FAUNA ASSESSMENT

APPENDIX F

NEWCASTLE COAL INFRASTRUCTURE GROUP COAL EXPORT TERMINAL

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COAL EXPORT TERMINAL

APPENDIX F
FAUNA ASSESSMENT

JUNE 2006
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F1 INTRODUCTION

This document, Fauna Assessment, assesses the potential impacts of the development of the proposed Coal Export Terminal (CET) (the Project) on fauna. This Fauna Assessment has been prepared in association with (i.e. co-authored by) Professor David Goldney. The Project is being developed by the Newcastle Coal Infrastructure Group (NCIG). As stipulated by the Project Environmental Assessment Requirements (EARs) (Section 1 of the Project Environmental Assessment [EA]) issued by the Director-General of the Department of Planning (DoP) on 26 April 2006, the Fauna Assessment has been prepared in accordance with the Draft *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005). These guidelines identify important factors that must be considered when assessing potential impacts on threatened species, populations, or ecological communities, or their habitats for development applications assessed under Part 3A of the *Environmental Planning and Assessment Act, 1979* (EP & A Act) (DEC and DPI, 2005).

F1.1 PROJECT DESCRIPTION

The Project is located on Kooragang Island in Newcastle, New South Wales (NSW) (Figure F-1). The Project involves the construction and operation of a 66 million tonne per annum (Mtpa) CET, including associated rail and coal handling infrastructure and wharf/ship loading facilities on the south arm of the Hunter River.

The Project general arrangement is shown on Figure F-2. A detailed description of the Project is provided in Section 2 of the Project EA.

F1.1.1 Regional Setting

The Project is situated on Kooragang Island approximately 6 kilometres (km) to the north-west of the Newcastle Central Business District (Figure F-1). The south arm of the Hunter River forms part of the southern boundary of the Project site (Figure F-2). Landuses in the immediate proximity of the Project site include the Australian Rail Track Corporation rail easement to the north and west, the south arm of the Hunter River to the south and Blue Circle Southern Cement and Origin Energy to the east. Kooragang Nature Reserve (NR), Port Waratah Coal Services Kooragang Coal Terminal and fines disposal area, and Delta EMD Australia's licensed landfill are located to the north of the Project site. The Kooragang Wetland Rehabilitation Project (KWRP) at Ash Island is situated to the west.

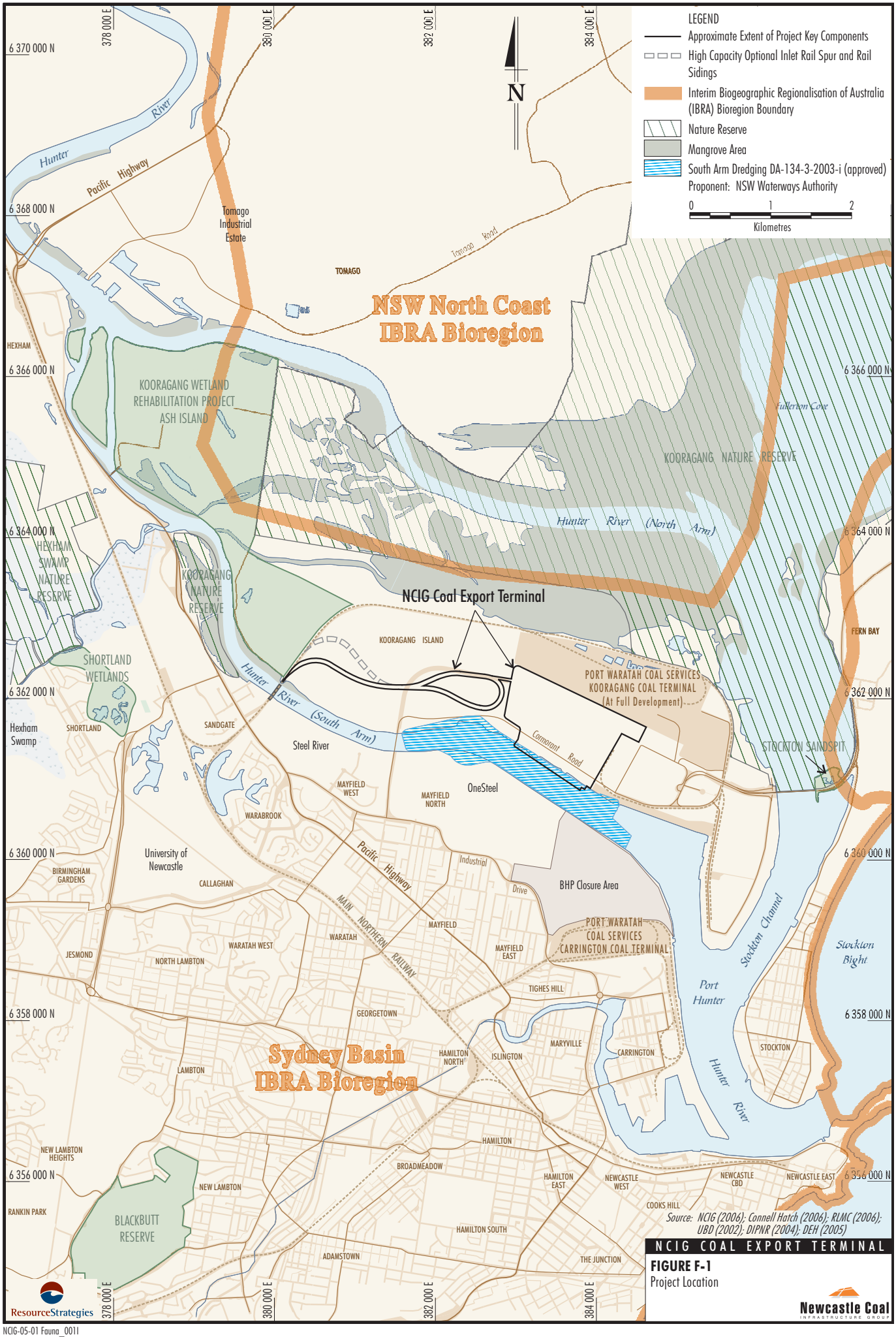
The Project site is situated in the far north-eastern corner of the Sydney Basin Interim Biogeographic Regionalisation of Australia (IBRA) Bioregion (DEH, 2005a). The Project site is also close to the NSW North Coast Bioregion immediately to the north (*ibid*.). Due to its close proximity, the Project site is also likely to be influenced by the environmental characteristics of the NSW North Coast Bioregion (Figure F-1).

The Project site is situated approximately 1 km to the south of the main area of Kooragang NR, approximately 500 m to the east of the small area of Kooragang NR adjacent to the south arm of the Hunter River, and approximately 2.5 km to the east of Hexham Swamp NR (Figure F-1). The importance of both of these NRs, including their significance for the conservation of migratory shorebirds, is detailed in the *Kooragang Nature Reserve and Hexham Swamp Nature Reserve Plan of Management* (NPWS, 1998). Kooragang and Hexham Swamp NRs, in addition to the Shortland Wetlands and the State Environmental Planning Policy (SEPP) 14 listed wetlands associated with the lower Hunter River Estuary, are part of the nearby Hunter Estuary Wetlands (DEH, 2006a) (Figure F-1).

The statements of significance for the listing of the Hunter Estuary Wetlands on the Register of the National Estate include recognition of their international significance as waterbird habitat (DEH, 2006a). Forty-five migratory species presently listed under JAMBA[1] and/or CAMBA[2] have been recorded in the Hunter Estuary Wetlands (*ibid*.). The Hunter Estuary Wetlands are also listed as a Wetland of International Importance under the Ramsar Convention (2006).

[1] The Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment.

[2] The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment.



Source: NCIG (2006); Connell Hatch (2006); RLMC (2006); UBD (2002); DIPNR (2004); DEH (2005)

NCIG COAL EXPORT TERMINAL

FIGURE F-1
Project Location

ResourceStrategies

Newcastle Coal INFRASTRUCTURE GROUP

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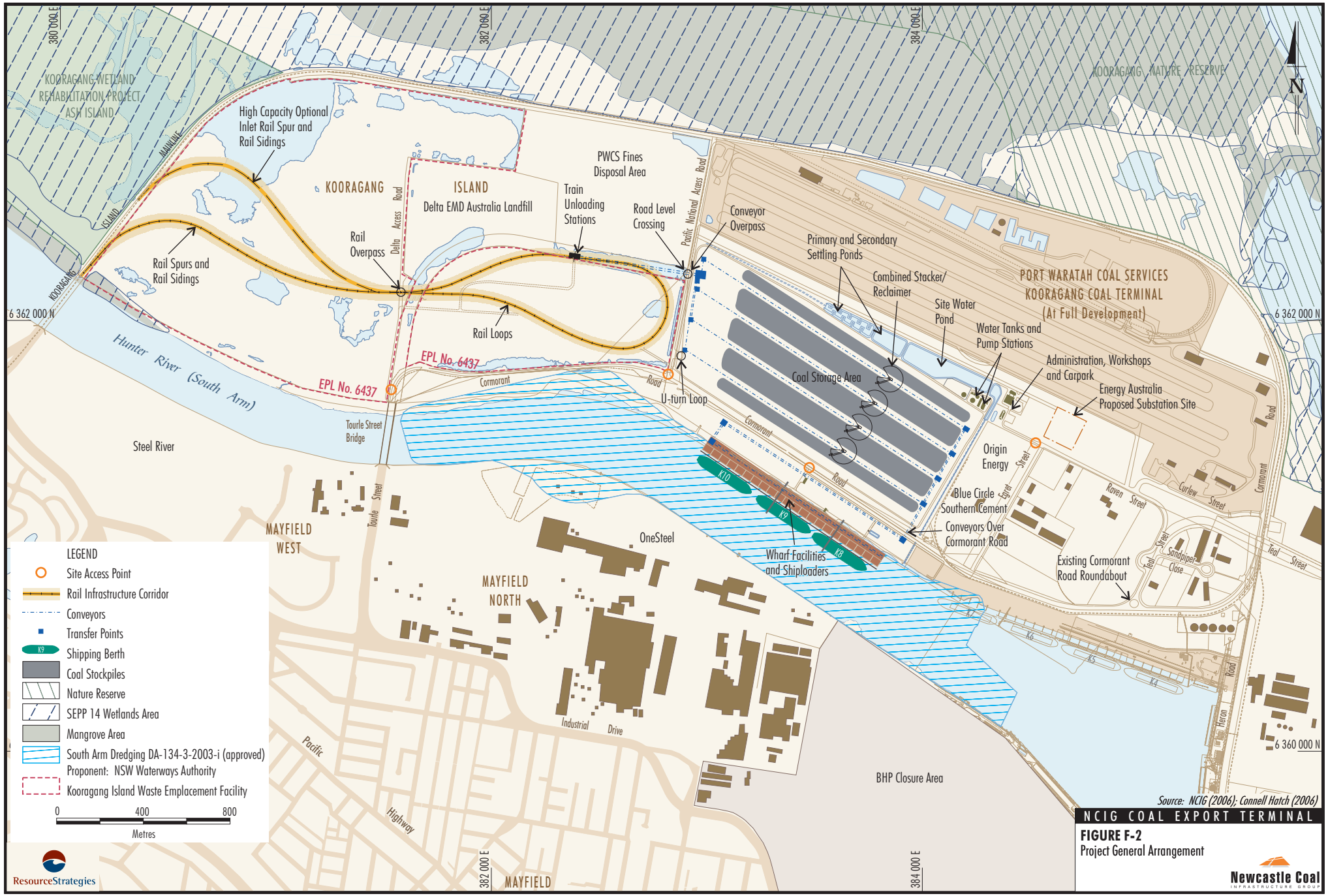

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F1.1.2 Description of the Project Site and Surrounds

History

Kooragang Island was originally several low-lying deltaic islands at the mouth of the Hunter River formed from a deposition of river-borne sediments (Winning, 1996; Hamer, 1998). The area has been used for agriculture (grazing and dairy farming) since the 1830s (Dames & Moore, 1999 and Umwelt, 2003a). Commencing in 1859, the deltaic islands were sporadically used for spoil disposal (mainly from dredging operations) up until the early 1950s (*ibid.*).

