratory	potential
large-eared pied-bat <i>Chalinolobus dwyeri</i>	vulnerable	potential
green and golden bell frog <i>Litoria aurea</i>	endangered	no potential
stuttering barred frog <i>Mixophyes balbus</i>	vulnerable	no potential
New Holland mouse <i>Pseudomys novaehollandiae</i>	vulnerable	potential
spotted-tailed quoll <i>Dasyurus maculatus</i>	endangered	potential
long-nosed potoroo <i>Potorous tridactylus</i>	vulnerable	potential
Migratory Species		
welcome swallow <i>Hirundo neoxena</i>	marine	recorded
tree martin <i>Hirundo nigricans</i>	marine	recorded
silveryeye <i>Zosterops lateralis</i>	marine	recorded
magpie-lark <i>Grallina cyanoleuca</i>	marine	recorded

Table 4.1 – EPBC Act Listed Threatened and Migratory Fauna Species (cont)

Species	EPBC Act Status	Recorded/Potential to Occur
spangled drongo <i>Dicrurus bracteatus</i>	marine	recorded
black-faced cuckoo-shrike <i>Coracina novaehollandiae</i>	marine	recorded
black-shouldered kite <i>Elanus axillarus</i>	migratory	recorded
white-bellied sea-eagle <i>Haliaeetus leucogaster</i>	marine & migratory	recorded
whistling kite <i>Haliastur sphenurus</i>	marine & migratory	recorded
swamp harrier <i>Circus approximans</i>	marine & migratory	recorded
white-throated needletail <i>Hirundapus caudacutus</i>	marine & migratory	potential
rainbow bee-eater <i>Merops ornatus</i>	marine & migratory	potential
black-faced monarch <i>Monarcha melanopsis</i>	marine & migratory	no potential
satin flycatcher <i>Myiagra cyanoleuca</i>	marine & migratory	no potential
rufous fantail <i>Rhipidura rufifrons</i>	marine & migratory	potential
great egret <i>Ardea alba</i>	marine & migratory	no potential
cattle egret <i>Ardea ibis</i>	marine & migratory	no potential
fork-tailed swift <i>Apus pacificus</i>	marine & migratory	potential

5.0 Impact Assessment

The following sections provide an assessment of the impacts of the proposed development (as described in **Section 1.2**), taking into consideration the proposed mitigation measures detailed in **Section 6.0** that would be adhered to for the project.

5.1 Flora Species and Vegetation Communities

The Project Area was found to have a moderately high floristic diversity, with a total of 136 flora species recorded in the 1.38 hectare vegetated portion of the Project Area. Eighty-one per cent of the species recorded are native species. The Project Area supports two forest vegetation communities totalling 0.88 hectares, comprising Coastal Sand Apple – Blackbutt Forest and Swamp Mahogany – Paperbark Forest. These communities and the flora species comprising them are regarded to be widespread locally and regionally as shown on **Figure 1.3**. These communities have moderately high ecological values, supporting habitats for a range of threatened flora and fauna species.

The preferred alignment involves the disturbance of approximately 0.42 hectares of Coastal Sand Apple – Blackbutt Forest and Swamp Mahogany – Paperbark Forest and 0.5 hectares of previously disturbed grassland. There is similar and higher quality vegetation in the large expanse of vegetation extending along the Stockton dune system, which is contiguous with the Project Area. This includes the Worimi Conservation Lands, including Worimi National Park.

Although the natural vegetation within the Project Area is of ecological significance, the small area (0.42 hectares) of native vegetation that will be impacted will not significantly reduce the area of any vegetation communities or affect floristic diversity on a local or regional scale.

5.2 Fauna Species and Habitats

The Project Area covers 2.63 hectares, of which approximately 1.38 hectares supports vegetated habitat utilised by a known 52 native fauna species and likely a wide variety of other species. These habitats provide known habitat for three threatened fauna species, and potential habitat for a further 16 threatened fauna species. As mentioned in **Section 5.1** above, there are similar and higher quality habitats in the large expanse of vegetation extending along the Stockton dune system, which is contiguous with the Project Area.

The habitats of the Project Area support a number of important ecological values. Nonetheless, they are widely represented and conserved in the local area and region and the removal of approximately 1.0 hectare of these vegetated habitats is not expected to be significant.

5.3 Threatened Flora Species

An intergrade of *Angophora floribunda* and *Angophora inopina* was identified in the Project Area. For the purpose of this report this species was assessed as the Charmhaven Apple (*Angophora inopina*). Eleven individuals of this species were recorded within or adjacent to the Project Area of which seven may be removed through construction of the Stockton Bight Track section of the alternate haul route.

Approximately, 250 individuals of the threatened orchid species rough doubletail (*Diuris praecox*) were recorded in or adjacent to the habitats in the Project Area of which nine to 10 would be removed as part of construction of Route A. In addition potential habitat (approximately 0.43 hectares) was identified for the sand doubletail (*Diuris arenaria*) (with 50 individuals recorded surrounding the Project Area). Survey indicates that adoption of Route A should result in the removal of only one to two of the identified *Diuris arenaria*. Furthermore, the Project Area was considered to have potential to provide suitable habitat for the leafless tongue orchid (*Cryptostylis hunteriana*).

Charmhaven apple (*Angophora inopina*), leafless tongue orchid (*Cryptostylis hunteriana*) and rough doubletail (*Diuris praecox*) are listed as vulnerable species under the TSC Act and sand doubletail (*Diuris arenaria*) is listed as an endangered species under the TSC Act. Assessments of significance (in accordance with the EP&A Act) prepared for Charmhaven apple, leafless tongue orchid, rough doubletail and sand doubletail (**Appendix D**) determined that the proposed development would not be likely to have a significant impact on any of these species.

The Charmhaven apple (*Angophora inopina*), leafless tongue orchid (*Cryptostylis hunteriana*) and rough doubletail (*Diuris praecox*) are also listed under the EPBC Act and therefore

require assessment under the EPBC Act as well. This assessment is provided in **Appendix E**, and also determines that the proposed development will not have a significant impact on this species.

Although the impact on these threatened flora species will be low, a number of impact mitigation measures (**Section 6.0**) have been developed to further reduce the impacts on the ecological values of the Project Area.

5.4 Threatened Ecological Communities

No TECs will be impacted upon as a result of the proposed development.

5.5 Endangered Populations

No endangered populations will be impacted upon as a result of the proposed development.

5.6 Threatened Fauna Species

Three threatened fauna species listed under the TSC Act were recorded in the Project Area; the little bentwing-bat (*Miniopterus australis*), the greater broad-nosed bat (*Scoteanax rueppellii*) and the grey-headed flying-fox (*Pteropus poliocephalus*), the latter being also listed under the EPBC Act. Potential foraging habitat for all three species occurs throughout the Project Area.

In addition to the three threatened fauna species recorded, 16 threatened fauna species were determined to have reasonable potential to occur in the Project Area. These species are listed in **Section 4.3** above.

Assessments of significance (in accordance with the EP&A Act) prepared for the three recorded threatened fauna species and the 16 potentially occurring threatened fauna species (**Appendix D**) determined that the proposed development would not have a significant impact on any threatened fauna species.

The regent honeyeater (*Anthochaera phrygia*), swift parrot (*Lathamus discolor*), spotted-tailed quoll (*Dasyurus maculatus*), long-nosed potoroo (*Potorous tridactylus*), New Holland mouse (*Pseudomys novaehollandiae*), grey-headed flying-fox (*Pteropus poliocephalus*) and large-eared pied-bat (*Chalinolobus dwyeri*) are also listed under the EPBC Act and therefore require assessment under that Act. These assessments, provided in **Appendix E**, determined that the proposed development will not have a significant impact on any threatened fauna species.

The proposed development has a footprint of 2.3 hectares with approximately 1.2 hectares comprising vegetation that provides known and potential habitat for threatened fauna species. The habitats of the Project Area are a small part of a very large remnant of continuous vegetation extending along the Stockton sand dune system, parts of which are protected in the Worimi Conservation Lands and National Park. Given the small scale of the proposed development, combined with the presence of large areas of similar and better quality habitats that will remain connected with those of the Project Area, there is no potential for there to be a significant impact on any known or potentially occurring threatened fauna species.

5.7 Koala Habitat

The Project Area supports potential habitat for the koala (*Phascolarctos cinereus*), in particular in the Coastal Sand Apple – Blackbutt Forest and the Swamp Mahogany – Paperbark Forest. Surveys in nearby, similar habitats (Umwelt 2004) identified a koala (*Phascolarctos cinereus*) and the Port Stephens Koala Plan of Management (CKPoM) (PSC 2002) identifies the site as providing supplementary koala habitat.

The proposed development will disturb less than 1 hectare of potential habitat for the koala (*Phascolarctos cinereus*), and will not result in the fragmentation of any habitats of this species in the local area. An assessment of significance prepared for this species (**Appendix D**) concludes that the proposed development will not result in a significant loss of potential habitat for the koala (*Phascolarctos cinereus*).

5.8 Matters of National Environmental Significance (EPBC Act)

Under the Commonwealth EPBC Act, the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance (NES). These matters are:

- listed threatened species and communities;
- migratory species protected under international agreements;
- Ramsar wetlands of international importance;
- the Commonwealth marine environment;
- World Heritage properties;
- National Heritage places; and
- nuclear actions.

Section 3.5 lists a hybrid of Charmhaven apple (*Angophora inopina*) and rough doubletail (*Diuris praecox*) as threatened species listed under the EPBC Act that are known to occur in the Project Area; as well as leafless tongue orchid (*Cryptostylis hunteriana*) as having potential to occur in the Project Area. **Section 4.4** lists the seven threatened fauna species and 14 migratory and/or marine fauna species recorded or with potential to occur in the Project Area.

The EPBC Act set out criteria which are used to determine whether an action is likely to have a significant impact on matters of NES. These criteria are addressed in the Assessment of Significance provided in **Appendix E** for each of the recorded and potentially occurring species listed as threatened or migratory under the EPBC Act. From this assessment of significance, it is concluded that the project will not result in a significant impact on any listed threatened species and communities or migratory species listed under the Schedules of the EPBC Act.

5.9 Key Threatening Processes

A number of Key Threatening Processes (KTP) listed under the Schedules of TSC Act and EPBC Act, are relevant to the proposed development. No relevant KTPs were identified under the *Fisheries Management Act 1994*. A discussion of the implications of the relevant KTP under each Act is detailed below.

5.9.1 Threatened Species Conservation Act KTPs

a) Invasion of native plant communities by bitou bush and boneseed

The invasion of native plant communities by bitou bush and boneseed contributes greatly to the loss of biodiversity along the NSW coast. The rapid colonisation of this species poses potential risk if disturbed areas are not monitored and maintained.

The development of the alternate haul route has potential to cause some localised outbreaks of bitou bush (already present in the Project Area), particularly along the track edge. As this alternate haul route is linked with a sand extraction operation that already has weed management commitments, these should be expanded to ensure monitoring and management of any weed outbreaks along the alternate haul route.

b) Invasion, establishment and spread of *Lantana camara*

The invasion, establishment and spread of lantana (*Lantana camara*) contributes greatly to the loss of biodiversity throughout NSW coast and ranges. The rapid colonisation of this species poses potential risk if disturbed areas are not monitored and maintained.

The development of the alternate haul route has potential to cause some localised outbreaks of lantana (already present in the Project Area), particularly along the track edge. As this alternate haul route is linked with a sand extraction operation that already has weed management commitments, these should be expanded to ensure monitoring and management of any weed outbreaks along the alternate haul route.

c) Clearing of native vegetation

The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The proposed development will involve the clearing of less than 2 hectares of native vegetation. Relative to the distribution of vegetation and habitats within the local area, the disturbance of less than 2 hectares is not regarded as a significant loss of native vegetation.

d) Loss of hollow-bearing trees

The loss of hollow-bearing trees is a major threat to native vertebrate fauna, in particular threatened species, throughout NSW. Hollow bearing trees provide nesting, roosting and foraging resources for a range of native fauna. Many fauna species are known to select hollows with specific characteristics highlighting the value of a range of hollow-bearing trees in an area.

The Project Area supports a number of hollow-bearing trees, providing potential habitats for a range of hollow-dependent species such as the threatened squirrel glider (*Petaurus norfolcensis*) and powerful owl (*Ninox strenua*). To reduce the impacts on any hollow-dependent species in the Project Area, an ecologically appropriate tree-clearing procedure

(as set out in the Landscape Management Plan (Umwelt 2009b)) will be followed for all clearing works.

e) Removal of dead wood and dead trees

Dead wood and dead trees provide valuable nesting, roosting and foraging resources for a range of native fauna. The removal of dead wood and dead trees results in a significant loss of habitat for native fauna. The proposed development will involve the clearing of less than 2 hectares of native vegetation which would support such habitats for native fauna. The Project Area is connected with large expanses of similar native vegetation, and as such the removal of less than 2 hectares does not comprise a significant loss of habitat in the local region.

5.9.2 Environment Protection and Biodiversity Conservation Act KTPs

a) Land clearance

The clearing of native vegetation is listed as a major factor contributing to the loss of biological diversity. The proposed development will involve the clearing of less than 2 hectares of native vegetation. Relative to the distribution of vegetation and habitats within the local area, the disturbance of less than 2 hectares is not regarded as a significant loss of native vegetation.

Conclusion

The loss of less than 2 hectares of native vegetation as a result of the proposed development is not significant given the large expanses of protected lands adjacent to the Project Area, including the 4438 hectares of Worimi Conservation Lands. While there is potential risk of the proposed development affecting some of these KTPs, there are no significant implications for the proposed development.

5.10 Critical Habitat

No critical habitat listed under the TSC Act or EPBC Act was identified in the Project Area.

6.0 Proposed Mitigation Measures

The following mitigation measures for the alternate haul route are based on and consistent with those developed for the existing approved sand quarry as outlined in Umwelt (2009a & b) and Major Project Approval 08_142. The following sections describe the relevant mitigation measures, how they relate to the proposed development and how they should be integrated with the ecological management of the approved sand extraction operations.

6.1 Protection and Management of Arboreal Habitat (Clearing Procedure)

A detailed vegetation clearing procedure was developed for the sand extraction proposal (Umwelt 2009b) which is now approved under Major Project Approval 08_0142. All vegetation clearing will be undertaken in accordance with this procedure for all vegetation

clearing activities. The clearing procedure is aimed to minimise the impacts of the proposed development on arboreal fauna species and habitat. In particular a number of hollow-bearing trees occur which provide potential habitat for threatened species recorded or potentially occurring in the Project Area such as the greater broad-nosed bat (*Scoteanax rueppellii*), squirrel glider (*Petaurus norfolcensis*), powerful owl (*Ninox strenua*) and masked owl (*Tyto novaehollandiae*).

The vegetation clearing procedure, as detailed in Umwelt (2009b), is provided below.

Vegetation Clearing Procedure

Trees will be cleared in accordance with the procedure described below. Where possible, salvaged micro-habitats (tree hollows, logs etc.) will be retained for use in rehabilitation once re-established vegetation is suitably mature. The identification of tree hollows is to be undertaken by an appropriately qualified and experienced ecologist during pre-clearance inspections.

- Within the area of clearing, hollow-bearing trees and other habitat structures such as stags, logs and stumps will be clearly marked by an appropriately qualified and experienced person to prevent accidental clearing.
- Vegetation surrounding the marked habitat structures will be cleared and the marked structures left undisturbed for a period of 24 hours.
- Marked hollow-bearing trees will be shaken prior to felling using a bulldozer and then left for a short period to allow any fauna using the hollows to be observed.
- Hollow-bearing trees will be slowly pushed over using a bulldozer, with care taken to avoid damage to hollows.
- Immediately following tree felling each of the identified hollows will be examined for fauna by a suitably qualified and experienced person.
- Where practical, felled trees will be left for a 24-hour period prior to removal in order to allow species to move in to adjoining vegetation of their own volition.
- Nocturnal species which do not immediately move into adjoining vegetation will be captured and kept in a warm, dark and quiet place prior to release within the same vegetation community from which it was captured at night.
- Captured nocturnal animals will be released on the evening of capture and will not be held for extended periods of time.
- Suitable hollows and other habitat structures (including logs, stumps and stags) appropriate for relocation to areas not intended for future development or for use in rehabilitation will be selected by the appropriately qualified and experienced person.
- Hollows intended for re-erection will be removed and then capped with marine plywood or other suitable material.
- Logs, stumps, stags and hollows intended for ground habitat will be cut into sections, as required and stockpiled for use in rehabilitation.
- In the event that injured fauna are identified, species will be immediately taken to the nearest veterinarian or certified wildlife carer for treatment.

The timing of clearing operations will be designed to reduce the potential impact on breeding species, particularly the squirrel glider and threatened micro-bats. Clearing will (where possible) avoid the winter months when micro-bats and the eastern pygmy possum are in a state of torpor and squirrel gliders begin to breed.

Salvaged tree hollows and logs will be stockpiled and used in site rehabilitation. Once rehabilitation is structurally mature, salvaged tree hollows will be replaced in similar densities to those in unaffected vegetation on the site. Salvaged logs and branches will be spread following topsoil spreading to enhance ground fauna characteristics.

Nest boxes will be used in lieu of salvaged tree hollows if appropriate, as determined as part of the rehabilitation management of the site.

6.2 Road Usage Rules for the Protection of Ecological Values

A number of threatened fauna species have potential to be injured or killed as a result of traffic on the alternate haul route. The koala (*Phascolarctos cinereus*), brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*) and the eastern pygmy possum (*Cercartetus nanus*) are examples of species that have potential to pass over the alternate haul route on the ground. Other fauna species such as kangaroos, wallabies and possums also have potential to be injured crossing this road.

Due to the potential risk of injury/death to fauna crossing the alternate haul route, it is appropriate to have road usage rules to minimise potential impacts on native fauna. The following road usage rules are proposed:

- enforce a maximum 40 kilometre/hour speed limit on the alternate haul route for all quarry traffic;
- minimise night traffic where possible (most fauna collisions are likely to occur at night time, in particular dusk and dawn);
- erect signage at either end of the alternate haul route to inform drivers of the ecological values of the habitats through which it passes and therefore the need to drive with caution; and
- leave tree canopies overhanging the track where safe and appropriate as this will allow some gliding species to cross without coming to the ground.

Due to the large cluster of threatened orchid species (rough doubletail (*Diuris praecox*) and sand doubletail (*Diuris arenaria*)) occurring within and in proximity to the Project Area, the following mitigation measures are recommended:

- construct the alternate haul route along the Route A alignment to avoid the majority of these individuals; and
- a pre-clearance survey conducted by a qualified ecologist would be undertaken to delineate areas to be avoided by construction. GPS coordinates for rough doubletail (*Diuris praecox*) and sand doubletail (*Diuris arenaria*) collected during flowering period of September 2011 are to be used to delineate the Route A alignment and no-go areas.

6.3 Rehabilitation

On completion of sand extraction works, if the alternate haul route is no longer required for other purposes such as fire fighting, rehabilitation of the road should be integrated with that of the quarry, in accordance with the rehabilitation principles outlined in Umwelt (2009b).

Broadly, rehabilitation of the alternate haul route will aim to re-establish the native vegetation communities that existed prior to clearing for its construction. Revegetation of disturbed areas will utilise locally occurring plant species in a composition that closely resembles that of the pre-development vegetation communities. Monitoring of any revegetated areas along the road access should be integrated with any monitoring program for the sand extraction areas as described in **Section 7.0** of Umwelt (2009b).

6.4 Biodiversity Offsetting Considerations

The vegetation present in the Project Area supports known and potential habitat for a number of threatened flora and fauna species. Although there are threatened species habitats present, the area of impact of the proposed development is relatively small (less than 2 hectares of remnant native vegetation) and the Project Area adjoins a very large remnant of vegetation which offers similar or higher quality habitats for the same threatened species, which is conserved in Worimi Conservation Lands and National Park. The Project Area does not comprise unique values or areas that are dissimilar to the surrounding coastal dune system. The proposed alternate haul route will have very little impact on threatened species habitats in the locality and as such is not regarded to warrant the negotiation of any biodiversity offsetting areas.

Further to this, the Worimi LALC owns a significant area (4438 hectares) of native vegetation along the Stockton dune system which is managed for its conservation values. The Worimi Conservation Land includes the 524 hectare Worimi National Park. The dedication of the Conservation Land was part of an agreement to allow some parts of the Stockton sand dune system to be developed (including for sand extraction) while dedicating other areas to conservation – in effect, the Worimi Conservation Land was a pre-emptive biodiversity offsetting agreement.

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APPENDIX A

Flora Species List

Appendix A – Flora Species List

The following list was developed from flora surveys undertaken as part of the proposed alternate haul route modification to Major Project 08_0142, located at Salt Ash, NSW. It includes all species of vascular plants observed along the alternate haul route during field surveys. Not all species are readily detected at any one time of the year, therefore the list will not necessarily include all plant species likely to occur in the project area. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp. specimens that are identified to genus level only.

The following abbreviations or symbols are used in the list:

asterisk (*) denotes species not indigenous to the study area;

Bold species indicated in bold text are indicative of threatened species or hybrids of threatened species;

subsp. subspecies;

var. variety.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2010), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Family	Scientific Name	Common Name
Cycadopsida (Cycads)		
Zamiaceae	<i>Macrozamia communis</i>	burrawang
Filicopsida (Ferns)		
Blechnaceae	<i>Blechnum indicum</i>	swamp water fern
Dennstaedtiaceae	<i>Hypolepis muelleri</i>	harsh ground fern
Dennstaedtiaceae	<i>Pteridium esculentum</i>	bracken
Dicksoniaceae	<i>Calochlaena dubia</i>	common ground fern
Polypodiaceae	<i>Platyserium</i> sp.	
Magnoliopsida (Flowering Plants) – Liliidae (Monocots)		
Arecaceae	<i>Livistona australis</i>	cabbage palm
Commelinaceae	<i>Commelina cyanea</i>	native wandering Jew
Cyperaceae	* <i>Cyperus aggregatus</i>	
Cyperaceae	<i>Cyperus</i> sp.	
Cyperaceae	<i>Gahnia sieberiana</i>	red-fruit saw-sedge
Cyperaceae	<i>Schoenus melanostachys</i>	black bog-rush
Hypoxidaceae	<i>Hypoxis</i> sp.	
Juncaceae	* <i>Juncus acutus</i>	sharp rush
Juncaceae	<i>Juncus continuus</i>	
Juncaceae	<i>Juncus prismatocarpus</i>	
Juncaceae	<i>Juncus</i> sp.	
Lomandraceae	<i>Lomandra longifolia</i>	spiny-headed mat-rush
Luzuriagaceae	<i>Eustrephus latifolius</i>	wombat berry
Orchidaceae	<i>Diuris arenaria</i>	sand doubletail
Orchidaceae	<i>Diuris praecox</i>	rough doubletail
Orchidaceae	<i>Spiranthes australis</i>	ladies tresses
Philydraceae	<i>Philydrum lanuginosum</i>	frogsmouth
Phormiaceae	<i>Dianella caerulea</i> var. <i>producta</i>	
Poaceae	* <i>Andropogon virginicus</i>	whisky grass
Poaceae	<i>Austrostipa</i> sp.	
Poaceae	* <i>Axonopus compressus</i>	broad-leaved carpet grass
Poaceae	<i>Cymbopogon refractus</i>	barbed wire grass
Poaceae	<i>Cynodon dactylon</i>	common couch
Poaceae	<i>Digitaria brownii</i>	cotton panic grass

Family	Scientific Name	Common Name
Poaceae	<i>Eragrostis australasica</i>	canegrass
Poaceae	* <i>Eragrostis curvula</i>	African lovegrass
Poaceae	<i>Eragrostis leptostachya</i>	paddock lovegrass
Poaceae	<i>Imperata cylindrica</i> var. <i>major</i>	blady grass
Poaceae	* <i>Melinis repens</i>	red Natal grass
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	weeping grass
Poaceae	* <i>Paspalum dilatatum</i>	paspalum
Poaceae	<i>Paspalum</i> sp.	
Poaceae	* <i>Pennisetum clandestinum</i>	kikuyu grass
Poaceae	<i>Phragmites australis</i>	common reed
Poaceae	<i>Sporobolus creber</i>	slender rat's tail grass
Poaceae	<i>Themeda australis</i>	kangaroo grass
Restionaceae	<i>Baloskion tetraphyllum</i> subsp. <i>meiostachyum</i>	
Restionaceae	<i>Restio</i> sp.	
Smilacaceae	<i>Smilax glyciophylla</i>	sweet sarsparilla
Typhaceae	<i>Typha orientalis</i>	broadleaf cumbungi
Magnoliopsida (Flowering Plants) – Magnoliidae (Dicots)		
Aizoaceae	<i>Carpobrotus glaucescens</i>	pigface
Apiaceae	* <i>Hydrocotyle bonariensis</i>	pennywort
Apiaceae	<i>Platysace lanceolata</i>	shrubby platysace
Apocynaceae	<i>Parsonsia lilacina</i>	crisped silkpod
Apocynaceae	<i>Parsonsia straminea</i>	common silkpod
Asclepiadaceae	* <i>Gomphocarpus fruticosus</i>	narrow-leaved cotton bush
Asteraceae	* <i>Acanthospermum australe</i>	
Asteraceae	<i>Ambrosia</i> sp.	ragweed
Asteraceae	* <i>Bidens pilosa</i>	cobbler's pegs
Asteraceae	* <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	bitou bush
Asteraceae	* <i>Conyza bonariensis</i>	flaxleaf fleabane
Asteraceae	<i>Euchiton involucratus</i>	star cudweed
Asteraceae	* <i>Hypochaeris radicata</i>	catsear
Asteraceae	<i>Ozothamnus diosmifolius</i>	white dogwood
Asteraceae	* <i>Senecio madagascariensis</i>	fireweed
Asteraceae	* <i>Tagetes minuta</i>	stinking Roger

Family	Scientific Name	Common Name
Bignoniaceae	<i>Pandorea pandorana</i>	wonga wonga vine
Campanulaceae	<i>Wahlenbergia communis</i>	tufted bluebell
Campanulaceae	<i>Wahlenbergia gracilis</i>	sprawling or bluebell
Casuarinaceae	<i>Allocasuarina littoralis</i>	black sheoak
Casuarinaceae	<i>Casuarina glauca</i>	swamp oak
Crassulaceae	* <i>Bryophyllum delagoense</i>	mother-of-millions
Dilleniaceae	<i>Hibbertia aspera</i>	rough guinea flower
Dilleniaceae	<i>Hibbertia scandens</i>	climbing guinea flower
Epacridaceae	<i>Leucopogon ericoides</i>	pink beard-heath
Epacridaceae	<i>Leucopogon lanceolatus</i>	
Epacridaceae	<i>Leucopogon parviflorus</i>	coastal beard-heath
Epacridaceae	<i>Leucopogon</i> sp.	
Epacridaceae	<i>Monotoca elliptica</i>	tree broom-heath
Euphorbiaceae	<i>Breynia oblongifolia</i>	coffee bush
Euphorbiaceae	<i>Glochidion ferdinandi</i>	cheese tree
Euphorbiaceae	<i>Homalanthus populifolius</i>	bleeding heart
Euphorbiaceae	* <i>Ricinus communis</i>	castor oil plant
Fabaceae (Faboideae)	<i>Bossiaea heterophylla</i>	variable bossiaea
Fabaceae (Faboideae)	<i>Bossiaea rhombifolia</i>	
Fabaceae (Faboideae)	<i>Desmodium gunnii</i>	slender tick trefoil
Fabaceae (Faboideae)	<i>Desmodium varians</i>	slender tick-trefoil
Fabaceae (Faboideae)	<i>Dillwynia retorta</i>	
Fabaceae (Faboideae)	<i>Glycine clandestina</i>	
Fabaceae (Faboideae)	<i>Glycine</i> sp.	
Fabaceae (Faboideae)	<i>Hardenbergia violacea</i>	false sarsaparilla
Fabaceae (Faboideae)	<i>Kennedia rubicunda</i>	red kennedy pea
Fabaceae (Faboideae)	<i>Trifolium repens</i>	white clover
Fabaceae (Mimosoideae)	<i>Acacia irrorata</i> subsp. <i>irrorata</i>	green wattle
Fabaceae (Mimosoideae)	<i>Acacia longifolia</i>	
Fabaceae (Mimosoideae)	* <i>Acacia saligna</i>	golden wreath wattle
Fabaceae (Mimosoideae)	<i>Acacia sophorae</i>	coastal wattle
Fabaceae (Mimosoideae)	<i>Acacia stricta</i>	straight wattle