The commencement of the *Newcastle Harbour Improvement Act, 1953* in 1953 permitted the progressive reclamation of the deltaic islands for industrial use (i.e. formation of Kooragang Island). Fill material for the reclamation process was originally sourced from the dredging of the Hunter River and dredge material has continued to be used intermittingly since 1953 (Dames & Moore, 1999).

Kooragang Island was zoned for heavy industrial use in the 1960s (Hamer, 1998). In 1972, BHP commenced operating a landfill at the Project site. Industrial waste materials (e.g. coal washery rejects, steel manufacturing waste and construction waste) were used to reclaim land in addition to dredge material.

Part of the Project site includes Big Pond which was artificially created (i.e. is a remnant of filling activities) and has been manipulated as a wetland foraging habitat for shorebirds (Straw, 1999). Originally, Big Pond was part of an intertidal mangrove area before it was cut off from tidal influence when Moscheto Creek was blocked by a railway and then bunded to create land suitable for industrial use (Straw, 1999). Shorebirds ceased to use Big Pond when water flows to the wetland were blocked by an extension of Port Waratah Coal Services (PWCS) in 1994 (*ibid*.). In order to make Big Pond attractive again to shorebirds, PWCS constructed a weir so that water levels could be manipulated but this was subsequently removed (*ibid*.).

Present

The Project is situated within land zoned Zone 4(b) (Port and Industry) and 5(a) (Special Uses Zone - Arterial Road) by the Newcastle City Council Local Environmental Plan (LEP) as well as on an unzoned area.

The Project rail infrastructure corridor would be constructed on land which is part of the Kooragang Island Waste Emplacement Facility (KIWEF) which is owned by the Regional Land Management Corporation (RLMC). This site is currently licensed (EPL 6437) as a Solid Waste Class 2 landfill under the *Protection of the Environment Operations Act, 1997* (POEO Act).

As a result of the reclamation and land filling activities described above, the majority of the Project site has been covered with fill (Dames & Moore, 1999 and NCIG, 2005). This landuse history has meant that much of the original vegetation has been covered by soil and industrial waste with consequent successional vegetation changes resulting in a series of vegetation communities dominated by weeds (Appendix E of the EA).

The Project site and surrounds are characterised by wetland habitat types ranging from semi-natural to highly disturbed habitats (Appendix E of the EA). The dominant terrestrial habitat is grassland dominated by exotic pasture and species used for landscape (i.e. amenity) plantings (*ibid*.). Part of the Project site includes Big Pond which is highly modified, consisting of an artificially raised section, and is completely cleared of woody vegetation (Department of Commerce, 2005).

F1.2 ASSESSMENT OBJECTIVES

The objectives of the Fauna Assessment were to:

- Assess terrestrial and aquatic fauna species diversity and habitats present within the Project site and surrounds using database searches and a review of existing literature.
- Conduct targeted surveys for the Green and Golden Bell Frog and Australasian Bittern and report findings.
- Undertake a Shorebird Study and Habitat Assessment and report findings.
- Conduct detailed evaluations to determine whether the Project is likely to have a significant effect on relevant threatened and migratory fauna species.
- Identify the potential impacts of the Project on fauna species.
- Propose mitigation and compensatory measures to address the potential impacts of the Project.

F2 METHODS

The methods used to obtain information for this Fauna Assessment included a literature review, database searches and field surveys (*viz*., targeted surveys for the Green and Golden Bell Frog and the Australasian Bittern as well as the Shorebird Study and Habitat Assessment). Detailed evaluations were also conducted to determine whether the Project is likely to have a significant effect on relevant threatened and migratory fauna species. These evaluations were based on information provided in the Draft *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005). A description of the assessment methodology is provided below.

F2.1 LITERATURE REVIEW

Numerous fauna studies of the Project site and surrounds have been undertaken in the past. A literature review was undertaken as part of this Fauna Assessment and included relevant reports (i.e. Environmental Impact Statements [EISs], reports prepared for government departments and scientific literature). The reports reviewed for this assessment included (but were not limited to) the following:

- *Big Pond Habitat Offset Scheme Flora and Fauna Studies* (BPHOS Report) (NSW Department of Commerce, 2005).
- *Flora and Fauna Assessment* (Appendix F) of the *Proposed Cold Mill Facility Kooragang Island Environmental Impact Assessment* (Protech Steel, 2001).
- *Terrestrial Ecology Impact Assessment Report* (Umwelt, 2003b) (Appendix H of the *Proposed Extension of Shipping channels Port of Newcastle Environmental Impact Assessment* [Waterways Authority, 2003]).
- *Kooragang Port and Transport Corridor Species Impact Statement* [SIS] (RLMC, 2003).
- *The Distribution of Frog Fauna in the Kooragang Wetland Rehabilitation Project site, Ash Island, NSW* (Hamer, 1997).
- *The Green and Golden Bell Frog on Kooragang Island Monitoring Study* (Premier's Department, 2003).
- *Flora and Fauna Assessment for Proposed Rehabilitation of Estuarine Wetlands at Tomago, NSW* (Winning, 1998).
- *Kooragang Coal Terminal Stage Three Expansion Environmental Impact Assessment* (PWCS, 1996).
- *Sandgate Rail Grade Separation Environmental Impact Assessment* (ARTC, 2005).
- *Aspects of the Ecology of the Green and Golden Bell Frog* (Litoria aurea) *on Kooragang Island, New South Wales, Australia* (Hamer, 1998).
- *Ecology of the Endangered Green and Golden Bell Frog* Litoria aurea: *roles of habitat determinants, spatial dynamics, population demography and threatening processes* (PhD Thesis) (Hamer, 2002).
- *Hunter River Estuary Wader Habitat Investigation – Report to NSW National Parks and Wildlife Service* (Straw, 1999).
- *Hunter Estuary Wader Habitat Investigation Stage 2 – Report to NSW National Parks and Wildlife Service* (Straw, 2000).

The fauna assessments conducted for the BPHOS Report (Department of Commerce, 2005) and the *Proposed Cold Mill Facility Kooragang Island EIS* (Protech Steel, 2001) included areas located within the NCIG Project site. In addition, the *Kooragang Port and Transport Corridor SIS* (RLMC, 2003) included the rail infrastructure corridor. The *Terrestrial Ecology Impact Assessment Report* (Umwelt, 2003b) included the area of the Project wharf and shiploading facilities (i.e. the banks of the south arm of the Hunter River). As these four reports included areas in and immediately adjacent to the Project site and are recent (i.e. within the last five years), all fauna species identified by these reports are considered for this Fauna Assessment (Section F3.1.2).

All of the other reports listed above were reviewed to determine whether any of the fauna species recorded by them were identified as threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) and/or Threatened Species or Populations as listed under the NSW *Threatened Species Conservation Act, 1995* (TSC Act). This included A. Hamer's Masters and PhD theses and P. Straw's shorebird habitat investigations which included areas located within the Project site (Hamer, 1998, 2002; Straw, 1999, 2000) and the PWCS (1996) and Cargill (2005) fauna assessments which considered areas on Kooragang Island proximal to the Project site.

F2.2 DATABASE SEARCHES

In addition to the literature review described in Section F2.1, fauna previously recorded in the Project site and surrounds were determined using the following database searches:

- Department of Conservation (DEC) (2006a) Atlas of NSW Wildlife (Newcastle [9232], Port Stephens [9332] and Lake Macquarie [9231] 1:100,000 map sheets);
- Birds Australia (2006);
- Hunter Bird Observers Club (HBOC) (2006); and
- Australian Museum (2006).

The Birds Australia and Australian Museum databases were searched using a search area of approximately 400 km^2 surrounding the Project site. The HBOC databases searched were Ash Island, Big Pond, Deep Pond, Fullerton Cove, Kooragang NR, Long Pond and Stockton Sand Spit.

These searches were used to determine whether any previously recorded fauna in the Project site and surrounds are species of conservation significance (including migratory and marine protected species) under the EPBC Act and/or Threatened Species or Populations as listed under the TSC Act. The results of these database searches were incorporated into the Fauna Assessment.

F2.3 FIELD SURVEYS

The following field surveys were conducted in Summer 2005-2006 for the Project:

- Targeted survey for the Green and Golden Bell Frog (*Litoria aurea*) (Connell Hatch, 2006a).
- Targeted survey for the Australasian Bittern (*Botaurus poiciloptilus*) (Connell Hatch, 2006b).
- Shorebird Study and Habitat Assessment (Avifauna Research and Services, 2006).

The Green and Golden Bell Frog, the Australasian Bittern and shorebirds were specifically targeted for this Fauna Assessment because preliminary ecological investigations of the site for the Project undertaken by Connell Hatch in early 2005 identified these key ecological issues as requiring further study (Connell Hatch, 2006a and b). The preliminary investigations involved a brief reconnaissance survey, literature review and database searches (*ibid*.).

The timing and techniques used during the field surveys were designed to maximise the potential of recording the Green and Golden Bell Frog, Australasian Bittern and shorebirds. The results of the field surveys were incorporated into the Fauna Assessment.

A summary of the survey methodology used for the Green and Golden Bell Frog and Australasian Bittern targeted surveys and the Shorebird Study and Habitat Assessment are provided in Sections F3.2.1, F3.2.2 and F3.2.3, respectively.

F2.3.1 Green and Golden Bell Frog

The targeted surveys for the Green and Golden Bell Frog were undertaken for the Project by Connell Hatch in summer 2005-2006 (Connell Hatch, 2006a). This timing was recommended by the BPHOS Report (Department of Commerce, 2005).

The aims of the targeted surveys for the Green and Golden Bell Frog were, firstly, to assess the suitability of waterbodies present in the study site as habitat for the Green and Golden Bell Frog and, secondly, to identify the presence or absence of the Green and Golden Bell Frog at each of these waterbodies (Connell Hatch, 2006a). The field methodology used was based on the procedures described in *Threatened Species Survey and Assessment - Guidelines for Developments and Activities* (DEC, 2004) (Connell Hatch, 2006a).

Air photo interpretation in conjunction with past literature was used to identify and map the 33 waterbodies which occur across the study site (Connell Hatch, 2006a). The survey included waterbodies proximal to the Project disturbance area (including Big Pond and Deep Pond [Attachment F-A]). Potential habitat for the Green and Golden Bell Frog was considered to include (Connell Hatch, 2006a):

- dense reedbeds (which potentially provide shelter, basking and foraging sites);
- chitter, rubble, slag and dense grassland (which potentially provide refuge and/or over-wintering sites);
- areas of open water adjacent to reedbeds (potentially used by Green and Golden Bell Frog for calling);
- ephemeral waterbodies (which potentially provide breeding habitat during significant rainfall events); and
- permanent to semi-permanent waterbodies (which potentially provide 'core' habitat which the Green and Golden Bell Frog can use during extended dry periods).