Family	Scientific Name	Common Name
Fabaceae (Mimosoideae)	<i>Acacia suaveolens</i>	sweet wattle
Fabaceae (Mimosoideae)	<i>Acacia ulicifolia</i>	prickly moses
Goodeniaceae	<i>Goodenia paniculata</i>	branched goodenia
Haloragaceae	<i>Gonocarpus micranthus</i>	
Haloragaceae	<i>Gonocarpus teucroides</i>	raspwort
Lamiaceae	<i>Plectranthus parviflorus</i>	cockspur flower
Lauraceae	<i>Endiandra sieberi</i>	hard corkwood
Malvaceae	* <i>Sida rhombifolia</i>	Paddy's lucerne
Meliaceae	<i>Synoum glandulosum</i>	scentless rosewood
Menispermaceae	<i>Stephania japonica</i> var. <i>discolor</i>	snake vine
Menyanthaceae	<i>Villarsia exaltata</i>	yellow marsh flower
Myrtaceae	<i>Angophora costata</i>	smooth-barked apple
Myrtaceae	<i>Angophora floribunda</i>	rough-barked apple
Myrtaceae	<i>Angophora floribunda</i> – <i>inopina</i>	rough-barked apple- Charmhaven apple intergrade
Myrtaceae	<i>Eucalyptus pilularis</i>	blackbutt
Myrtaceae	<i>Eucalyptus robusta</i>	swamp mahogany
Myrtaceae	<i>Eucalyptus umbra</i>	white mahogany
Myrtaceae	<i>Leptospermum juniperinum</i>	prickly tea-tree
Myrtaceae	<i>Leptospermum polygalifolium</i>	lemon-scented tea-tree
Myrtaceae	<i>Leptospermum trinervium</i>	paperbark tea tree
Myrtaceae	<i>Melaleuca linariifolia</i>	snow-in-summer
Myrtaceae	<i>Melaleuca quinquenervia</i>	broad-leaved paperbark
Oxalidaceae	<i>Oxalis perennans</i>	
Pittosporaceae	<i>Pittosporum revolutum</i>	rough fruit pittosporum
Polygonaceae	<i>Persicaria decipiens</i>	slender knotweed
Polygonaceae	<i>Persicaria hydropiper</i>	water pepper
Polygonaceae	<i>Persicaria strigosa</i>	spotted knotweed
Polygonaceae	<i>Rumex</i> sp.	dock
Proteaceae	<i>Banksia integrifolia</i>	coast banksia
Proteaceae	<i>Banksia serrata</i>	old-man banksia
Proteaceae	<i>Conospermum ericifolium</i>	
Proteaceae	<i>Conospermum taxifolium</i>	variable smoke-bush

Family	Scientific Name	Common Name
Proteaceae	<i>Persoonia levis</i>	broad-leaved geebung
Proteaceae	<i>Persoonia linearis</i>	narrow-leaved geebung
Rosaceae	* <i>Rubus fruticosus</i> sp. agg.	blackberry complex
Rubiaceae	<i>Pomax umbellata</i>	pomax
Rubiaceae	* <i>Richardia stellaris</i>	
Solanaceae	* <i>Solanum nigrum</i>	black-berry nightshade
Thymelaeaceae	<i>Pimelea linifolia</i>	slender rice flower
Verbenaceae	<i>Clerodendrum tomentosum</i>	hairy clerodendrum, downy chance tree
Verbenaceae	* <i>Lantana camara</i>	lantana
Verbenaceae	* <i>Verbena bonariensis</i>	purpletop

APPENDIX B

Threatened Flora Species, Endangered Populations and TECs recorded or with Potential to Occur

Appendix B – Threatened Flora and Fauna Species, Endangered Populations and TECs recorded or with Potential to Occur

Threatened species, endangered populations and threatened ecological communities (TECs) recorded during surveys and known to occur in the local area are listed in **Tables 1, 2** and **3** below. The results of the searches of the Office of Environment and Heritage Atlas of NSW Wildlife and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) Protected Matters Database are also included. These database searches provided lists of species, populations or TECs previously recorded within a 10 kilometre radius of the project area, or with potential habitat within that radius.

Tables 1, 2 and **3** provide information on each threatened species (including specific habitat, distribution and reservation) which has contributed to determine their likelihood of occurring within the proposed access road, as well as the likelihood of being impacted as a result of the proposed development. Where indicated in the tables, species with potential to occur and potential to be impacted have been further assessed in **Appendices D** and **E**.

Table 1 – Threatened Flora Assessment

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
THREATENED FLORA SPECIES						
netted bottle brush <i>Callistemon linearifolius</i>	V (TSC)	This species typically grows in dry sclerophyll forest on the coast and adjacent ranges.	Occurs chiefly from the Georges River to the Hawkesbury River.	Karuah NR	The project area is unlikely to provide potential habitat for this species and the species was not recorded during flora surveys. There is no potential for a significant impact on this species.	No
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	V (TSC) V (EPBC)	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant.	There are two separate meta-populations of this species. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamstown and Tomago in the south. The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Aberdare in the south. Large aggregations of the sub-species are located in the Tomalpin area.	This species is not known from any reservation areas in the region.	This species was not recorded during flora surveys undertaken in potential habitat for the species. This species is not expected to occur. There is no potential for a significant impact on this species.	No

Table 1 – Threatened Flora Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Charmhaven apple <i>Angophora inopina</i>	V (TSC) V (EPBC)	Habitat for this species typically occurs on the shallow sandy soils of the Narrabeen Group, on exposed ridges and slopes with westerly or northerly aspect. It has also been recorded on shallow alluvial soils in upper catchments and in embedded clay soil lenses with sandstone. This species is known to naturally hybridise with <i>A. floribunda</i> , particularly around major drainage lines.	This species has a restricted distribution, being confined to the Wyong, Lake Macquarie and Port Stephens Shires of NSW. Pure forms of this species have been recorded from the Wallarah catchment in the south and north to the Toronto area. Disjunct populations have been identified at Karuah.	Medowie SCA	An intergrade of <i>Angophora floribunda</i> and <i>Angophora inopina</i> was recorded in the project area. However, for the purposes of this assessment, using the Precautionary Principle, the hybrid is treated as the threatened species, <i>Angophora inopina</i> .	Yes
leafless tongue-orchid <i>Cryptostylis hunteriana</i>	V (TSC) V (EPBC)	This species appears to favour moist soils on the flat coastal plains. Occupies swamp heath, but also sclerophyll forest and woodland, often on sandy soils. Typically found in communities containing <i>Eucalyptus haemastoma</i> , <i>E. capitellata</i> and <i>Corymbia gummifera</i> .	This species is known to occur in the Karuah Manning and Wyong CMA sub-regions in the Hunter Central Rivers region.	This species is not known from any reservation areas in the region.	This species was not recorded during flora surveys, however potential habitat was identified within the project area.	Yes

Table 1 – Threatened Flora Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
sand doubletail <i>Diuris arenaria</i>	E (TSC)	This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil.	This species is known to occur in the Karuah Manning sub-region of the Hunter/Central Rivers Catchment.	Tomaree NP	This species was recorded during targeted orchid surveys. There is potential for impact on this species.	Yes
rough doubletail <i>Diuris praecox</i>	V (TSC) V (EPBC)	Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey.	Occurs between Ourimbah and Nelson Bay.	Glenrock SCA	This species was recorded during targeted orchid surveys. There is potential for impact on this species.	Yes
Camfields stringybark <i>Eucalyptus camfieldii</i>	V (TSC) V (EPBC)	Occurs in poor coastal country in shallow sandy soils and coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace Area south to Waterfall. Localised and scattered distribution includes sites at Norah Head, Peats Ridge, Mt Colah, Elvina Bay Trail, Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park.	This species is not known from any reservation areas in the region.	This species was not recorded during flora surveys undertaken in potential habitat for the species. This species is not expected to occur and further assessment is not required.	No

Table 1 – Threatened Flora Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
knotweed <i>Persicaria elatior</i>	V (TSC) V (EPBC)	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	This species has been recorded in south-eastern and northern NSW. In the north it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). This species also occurs in Queensland.	This species is not known from any reservation areas in the region.	The project area does not provide potential habitat for this species. There is no potential for a significant impact on this species.	No
dwarf kerrawang <i>Rulingia prostrata</i>	E (TSC) E (EPBC)	Occurs on sandy, sometimes peaty soils in a wide variety of habitats. Chiefly in gullies along the escarpment south from Picton.	This species is known to occur in the Karuah Manning sub-region of the Hunter/Central Rivers Catchment and a disjunct population occurs on Swamp Mahogany ecotonal forest at Tomago.	This species is not known from any reservation areas in the region.	The project area does not provide potential habitat for this species. There is no potential for a significant impact on this species.	No
dwarf heath casuarina <i>Allocasuarina defungens</i>	E (TSC) E (EPBC)	Grows mainly in tall heath on sand, but can also occur on clay soils and sandstone or exposed nearby-coastal hills/ headlands adjacent to sandplains.	Occurs only in NSW from the Nahiab area, north-west of Forster, to Byron Bay on the NSW north coast.	This species is not known from any reservation areas in the region.	The project area does not provide potential habitat for this species. There is no potential for a significant impact on this species.	No

Table 1 – Threatened Flora Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
biconvex paperbark <i>Melaleuca biconvexa</i>	V (TSC) V (EPBC)	Biconvex paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Scattered and dispersed populations of this species are known to occur in the Karuah Manning and Wyong sub-regions of the Hunter/Central Rivers Catchment.	Tilligery SCA	The project area does not provide potential habitat for this species. There is no potential for a significant impact on this species.	No

Key: TSC = *Threatened Species Conservation Act 1995*;
 EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*;
 E = Endangered;
 V = Vulnerable;
 PD = Preliminary Determination;
 EEC = Endangered Ecological Community;
 CEEC = Critically Endangered Ecological Community;
 EP = Endangered Population;
 SCA = State Conservation Area; and
 NP = National Park.

Table 2 – Threatened Ecological Communities

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Generally occur below 20 m elevation on level areas.	Known from along the majority of the NSW coast. There is less than 150 ha remaining on the Tweed lowlands (estimate in 1985); about 10,600 ha on the lower Clarence floodplain (in 1982); about 11,200 ha on the lower Macleay floodplain (in 1983); about 3500 ha in the lower Hunter – Central Hunter region (in 1990s); less than 2700 ha on the NSW south coast from Sydney to Moruya (in the mid 1990s), including about 660 ha on the Cumberland Plain (in 1998) and about 100 ha on the Illawarra Plain (in 2001); and less than 1000 ha in the Eden region (in 1990).	Hunter Estuary NP Pambalong NR	There are no open wetland habitats in the project area. There is no potential for this TEC to occur.	No

Table 2 – Threatened Ecological Communities (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation.	Known from parts of the LGAs of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes, Port Stephens, Maitland, Newcastle, Cessnock, Lake Macquarie, Wyong, Gosford, Pittwater, Warringah, Hawkesbury, Baulkham Hills, Hornsby, Lane Cove, Blacktown, Auburn, Parramatta, Canada Bay, Rockdale, Kogarah, Sutherland, Penrith, Fairfield, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Wollongong, Shellharbour, Kiama, Shoalhaven,	Pambalong NR	The project area is not on or associated with a coastal floodplain. As such, there is no potential for this TEC to occur.	No

Table 2 – Threatened Ecological Communities (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (cont)			Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Major examples once occurred on the floodplains of the Clarence, Macleay, Hastings, Manning, Hunter, Hawkesbury, Shoalhaven and Moruya Rivers.			
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Generally occurs below 20 m (though sometimes up to 50 m) elevation. The composition of the community is primarily determined by the frequency and duration of water logging and the texture, salinity nutrient and moisture content of the soil, and latitude. The composition and structure	This community is known to occur in numerous LGAs, but is believed to be restricted to the areas of coastal NSW; no further south than the Shoalhaven LGA and as far north as the NSW-Queensland border, but no further west than Bathurst.	This EEC is not known to occur in reserves in the region.	Swamp Mahogany – Parperbark Forest was identified on site however the project area is not on or associated with a coastal floodplain, as specified in the Final Determination for this EEC. As such, there is no potential for this TEC to occur.	No

Table 2 – Threatened Ecological Communities (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (cont)		of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.				
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	Occurs on sand dunes and on soil derived from underlying rocks. Stands on headlands exposed to strong wind-action may take the form of dense, wind-pruned thickets. Stands are generally taller in sheltered sites such as hind dunes, although wind-pruning may still occur on their windward sides. Most stands occur within 2 km of the sea, though are occasionally found further inland within reach of the maritime influence.	Littoral Rainforest occurs only on the coast and is found at locations in the NSW North Coast Bioregion, Sydney Basin Bioregion and South East Corner Bioregion.	Glenrock SCA	This EEC is not present within the project area and there is no potential for a significant impact on this EEC.	No

Table 3 – Threatened Fauna Assessment

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
AMPHIBIANS						
wallum froglet <i>Crinia tinnula</i>	V (TSC)	Wallum Froglets are found only in acid paperbark swamps and sedge swamps of the coastal 'wallum' country.	This species is known to occur in the Hunter, Karuah Manning, Wyong and Macleay Hastings subregions of the Hunter/Central Rivers Catchment.	Tomaree NP	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. wallum sedgeland). There is no potential for a significant impact on this species.	No
stuttering barred frog <i>Mixophyes balbus</i>	E (TSC) V (EPBC)	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	Occur along the east coast of Australia from southern Queensland to the north-eastern Victoria	Killarney NR Watagans NP	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. rainforest or tall open forest). There is no potential for a significant impact on this species.	No
green and golden bell frog <i>Litoria aurea</i>	E (TSC) V (EPBC)	Occurs amongst emergent aquatic or riparian vegetation and amongst vegetation, fallen timber, including grassland, cropland and modified pastures. Breeds in still or slow flowing waterbodies with some vegetation such as <i>Typha</i> spp. and <i>Eleocharis</i> spp.	NSW North Coast near Brunswick Heads, southwards along the NSW Coast to Victoria where it extends into east Gippsland.	This species is not known from any conservation reserves in the region.	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. wetlands and ponds). There is no potential for a significant impact on this species.	No

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
BIRDS						
little lorikeet <i>Glossopsitta pusilla</i>	V (TSC)	This species can be found in dry-open eucalypt forests and woodlands, and have been identified in remnant vegetation, old growth vegetation, logged forests, and roadside vegetation. The little lorikeet usually forages in small flocks, not always with birds of their own species. They nest in hollows, mostly in living smooth-barked apples.	This species is distributed from just north of Cairns, around the east coast of Australia down to Adelaide. In NSW this species is found from the coast to the western slopes of the Great Dividing Range, extending as far west as Albury, Dubbo, Parkes and Narrabri.	Glenrock SCA Joe Redman Reserve Wallaroo NP Worimi NR Wallaroo SF	This species was not recorded during surveys in the project area, and it is unlikely to support potential habitat. There is no potential for a significant impact on this species.	No
spotted harrier <i>Circus assimilis</i>	V (TSC)	Their habitat of choice is open grassy woodland, grassland, inland riparian woodland and shrub steppe. Although mostly associated with native grasslands it has also been identified in agricultural farmland. Their nest is made in a tree and composed of sticks. Individuals of this species are sparsely distributed throughout Australia and occur as a single population.	The spotted harrier can be found throughout mainland Australia except for areas of dense forest on the coast, escarpments and ranges and rarely ever in Tasmania.	This species is not known to occur in any reserves in the region.	This species was not recorded during surveys of the project area. There is some potential for this species to fly over or forage within the habitats of the project area as part of its wider foraging range, however the habitats of the project area are unlikely to be important for this species. There is no potential for a significant impact on this species.	No

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
flame robin <i>Petroica phoenicea</i>	V (TSC)	This species is known to breed in moist eucalypt forests and woodlands. It can usually be seen on ridges and slopes in areas where there is an open understorey layer. This species migrates during the winter to more lowland areas such as grasslands where there are scattered trees, as well as open woodland of the inland slopes and plains.	This robin is located in south-eastern Australia from the Queensland border to Tasmania and into Victoria as well as south-east SA.	This species is not known to occur in any reserves in the region.	This species was not recorded in the project area, and there is no potential habitat. There is no potential for a significant impact on this species.	No
scarlet robin <i>Petroica boodang</i>	V (TSC)	This robin can be found in woodlands and open forests from the coast through to inland slopes. The birds can sometimes be found on the eastern fringe of the inland plains in the colder months of the year. Woody debris and logs are both important structural elements of its habitat. It forages from low perches on invertebrates either on the ground or in woody debris or tree trunks.	The scarlet robin can be found in south-eastern Australia, from Tasmania to the southern end of Queensland, to western Victoria and south SA.	Worimi NP	This species was not recorded during surveys of the project area. The project area is not regarded to support appropriate habitats for this species. There is no potential for a significant impact on this species.	No

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
varied sittella <i>Daphoenositta chrysoptera</i>	V (TSC)	The varied sittella can typically be found in eucalypt forests and woodlands, especially of rough-barked species and mature smooth-barked gums with dead branches, it can also be identified in mallee and acacia woodlands. This species builds a cup shaped nest made of plant fibres and spiders webs which is placed at the canopy level in the fork of a living tree.	The varied sittella is a sedentary species that inhabits the majority of mainland Australia with the exception of the treeless deserts and open grasslands. Its NSW distribution is basically continuous from the coast to the far west.	Medowie SF Worimi SF	This species was not recorded in the project area, however there is potential habitat and it has been recorded in nearby habitats of a similar nature. There is potential for an impact on this species.	Yes
Australasian bittern <i>Botaurus poiciloptilus</i>	V (TSC)	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.).	This species may be found over most of the state except for the far north-west.	Limeburners Creek NR Lake Innes NR	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. wetlands). There is no potential for a significant impact on this species.	No
black bittern <i>Ixobrychus flavicollis</i>	V (TSC)	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland.	This species is not known from any reservation areas in the region.	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. wetlands). There is no potential for a significant impact on this species.	No

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
black-necked stork <i>Ephippiorhynchus asiaticus</i>	E (TSC)	Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.	This species is widespread across coastal northern and eastern Australia, becoming uncommon further south into NSW, and rarely found south of Sydney.	Limeburners Creek NR Lake Innes NR Crowdy Bay NP Myall Lakes NP Booti Booti NP	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. wetlands). There is no potential for a significant impact on this species.	No
Osprey <i>Pandion haliaetus</i>	V (TSC)	Habitat for this species includes inshore coastal and estuarine waters, and occasionally inland rivers and lakes (Debus 2001). This species feeds mainly on fish, however also takes crustaceans, reptiles, small mammals or birds (Debus 2001). Breeding occurs from July to September and nests are often in dead trees and on headlands and rocky islands (Hollands 2003). Nests are re-used for many years (Hollands 2003), and are usually within 1 km of the ocean (DECC 2008).	The osprey has a distribution along the majority of the eastern coastline, however is absent from Tasmania and rare in Victoria (Debus 2001). It is common around the northern coast, especially on rocky shorelines, islands and reefs (DECC 2008). The species is uncommon to rare or absent from closely settled parts of south-eastern Australia.	This species is not known from any conservation reserves in the region.	This species was not recorded within the project area during surveys. There are limited foraging resources and no preferred nesting habitats for this species in the project area. There is no potential for a significant impact on this species.	No

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
<p>pieb oystercatcher <i>Haematopus longirostris</i></p>	V (TSC)	Favours intertidal flats of inlets and bays, open beaches and sandbanks.	This species is thinly scattered along the entire coast of NSW.	<p>Limeburners Creek NR Crowdy Bay NP Myall Lakes NP Darawank NR Booti Booti NP</p>	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species (i.e. open beaches and coastal rock platforms). There is no potential for a significant impact on this species.	No
<p>glossy black-cockatoo <i>Calyptorhynchus lathami</i></p>	V (TSC)	Habitat for this species includes forests on low-nutrient soils, specifically those containing key <i>Allocasuarina</i> feed species. They will also eat seeds from eucalypts, angophoras, acacias, cypress pine and hakeas, as well as eating insect larvae. Breeding occurs in autumn and winter, with large hollows required.	The glossy black-cockatoo has a sparse distribution along the east coast and adjacent inland areas from western Victoria to Rockhampton in Queensland. In NSW, it has been recorded as far inland as Cobar and Griffith.	This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP, and Mount Royal NP.	This species was not recorded during surveys. Potential nesting and roosting trees for this species are present, as are scattered preferred feeding trees (<i>Allocasuarina littoralis</i>). There is potential for this species to be impacted by the proposed development.	Yes

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
grey-crowned babbler (eastern subsp.) <i>Pomatostomus temporalis temporalis</i>	V (TSC)	Open box-gum woodlands on the slopes. Box-cypress-pine and open box woodlands on alluvial plains. Also found in acacia shrubland and adjoining areas. Feeds on invertebrates; forage on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses (DECC 2008). Occupy territories from 1 to 50 ha.	Occurs throughout northern and south-eastern Australia. In NSW, this species occurs on the western slopes of the Great Dividing Range and on the western plains reaching as far west as Louth and Hay. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW.	This species is known to occur in Belford NP, Goulburn River NP, Wollemi NP, Yengo NP and it is also known to occur in Belford NP.	This species was not recorded within the project area during surveys. The Survey Area does not contain preferred habitat features for this species. There is no potential for a significant impact on this species.	No
brown treecreeper (eastern subsp.) <i>Climacteris picumnus victoriae</i>	V (TSC)	Typical habitat for this species includes drier forests, woodlands and scrubs with fallen branches; river red gums on watercourses and around lake-shores; paddocks with standing dead timber; and margins of denser wooded areas. This species prefers areas without a dense understorey.	This species occurs over central NSW, west of the Great Dividing Range and sparsely scattered to the east of the divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys.	This species is known to occur in Goulburn River NP, Wollemi NP and Yengo NP.	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species. There is no potential for a significant impact on this species.	No

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
swift parrot <i>Lathamus discolor</i>	E (TSC) E (EPBC)	This species often visits box-ironbark forests, feeding on nectar and lerps. This species occupy areas where winter-flowering eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Preferred winter-flowering resources include swamp mahogany (<i>Eucalyptus robusta</i>), spotted gum (<i>Corymbia maculata</i>), red bloodwood (<i>C. gummifera</i>), Mugga ironbark (<i>E. sideroxylon</i>), and white box (<i>E. albens</i>).	In NSW this species has been recorded from the western slopes region along the inland slopes of the Great Dividing Range, as well as forests along the coastal plains from southern to northern NSW.	This species is known to occur in Wollemi NP.	This species was not recorded within the project area during surveys. Potential winter foraging resources (<i>Eucalyptus robusta</i>) present in the project area may attract this migratory species. There is potential for the proposed development to impact on this species.	Yes

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
regent honeyeater <i>Anthochaera phrygia</i>	CE (TSC) E (EPBC)	Generally occurs in temperate eucalypt woodlands and open forests of south eastern Australia. It is commonly recorded from box-ironbark eucalypt associations, wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine casuarina woodlands. Key foraging species (typically winter-flowering species in the Hunter Valley) include mugga ironbark (<i>Eucalyptus sideroxylon</i>), yellow box (<i>E. melliodora</i>), Blakelys red gum (<i>Eucalyptus blakelyi</i>), white box (<i>E. albens</i>) and swamp mahogany (<i>E. robusta</i>).	Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland.	This species is known to occur in Goulburn River NP, Wollemi NP and Yengo NP.	This species was not recorded within the project area during surveys. Potential winter foraging resources (<i>Eucalyptus robusta</i>) present in the project area may attract this migratory species. There is potential for the proposed development to impact on this species.	Yes
masked owl <i>Tyto novaehollandiae</i>	V (TSC)	This species is generally recorded from open forest habitat with sparse mid-storey but patches of dense, low ground cover. It is also recorded from ecotones between wet and dry eucalypt forest, along minor drainage lines and near boundaries between forest and cleared land.	The masked owl occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea.	This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP.	This species was not recorded within the project area during surveys. The project area supports potential roosting and foraging habitat for this species.	Yes

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
powerful owl <i>Ninox strenua</i>	V (TSC)	The powerful owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It generally requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation.	The powerful owl occurs in eastern Australia, mostly on the coastal side of the Great Dividing Range, from south western Victoria to Bowen in Queensland.	This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP.	This species was not recorded within the project area during surveys. The species has been tentatively recorded in adjacent habitats (Umwelt 2004). The project area supports potential roosting and foraging habitats for this species.	Yes
MAMMALS						
spotted-tailed quoll <i>Dasyurus maculatus</i>	V (TSC) E (EPBC)	Habitat for this species is highly varied, ranging from sclerophyll forest, woodlands, coastal heathlands and rainforests. Records exist from open country, grazing lands and rocky outcrops. Suitable den sites including hollow logs, tree hollows, rocky outcrops or caves.	In NSW the spotted-tailed quoll occurs on both sides of the Great Dividing Range, with the highest densities occurring in the north east of the state. It occurs from the coast to the snowline and inland to the Murray River.	This species is known to occur in Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP.	This species was not recorded within the project area during surveys. However, the open forest habitats provide potential habitat for this species.	Yes

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
brush-tailed phascogale <i>Phascogale tapoatafa</i>	V (TSC)	Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	This species has a patchy distribution around the coast of Australia. In NSW it is more frequently found in forest on the Great Dividing Range in the north-east and south-east of the State. There are also a few records from central NSW.	Cotton-Bimbang NP Limeburners Creek NR Werrikimbe NP Talawahli NR Khappinghat NR	This species was not recorded within the project area during surveys however potential nesting and roosting resources for this species are present.	Yes
koala <i>Phascolarctos cinereus</i>	V (TSC)	This species inhabits eucalypt forest and woodland, with suitability influenced by tree species and age, soil fertility, climate, rainfall and fragmentation patterns. The species is known to feed on a large number of eucalypt and non-eucalypt species, however it tends to specialise on a small number in different areas. <i>Eucalyptus tereticornis</i> , <i>E. punctata</i> , <i>E. cypellocarpa</i> , <i>E. viminalis</i> , <i>E. microcorys</i> , <i>E. robusta</i> , <i>E. albens</i> , <i>E. camaldulensis</i> and <i>E. populnea</i> are some preferred species.	The koala has a fragmented distribution throughout eastern Australia, with the majority of records from NSW occurring on the central and north coasts, as well as some areas further west. It is known to occur along inland rivers on the western side of the Great Dividing Range.	This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP.	This species was not recorded in the project area but has been previously recorded nearby in similar habitats (Umwelt 2004) The site is identified as Supplementary Koala Habitat by the Port Stephens Council CKPoM. There is potential for the proposed development to impact on this species.	Yes