Areas of estuarine wetland were also surveyed although they were considered to be habitat of low suitability for the Green and Golden Bell Frog (Connell Hatch, 2006a).

Targeted surveys were undertaken from 29 November 2005 to 28 February 2006 and included a combination of diurnal and nocturnal census techniques, including listening for frog calls, spotlighting, call playback and call recording and searching within habitat (Connell Hatch, 2006a). Playback of the Green and Golden Bell Frog mating call was undertaken for two sessions at each site, with calls broadcast for 15 minutes at each site (*ibid*.).

Daytime searches for tadpoles and adult Green and Golden Bell Frog were conducted for a minimum of one hour at each pond containing habitat suitable for the species (Connell Hatch, 2006a). Searches included turning over rocks, logs, and debris (e.g. concrete) (*ibid*.). Nocturnal searches were undertaken during or following rain or storm events where practicable (Connell Hatch, 2006a). Wetlands, soaks and seepages were searched on two separate nights for 30 minutes each and certain roads (e.g. Cormorant Road) were traversed to record any Green and Golden Bell Frogs (*ibid*.).

F2.3.2 Australasian Bittern

Targeted surveys for the Australasian Bittern were undertaken in summer 2005-2006 (Connell Hatch, 2006b). The aims of the targeted Australasian Bittern survey were to assess the suitability of the study site as habitat for the Australasian Bittern and to identify the presence or absence of the species in the 33 ponds across the study site (*ibid*.) (Attachment F-B).

Habitat assessment for the Australasian Bittern was undertaken using a combination of sampling plots (quadrats) and walking transects (i.e. to gain an understanding of habitat types and to identify community boundaries) (Connell Hatch, 2006b).

Surveys were conducted at ponds which support potential habitat for the Australasian Bittern using the following methods: listening at dusk for calling individuals, spotlighting and opportunistic sightings (Connell Hatch, 2006b).

F2.3.3 Shorebird Study and Habitat Assessment

The Shorebird Study and Habitat Assessment was conducted in summer 2005-2006 by Avifauna Research and Services (2006). The surveys included wetland sites in the Project site and surrounds including Big Pond and Deep Pond (Attachment F-C). Two replicate bird counts were made over two consecutive days at wetlands that contain habitat for waterbirds during November and December 2005 and January 2006 (Avifauna Research and Services, 2006).

All wetland bird species were counted or, in the case of cryptic species, their presence established only (Avifauna Research and Services, 2006). Cryptic species were recorded from observations and/or characteristic vocalisations (*ibid*.).

Most wetlands were scanned using binoculars and spotting scope and each species of bird was recorded (Avifauna Research and Services, 2006). However, at Big Pond, transects were walked across the length and breadth of Big Pond to determine the presence of birds by flushing any birds or by identification from vocalisations (*ibid*.).

F2.4 ASSESSMENT OF POTENTIAL IMPACTS

As previously stated, this Fauna Assessment considers the potential impacts of the Project on relevant threatened fauna species and their habitats in accordance with the Draft *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005).

To assist in identifying whether the potential impacts of the Project are likely to have a significant effect on threatened and migratory fauna species, evaluations were conducted. These evaluations were based on the Draft *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005) and included consideration of the following items:

- How is the proposal likely to affect the lifecycle of a threatened species and/or population?
- How is the proposal likely to affect the habitat of a threatened species, population or ecological community?
- Does the proposal affect any threatened species or populations that are at the limit of its known distribution?
- How is the proposal likely to affect current disturbance regimes?
- How is the proposal likely to affect habitat connectivity?
- How is the proposal likely to affect critical habitat?

Evaluations were conducted for threatened fauna species previously recorded at the Project site as well as for other threatened species specified by the Project EARs (*viz*., Painted Snipe [*Rostratula benghalensis*], Masked Owl [*Tyto novaehollandiae*] and Beach Stone-curlew [*Esacus neglectus*]) (Section 1 of the Project EA).

In addition, an individual evaluation was conducted for the Grass Owl (*Tyto capensis*) as the DEC has informed NCIG that this species was recorded in the vicinity of the Project site (i.e. Kooragang NR approximately 1 km to the north) earlier this year. An individual evaluation was also conducted for the Red-backed Button-quail (*Turnix maculosa*) as a result of consultation with the HBOC which recorded this species near the Project disturbance area on 2 February 2006 (Section 3.7.2 of the Project EA).

The Project EARs required all other threatened fauna species that have been recorded in the Kooragang or surrounding wetlands to be considered. Hence, included in the evaluations were threatened species listed under the TSC Act and/or EPBC Act that were recorded within 20 km of the Project site according to a search of the DEC Atlas of NSW Wildlife (Newcastle [9232], Port Stephens [9332] and Lake Macquarie [9231] 1:100,000 map sheets [DEC, 2006a]). These species were grouped according to broad habitat requirement similarities and evaluations conducted for each group.

In addition, group evaluations were conducted for species listed as migratory under the EPBC Act recorded by the DEC Atlas of NSW Wildlife (Newcastle [9232], Port Stephens [9332] and Lake Macquarie [9231] 1:100,000 map sheets ([DEC, 2006a]). These group evaluations were for migratory turtles and migratory birds. A broader search area was used for migratory species due to their greater mobility. An additional three migratory birds were considered in the evaluations as a result of consultation with the HBOC (*viz*., Grey-tailed Tattler [*Heteroscelus brevipes*], Wandering Tattler [*Heteroscelus incanus*] and Lesser Yellowlegs [*Tringa flavipes*]) (Section 3.7.2 of the Project EA).

Based on the above selection process, evaluations were conducted for the following threatened species and groups of threatened species:

- Green and Golden Bell Frog (*Litoria aurea*);
- Australasian Bittern (*Botaurus poiciloptilus*);
- Black-tailed Godwit (*Limosa limosa*);
- Blue-billed Duck (*Oxyura australis*);
- Freckled Duck (*Stictonetta naevosa*);
- Grass Owl (*Tyto capensis*);
- Painted Snipe (*Rostratula benghalensis*);
- Masked Owl (*Tyto novaehollandiae*);
- Beach Stone-curlew (*Esacus neglectus*);
- Red-backed Button-quail (*Turnix maculosa*);
- threatened frogs (excluding the Green and Golden Bell Frog);
- migratory turtles;
- migratory birds;
- non-migratory birds;
- threatened mammals (excluding bats);
- threatened bats; and
- threatened marine mammals.

The evaluations are provided in Section F3.6.

F3 RESULTS

F3.1 FAUNA SPECIES RECORDED IN THE PROJECT SITE AND SURROUNDS

F3.1.1 Database Records

The database searches revealed which fauna species occur in the Project site and surrounds. A list of fauna species, including both native and introduced species, known to occur in the Project site and surrounds is provided in Attachment F-D. Thirty-seven amphibian species and 62 reptile species have been recorded in the surrounding region, respectively. A total of 388 bird species and 107 mammal species have previously been recorded in the surrounding region, respectively (Attachment F-D).

A total of 27 introduced species have been recorded in the surrounding region. The DEC Atlas of NSW Wildlife online database (DEC, 2006b) also indicates that a number of introduced species have been recorded in nearby Kooragang NR including the Rock Dove (*Columba livia*), Spotted Turtle-Dove (*Streptopelia chinensis*), Fox (*Vulpes vulpes*), Brown Hare (*Lepus capensis*) and Rabbit (*Oryctolagus cuniculus*).

Attachment F-E provides a list of threatened species recorded in the wider region, together with an indication of the closest Atlas of NSW Wildlife (DEC, 2006a) record to the Project site. Most of these threatened species are considered unlikely to occur in the Project site because available habitat for these species is either absent or limited.

F3.1.2 Fauna Species Recorded by Previous Studies

Previous fauna studies conducted in the industrial area of Kooragang Island have found few native mammals (e.g. Protech Steel, 2001; Cargill, 2005; Department of Commerce, 2005). For example, the only fauna observed in Big Pond during field surveys conducted for the BPHOS Report were common birds and feral mammals (Department of Commerce, 2005).

A list of fauna species recorded in the Project site and immediate surrounds by previous studies (*viz*. Protech Steel [2001], Department of Commerce [2005], RLMC [2003] and Umwelt [2003b]) is provided in Attachment F-F.

No threatened fauna listed under the TSC or EPBC Acts was observed during the field surveys conducted for the BPHOS Report (Department of Commerce, 2005) or by Protech Steel (2001). No threatened species under the TSC Act, EPBC Act or *Fisheries Management Act, 1994* were recorded by Umwelt (2003c).

The Eastern Bent-wing Bat (*Miniopterus schreibersii*), a threatened species listed under the TSC Act, was recorded near ponds in the adjoining Port Waratah Coal Services Kooragang Coal Terminal (PWCS, 1996). Recent surveys conducted for the Kooragang Port and Transport Corridor SIS (which included the rail infrastructure corridor) recorded an unidentified species of Flying Fox flying over the study area, however, did not find any Grey-headed Flying Fox (*Pteropus poliocephalus*) camps (RLMC, 2003).

Protech Steel (2001)

As previously explained, the eastern section of the Project site was the subject of field fauna surveys by Protech Steel as part of the *Proposed Cold Mill Facility Kooragang Island EIS* (Protech Steel, 2001).

The most diverse group of species recorded by Protech Steel (2001) were birds (25 species observed). These were manly birds that forage on herbaceous material, seeds, small invertebrates and vertebrates found within grassland (Protech Steel, 2001). Four species of frog were recorded, all from reed beds (Attachment F-F) (Protech Steel, 2001). No fauna species of conservation significance were recorded (Protech Steel, 2001). Protech Steel (2001) attributed the low diversity of vertebrates recorded in the area to the disturbed nature of the site, lack of refuge sites and poor vegetation structure.

F3.2 RESULTS OF PROJECT SURVEYS

F3.2.1 Green and Golden Bell Frogs Recorded by Project Surveys

Potential Habitat

Approximately twenty-three out of the 33 ponds surveyed were identified as supporting suitable habitat for the Green and Golden Bell Frog (Attachment F-G). Several of the ponds assessed as having habitat of low suitability were dominated by introduced grasses and weeds, including noxious species such as Pampas Grass and Bitou Bush (Connell Hatch, 2006a).

Green and Golden Bell Frog Records

The Green and Golden Bell Frog was recorded during Project surveys at approximately 15 out of the 33 ponds in the study area, *viz*.: Big Pond, Deep Pond and Ponds H, I, J, K, N, O, Q, AC, C, F, G, L and V (Attachment F-H). The Green and Golden Bell Frog was recorded at Big Pond on 28 February 2006 when two males responded to call playback (Connell Hatch, 2006a). Previously to this, Green and Golden Bell Frog tadpoles were recorded in Big Pond in late February 2005 following significant rain earlier in the month (*ibid*.).

Most of the records of Green and Golden Bell Frogs across the Project site and surrounds were of adults (Connell Hatch, 2006a). In addition, there were a few metamorphs and sub-adults, but no tadpoles, recorded (*ibid*.). Seventy-five Green and Golden Bell Frogs were recorded at Pond C amongst Cumbungi (*Typha orientalis*) reedbeds during one survey effort on 3 February 2006 (*ibid*.). However, during a subsequent visit to Pond C after significant rainfall on 28 February 2006, no Green and Golden Bell Frogs were heard calling (*ibid*.).