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
eastern pygmy possum (<i>Cercartetus nanus</i>)	V (TSC)	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.	This species is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes.	This species is not known from any reservation areas in the region.	This species was not recorded within the project area during surveys, however the eastern pygmy possum was identified in nearby, similar habitats (Umwelt 2004).	Yes
squirrel glider <i>Petaurus norfolcensis</i>	V (TSC)	Inhabits a variety of mature or old growth habitats, including box, box-ironbark woodlands, river red gum forest, and blackbutt-bloodwood forest with heath understorey. It prefers mixed species stands with a shrub or acacia mid-storey, and requires abundant tree hollows for refuge and nest sites.	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria.	This species is known to occur in Wollemi NP, Yengo NP and Mount Royal NP.	This species was not recorded, however the project area does support potential nesting and foraging habitat for this species.	Yes

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
long-nosed potoroo <i>Potorous tridactylus</i>	V (TSC) V (EPBC)	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	This species is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range.	Cotton-Bimbang NP Werrikimbe NP	This species was not recorded within the project area during surveys. However, the open forest habitats provide potential habitat for this species.	Yes
New Holland mouse <i>Pseudomys novaehollandiae</i>	V (EPBC)	This species inhabits a range of habitats from open heathlands, open woodlands with a heath understorey, as well as vegetated dunes. The New Holland mouse lives in a burrow which is shared with other individuals.	This species has a disjunct distribution across Tasmania, Victoria, Queensland and NSW	This species is not known to occur in any reserves in the region.	This species was not recorded within the project area during surveys. However, the open forest habitats provide potential habitat for this species.	Yes

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
grey-headed flying-fox <i>Pteropus poliocephalus</i>	V (TSC) V (EPBC)	This species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Grey-headed flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria.	This species is known to occur in Wollemi NP, Yengo NP and Barrington Tops NP.	This species was recorded during surveys.	Yes
eastern freetail-bat <i>Mormopterus norfolkensis</i>	V (TSC)	This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures.	The eastern freetail-bat is found along the east coast from south Queensland to southern NSW.	This species is known to occur in Wollemi NP, Yengo NP and Barrington Tops NP.	This species was not recorded during surveys. However, the open forest habitats provide foraging resources for this species.	Yes
little bentwing-bat <i>Miniopterus australis</i>	V (TSC)	Prefers moist eucalypt forest, rainforest or dense coastal banksia scrub. This species roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Occurs in coastal north-eastern NSW and eastern Queensland.	Medowie SCA	This species was recorded during surveys.	Yes

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
eastern bentwing-bat <i>Miniopterus schreibersii oceanensis</i>	V (TSC)	This species hunts in forested areas and uses caves as the primary roosting habitat, but also uses derelict mines, storm-water tunnels, buildings and other man-made structures. It forms discrete populations centered on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Eastern bentwing-bats occur along the east and north-west coasts of Australia.	This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP.	This species was not recorded during surveys. However, the open forest habitats provide foraging resources for this species.	Yes
greater broad-nosed bat <i>Scoteanax rueppellii</i>	V (TSC)	The greater broad-nosed bat appears to prefer moist environments such as moist gullies in coastal forests, or rainforest. They have also been found in gullies associated with wet and dry sclerophyll forests and open woodland. It roosts in hollows in tree trunks and branches and has also been found to roost in the roofs of old buildings.	The greater broad-nosed bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however it does not occur at altitudes above 500 m.	The species is known to occur in Wollemi NP, Yengo NP and Barrington Tops NP.	This species was recorded during surveys.	Yes

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
yellow-bellied sheath-tail-bat <i>Saccolaimus flaviventris</i>	V (TSC)	This species forages for insects, flies high and fast over the forest canopy, but lower in more open country. It forages in most habitats across its very wide range, with and without trees; and appears to defend an aerial territory. It roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to use mammal burrows.	The yellow-bellied sheath-tail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes.	The species is known to occur in Wollemi NP.	This species was not recorded during surveys. However, the open forest habitats provide potential foraging resources for this species.	Yes
large-footed myotis <i>Myotis macropus</i>	V (TSC)	This species generally roosts in groups of 10-15 close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. It forages over streams and pools catching insects and small fish by raking its feet across the water surface.	The large-footed myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers.	The species is known to occur in Wollemi NP.	There are no potential foraging habitats for this species within the project area (i.e. streams and pools). As such, there is no potential for a significant impact on this species.	No

Table 3 – Threatened Fauna Assessment (cont)

Species	Legal Status	Specific Habitat	Distribution in Relation to Project Area	Reservation in the Region	Occurrence in Project Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
large-eared pied bat <i>Chalinolobus dwyeri</i>	V (EPBC) V (TSC)	The large-eared pied bat is generally found in a variety of drier habitats, including dry sclerophyll forests and woodlands, however, it probably tolerates a wide range of habitats. It tends to roost in the twilight zones of mines and caves, generally in colonies or common groups.	This species has a distribution from south western Queensland to NSW from the coast to the western slopes of the Great Dividing Range.	The species is known to occur in Goulburn River NP, Wollemi NP and Yengo NP.	This species was not recorded during surveys. However, the open forest habitats provide potential foraging resources for this species.	Yes
Endangered Population						
Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	EP (TSC)	Occur in open forest, woodland, coastal heath, coastal dunes, wetland areas, tea tree plantations and open farmland, and occasionally in littoral rainforest.	Previously widespread on the NSW north coast, but now largely restricted to coastal and near coastal areas between Evans Head and Red Rock and west to the Bungawalbin area. There have also been some recent records from the Port Stephens area.	Medowie SCA	This species was not recorded within the project area during surveys. The project area does not contain preferred habitat features for this species and there is no connectivity to known populations of this species. There is no potential for a significant impact on emu populations.	No

Key: TSC = *Threatened Species Conservation Act 1995*;
 EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*;
 EEC = *Endangered Ecological Community*;
 E = *Endangered*;
 V = *Vulnerable*;
 NP = *National Park*;

EP = *Endangered Population*;
 SCA = *State Conservation Area*;
 NR = *Nature Reserve*; and
 SF = *State Forest*.

APPENDIX C

Fauna Species List

Appendix C – Fauna Species List

The following list was compiled from fauna surveys undertaken along the alternate haul route, as shown on Figure 2.1 of the main report. It includes all vertebrate fauna species observed along the alternate haul route during field surveys.

The following abbreviations or symbols are used in the list:

asterisk (*) denotes species not indigenous to the project area;

MAR Listed marine species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);

MIG Listed migratory species under the EPBC Act;

V Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995* (TSC Act).

Birds recorded were identified using descriptions in Slater et al. (2003) and the scientific and common name nomenclature of Birds Australia. Reptiles recorded were identified using keys and descriptions in Cogger (2000), Swan et al. (2004), Weigel (1990) and Wilson & Swan (2003) and the scientific and common name nomenclature of Cogger (2000).

Amphibians recorded were identified using keys and descriptions in Cogger (2000), Robinson (1998), Anstis (2002) and Barker et al. (1995) and the scientific and common name nomenclature of Cogger (2000). Mammals recorded were identified using keys and descriptions in Strahan (2002), Churchill (2008) and Menkhorst & Knight (2004) and the scientific and common name nomenclature of Strahan (2002) for non-bat species and Churchill (1998) for bats.

Scientific Name	Common Name	Conservation Status	
		TSC Act	EPBC Act
BIRDS			
Accipitridae			
<i>Elanus axillaris</i>	black-shouldered kite		MIG
<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle		MAR & MIG
<i>Haliastur sphenurus</i>	whistling kite		MAR & MIG
<i>Circus approximans</i>	swamp harrier		MAR & MIG
Cacatuidae			
<i>Calyptorhynchus funereus</i>	yellow-tailed black-cockatoo		
<i>Cacatua roseicapillus</i>	galah		
Psittacidae			
<i>Trichoglossus haematodus</i>	rainbow lorikeet		
<i>Trichoglossus chlorolepidotus</i>	scaly-breasted lorikeet		
<i>Glossopsitta concinna</i>	musk lorikeet		
<i>Platycercus eximius</i>	eastern rosella		
Cuculidae			
<i>Centropus phasianinus</i>	pheasant coucal		
Halcyonidae			
<i>Dacelo novaeguineae</i>	laughing kookaburra		
Climacteridae			
<i>Corombates leucophaea</i>	white-throated treecreeper		
Maluridae			
<i>Malurus cyaneus</i>	superb fairy-wren		
Acanthizidae			
<i>Sericornis frontalis</i>	white-browed scrubwren		
<i>Acanthiza pusilla</i>	brown thornbill		
Pardalotidae			
<i>Pardalotus striatus</i>	striated pardalote		
Meliphagidae			
<i>Meliphaga lewinii</i>	Lewin's honeyeater		
<i>Lichenostomus chrysops</i>	yellow-faced honeyeater		
<i>Manorina melanocephala</i>	noisy miner		
<i>Anthochaera carunculata</i>	red wattlebird		
<i>Philemon corniculatus</i>	noisy friarbird		
Eupetidae			
<i>Psophodes olivaceus</i>	eastern whipbird		
Campephagidae			
<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		MAR
Pachycephalidae			
<i>Pachycephala pectoralis</i>	golden whistler		
<i>Pachycephala rufiventris</i>	rufous whistler		
Artamidae			
<i>Cracticus torquatus</i>	grey butcherbird		
<i>Gymnorhina tibicen</i>	Australian magpie		

Scientific Name	Common Name	Conservation Status	
		TSC Act	EPBC Act
Dicruridae			
<i>Dicrurus bracteatus</i>	spangled drongo		MAR
Rhipiduridae			
<i>Rhipidura albiscapa</i>	grey fantail		
<i>Rhipidura leucophrys</i>	willie wagtail		
Laniidae			
<i>Corvus coronoides</i>	Australian raven		
Monarchidae			
<i>Grallina cyanoleuca</i>	magpie-lark		MAR
Petroicidae			
<i>Eopsaltria australis</i>	eastern yellow robin		
Timaliidae			
<i>Zosterops lateralis</i>	silveryeye		MAR
Hirundinidae			
<i>Hirundo neoxena</i>	welcome swallow		MAR
<i>Hirundo nigricans</i>	tree martin		MAR
MAMMALS			
Dasyuridae			
<i>Antechinus</i> sp.			
Phalangeridae			
<i>Trichosurus vulpecula</i>	common brushtail possum		
Macropodidae			
<i>Macropus giganteus</i>	eastern grey kangaroo		
<i>Macropus rufogriseus</i>	red-necked wallaby		
Pteropodidae			
<i>Pteropus poliocephalus</i>	grey-headed flying-fox	V	V
Molossidae			
<i>Mormopterus</i> sp. 2	freetail-bat		
Vespertilionidae			
<i>Miniopterus australis</i>	little bentwing-bat	V	
<i>Nyctophilus</i> sp.	unidentified long-eared Bat		
<i>Chalinolobus gouldii</i>	Gould's wattled bat		
<i>Scoteanax rueppellii</i>	greater broad-nosed bat	V	
<i>Scotorepens orion</i>	eastern broad-nosed bat		
<i>Vespadelus pumilus</i>	eastern forest bat		
<i>Vespadelus vulturnus</i>	little forest bat		
Leporidae			
* <i>Oryctolagus cuniculus</i>	rabbit		
AMPHIBIANS			
Myobatrachidae			
<i>Crinia signifera</i>	common eastern froglet		
REPTILES			
Scincidae			
<i>Lampropholis delicata</i>	grass skink		

APPENDIX D

Assessment of Significance under the Environmental Planning and Assessment Act 1979

Appendix D – EP&A Act Assessment of Significance

Threatened species, endangered populations, or threatened ecological communities (TECs) recorded during surveys and known to occur in the local area are listed in **Appendix B**, as are the results of the searches of the relevant ecological databases. These database searches provided lists of species, populations or TECs previously recorded within a 10 kilometre radius of the project area, or with potential habitat within that radius.

Appendix B provides information on each threatened species, population and TEC (including specific habitat, distribution and reservation) and provides assessments of the potential for an impact from the project. Those considered to have reasonable potential to occur within the project area (based on known distribution and habitat requirements) and with reasonable potential to be impacted by the project are addressed in more detail in the 'Assessment of Significance' included in this appendix.

Part 3A of the EP&A Act requires an assessment of significance be prepared relating to the potential impacts of the project on listed threatened species, endangered populations or TECs. As a formal assessment method format has not been established for the Part 3A pathway, an assessment that applies the key principles of the Part 5A assessment is used here to assess the potential for the project to impact on threatened species, endangered populations or TECs within the project area.

An assessment of significance is provided below for those identified threatened species, endangered populations or TECs considered (within **Appendix B**) to have the potential to be impacted by the project.

Species and TECs listed under the *Environment Protection and Biodiversity Conservation Act 1999* requiring further assessment are considered in a separate assessment provided in **Appendix E**.

Threatened flora and fauna species included under this assessment are listed below.

Threatened Flora Species

- Charmhaven apple *Angophora inopina*;
- leafless tongue orchid *Cryptostylis hunteriana*;
- rough doubletail *Diuris praecox*; and
- sand doubletail *Diuris arenaria*

Threatened Fauna Species

- varied sittella *Daphoenositta chrysoptera*;
- glossy black-cockatoo *Calyptorhynchus lathami*;
- swift parrot *Lathamus discolor*;
- regent honeyeater *Anthochaera phrygia*;
- masked owl *Tyto novaehollandiae*;

-
- powerful owl *Ninox strenua*;
 - spotted-tailed quoll *Dasyurus maculatus*;
 - brush-tailed phascogale *Phascogale tapoatafa tapoatafa*;
 - koala *Phascolarctos cinereus*;
 - eastern pygmy possum *Cercartetus nanus*;
 - squirrel glider *Petaurus norfolcensis*;
 - long-nosed potoroo *Potorous tridactylus*;
 - grey-headed flying-fox *Pteropus poliocephalus*;
 - yellow-bellied sheath-tail-bat *Saccolaimus flaviventris*;
 - eastern freetail-bat *Mormopterus norfolkensis*;
 - little bentwing-bat *Miniopterus australis*;
 - eastern bentwing-bat *Miniopterus schreibersii oceanensis*;
 - large-eared pied bat *Chalinolobus dwyeri*; and
 - greater broad-nosed bat *Scoteanax rueppellii*.

Threatened Flora Species

Charmhaven Apple – *Angophora inopina*

Eleven individuals of hybrid *A. inopina* – *A. floribunda* trees were recorded within the project area. It is likely that pure forms of *A. inopina* also occur in the project area. Both the hybrid trees and the pure forms of *A. inopina* are estimated to occur in low numbers in the project area in a small isolated patch within the Coastal Sand Apple-Blackbutt Forest. For the purposes of this assessment, both the hybrid and the pure form of *A. inopina* are considered as the *Threatened Species Conservation Act 1995* does not discriminate between pure forms and hybrid forms.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project area supports 11 individuals of *A. inopina* – *A. floribunda*, and potential habitat for the pure form of *A. inopina*. There are no other records of *Angophora inopina* or the hybrid on the OEH Atlas of NSW wildlife on the east coast of Port Stephens. As such, the stand within the project area is of moderate local conservation significance, and therefore should experience minimal disturbance as a result of the proposed development.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

The proposed development will result in the disturbance to a small stand of *Angophora inopina* – *floribunda*, with eight individuals proposed to be removed. This stand is currently isolated from any other known stands of *Angophora inopina* in the local area. The proposed development will reduce the size of the stand, however will not cause any further isolation from other known stands of *Angophora inopina* in the locality or region.

Conclusion – The proposed development will not have a significant impact on the Charmhaven apple (*Angophora inopina*).

Leafless Tongue Orchid – *Cryptostylis hunteriana*

Although no leafless tongue orchids (*Cryptostylis hunteriana*) were identified within the project area during targeted orchid surveys conducted in September 2011, the project area is considered to provide appropriate habitat for this species. This species is known to occur in the Karuah-Manning and Wyong Catchment Management Areas.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species.

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. There is an abundance of additional suitable habitat throughout this larger remnant for this species.

Given the small area of disturbance (<1 hectare) relative to the availability of habitats in the broader locality there is no potential that the lifecycle of the leafless tongue orchid (*Cryptostylis hunteriana*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area (<1 hectare) of potential habitat for the leafless tongue orchid (*Cryptostylis hunteriana*). While this species is immobile and therefore sensitive to fragmentation, the 10 metre width of Alternate Route A is not expected to cause the isolation of any known populations of this species.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the leafless tongue orchid (*Cryptostylis hunteriana*).

Conclusion

The proposed development will not have a significant impact on the leafless tongue orchid (*Cryptostylis hunteriana*).

Rough Doubletail – *Diuris praecox*

Approximately nine rough doubletail (*Diuris praecox*) were identified within Alternate Route A during targeted orchid surveys conducted in September 2011. The species has a distributional range between Ourimbah and Nelson Bay NSW. These nine individuals were part of a larger cluster of approximately 250 individuals occurring south of Salt Ash, these records would be nearing the northern limit of the species range in Nelson Bay.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

Rough doubletail (*Diuris praecox*) has been recorded in significant numbers (approximately 250 individuals) near Alternate Route B. The species has been previously recorded scattered on hills and slopes along the coastal areas of Port Stephens. The records within the project area are highly concentrated and would constitute part of a local viable population of the species.

The project area forms part of a large, continuous vegetation remnant that spans the south-east coast of Port Stephens from Salt Ash to Anna Bay, which includes 4438 hectares of Worimi Conservation Lands. The rough doubletail (*Diuris praecox*) is known to occur in parts of this large vegetation remnant, and elsewhere throughout Port Stephens, where important habitats for it exist.

Less than 0.25 hectares of known habitat for the rough doubletail (*Diuris praecox*) will be disturbed for the construction and operation of Alternate Route A, and given the presence of higher quality habitat for this species in the locality, the proposed development is not likely to disrupt the lifecycle of the species such that a local population would be at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will pass through a small area of known habitat for the rough doubletail (*Diuris praecox*) and remove approximately nine individuals, however is not expected to cause the isolation of any known populations of this species. There are several important areas of known habitat for this species within nearby habitats within the locality, the majority of which occur to the east/north-east of the project area. These areas of known habitat will not be affected as a result of the proposed development.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the rough doubletail (*Diuris praecox*).

Conclusion

The proposed development will not have a significant impact on the rough doubletail (*Diuris praecox*).

Sand Doubletail – *Diuris arenaria*

Although no sand doubletail (*Diuris arenaria*) was identified within Alternate Route A during targeted orchid surveys conducted in September 2011, approximately 50 individuals were recorded surrounding the project area. This species is only known to occur along the Tomaree Peninsula near Port Stephens NSW.

c) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

Sand doubletail (*Diuris arenaria*) was recorded in a large cluster of individuals near Alternate Route A. The species has been previously recorded in scattered occurrences along the Tomaree Peninsula north of Newcastle. The records within the Project Area are highly concentrated and would constitute part of a local viable population of the species.

The project area is part of a large, continuous vegetation remnant that spans the south-east coast of Port Stephens from Salt Ash to Anna Bay, which includes 4438 hectares of Worimi Conservation Lands. The sand doubletail (*Diuris arenaria*) is known to occur in parts of this large vegetation remnant, and elsewhere throughout Port Stephens, where important habitats for it exist.

Less than 0.25 hectares of potential habitat for the sand doubletail (*Diuris arenaria*) will be disturbed for the construction and operation of Alternate Route A and given the presence of higher quality habitat for this species in the locality, the proposed development is not likely to disrupt the lifecycle of the species such that a local population would be at risk of extinction.

d) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will pass through a small area of known habitat for the sand doubletail (*Diuris arenaria*) and remove approximately 0.25 hectares of potential habitat. There are several important areas of known habitat for this species within nearby habitats within the locality, the majority of which occur to the east/north-east of the project area. These areas of known habitat will not be affected as a result of the proposed development.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the sand doubletail (*Diuris arenaria*).

Conclusion

The proposed development will not have a significant impact on the sand doubletail (*Diuris arenaria*).

Threatened Fauna Species

Varied Sittella – *Daphoenositta chrysoptera*

The varied sittella (*Daphoenositta chrysoptera*) was not recorded in the project area, however it is regarded to have potential to occur. The OEH Atlas of NSW Wildlife shows a small number of records of this species in nearby, adjacent habitats of a similar nature.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species. The project area supports both foraging and nesting habitat for the varied sittella (*Daphoenositta chrysoptera*).

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. While the varied sittella (*Daphoenositta chrysoptera*) is a fairly sedentary bird with a small home range, there is an abundance of suitable habitat throughout this larger remnant.

Given the small area of disturbance (<1 hectare) relative to the availability of habitats in the broader locality, there is no potential that the lifecycle of the varied sittella (*Daphoenositta chrysoptera*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area (<1 hectare) of potential habitat for the varied sittella (*Daphoenositta chrysoptera*). While this species is a sedentary bird and therefore sensitive to fragmentation, the 10 metre width of Alternate Route A is not expected to cause the isolation of any known populations of this species.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the varied sittella (*Daphoenositta chrysoptera*).

Conclusion

The proposed development will not have a significant impact on the varied sittella (*Daphoenositta chrysoptera*).

Glossy Black-cockatoo – *Calyptorhynchus lathami*

The glossy black-cockatoo (*Calyptorhynchus lathami*) was not identified within the project area during the surveys, however *Allocasuarina littoralis*, a known food resource for the species, was recorded (albeit in low abundance), offering potential foraging habitat. Tree hollows throughout the project area also offer potential roosting habitat for this species.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species. The suitability of these habitats is only marginal as there is a low abundance of food resources (in particular *Allocasuarina littoralis*). However there is some potential that this species roosts in one of the small number of large tree hollows present in the project area.

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. If the glossy black-cockatoo (*Calyptorhynchus lathami*) occurs in the locality, it likely forages widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be relatively insignificant.

A tree-clearing procedure has been designed for the project to minimise impacts on any potentially occurring hollow-roosting species such as the glossy black-cockatoo (*Calyptorhynchus lathami*).

Given that only marginal habitats exist in the project area relative to the available habitats in the wider locality, and provided that the tree-clearing procedure is adhered to, there is no potential that the lifecycle of the glossy black-cockatoo (*Calyptorhynchus lathami*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area (<1 hectare) of marginal potential habitat for the glossy black-cockatoo (*Calyptorhynchus lathami*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of the road is not enough to fragment habitats for this highly mobile bird species.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the glossy black-cockatoo (*Calyptorhynchus lathami*).

Conclusion

The proposed development will not have a significant impact on the glossy black-cockatoo (*Calyptorhynchus lathami*).

Swift Parrot – *Lathamus discolor*

The swift parrot (*Lathamus discolor*) was not identified within the project area during surveys. Winter flowering swamp mahogany (*Eucalyptus robusta*) occurs throughout parts of the project area which provides a potential foraging resource for this migratory species.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for the swift parrot (*Lathamus discolor*). This is a highly mobile, migratory species, which is likely to make use of habitat within a number of vegetated areas within the region, depending on the availability of winter flowering resources. The species has potential to opportunistically forage on trees within the project area, however given there is less than 1 hectare of habitat, this species would not be dependent on these resources during migrations. The significant area of adjacent habitats, 4438 hectares of which are protected in the Worimi Conservation Lands, potentially collectively provide an important resource.

Given the small area of disturbance to possible foraging habitat for the swift parrot (*Lathamus discolor*), the life cycle of this species will not be disrupted such that a local viable population would be interrupted.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of marginal potential habitat for the swift parrot (*Lathamus discolor*), however will not cause the isolation of any known areas of important habitat for this species. The proposed 10 metre width of the road will not significantly reduce or fragment foraging habitats for this migratory bird species.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the swift parrot (*Lathamus discolor*).

Conclusion

The proposed development will not have a significant impact on the swift parrot (*Lathamus discolor*).

Regent Honeyeater – *Anthochaera phrygia*

The regent honeyeater (*Anthochaera phrygia*) was not identified within the project area during surveys. Winter flowering swamp mahogany (*Eucalyptus robusta*) occurs throughout parts of the project area, providing a potential foraging resource for this migratory species.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for the regent honeyeater (*Anthochaera phrygia*). This is a highly mobile, migratory species, which is likely to make use of habitat within a number of vegetated areas within the region, depending on the availability of winter flowering resources. The species has potential to opportunistically forage on trees within the project area, however given there is less than 1 hectare of habitat, this species would not be dependent on these resources during migrations. The significant area of adjacent habitats, 4438 hectares of which are protected in the Worimi Conservation Lands, potentially collectively provide an important resource.

Given the small area of disturbance to possible foraging habitat for the regent honeyeater (*Anthochaera phrygia*), the life cycle of this species will not be disrupted such that a local viable population would be interrupted.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of marginal potential habitat for the regent honeyeater (*Anthochaera phrygia*), however will not cause the isolation of any known areas of important habitat for this species. The proposed 10 metre width of the road will not significantly reduce or fragment foraging habitats for this migratory bird species.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the regent honeyeater (*Anthochaera phrygia*).

Conclusion

The proposed development will not have a significant impact on the regent honeyeater (*Anthochaera phrygia*).

Powerful Owl – *Ninox strenua*

The powerful owl (*Ninox strenua*) was not identified within the project area during surveys. This species is known to occur in adjacent habitats and the project area supports potential foraging and nesting habitats for this species.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species. The adjacent habitats, which are similar in characteristics to those of the project area, are known habitats for the powerful owl (*Ninox strenua*).

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. The powerful owl (*Ninox strenua*) would forage widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be a relatively insignificant component of any individual's range.

A tree-clearing procedure has been designed for the project to minimise impacts on any potentially occurring hollow-roosting species such as the powerful owl (*Ninox strenua*).

Given that the project will disturb a small area of potential habitat relative to the available habitats in the wider locality, and provided that the tree-clearing procedure is adhered to, there is no potential that the lifecycle of the powerful owl (*Ninox strenua*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the powerful owl (*Ninox strenua*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of the road is not enough to fragment habitats for this highly mobile bird species.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the powerful owl (*Ninox strenua*).

Conclusion

The proposed development will not have a significant impact on the powerful owl (*Ninox strenua*).

Masked Owl – *Tyto novaehollandiae*

The masked owl (*Tyto novaehollandiae*) was not identified within the project area during surveys. Surveys undertaken in 2002 (ERM 2002) in nearby, similar habitats identified a pair of masked owls. The site provides potential nesting habitat and marginal foraging habitat for the species.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species. The adjacent habitats, which are similar in characteristics to those of the project area, are known habitats for the masked owl (*Tyto novaehollandiae*).

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. The masked owl (*Tyto novaehollandiae*) would forage widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be a relatively insignificant component of any individual's range.

A tree-clearing procedure has been designed for the project to minimise impacts on any potentially occurring hollow-roosting species such as the masked owl (*Tyto novaehollandiae*).

Given that the project will disturb a small area of potential habitat relative to the available habitats in the wider locality, and provided that the tree-clearing procedure is adhered to, there is no potential that the lifecycle of the masked owl (*Tyto novaehollandiae*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the masked owl (*Tyto novaehollandiae*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of the road is not enough to fragment habitats for this highly mobile bird species.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the masked owl (*Tyto novaehollandiae*).