It is considered that the number of Green and Golden Bell Frogs recorded during the field surveys may have been influenced by the extremely dry conditions encountered during the 2005-2006 period (Connell Hatch, 2006a).

F3.2.2 Australasian Bittern Recorded by Project Surveys

Potential Habitat

Approximately twenty-six of the 33 ponds in the study site were identified as having potential habitat for the Australasian Bittern as they were typically dominated by dense reedbeds or sedgelands with shallow water suitable for foraging (Attachment F-I).

Collectively, these ponds provide dense reedbeds for roosting and nesting habitat, areas of shallow open water adjacent to reedbeds for foraging and permanent/semi-permanent waterbodies supporting dense reedbed habitat to which the Australasian Bittern can retreat during lengthy dry periods (Connell Hatch, 2006b).

Approximately seven ponds (i.e. Ponds AB, AE, M, N, R, X and Z) were assessed as being unlikely to provide habitat for the Australasian Bittern (Connell Hatch, 2006b). The majority of Deep Pond was considered to be unsuitable habitat for the Australasian Bittern, however, potential habitat for this species occurs in pockets around its margin (*ibid*.).

Australasian Bittern Records

One tentative record of the Australasian Bittern, an individual sighted flying near reedbeds near Pond A, was recorded during the targeted surveys (Connell Hatch, 2006b).

F3.2.3 Species Recorded by the Shorebird Study and Habitat Assessment

A total of 78 bird species (including shorebirds and non-shorebirds) were recorded at the Project site and surrounds during the Shorebird Study and Habitat Assessment (Avifauna Research and Services, 2006). Of these, most species were shorebirds. The bird species recorded at each of the sampling sites is provided in Attachment F-J.

Potential Habitat

Deep Pond is the largest body of water in the Project site and provides habitat for the largest number of wetland-associated bird species (Avifauna Research and Services, 2006). During the surveys in December and January, the water levels at Deep Pond were relatively low, providing extensive mudflats and shallows and perhaps explaining the large numbers of migratory and resident species observed during these months (*ibid*.).

The shallower, southern part of Deep Pond was most frequently used by resident shorebirds (especially Red-necked Avocets and Black-winged Stilts) (Avifauna Research and Services, 2006). Dead mangrove tree stumps that were present over the northern half of Deep Pond were used by ducks and terns for roosting (*ibid*.). The survey found approximately 3,556 wetland birds during one survey period utilising Deep Pond (Avifauna Research and Services, 2006.).

No waterbirds or threatened species were observed during the survey at Big Pond (Avifauna Research and Services, 2006). This is most likely because Big Pond has evolved from a brackish/saline open wetland with extensive mudflats and shallows to a largely freshwater wetland dominated by sedge and reeds as well as some open areas of mudflats or grass (*ibid*.). Alternatively, this may have been because Big Pond was mostly dry during the surveys (Avifauna Research and Services, 2006).

F3.3 THREATENED SPECIES

As described previously, Attachment F-E provides a list of threatened species recorded in the wider region, together with an indication of the closest Atlas of NSW Wildlife (DEC, 2006a) record to the Project site. Most of these threatened species are considered unlikely to occur in the Project site because available habitat for these species is either absent or limited.

Several threatened fauna species have been recorded in the Project site, including the Green and Golden Bell Frog, Black-tailed Godwit, Blue-billed Duck, Freckled Duck and the Australasian Bittern (Table F-1).

Where there have been records of threatened fauna species in the Project site, it has been conservatively assumed for the purposes of this assessment that a population exists. This assumption is conservative because an individual record, or small number of records, does not necessarily indicate the existence of a viable population.

The Green and Golden Bell Frog and Australasian Bittern were recorded by RLMC (2003) in the Project rail infrastructure corridor area. No threatened fauna listed under the TSC or EPBC Acts were observed during the field surveys conducted for the BPHOS Report (Department of Commerce, 2005) or by Protech Steel (2001). Similarly, no threatened species under the TSC Act, EPBC Act or *Fisheries Management Act, 1994* were recorded by the Aquatic Ecology Impact Assessment Report for the *Proposed Extension of Shipping Channels, Port of Newcastle* (Umwelt, 2003c). Although several Grey-headed Flying Fox (*Pteropus poliocephalus*) were observed flying high over the area near the Project wharf facilities (Umwelt, 2003b), this species was not observed using the Project site as habitat.

The Eastern Bent-wing Bat (*Miniopterus schreibersii*), a threatened species listed under the TSC Act, was recorded near ponds in the adjoining PWCS Kooragang Coal Terminal (PWCS, 1996). In addition, the HBOC recorded the Red-backed Button-quail west of the Delta access road near the Project rail infrastructure corridor on 2 February 2006 (Section 3.7.2 of the Project EA).

Table F-1
Threatened Fauna Recorded in the Project Site

Common Name	Scientific Name	Conservation Status		Location	Number of Individuals	Reference
		TSC Act[1]	EPBC Act[2]			
Green and Golden Bell Frog	*Litoria aurea*	E	V	Various[3]	Many	RLMC (2003)
						PWCS (1996)
						Hamer (1997, 1998 and 2002)
						Premier's Department (2003)
Black-tailed Godwit	*Limosa limosa*	V	-	Deep Pond[4]	Five records	Avifauna Research and Services (2006)
Blue-billed Duck	*Oxyura australis*	V	-	Pond H[4]	One record	Avifauna Research and Services (2006)
				Pond H, Deep Pond[4]	Several records	HBOC (Section 3.7.2 of the Project EA)
Freckled Duck	*Stictonetta naevosa*	V	-	Deep Pond[4]	Four records	Avifauna Research and Services (2006)
				Deep Pond and Ash Island[4]	Not specified	RLMC (2003)
Australasian Bittern	*Botaurus poiciloptilus*	V	-	Proximal to Project rail infrastructure corridor[4]	One record	RLMC (2003)
				Western end of Pond A[4]	One record (tentative)	Connell Hatch (2006b)
				North-west of Pond I near Delta access road[4]	One record	HBOC (Section 3.7.2 of the Project EA)

1 NSW *Threatened Species Conservation Act, 1995*
2 Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*
3 Refer to Figure F-4
4 Refer to Figure F-3
V Listed as Vulnerable
E Listed as Endangered

F3.4 MIGRATORY SPECIES

Attachment F-K presents the migratory species listed under the EPBC Act that have been recorded in the Project site and surrounds by the following sources: Project surveys (Avifauna Research and Services, 2006), Atlas of NSW Wildlife (DEC, 2006a), HBOC (2006), Australian Museum (2006) and Birds Australia (2006).

There were 81 migratory species recorded in the Project site and surrounds (Attachment F-K).

F3.5 MARINE PROTECTED SPECIES

Attachment F-L presents the marine protected species listed under the EPBC Act that have been recorded in the Project site and surrounds by the following sources: Project surveys (Avifauna Research and Services, 2006), Atlas of NSW Wildlife (DEC, 2006a), HBOC (2006), Australian Museum (2006) and Birds Australia (2006).

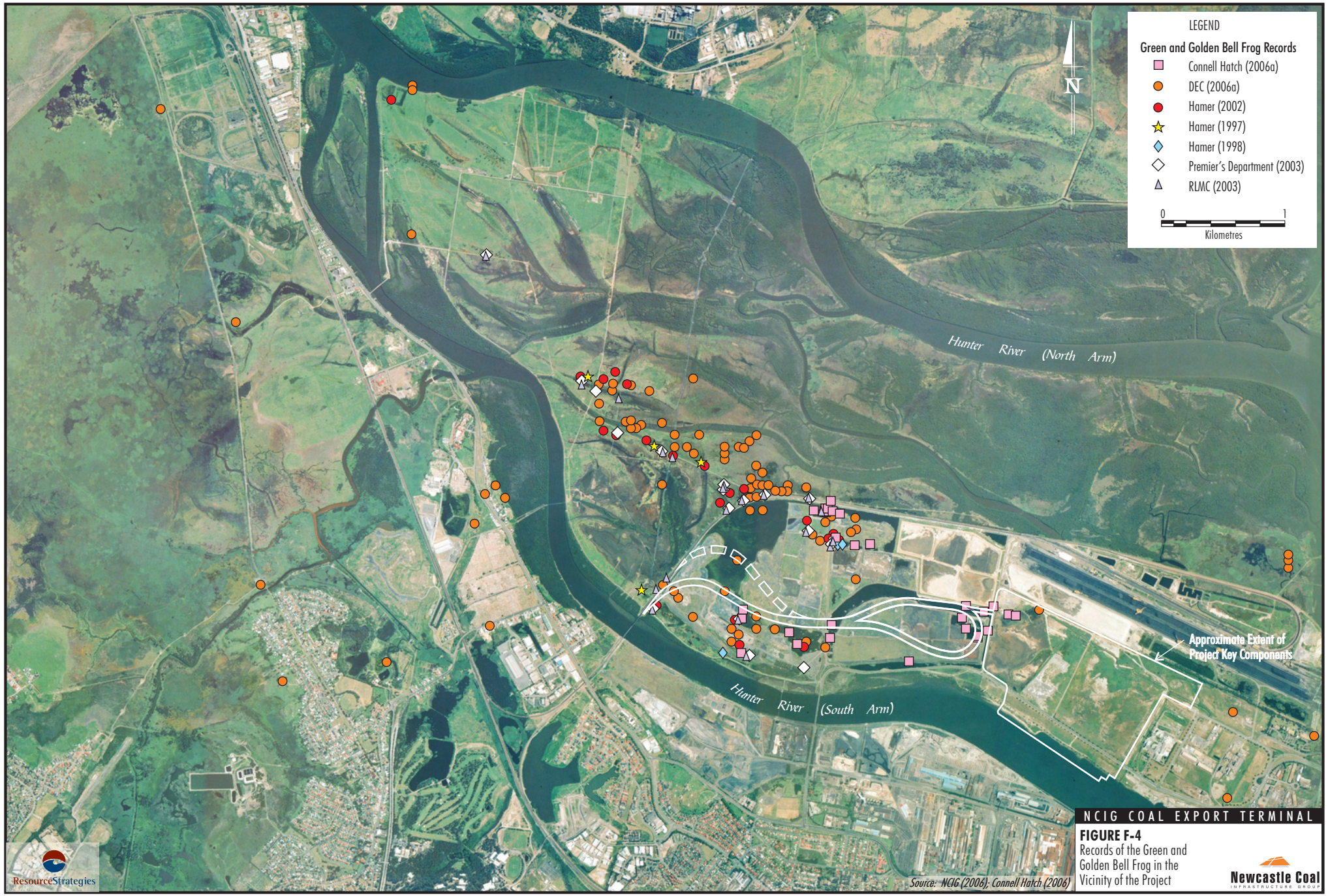
Source: NCIG (2006); Connell Hatch (2006)

NCIG COAL EXPORT TERMINAL

FIGURE F-3
Project Site and Ponds

ResourceStrategies

Newcastle Coal
INFRASTRUCTURE GROUP



NCIG COAL EXPORT TERMINAL

FIGURE F-4
Records of the Green and Golden Bell Frog in the Vicinity of the Project

Newcastle Coal INFRASTRUCTURE GROUP

NCIG-05-01Fauna_009M

There were 165 marine protected species recorded in the Project site and surrounds (Attachment F-L).