Conclusion

The proposed development will not have a significant impact on the masked owl (*Tyto novaehollandiae*).

Spotted-Tailed Quoll – *Dasyurus maculatus*

The spotted tailed-quoll (*Dasyurus maculatus*) was not identified within the project area during surveys, however there is considered to be suitable habitat present for it to occur.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species. The adjacent habitats, which are similar in characteristics to those of the project area, provide better quality habitat for the spotted-tailed quoll (*Dasyurus maculatus*).

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. The spotted-tailed quoll (*Dasyurus maculatus*) if present would forage widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be a relatively insignificant component of any individual's range.

Given that the project will disturb a small area of potential habitat relative to the available habitats in the wider locality, there is no potential that the lifecycle of the spotted-tailed quoll (*Dasyurus maculatus*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the spotted-tailed quoll (*Dasyurus maculatus*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of the road is not enough to fragment habitats for this mobile species.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the spotted-tailed quoll (*Dasyurus maculatus*).

Conclusion

The proposed development will not have a significant impact on the spotted-tailed quoll (*Dasyurus maculatus*).

Brush-tailed Phascogale – *Phascogale tapoatafa tapoatafa*

The brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*) was not identified within the project area during the surveys.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species.

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. Much of this remnant also offers suitable habitat for the brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*). The less than 1 hectare of resources in the project area is likely to be relatively insignificant relative to the local availability of habitats.

A tree-clearing procedure has been designed for the project to minimise impacts on any potentially occurring hollow-roosting species such as the brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*).

Given that the project will disturb a small area of potential habitat relative to the available habitats in the wider locality, and provided that the tree-clearing procedure is adhered to, there is no potential that the lifecycle of the brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*), however will not cause the isolation of any known populations of this species.

The easement for Alternate Route A is 10 metres in width. The brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*) would possibly need to cross this track when moving between the bushland on the north and south of the track, as there are no other corridors. Mitigation measures relating to the sensitive use of this road by vehicles have been developed to minimise any impacts on species such as the brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*) that would need to cross the track. Even with these mitigation measures in place, there is potential for individuals of this species to be injured or killed while attempting to cross the access track.

The proposed development will create a minor barrier to movement for the brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*) passing between habitats to the north and south of the proposed access track. However, the extent of this is not such that a significant area of known habitat will be modified, removed or isolated from currently interconnecting or proximate areas.

Conclusion

The project will not have a significant impact on the brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*).

Koala – *Phascolarctos cinereus*

The koala (*Phascolarctos cinereus*) was not recorded in the project area, however has been recorded previously in adjacent, similar habitats. The project area is considered to provide secondary habitat and connectivity between preferred habitats.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of supplementary habitat for the koala (*Phascolarctos cinereus*).

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which spans the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. The koala (*Phascolarctos cinereus*) would utilise the resources of the project area opportunistically as part of a much wider foraging range throughout this adjacent bushland. The less than 1 hectare of secondary foraging habitat in the project area is expected to be a relatively insignificant component of any individual's range in the locality.

Given that the project will disturb a small area of potential habitat relative to the available habitats in the wider locality, there is no potential for the lifecycle of koala (*Phascolarctos cinereus*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area (<1 hectare) of potential habitat for the koala (*Phascolarctos cinereus*). The easement for Alternate Route A is 10 metres in width. The koala (*Phascolarctos cinereus*) would need to cross this track on foot when moving between the bushland on the north and south of the track, as there are no other corridors. Mitigation measures relating to the sensitive use of this road by vehicles have been developed to minimise any impacts on species such as the koala (*Phascolarctos cinereus*) that would need to cross the track. Even with these mitigation measures in place, there is potential for a small number of individuals of this species to be injured or killed while attempting to cross the access track.

The proposed development will create a minor barrier to movement for the koala (*Phascolarctos cinereus*) passing between habitats to the north and south of the proposed access track. However, the extent of this is not such that a significant area of known habitat will be modified, removed or isolated from currently interconnecting or proximate areas.

Conclusion

The project will not have a significant impact on the koala (*Phascolarctos cinereus*).

Eastern Pygmy Possum – *Cercartetus nanus*

The eastern pygmy possum (*Cercartetus nanus*) was not recorded in the project area, however was recorded in nearby, similar habitats in 2004 (Umwelt 2004). The open woodland habitats of the project area supports potential foraging and nesting habitats for this species.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species. The adjacent habitats, which are similar in characteristics to those of the project area, are known habitats for the eastern pygmy possum (*Cercartetus nanus*).

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. Much of this remnant offers suitable habitat for the eastern pygmy possum (*Cercartetus nanus*). The less than 1 hectare of resources in the project area is likely to be relatively insignificant relative to the local availability of habitats.

A tree-clearing procedure has been designed for the project to minimise impacts on any potentially occurring hollow-roosting species such as the eastern pygmy possum (*Cercartetus nanus*).

Given that the project will disturb a small area of potential habitat relative to the available habitats in the wider locality, and provided that the tree-clearing procedure is adhered to, there is no potential that the lifecycle of the eastern pygmy possum (*Cercartetus nanus*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the eastern pygmy possum (*Cercartetus nanus*), however will not cause the isolation of any known populations of this species.

Alternate Route A will be 10 metres in width. The eastern pygmy possum (*Cercartetus nanus*) would possibly need to cross this track when moving between the bushland on the north and south of the track, as there are no other corridors. It is likely that this species can glide across that distance, in particular if there are overhanging canopies across the track. However, on occasion an individual of this species may be forced to cross the track on the ground. Mitigation measures relating to the sensitive use of this road by vehicles have been developed to minimise any impacts on species such as the eastern pygmy possum (*Cercartetus nanus*) that would need to cross the track. Even with these mitigation measures in place, there is potential for individuals of this species to be injured or killed while attempting to cross the access track.

The proposed development will create a minor barrier to movement for the eastern pygmy possum (*Cercartetus nanus*) passing between habitats to the north and south of the proposed access track. However, the extent of this is not such that a significant area of known habitat will be modified, removed or isolated from currently interconnecting or proximate areas.

Conclusion

The project will not have a significant impact on the eastern pygmy possum (*Cercartetus nanus*).

Squirrel Glider (*Petaurus norfolcensis*)

The squirrel glider (*Petaurus norfolcensis*) was not recorded in the project area, however the open woodland habitats provide potential foraging and nesting resources for this species. This species has previously been recorded in nearby, interconnected habitats (Umwelt 2004 and 2009).

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species. The adjacent habitats, which are similar in characteristics to those of the project area, are known habitats for the squirrel glider (*Petaurus norfolcensis*).

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. Much of this remnant offers suitable habitat for the squirrel glider (*Petaurus norfolcensis*). The less than 1 hectare of resources in the project area is likely to be relatively insignificant relative to the local availability of habitats.

A tree-clearing procedure has been designed for the project to minimise impacts on any potentially occurring hollow-roosting species such as the squirrel glider (*Petaurus norfolcensis*).

Given that the project will disturb a small area of potential habitat relative to the available habitats in the wider locality, and provided that the tree-clearing procedure is adhered to, there is no potential that the lifecycle of the squirrel glider (*Petaurus norfolcensis*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for squirrel glider (*Petaurus norfolcensis*), however will not cause the isolation of any known populations of this species.

The easement for Alternate Route A is 10 metres in width. The squirrel glider (*Petaurus norfolcensis*) would possibly need to cross this track when moving between the bushland on the north and south of the track, as there are no other corridors. It is most likely that this species can glide across that distance, in particular if there are overhanging canopies across the track. Mitigation measures relating to the sensitive use of this road by vehicles have been developed to minimise any impacts on species such as the squirrel glider (*Petaurus norfolcensis*) that would need to cross the track. Even with these mitigation measures in place, there is potential for individuals of this species to be injured or killed while attempting to cross the access track.

The proposed development will create a minor barrier to movement for the squirrel glider (*Petaurus norfolcensis*) passing between habitats to the north and south of the proposed access track. However, the extent of this is not such that a significant area of known habitat will be modified, removed or isolated from currently interconnecting or proximate areas.

Conclusion

The project will not have a significant impact on the squirrel glider (*Petaurus norfolcensis*).

Long-nosed Potoroo – *Potorous tridactylus*

The long-nosed potoroo (*Potorous tridactylus*) was not recorded in the project area; however the habitat provided by the project area is considered to provide suitable habitat for this species.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species. The adjacent habitats, which are similar in characteristics to those of the project area similarly provide potential habitat for the long-nosed potoroo (*Potorous tridactylus*).

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. Much of this remnant offers suitable habitat for the long-nosed potoroo (*Potorous tridactylus*). The less than 1 hectare of resources in the project area is likely to be relatively insignificant relative to the local availability of habitats.

Given that the project will disturb a small area of potential habitat relative to the available habitats in the wider locality there is no potential that the lifecycle of the long-nosed potoroo (*Potorous tridactylus*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the long-nosed potoroo (*Potorous tridactylus*), however will not cause the isolation of any known populations of this species.

The easement for Alternate Route A is 10 metres in width. The long-nosed potoroo (*Potorous tridactylus*) would possibly need to cross this track when moving between the bushland on the north and south of the track, as there are no other corridors. Mitigation measures relating to the sensitive use of this road by vehicles have been developed to minimise any impacts on species such as the long-nosed potoroo (*Potorous tridactylus*) that would need to cross the track. Even with these mitigation measures in place, there is potential for individuals of this species to be injured or killed while attempting to cross the access track.

The proposed development will create a minor barrier to movement of potentially present long-nosed potoroo (*Potorous tridactylus*) passing between habitats to the north and south of the proposed access track. However, the extent of this is not such that a significant area of known habitat will be modified, removed or isolated from currently interconnecting or proximate areas.

Conclusion

The project will not have a significant impact on the long-nosed potoroo (*Potorous tridactylus*).

Grey-headed Flying-fox – *Pteropus poliocephalus*

The grey-headed flying-fox (*Pteropus poliocephalus*) was recorded within the project area during current surveys, and has been recorded widely in nearby, connected habitats previously (Umwelt 2004 and 2009).

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of known habitat for this species. The project area supports foraging habitat for the grey-headed flying-fox (*Pteropus poliocephalus*), however there are no roost sites.

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. The grey-headed flying-fox (*Pteropus poliocephalus*) would forage widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be a relatively insignificant component of any individual's range.

Given the small area of disturbance (<1 hectare) relative to the availability of habitats in the broader locality, there is no potential that the lifecycle of the grey-headed flying-fox (*Pteropus poliocephalus*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the grey-headed flying-fox (*Pteropus poliocephalus*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of road easement is not enough to fragment habitats for this highly mobile bat species which has a very wide foraging range.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the grey-headed flying-fox (*Pteropus poliocephalus*).

Conclusion

The project will not have a significant impact on the grey-headed flying-fox (*Pteropus poliocephalus*).

Yellow-bellied Sheathtail Bat – *Saccolaimus flaviventris*

The yellow-bellied sheathtail bat (*Saccolaimus flaviventris*) was not recorded within the project area. The open forest habitats of the project area provide potential foraging and roosting resources for this species.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for the yellow-bellied sheathtail bat (*Saccolaimus flaviventris*). The project area supports both foraging habitat and roosting habitat for this hollow-roosting species.

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. Any locally occurring population of the yellow-bellied sheathtail bat (*Saccolaimus flaviventris*) would forage widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be a relatively insignificant component of any individual's range.

A tree-clearing procedure has been designed for the project to minimise impacts on any potentially occurring hollow-roosting species such as the yellow-bellied sheathtail bat (*Saccolaimus flaviventris*).

Given the small area of disturbance (<1 hectare) relative to the availability of habitats in the broader locality, and provided that the tree-clearing procedure is adhered to, there is no potential that the lifecycle of the yellow-bellied sheathtail bat (*Saccolaimus flaviventris*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the yellow-bellied sheathtail bat (*Saccolaimus flaviventris*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of the road easement is not enough to fragment habitats for this highly mobile bat species which has a wide foraging range.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the yellow-bellied sheathtail bat (*Saccolaimus flaviventris*).

Conclusion: The proposed development will not have a significant impact on the yellow-bellied sheathtail bat (*Saccolaimus flaviventris*).

Eastern Freetail-bat – *Mormopterus norfolkensis*

The eastern freetail-bat (*Mormopterus norfolkensis*) was not recorded within the project area. The open forest habitats of the project area provide potential foraging and roosting resources for this species.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for the eastern freetail-bat (*Mormopterus norfolkensis*). The project area supports both foraging habitat and roosting habitat for this hollow-roosting species.

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. Any locally occurring population of the eastern freetail-bat (*Mormopterus norfolkensis*) would forage widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be a relatively insignificant component of any individual's range.

A tree-clearing procedure has been designed for the project to minimise impacts on any potentially occurring hollow-roosting species such as the eastern freetail-bat (*Mormopterus norfolkensis*).

Given the small area of disturbance (<1 hectare) relative to the availability of habitats in the broader locality, and provided that the tree-clearing procedure is adhered to, there is no potential that the lifecycle of the eastern freetail-bat (*Mormopterus norfolkensis*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the eastern freetail-bat (*Mormopterus norfolkensis*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of the road easement is not enough to fragment habitats for this highly mobile bat species which has a wide foraging range.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the eastern freetail-bat (*Mormopterus norfolkensis*).

Conclusion

The project will not have a significant impact on the eastern freetail-bat (*Mormopterus norfolkensis*).

Little Bentwing-bat – *Miniopterus australis*

The little bentwing-bat (*Mormopterus australis*) was recorded within the project area. The open forest habitats of the project area provide foraging resources for this species. This species occasionally roosts in tree hollows, in which case there is potential roosting habitat for this species in the project area.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of known habitat for the little bentwing-bat (*Miniopterus australis*). The project area supports foraging habitat and roosting habitat for this occasional hollow-roosting species.