F3.6 EVALUATION OF POTENTIAL IMPACTS

As previously described in Section F2.4, to assist in identifying whether the potential impact of the Project is likely to have a significant effect on threatened and migratory fauna, evaluations were conducted. These evaluations are provided below.

F3.6.1 Green and Golden Bell Frog (*Litoria aurea*)

Background

The Green and Golden Bell Frog is listed as Endangered under the TSC Act and Vulnerable under the EPBC Act. The Green and Golden Bell Frog is estimated to have disappeared from 90% of its former range within NSW (White and Pyke, 1996) although populations in Victoria are believed to be secure (Gillespie, 1996).

There are about 50 known populations of Green and Golden Bell Frog within NSW (NPWS, 1999a), and of these, approximately 14 are situated within conservation reserves (*viz*.: Yuraygir National Park (NP), Hat Head NP, Lake Innes NR, Myall Lakes NP, Kooragang Island NR, Seven Mile Beach NR, Meroo NP, Towra Point NR, Jervis Bay NR, Narawallee NR, Ben Boyd NP, Nadgee NR, Booderee NP and Department of Defence land at Jervis Bay [NPWS, undated in DEC, 2005a]).

The Green and Golden Bell Frog is not considered to be adequately protected within the reserve system because in only 25% of cases does the major portion of the population habitat actually occur within the reserve – the majority of the Green and Golden Bell Frog habitat occurs on other tenures (NPWS, undated in DEC, 2005a).

The Green and Golden Bell Frog was historically widespread across much of the Hunter Valley, commonly associated with floodplain wetlands of the Hunter River and its tributaries (DEC, 2005a). In the Hunter region, the Green and Golden Bell Frog is now believed to be restricted to four key populations (*ibid.*), *viz*.:

- large population on Kooragang Island;
- small, isolated populations at Sandgate on the margins of Hexham Swamp;
- metapopulation in the Gillieston Heights/East Maitland, Ravensdale areas (also including Wentworth Swamp); and
- metapopulation in the Ravensworth/Liddell/Bayswater area.

The Green and Golden Bell Frog was found in large numbers in 1970 on Kooragang Island (Gosper, 1975). It has since been recorded by numerous studies of Kooragang Island. Further information regarding the distribution of the Green and Golden Bell Frog on Kooragang Island is provided below.

Evaluation

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

The Green and Golden Bell Frog can be regarded as a 'colonising'/'pioneering' species as it is a habitat generalist, disperses widely and matures early (Hamer, 1998, 2002). These characteristics (also known as '*r*'-selective characteristics) are an adaptation to living in an unpredictable environment (Begon *et al*., 1990).

The Green and Golden Bell Frog breeds in summer (Cogger, 1992). Males call while floating in water and females produce a floating raft of eggs which gradually settle to the bottom (Harrison, 1922 in NPWS, 1999a). Tadpoles take around six weeks to develop depending on environmental conditions (e.g. temperature) (Pyke and White, 1996 in NPWS, 1999). Adult male Green and Golden Bell Frogs may only live for around two years in difficult terrain (Goldingay and Newell, 2005; White pers. comm., 2006) but life expectancy is likely to vary markedly according to the quality of the habitat (White pers. comm., 2006).

The Green and Golden Bell Frog is active or basks by day but at night they forage on insects as well as other frogs (Cogger, 1992; NPWS, 1999a; White, pers. comm., 2005). Tadpoles feed on algae and other vegetative matter (NPWS, 1999a). The Green and Golden Bell Frog exhibits strong migration tendencies, including the ability to move several kilometres (NPWS, undated in DEC, 2005a).

The *Draft Recovery Plan for the Green and Golden Bell Frog* Litoria aurea (Recovery Plan) (DEC, 2005a) lists a number of threatening processes relevant to the Green and Golden Bell Frog, including habitat loss and/or modification and disturbance as well as fragmentation and isolation of habitat. The Recovery Plan also lists predation by introduced fish, disease and water quality and pollutant issues as threatening processes (DEC, 2005a).

Vegetation and aquatic habitat in the Project site and surrounds offers known and potential foraging, roosting and breeding habitat resources for the Green and Golden Bell Frog. The Project would involve the disturbance (i.e. removal and/or modification) of a portion of known and potential habitat resources (i.e. ponds and associated vegetation) for this species and has the potential to disrupt foraging, roosting and breeding in these areas.

The Atlas of NSW Wildlife (DEC, 2006a) indicates the Green and Golden Bell Frog has been recorded at 229 locations in the region (i.e. Newcastle and Port Stephens 1:100,000 map sheets), including inside the Project site.

During recent targeted surveys within the Project site and surrounds, the Green and Golden Bell Frog was recorded at numerous locations. The Green and Golden Bell Frog was recorded at approximately 15 out of the 33 ponds in the study area by the Project surveys, *viz*.: Big Pond, Deep Pond and Ponds H, I, J, K, N, O, Q, AC, C, F, G, L and V (Connell Hatch, 2006a) (Attachment F-H). The Green and Golden Bell Frog was also recorded at a further six ponds during earlier studies by Hamer (1998, 2002) (Ponds A, AB, W, X, Y, Z) (Connell Hatch, 2006a) (Attachment F-H). The majority of these ponds (i.e. Ponds A, AB, I, J, O, AC, C, F, G, L, W, X, Y, Z and V) would not be directly disturbed by the Project.

It cannot be concluded from the Project surveys whether or not the Green and Golden Bell Frog was using the ponds in the Project site as breeding habitat. However, in accordance with the *Assessment Guidelines* (DEC, 2005b), any known or presumed local population should be assumed to be viable unless the contrary can be conclusively demonstrated. Therefore, the population of Green and Golden Bell Frog that occurs in the Project site and surrounds has been assumed to be viable for the purposes of this evaluation.

Recent surveys conducted for the Kooragang Port and Transport Corridor SIS (which included the rail infrastructure corridor) recorded the Green and Golden Bell Frog at several waterbodies (RLMC, 2003). The Green and Golden Bell Frog was also recorded in vegetation adjacent to an artificial pond in the adjoining Port Waratah Coal Services Kooragang Coal Terminal (PWCS, 1996). However, the BPHOS Report did not find the Green and Golden Bell Frog in Big Pond (Department of Commerce, 2005). The distribution of Green and Golden Bell Frog in proximity to the Project site determined from available records (e.g. the Project surveys [Connell Hatch, 2006a], DEC [2006a], Hamer [1997], Hamer [2002], RLMC [2003] and Premier's Department [2003]) is provided in Figure F-4.

The disturbance of a portion of the Green and Golden Bell Frog habitat by the Project is unlikely to disrupt the lifecycle such that a local viable population of this species would be placed at risk given:

- the localised nature of the Project site disturbance (i.e. the majority of the Green and Golden Bell Frog records are located outside of the Project disturbance areas) (Figure F-4);
- part of the local Green and Golden Bell Frog population already exists in close proximity to the existing Kooragang Island main line and KIWEF activities (e.g. Ponds C, F, V, and Deep Pond [Attachment F-H]) including its ability to exist in close proximity to industrial development;
- known breeding habitat for the Green and Golden Bell Frog nearby (including *Schoenoplectus/ Bolboschoenus* sedgeland) in the KWRP at Ash Island. Green and Golden Bell Frog adults and juveniles have been recorded here at a number of sites which suggests that these sites may represent potential core breeding habitat (Hamer, 1997);
- the implementation of the Project mitigation measures (Section F4.2 and Section 4 of the Project EA) which would minimise the potential for impacts on the Green and Golden Bell Frog beyond the limits of the Project disturbance area;

- the Project mitigation measures would include a threatened species management protocol (TSMP) which would include procedures to move individual Green and Golden Bell Frogs from the footprint of direct disturbance, where practicable; and
- the occurrence of proximal known and potential habitat to the Project site, including Ponds A, B, C, D, E, F, G, I, J, L, O, T, U, V, AA, AC, AD, which would not be directly disturbed by the Project. Other nearby occurrences of Green and Golden Bell Frog habitat include areas in the KWRP on Ash Island, a *Typha* wetland in Kooragang NR, a site north of the eastern end of the Kooragang Island mainline railway embankment and an artificial pond within the Port Waratah Coal Services Kooragang Coal Terminal (Hamer, 1997, 1998, 2002; PWCS, 1996).

Notwithstanding the above, the Project compensatory measures would aid the creation, enhancement and ongoing management of Green and Golden Bell Frog habitat which is expected to benefit existing populations (Section F4.3).

Similarly, the BPHOS Report concluded that, in a local context, the loss of potential habitat within the Big Pond site is not considered a threat to the population of Green and Golden Bell Frogs given the presence of other suitable habitat nearby (Department of Commerce, 2005).

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

The Green and Golden Bell Frog inhabits marshes, dams and stream sides and appears to prefer those waterbodies where bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.) grow (NPWS, 1999a). Optimum habitat for the Green and Golden Bell Frog is considered to be waterbodies which are unshaded, free of *Gambusia holbrooki* (an introduced predatory fish), have a grassy area nearby and diurnal sheltering sites (e.g. vegetation and/or rocks) (*ibid*.). Consistent with what has been observed at the Project site, some Green and Golden Bell Frog populations, especially in the Greater Sydney region, exist in highly disturbed areas such as disused industrial sites, landfill areas and cleared land (*ibid*.). The Green and Golden Bell Frog also occasionally inhabit farm dams and ornamental ponds (Robinson, 1998).

Known and potential Green and Golden Bell Frog habitat is located within the Project disturbance areas. Potential habitat for the Green and Golden Bell Frog was mapped by Connell Hatch (2006a) (Attachment F-G). In particular, Project disturbance to habitat would include Ponds Q and Big Pond which would be fully infilled and Ponds H, K and Deep Pond (if the northern rail spur is required) which would be partially disturbed. However, most of the known and potential Green and Golden Bell Frog habitat recorded across the Project site and surrounds would not be directly disturbed by the Project (i.e. Ponds A, B, C, D, E, F, G, I, J, L, O, T, U, V, AA, AC, AD) (Attachment F-G).

The distribution of Green and Golden Bell Frog in proximity to the Project site determined from available records (e.g. the Project surveys [Connell Hatch, 2006a], DEC [2006a], Hamer [1997], Hamer [2002], RLMC [2003] and Premier's Department [2003]) is provided in Figure F-4 and indicates known habitat for this species.

As previously mentioned, there exists proximal known and potential habitat to the Project site, including Ponds A, B, C, D, E, F, G, I, J, L, O, T, U, V, AA, AC, AD, which would not be directly disturbed by the Project. Other nearby occurrences of Green and Golden Bell Frog habitat include areas on Ash Island, a *Typha* wetland in Kooragang NR, a site north of the eastern end of the railway embankment and an artificial pond within the Port Waratah Coal Services Kooragang Coal Terminal (Hamer, 1997, 1998, 2002; PWCS, 1996). In addition, there is known habitat for the Green and Golden Bell Frog nearby (including *Schoenoplectus/ Bolboschoenus* sedgeland) in the KWRP at Ash Island. Green and Golden Bell Frog adults and juveniles have been recorded here at a number of sites which suggests that these sites may represent potential core breeding habitat (Hamer, 1997). Several ponds have also been artificially created for frogs as part of the KWRP (KWRP, 2006).