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. The little bentwing-bat (*Miniopterus australis*) would forage widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be a relatively insignificant component of any individual's range.

A tree-clearing procedure has been designed for the project to minimise impacts on any hollow-roosting species such as the little bentwing-bat (*Miniopterus australis*).

Given the small area of disturbance (<1 hectare) relative to the availability of habitats in the broader locality, and provided that the tree-clearing procedure is adhered to, there is no potential that the lifecycle of the little bentwing-bat (*Miniopterus australis*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of known habitat for little bentwing-bat (*Miniopterus australis*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of the road easement is not enough to fragment habitats for this highly mobile bat species which has a wide foraging range.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the little bentwing-bat (*Miniopterus australis*).

Conclusion

The project will not have a significant impact on the little bentwing-bat (*Miniopterus australis*).

Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)

The eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) was not recorded within the project area during current surveys. The open forest habitats of the project area provide suitable foraging resources, however no suitable roosting habitats.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species. The project area supports foraging habitat for the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), however there are no suitable roost sites.

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. Any locally occurring populations of the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) would forage widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be a relatively insignificant component of any individual's range.

Given the small area of disturbance (<1 hectare) relative to the availability of habitats in the broader locality, there is no potential that the lifecycle of the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of the road easement is not enough to fragment habitats for this highly mobile bat species which has a very wide foraging range.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*).

Conclusion

The project will not have a significant impact on the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*).

Large-eared Pied bat – *Chalinolobus dwyeri*

The large-eared pied bat (*Chalinolobus dwyeri*) was not recorded within the project area during current surveys. The open forest habitats of the project area provide suitable foraging resources, however no suitable roosting habitats.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of potential habitat for this species. The project area supports foraging habitat for the large-eared pied bat (*Chalinolobus dwyeri*), however there are no suitable roost sites.

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. Any locally occurring populations of the large-eared pied bat (*Chalinolobus dwyeri*) would forage widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be a relatively insignificant component of any individual's range.

Given the small area of disturbance (<1 hectare) relative to the availability of habitats in the broader locality, there is no potential that the lifecycle of the large-eared pied bat (*Chalinolobus dwyeri*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of potential habitat for the large-eared pied bat (*Chalinolobus dwyeri*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of the road easement is not enough to fragment habitats for this highly mobile bat species which has a very wide foraging range.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the large-eared pied bat (*Chalinolobus dwyeri*).

Conclusion

The project will not have a significant impact on the large-eared pied bat (*Chalinolobus dwyeri*).

Greater Broad-nosed Bat – *Scoteanax rueppellii*

The greater broad-nosed bat (*Scoteanax rueppellii*) was recorded within the project area. The open forest vegetation of the project area provides foraging and roosting habitats for this species.

a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction*

The project will require the removal of less than 1 hectare of known habitat for the broad-nosed bat (*Scoteanax rueppellii*). The project area supports foraging habitat and roosting habitat for this hollow-roosting species.

The project area comprises a very small area of a much larger remnant of vegetation, of similar or better condition, which occurs along the south-east coast of Port Stephens from Salt Ash to Anna Bay, some of which is included in the 4438 hectare Worimi Conservation Lands. The broad-nosed bat (*Scoteanax rueppellii*) would forage widely through this broader remnant, and therefore the less than 1 hectare of resources in the project area would be a relatively insignificant component of any individual's range.

A tree-clearing procedure has been designed for the project to minimise impacts on any hollow-roosting species such as the broad-nosed bat (*Scoteanax rueppellii*).

Given the small area of disturbance (<1 hectare) relative to the availability of habitats in the broader locality, and provided that the tree-clearing procedure is adhered to, there is no potential that the lifecycle of the broad-nosed bat (*Scoteanax rueppellii*) would be disrupted such that a local viable population of the species would be placed at risk of extinction.

b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas*

Alternate Route A will disturb a small area of habitat for broad-nosed bat (*Scoteanax rueppellii*), however will not cause the isolation of any known populations of this species. The proposed 10 metre width of the road easement is not enough to fragment habitats for this highly mobile bat species which has a wide foraging range.

The proposed development will not result in the fragmentation, modification or removal of a significant area of known habitat for the broad-nosed bat (*Scoteanax rueppellii*).

Conclusion

The project will not have a significant impact on the bat broad-nosed bat (*Scoteanax rueppellii*).

Significance Assessment Conclusion

The proposed development will not result in a significant impact on any TSC Act or EPBC listed threatened species, endangered populations or endangered ecological communities.

APPENDIX E

Assessment of Significance under the Environment Protection and Biodiversity Conservation Act 1999

Appendix E – Assessment of Significance under the *Environment Protection and Biodiversity Conservation Act 1999*

A search of the DSEWPC Protected Matters Database identified (discounting fishes and marine species) 17 EPBC Act listed threatened species (refer to Tables 3.2 and 4.1 of the main report) and 18 migratory species (refer to Table 4.1 of the main report) known to occur or considered likely to occur, on the basis of habitat modelling, within a 10 kilometre radius of the project area.

The EPBC Act listed species recorded or with potential to occur in the project area, and therefore covered under this assessment are listed in **Table 1** below.

Table 1 – EPBC Act Listed Threatened and Migratory Species Included in this Assessment of Significance for the Proposed Development

Species	EPBC Act Status	Recorded/Potential to Occur
Endangered Species		
swift parrot <i>Lathamus discolor</i>	endangered	potential
regent honeyeater <i>Anthochaera phrygia</i>	endangered	potential
Vulnerable Species		
rough doubletail <i>Diuris praecox</i>	vulnerable	recorded
leafless tongue-orchid <i>Cryptostylis hunteriana</i>	vulnerable	potential
Charmhaven apple <i>Angophora inopina</i>	vulnerable	recorded
grey-headed flying-fox <i>Pteropus poliocephalus</i>	vulnerable	recorded
large-eared pied-bat <i>Chalinolobus dwyeri</i>	vulnerable	potential
New Holland mouse <i>Pseudomys novaehollandiae</i>	vulnerable	potential
spotted-tailed quoll <i>Dasyurus maculatus</i>	endangered	potential
long-nosed potoroo <i>Potorous tridactylus</i>	vulnerable	potential
Migratory Species		
welcome swallow <i>Hirundo neoxena</i>	migratory	recorded
tree martin <i>Hirundo nigricans</i>	migratory	recorded
Silvereye <i>Zosterops lateralis</i>	migratory	recorded
magpie-lark <i>Grallina cyanoleuca</i>	migratory	recorded
spangled drongo <i>Dicrurus bracteatus</i>	migratory	recorded

Species	EPBC Act Status	Recorded/Potential to Occur
black-faced cuckoo-shrike <i>Coracina novaehollandiae</i>	migratory	recorded
black-shouldered kite <i>Elanus axillaris</i>	migratory	recorded
white-bellied sea-eagle <i>Haliaeetus leucogaster</i>	migratory	recorded
whistling kite <i>Haliastur sphenurus</i>	migratory	recorded
swamp harrier <i>Circus approximans</i>	migratory	recorded
white-throated needletail <i>Hirundapus caudacutus</i>	migratory	potential
rainbow bee-eater <i>Merops ornatus</i>	migratory	potential
rufous fantail <i>Rhipidura rufifrons</i>	migratory	potential
fork-tailed swift <i>Apus pacificus</i>	migratory	potential

An assessment of the potential impacts of the proposed development is provided below for each threatened and migratory species listed in **Table 1** above. The assessment is based on the removal of less than 2 hectares of native vegetation and assuming the impact mitigation measures identified in Section 6 of the main report are adhered to.

The aim of this assessment is to determine whether the proposed development is likely to have a significant impact on any EPBC Act Matters of National Environmental Significance (MNES). In this instance, MNES with potential to occur within the project area include:

- listed threatened species (including endangered and vulnerable species); and
- listed migratory species.

Each category is addressed separately below.

Endangered

The following EPBC Act listed Endangered species are considered in this assessment:

- swift parrot (*Lathamus discolor*); and
- regent honeyeater (*Anthochaera phrygia*).

An assessment in accordance with the DSEWPC principal significant impact guidelines is provided below for these species.

In this case, a *population* means:

- a geographically distinct regional population, or collection of local populations; or
- a regional population, or collection of local populations, that occurs within a particular bioregion.

The two species listed above were not recorded in the project area, however have potential to occur. The species are known to occur in the locality seasonally, opportunistically foraging on available winter-flowering vegetation. The project area does not contain a geographically distinct regional population, or collection of local populations for these species, and does not contain a regional population, or collection of local populations of this species that occur within the NSW North Coast Bioregion.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a *population*; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*) were recorded within the project area. The proposed development will not lead to a decrease in the size of a *population* (as defined above) of any of these endangered species.

- **reduce the area of occupancy of the species; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*) were recorded within the project area. Less than 2 hectares of marginal potential foraging habitat will be disturbed as a result of the proposed development. While the proposed development has potential to modify the area of potential habitat for these endangered species, it will not lead to a significant reduction. Substantial areas of similar potential habitats for these species are protected within a large expanse of continuous vegetation adjacent to the project area, some of which is protected within the Worimi Conservation Lands.

- **fragment an existing *population* into two or more populations; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*) were recorded within the project area. Given the small scale of the impact area (<2 hectares) and the mobile nature of the above species, the proposed development will not fragment an existing population of either species into two or more populations.

-
- **adversely affect habitat critical to the survival of a species; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*) were recorded within the project area. The project area does not contain habitat critical to the survival of these endangered species, and therefore such habitats will not be affected as a result of the proposed development.

- **disrupt the breeding cycle of a population; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*) were recorded within the project area. Neither species has potential for breeding within the project area. The proposed development will not disrupt the breeding cycle of any population of any endangered species.

- **modify, destroy, remove isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

The habitats of the project area provide only marginal foraging habitat for the swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*), and less than two hectares of such habitats will be disturbed as a result of the proposed development. The proposed development will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that these endangered species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat; or**

The project area currently supports introduced plant and animal species in a low to moderate abundance that is unlikely to be harmful to the swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*). The proposed development will not result in a significant increase in invasive species that are harmful to the swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*).

- **interfere with the recovery of the species.**

Given the small area of potential, marginal foraging habitat to be disturbed, the proposed development will not interfere with the recovery of the swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*).

Vulnerable Species

The following EPBC Act listed vulnerable species are considered in this assessment:

- New Holland mouse (*Pseudomys novaehollandiae*);
- spotted-tailed quoll (*Dasyurus maculatus*);
- long-nosed potoroo (*Potorous tridactylus*);
- large-eared pied bat (*Chalinolobus dwyeri*);
- grey-headed flying-fox (*Pteropus poliocephalus*);
- Charmhaven apple (*Angophora inopina*);
- rough doubletail (*Diuris praecox*); and
- leafless tongue-orchid (*Cryptostylis hunteriana*).

An assessment in accordance with the DSEWPC principal significant impact guidelines is provided below for these species.

In this case, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity; and/or**
- **populations that are near the limit of the species range.**

There are no species for which the project area supports an important population based on the DSEWPC definition.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of an *important population* of a species; or**

The proposed development will not result in a long-term decrease in an important population of any vulnerable species.

- **reduce the area of occupancy of an *important population*; or**

The proposed development will not result in the reduction in the area of occupancy of any important population of these species.

- **fragment an existing important population into two or more populations; or**

The proposed development will not result in the fragmentation of an existing important population into two or more populations.

-
- **adversely affect habitat critical to the survival of a species; or**

The project area does not contain habitat critical to the survival of New Holland mouse (*Pseudomys novaehollandiae*), spotted-tailed quoll (*Dasyurus maculatus*), long-nosed potoroo (*Potorous tridactylus*), large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*), Charmhaven apple (*Angophora inopina*), leafless tongue-orchid (*Cryptostylis hunteriana*) or rough doubletail (*Diuris praecox*). The proposed development will not result in any adverse affect on habitat critical to the survival of these species.

- **disrupt the breeding cycle of an important population; or**

The proposed development will not disrupt the breeding cycle of an important population of these species.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

The proposed development involves the disturbance to less than 2 hectares of potential habitat for large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*); and five individual Charmhaven apple (*Angophora inopina x floribunda*) and nine individuals of rough doubletail (*Diuris praecox*). However, it is unlikely that this loss would be to the extent that these species are likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or**

The project area currently supports introduced plant and animal species in a low to moderate abundance that is unlikely to be harmful to the large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*), Charmhaven apple (*Angophora inopina*) and rough doubletail (*Diuris praecox*). The proposed development will not result in a significant increase in invasive species that are harmful to these species.

- **interfere substantially with the recovery of the species.**

The proposed development will involve the disturbance to less than 2 hectares of potential habitat for large-eared pied bat (*Chalinolobus dwyeri*), grey-headed flying-fox (*Pteropus poliocephalus*); and five individual Charmhaven apple (*Angophora inopina x floribunda*) and nine individuals of rough doubletail (*Diuris praecox*). Significant areas of similar habitats occur within the local area. The habitats of the project area are not vital for these species.

The proposed development will not interfere substantially with the recovery of these species.

Migratory Species

The 14 EPBC Act migratory species listed in **Table 1**, recorded or found to have potential to occur in the project area are considered in this assessment.

A proposed development is regarded to have a significant impact if it affects an area of important habitat for any migratory species. Under the definition of the Act, an area of *important habitat* is:

- **habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; or**
- **habitat utilised by a migratory species which is at the limit of the species range; or**
- **habitat within an area where the species is declining.**

The project area is not considered to comprise important habitat for any of the listed migratory species, based on the DSEWPC criteria described above. As such, no further assessment is required for any EPBC Act listed vulnerable species recorded or potentially occurring in the project area. The proposed development will not impact on an important population of any EPBC Act listed vulnerable species.

Conclusion

The proposed development will not result in a significant impact on any EPBC Act listed threatened, vulnerable or migratory species.