Based on the above (i.e. small amount of habitat disturbance and availability of proximal habitat external to the Project disturbance areas), it is considered that the Project would not have a significant impact on the locally available habitat for the Green and Golden Bell Frog. Notwithstanding, a number of mitigation and compensatory measures are proposed as part of the Project in relation to the management of Green and Golden Bell Frog habitat (Sections F4.2 and F4.3).

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

The Green and Golden Bell Frog is distributed across eastern and south-eastern NSW as well as far eastern Victoria, typically at lower altitudes (Cogger, 1992). Most extant populations are coastal or near coastal (NPWS, 1999a).

The Project site is located within the known distribution of the Green and Golden Bell Frog and does not represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

A comprehensive study of the habitat features of waterbodies on Kooragang Island by Hamer (2002) during the breeding season has shown that the Green and Golden Bell Frog occupies a wide range of waterbodies (i.e. various size, structure and water chemistry), however, is more likely to occupy waterbodies that are within 50 metres (m) of other occupied waterbodies.

A series of ponds (e.g. Ponds A, B, C, D, E, F, G, I, J, L, O, T, U, V, AA, AC, AD) which contain potential habitat for the Green and Golden Bell Frog are in the immediate area surrounding the Project site and would not be directly disturbed by the Project.

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. The Project infrastructure may potentially create a barrier between habitats for terrestrial species including the Green and Golden Bell Frog. However, existing industrial development in the immediate area of the Project (including PWCS Kooragang Island Terminal to the north and Blue Circle Southern Cement and Origin Energy to the east) is likely to already present a barrier to wildlife movement, including the Green and Golden Bell Frog.

Hamer (2002) identified possible Green and Golden Bell Frog movement corridors in the Project site and surrounds, one of which would be disturbed by the Project rail infrastructure corridor. However, the Project rail infrastructure corridor is unlikely to impact on the movement/dispersal of the Green and Golden Bell Frog between the areas north and south of the rail line (Figure F-4) because the design of the rail culverts would include relevant specifications to facilitate the migration/dispersal of the Green and Golden Bell Frog, as discussed in Section F4.2.

Furthermore, the Green and Golden Bell Frog exhibits strong migration tendencies (including the ability to move several kilometres) and will traverse roads and other unfavourable surfaces to reach desired habitat (NPWS, undated in DEC, 2005a). Based on the above, it is considered that the Project would not significantly affect habitat connectivity for the Green and Golden Bell Frog.

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

Critical Habitat, as defined by the TSC Act, has not been declared for the Green and Golden Bell Frog (DEC, 2005a). According to the *Draft Recovery Plan for the Green and Golden Bell Frog* (DEC, 2005a), the declaration of critical habitat in NSW is not considered a priority for the Green and Golden Bell Frog as other mechanisms provide for its protection. There is no critical habitat as listed on the National Parks and Wildlife Service (NPWS) Critical habitat register (NPWS, 2006) or Department of the Environment and Heritage (DEH) Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.2 Australasian Bittern (*Botaurus poiciloptilus*)

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

The Australasian Bittern is a shy and cryptic bird which breeds using nests made from a well-constructed platform of broken and trampled weeds, rushes and Cumbungi (Marchant and Higgins, 1990). The nest is generally located approximately 30 centimetres (cm) above water level in heavy vegetation fringing freshwater pools (*ibid*.).

The Australasian Bittern forages in shallows or hunts in deeper water from bent-over reeds or other platforms (Morcombe, 2004). The species appears to be sedentary in permanent habitat but may move short distances during winter and in response to years with high rainfall (Marchant and Higgins, 1990).

Threats to the Australasian Bittern include drainage of wetlands for agriculture, salinisation of wetlands and overgrazing of wetland vegetation (Garnett and Crowley, 2000; Garnett, 1992 in Smith *et al*., 1995).

Vegetation and aquatic habitat in the Project site and surrounds offers known and potential foraging, roosting and breeding habitat resources for the Australasian Bittern. The Project would involve the disturbance of a portion of potential habitat resources (i.e. ponds and associated vegetation) for this species and has the potential to disrupt foraging, roosting and breeding in these areas.

The Atlas of NSW Wildlife (NPWS, 2006) indicates the Australasian Bittern has been recorded at 14 locations in the region (i.e. Newcastle 1:100,000 map sheet), the closest of which is located approximately 0.5 km north of the Project site[3].

During recent targeted surveys within the Project site and surrounds, a tentative record of an Australasian Bittern flying over the western end of Pond A was taken (Connell Hatch, 2006b) (Attachment F-I). Relevant habitat in Pond A lies outside of the Project direct disturbance area. The HBOC also recently recorded the Australasian Bittern north-west of Pond I near the Delta access road on 13 May 2006 (Section 3.7.2 of the Project EA). This record is also outside of the direct Project disturbance area.

The Australasian Bittern has been previously recorded in the Project site, proximal to the proposed Project rail corridor (RLMC, 2003). It has also been recorded approximately several hundred metres across the Kooragang Island mainline railway and on Ash Island (*ibid*.). A sighting of an Australasian Bittern was also made during site investigations for the Kooragang Coal Terminal Stage Three Expansion which adjoins the Project site to the north (PWCS, 1996).

The disturbance of a portion of the habitat for the Australasian Bittern by the Project is unlikely to disrupt the lifecycle such that a local viable population of this species would be placed at risk given:

- the localised nature of the Project site disturbance (i.e. the majority of the Australasian Bittern records are located outside of the direct Project disturbance areas);
- the implementation of the Project mitigation measures (Section F4.2 and Section 4 of the Project EA) which would minimise the potential for impacts on the Australasian Bittern beyond the limits of the Project disturbance area; and
- occurrence of proximal known and potential habitat to the Project site, including Ponds A, AC, J, L, AD, O, S, I, B, C, D, E, V, U, W, Y, T, F, G and AA, which would not be directly disturbed by the Project. Other nearby occurrences of Australasian Bittern habitat include Hexham Swamp NR and Kooragang NR.

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

The Australasian Bittern's preferred habitat is shallow terrestrial and estuarine wetlands with permanent water and dense vegetation (e.g. sedges, rushes and reeds) (Garnett and Crowley, 2000; Morcombe, 2004).

[3] This record has an accuracy of 1 km (DEC, 2006a).

Known and potential Australasian Bittern habitat is located in the Project disturbance areas. Potential habitat for the Australasian Bittern was mapped by Connell Hatch (2006b) (Attachment F-I). In particular, Project disturbance to habitat would include Ponds P and Q and Big Pond which would be fully infilled and Ponds H and K and Deep Pond which would be partially disturbed. However, most of the known and potential habitat for the Australasian Bittern across the Project site and surrounds would not be directly disturbed by the Project (i.e. Ponds A, AC, J, L, AD, O, S, B, I, C, D, E, V, U, W, Y, T, F, G and AA) (Attachment F-I).

As previously mentioned, other nearby occurrences of Australasian Bittern habitat include Hexham Swamp NR and Kooragang NR.

A number of mitigation measures are proposed as part of the Project in relation to the management of Australasian Bittern habitat (Sections F4.2). Based on the above (i.e. small amount of habitat disturbance and availability of proximal habitat external to the Project disturbance areas), it is considered that the Project would not have a significant impact on the locally available habitat for the Australasian Bittern.

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

The national distribution of the Australasian Bittern is from southern Queensland to Tasmania and south eastern South Australia (including most of NSW and Victoria) and the south-western corner of Western Australia (Marchant and Higgins, 1990). Therefore, the Project site is located within the known distribution of the Australasian Bittern and does not represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations.

A series of ponds (e.g. Ponds A, AC, J, L, AD, O, S, B, I, C, D, E, V, U, W, Y, T, F, G and AA) which contain potential habitat for the Australasian Bittern are in the immediate area surrounding the Project site and would not be directly disturbed by the Project (Attachment F-I). It is reasonable to conclude that habitat connectivity between these ponds would not be affected by the Project.

The Project infrastructure may potentially create an obstruction for low flying birds such as the Australasian Bittern which generally flies low over water or reeds (Jaensch, 1982 in Marchant and Higgins, 1990). However, any impact is likely to be small as existing industrial development in the immediate area of the Project (including PWCS Kooragang Island Terminal to the north and Blue Circle Southern Cement and Origin Energy to the east) may already present some barrier to wildlife movement, including the Australasian Bittern. Therefore, there is unlikely to be any significant change in the habitat connectivity for the Australasian Bittern due to the Project.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.3 Black-tailed Godwit (*Limosa limosa*)

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

The Black-tailed Godwit is a shorebird which breeds in Mongolia and Siberia and migrates to Australia for summer (August – March) (Kingsford, 1991, Higgins and Davies, 1996 in Ayers *et al*., 1996). The Black-tailed Godwit's diet consists of invertebrates, spawn and tadpoles of frogs, fish eggs, seeds and berries (Higgins and Davies, 1996 in Ayers *et al*., 1996). The main threat relevant to the Black-tailed Godwit is hydrological changes to habitat (Ayers *et al*., 1996).

Vegetation and aquatic habitat in the Project site and surrounds offers known and potential foraging and roosting habitat resources for the Black-tailed Godwit. The Project would involve the disturbance of a portion of known and potential habitat resources (i.e. ponds and associated vegetation) for this species and may disrupt foraging and roosting in these areas.

The Atlas of NSW Wildlife (DEC, 2006a) indicates the Black-tailed Godwit has been recorded at 14 locations in the region (i.e. Newcastle and Lake Macquarie 1:100,000 map sheets), the closest of which is located approximately 0.4 km west of the Project site[4].

During recent surveys within the Project site and surrounds, five Black-tailed Godwits were observed at Deep Pond (Avifauna Research and Services, 2006). A portion of Deep Pond would be disturbed for the Project.

The disturbance of a portion of the habitat for the Black-tailed Godwit by the Project is unlikely to disrupt the lifecycle such that a local viable population of this species would be placed at risk given:

- the localised nature of the Project site disturbance;
- the implementation of the Project mitigation measures (Section F4.2 and Section 4 of the Project EA) which would minimise the potential for impacts on the Black-tailed Godwit beyond the limits of the Project disturbance area; and
- occurrence of proximal known and potential habitat to the Project site which would not be disturbed by the Project (nearby occurrences of Black-tailed Godwit habitat include Kooragang NR).

Notwithstanding the above, the Project compensatory measures would aid the creation, enhancement and ongoing management of shorebird habitat which is expected to benefit existing populations (Section F4.3).

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

The Black-tailed Godwit is predominantly found along the coast on sand spits, lagoons and mudflats, as well as wet meadows and sewerage treatment plants (Kingsford, 1991 in Ayers *et al*., 1996). Known and potential Black-tailed Godwit habitat is located in the Project disturbance areas at Deep Pond. A small portion of Deep Pond would be disturbed by the Project. However, as previously mentioned, nearby occurrences of Black-tailed Godwit habitat include Kooragang NR.

A number of mitigation and compensatory measures are proposed as part of the Project in relation to the management of shorebird habitat (Sections F4.2). Based on the above (i.e. small amount of habitat disturbance and availability of proximal habitat external to the Project disturbance areas), it is considered that the Project would not have a significant impact on the locally available habitat for the Black-tailed Godwit.

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

Within Australia, the Black-tailed Godwit is common along the northern coastline between Weipa and Darwin, however also occurs in Queensland, Western Australia, South Australia, and Victoria (Ayers *et al*., 1996). Within NSW, the Black-tailed Godwit has been regularly recorded on Kooragang Island as well as scattered sightings recorded both coastally and inland (Higgins and Davies, 1996 in Ayers *et al*., 1996).

[4] This record has an accuracy of 0.02 km (DEC, 2006a).

Considering the above, the Project site is located within the known distribution of the Black-tailed Godwit and does not represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

As previously stated, the Black-tailed Godwit is migratory between Mongolia/Siberia and Australia (Kingsford, 1991; Higgins and Davies, 1996 in Ayers *et al*., 1996). Migratory shorebirds including the Black-tailed Godwit use geographical routes called 'flyways' (i.e. broad corridors) for migrating. Australia is near the southern end of the East Asian–Australasian Flyway which stretches from the breeding grounds of Siberia and Alaska, southwards through Asia, to the non-breeding grounds of Australia and New Zealand (DEH, 2005b).

There are an estimated 165,000 Black-tailed Godwits which visit Australia each year (DEH, 2005b). The Kooragang NR is within the East Asian–Australasian Flyway. The Project is not likely to impact significantly on Kooragang NR and/or the East Asian–Australasian Flyway and is therefore unlikely to modify habitat connectivity for Black-tailed Godwit.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.4 Blue-billed Duck (*Oxyura australis*)

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

Blue-billed Ducks roost usually on open water or in a small, concealed bay (Marchant and Higgins, 1990). Breeding can either be seasonal or opportunistic depending on water levels prevailing in an area (*ibid*.). Blue-billed Ducks disperse to well-vegetated freshwater swamps and lakes to breed (Slater *et al*., 1986 in Ayers *et al.*, 1996). Nests are usually constructed in dense vegetation including Cumbungi (*Typha*) or Lignum sedges, Canegrass (*Eragrostris*), Spike-rush or Nitre-bush (*Chenopodium*) (Ayers *et al.*, 1996). The Blue-billed Duck obtains food such as aquatic insects by diving in deep water as well as foraging for seeds and leaves of freshwater plants (Marchant and Higgins, 1990).

Young Blue-billed Ducks (yearlings and subadults) in particular are regionally and seasonally nomadic where they migrate each year from the natal swamps of inland NSW to non-breeding areas on the Murray River system and coastal lakes of Victoria and South Australia (Firth, 1977 and Serventy, 1985 in Ayers *et al.*, 1996). The Blue-billed Duck readily colonises new areas of habitat following floods (Firth, 1977 in Ayers *et al.*, 1996).

Threats to the Blue-billed Duck include destruction/modification of breeding habitat (e.g. drainage works, clearing, increased salinity, grazing, groundwater extraction and hunting) (Marchant and Higgins, 1990; Ayers *et al.*, 1996).

Vegetation and aquatic habitat in the Project site and surrounds offers known and potential foraging, roosting and breeding habitat resources for the Blue-billed Duck. The Project would involve the disturbance of a portion of known and potential habitat resources (i.e. ponds and associated vegetation) for this species and may disrupt foraging, roosting and breeding in these areas.

The Atlas of NSW Wildlife (NPWS, 2006) indicates the Blue-billed Duck has been recorded at five locations in the region (i.e. Newcastle 1:100,000 map sheets), the closest of which is located approximately 3 km south-west of the Project site[5].

During recent surveys within the Project site and surrounds, the Blue-billed Duck was recorded at Pond H (Avifauna Research and Services, 2006). The HBOC also recorded the Blue-billed Duck earlier in the western and central parts of Deep Pond as well as recently in Pond H (Section 3.7.2 of the Project EA). Both Pond H and Deep Pond would be partially disturbed for the Project, although the disturbance to Deep Pond would be in the southern area.

The disturbance of a portion of the habitat for the Blue-billed Duck is unlikely to disrupt the lifecycle such that a local viable population of this species would be placed at risk given:

- the localised nature of the Project site disturbance;
- the implementation of the Project mitigation measures (Section F4.2 and Section 4 of the Project EA) which would minimise the potential for impacts on the Blue-billed Duck beyond the limits of the Project disturbance area; and
- occurrence of proximal known and potential habitat to the Project site (for example, the Blue-billed Duck was recorded on Ash Island in 1983 [RLMC, 2003]).

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

The habitat of the Blue-billed Duck is temperate, fresh to saline terrestrial wetlands (Marchant and Higgins, 1990). The species is almost exclusively aquatic and is seldom seen on land (Marchant and Higgins, 1990). During the day, the Blue-billed Duck is found alone in small concealed bays within vegetation or communally in large rafts offshore (Ayers *et al*., 1996).

Known and potential Blue-billed Duck habitat is located in the Project disturbance areas. A portion of this habitat (i.e. Pond H and Deep Pond) would be partially disturbed for the Project. However, nearby known habitat for the Blue-billed Duck includes Ash Island (RLMC, 2003). A number of mitigation measures are proposed as part of the Project in relation to the management of habitat for the Blue-billed Duck (Section F4.2). Based on the above (i.e. small amount of habitat disturbance and availability of proximal habitat external to the Project disturbance areas), it is considered that the Project would not have a significant impact on the locally available habitat for the Blue-billed Duck.

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

The distribution of the Blue-billed Duck includes south-western and south-eastern Australia, particularly southern Victoria and the Murray-Darling basin (Ayers *et al.*, 1996; Garnett and Crowley, 2000).

Considering the above, the Project site is located within the known distribution of the Blue-billed Duck and does not represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

[5] This record has an accuracy of 1 km (DEC, 2006a)

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

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. Young Blue-billed Ducks (yearlings and subadults) in particular are regionally and seasonally nomadic (Firth, 1977 and Serventy 1985 in Ayers *et al.*, 1996). Given the Blue-billed Duck's mobility, the Project is not likely to modify habitat connectivity for this species.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.5 Freckled Duck (*Stictonetta naevosa*)

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

During the day, the Freckled Duck congregate in small or large groups on permanent open waterbodies, frequently roosting on fallen trees and sand spits (Ayers *et al*., 1996; Simpson and Day, 1999). The Freckled Duck breeds on densely vegetated freshwater swamps, creeks or temporary floodwaters (Morcombe, 2004), often breeding prolifically after very wet years (Garnett and Crowley, 2000).

The Freckled Duck forages at wetland edges or by dabbling in shallow water (Ayers *et al*., 1996; Morcombe, 2004). Preferred food includes algae, seeds of aquatic grasses and sedges, small invertebrates, small fish and the vegetative parts of aquatic plants (Ayers *et al*., 1996). The Freckled Duck is nomadic between ephemeral inland wetlands, although during the driest years, they congregate on permanent wetlands (Garnett and Crowley, 2000).

Garnett and Crowley (2000) list threats to the Freckled Duck to include irrigation which affects flooding of swamps and accidental killing while hunting for game species. Other threats include pollution of wetlands (e.g. pesticides or lead shot), drainage of wetlands and predation by feral cats and foxes (Smith *et al*., 1995).

Vegetation and aquatic habitat in the Project site and surrounds offers known and potential foraging, roosting and breeding habitat resources for the Freckled Duck. The Project would involve the disturbance of a portion of known and potential habitat resources (e.g. ponds and associated vegetation) for this species and may disrupt foraging, roosting and breeding in these areas.

The Atlas of NSW Wildlife (NPWS, 2006) indicates the Freckled Duck has been recorded at ten locations in the region (i.e. Newcastle 1:100,000 map sheets), the closest of which was located 1.1 km north-west of the Project site[6].

During recent surveys within the Project site and surrounds, four Freckled Ducks were recorded at Deep Pond (Avifauna Research and Services, 2006). The Freckled Ducks seemed to prefer the central and eastern part of Deep Pond (*ibid*.). Deep Pond would be partially disturbed for the Project. However, the disturbance would be in the southern area of Deep Pond and is therefore less likely to impact on the Freckled Duck.

The Freckled Duck has also previously been recorded in Deep Pond, the area to the west of Deep Pond and Ash Island (RLMC, 2003). However, recent surveys conducted for the Kooragang Port and Transport Corridor SIS (which included the rail infrastructure corridor) did not find any Freckled Ducks (RLMC, 2003). It has been suggested that the area may provide a coastal refuge for the Freckled Duck during inland drought (Stuart, 2002 in RLMC, 2003).

[6] This record has an accuracy of 1 km (DEC, 2006a).

The disturbance of a portion of the habitat for the Freckled Duck is unlikely to disrupt the lifecycle such that a local viable population of this species would be placed at risk given:

- the localised nature of the Project site disturbance;
- the implementation of the Project mitigation measures (Section F4.2 and Section 4 of the Project EA) which would minimise the potential for impacts on the Freckled Duck beyond the limits of the Project disturbance area; and
- occurrence of proximal known and potential habitat to the Project site. Nearby occurrences of Freckled Duck habitat include Kooragang NR and Ash Island (RLMC, 2003).

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

The preferred habitat of the Freckled Duck is freshwater wetlands, including swamps heavily vegetated with Lignum (*Muehlenbeckia*) or Canegrass (*Eragrostis*) (Marchant and Higgins, 1990). The Freckled Duck also congregates in small or large groups on permanent open waterbodies, often roosting on fallen trees and sand spits (Ayers *et al*., 1996; Simpson and Day, 1999).

Known habitat for the Freckled Duck is located within the Project disturbance areas. A portion of this habitat (i.e. Deep Pond) would be partially disturbed by the Project. However, nearby habitat for the Freckled Duck includes Kooragang NR and Ash Island (RLMC, 2003). A number of mitigation measures are proposed as part of the Project in relation to the management of habitat for the Freckled Duck (Section F4.2). Based on the above (i.e. small amount of habitat disturbance and availability of proximal habitat external to the Project disturbance areas), it is considered that the Project would not have a significant impact on the locally available habitat for the Freckled Duck.

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

The Freckled Duck is endemic to south-eastern and south-western Australia but also occur as vagrants in coastal districts during drought years (Marchant and Higgins, 1990).

Considering the above, the Project site is located within the known distribution of the Freckled Duck and does not represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. The Freckled Duck is nomadic between ephemeral inland wetlands (Garnett and Crowley, 2000). Given the species' mobility, the Project is not likely to modify habitat connectivity for the Freckled Duck.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.6 Grass Owl (*Tyto capensis*)

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

The Grass Owl roosts by day on the ground in a 'form' (trampled platform) under tussocks of tall grass or sedges/reeds (DEC, 2005c). The species forages in open, treeless habitats or marshy ground supporting tussocks of grass, low heath or recently harvested cane fields/paddocks (DEC, 2005c). The Grass Owl preys on rodents and Grass Owl populations generally increase in response to increases in rodent numbers (*ibid*.). Breeding habitat for the Grass Owl is generally on the ground in trampled grass amongst vegetation less than 2 m tall (with a greater than 90% projected canopy) (DEC, 2005c).

Threats to the Grass Owl include loss of habitat due to development, grazing and agriculture, use of pesticides to control rodent populations and frequent burning which reduces ground cover (DEC, 2005c).

Grassland habitat in the Project site and surrounds offers potential foraging, roosting and breeding habitat resources for the Grass Owl. The Project would involve the disturbance of a portion of potential habitat resources (i.e. grasslands) for this species and may disrupt foraging, roosting and breeding (were this species to occur in the Project site).

The Atlas of NSW Wildlife (DEC, 2006a) indicates the Grass Owl has been recorded at nine locations in the region (i.e. Newcastle and Port Stephens 1:100,000 map sheets), the closest of which was located 19.5 km north-west of the Project site[7].

The Grass Owl was not recorded by the recent Project surveys (Avifauna Research and Services, 2006).

However, the DEC has informed NCIG that in January 2006, two Grass Owls were flushed from their ground roost near the Hunter River in Kooragang NR at Ash Island to the north of the Project site. They were found in Kikuyu/paspalum/sedge approximately 40 cm deep. It is understood that in late February 2006, Grass Owls were recorded in the Kooragang NR.

The disturbance of a portion of the habitat for the Grass Owl is unlikely to disrupt the lifecycle such that a local viable population of this species would be placed at risk given:

- the localised nature of the Project site disturbance;
- the implementation of the Project mitigation measures (Section F4.2 and Section 4 of the Project EA) which would minimise the potential for impacts on the Freckled Duck beyond the limits of the Project disturbance area; and
- occurrence of proximal known and potential habitat to the Project site. Nearby occurrences of known Grass Owl habitat include Kooragang NR.

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

Habitat for the Grass Owl in the Hunter/Central Rivers includes freshwater wetlands, grasslands, grassy woodlands and heathlands (DEC, 2005c).

Potential habitat for the Grass Owl is located within the Project disturbance area (i.e. grasslands) and a portion of this habitat would be disturbed by the Project. However, nearby known habitat for the Grass Owl includes Kooragang NR. A number of mitigation measures are proposed as part of the Project in relation to the management of habitat for the Grass Owl (Section F4.2). Based on the above (i.e. small amount of habitat disturbance and the availability of proximal habitat external to the Project disturbance areas), it is considered that the Project would not have a significant impact on the locally available habitat for the Grass Owl.

[7] This record has an accuracy of 0.1 km (DEC, 2006a).

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

Although recorded in all mainland states of Australia, Grass Owls tend to be found in northern and north-eastern Australia as well as the north-east of NSW (DEC, 2005c).

Considering the above, the Project site is located near the southern known distribution of the Grass Owl and may represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. The Project infrastructure may potentially create a barrier for low flying birds. However, existing industrial development in the immediate area of the Project (including PWCS Kooragang Island Terminal to the north and Blue Circle Southern Cement and Origin Energy to the east) is likely to already present a barrier to wildlife movement, including the Grass Owl. Therefore, there is unlikely to be any significant change in the habitat connectivity for the Grass Owl due to the Project.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.7 Painted Snipe (*Rostratula benghalensis*)

A recent review of the taxonomic status of the Painted Snipe (also known as the Australian Painted Snipe) has been undertaken and subsequently, the Painted Snipe in Australia is now classified as a distinct species, *Rostratula australis* (DEH, 2003). However, as this species is still listed as *Rostratula benghalensis* under the TSC Act, it will be referred to as such for the purposes of the Fauna Assessment.

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

During the day, the Painted Snipe roosts in dense vegetation, becoming active at dusk and throughout the night (NPWS, 1999b; NSW Scientific Committee, 2004). The Painted Snipe use a shallow scrape nest for breeding (*ibid*.).

Nesting generally occurs in ephemeral freshwater wetlands after they have been inundated with fresh water (Rogers *et al*., 2003). The Painted Snipe builds a nest by lining a scrape in the ground with grass and leaves, usually amongst tall vegetation such as grass tussocks or reeds (NPWS, 1999b). During the night, the Painted Snipe forages on mud flats and in shallow water, favouring plant material such as seeds and invertebrates (e.g. worms, snails and water beetles) (*ibid*.). The Painted Snipe is thought to be migratory within Australia (Blakers *et al*., 1984 in NSW Scientific Committee, 2004).

Threats to the Painted Snipe include loss and degradation of wetland areas, alteration of river flows for irrigation, clearing of wetland vegetation, grazing and predation by foxes and cats (NPWS, 1999b; NSW Scientific Committee, 2004).

Vegetation and aquatic habitat in the Project site and surrounds offers potential foraging, roosting and breeding habitat resources for the Painted Snipe. The Project would involve the disturbance of a portion of potential habitat resources (i.e. ponds and associated vegetation) for this species and may disrupt foraging, roosting and breeding (were this species to occur in the Project site).

The Atlas of NSW Wildlife (NPWS, 2006) indicates the Painted Snipe has been recorded at four locations in the region (i.e. Newcastle 1:100,000 map sheets), the closest of which was located 10 km south-west of the Project site[8].

The Project surveys did not record the Painted Snipe (Avifauna Research and Services, 2006).

The disturbance of a portion of the habitat for the Painted Snipe is unlikely to disrupt the lifecycle such that a local viable population of this species would be placed at risk given:

- the localised nature of the Project site disturbance;
- the implementation of the Project mitigation measures (Section F4.2 and Section 4 of the Project EA) which would minimise the potential for impacts on the Painted Snipe beyond the limits of the Project disturbance area; and
- occurrence of proximal known and potential habitat to the Project site. For example, known habitat for the Painted Snipe is located at Hexham Swamp (NPWS, 1999b).

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

The Painted Snipe prefers habitat areas of tussock grass, reeds, sedges or rushes in or near shallow wetlands or ephemeral/permanent waterbodies, as well as inundated grasslands or paddocks, for breeding and foraging (DEC, 2005d). The structure of the vegetation is important to nesting Painted Snipes which prefer patchy to continuous low vegetation and avoid extensive reed-beds (Rogers *et al*., 2003).

Potential habitat for the Painted Snipe is located within the Project disturbance area. A portion of this habitat (e.g. the southern area of Deep Pond) would be disturbed for the Project. However, nearby known habitat for the Painted Snipe is located at Hexham Swamp (NPWS, 1999b). A number of mitigation measures are proposed as part of the Project in relation to the management of habitat for the Painted Snipe (Section F4.2). Based on the above (i.e. small amount of habitat disturbance and availability of proximal habitat external to the Project disturbance areas), it is considered that the Project would not have a significant impact on the locally available habitat for the Painted Snipe.

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

The distribution of the Painted Snipe is primarily along the east coast of Australia from northern Queensland to the Eyre Peninsula in South Australia, including most of Victoria and NSW (NPWS, 1999b).

Considering the above, the Project site is located within the known distribution of the Painted Snipe and does not represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

[8] This record has an accuracy of 10 km (DEC, 2006a)

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

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. As previously discussed, the Painted Snipe is thought to be migratory within Australia (Blakers *et al*., 1984 in NSW Scientific Committee, 2004). Given the mobility of the Painted Snipe, the Project is not likely to modify habitat connectivity for this species.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.8 Masked Owl (*Tyto novaehollandiae*)

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

The Masked Owl (*Tyto novaehollandiae*) roosts communally within a diverse range of wooded habitats that provide large hollow-bearing trees, often in riparian forests (Garnett and Crowley, 2000). The species breeds mostly from autumn to winter and nests on decayed debris in hollow Eucalypts 12-20 m high, bare sand or in caves (Pizzey and Knight, 1999).

The Masked Owl forages in nearby open areas (Kavanagh and Murray, 1996; Higgins, 1999 in Garnett and Crowley, 2000). The Masked Owl's diet mainly consists of possums, rabbits, currawongs, gliders, bats, birds and lizards (Pizzey and Knight, 1999; Garnett and Crowley, 2000). This species keeps to the same territory all year round (Schodde and Tidemann, 1997). The mobility and ranging behaviour of *T. novaehollandiae* enable it to utilise large areas as a forage resource including cleared, open land characteristic of the region.

Critical habitat components for this species include roomy cavities in large mature trees for nesting (and sometimes roosting) and open forest and woodland (as well as adjacent farmland and open country) for foraging (Debus, 1993; Debus and Rose, 1994). Clearance for agriculture has affected the abundance of this species in many parts of its distribution (Garnett and Crowley, 2000). The reason for the low density however, is unknown. Although food does not appear to be limiting on the east coast (Kavanagh, 1996 in Garnett and Crowley, 2000), the apparent decline in arid Australia may be linked to that of mammals of between 50 and 200 grams (Burbridge and McKenzie, 1989). Other threats to this species include predation by foxes.

The Project site and surrounds offers potential foraging habitat resources for the Masked Owl. The Project would involve the disturbance of a portion of potential habitat resources for this species and may disrupt foraging (were this species to occur in the Project site).

The Atlas of NSW Wildlife (DEC, 2006a) indicates the Masked Owl has been recorded at 63 locations in the region (i.e. Newcastle, Port Stephens and Lake Macquarie 1:100,000 map sheets), the closest of which was located 5 km north-west of the Project site[9].

The Masked Owl was not recorded by the Project surveys (Avifauna Research and Services, 2006).

The disturbance of a portion of the habitat for the Masked Owl is unlikely to disrupt the lifecycle such that a local viable population of this species (were it to occur in the Project site) would be placed at risk given the localised nature of the Project site disturbance.

[9] This record has an accuracy of 10 km (DEC, 2006a).

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

The Masked Owl inhabits forests, woodlands and nearby clearings (Flegg, 2002). As previously mentioned, critical habitat components for this species include roomy cavities in large mature trees for nesting (and sometimes roosting) (Debus, 1993; Debus and Rose, 1994). There are no large mature trees in the Project site which would offer such habitat (Connell Hatch, 2006c). However, limited potential habitat for the Masked Owl (e.g. foraging habitat) is located in the Project site and would be disturbed by the Project.

Potential habitat for the Masked Owl is located within the Project disturbance area (i.e. grasslands) and a portion of this habitat would be disturbed by the Project. A number of mitigation measures are proposed as part of the Project in relation to the management of habitat for the Masked Owl (Section F4.2). Based on the above (i.e. small amount of habitat disturbance and availability of proximal habitat external to the Project disturbance areas), it is considered that the Project would not have a significant impact on the locally available habitat for the Masked Owl.

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

The main distribution of the Masked Owl is located along the coast. However this species is sparsely distributed through sub-coastal mainland Australia from Fraser Island to Carnarvon (Western Australia) including the Nullarbor Plain and inland of the Great Dividing Range (Schodde and Mason, 1980; Smith *et al.,* 1995; Higgins, 1999 in Garnett and Crowley, 2000).

Considering the above, the Project site is located within the distribution of the Masked Owl and does not represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

The mobility and ranging behaviour of the Masked Owl enable it to utilise large areas as a foraging resource including cleared, open land characteristic of the region. All occurrences of potential habitat for this species within the Project site and close surrounds are considered proximate habitat areas for this species.

An area of potential habitat is unlikely to become isolated from current interconnecting or proximate areas of habitat for the Masked Owl given the mobility of the species, the localised nature of the Project and the connectivity of the surrounding potential habitat.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.9 Beach Stone-curlew (*Esacus neglectus*)

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

The Beach Stone-curlew is a shorebird which forages for marine invertebrates (e.g. crabs) (DEC, 2005e). The species breeds from September to November and builds nests among mangroves or in sand surrounded by short grasses and scattered casuarinas, typically on sandbanks, spits or islands in estuaries (*ibid*.).

Threats to the Beach Stone-curlew include loss of habitat due to industrial/urban development, nest disturbance caused by recreational activities (e.g. caused by people walking, boating and using cars on the beach) and feral pigs) and predation by raptors, dogs and foxes (NPWS, 1999c; DEC, 2005e).

Given the habitat requirements of the Beach Stone-curlew as described above, the Project site offers very limited potential foraging, roosting and breeding habitat resources for the Beach Stone-curlew. The Project would therefore be unlikely result in the disturbance of habitat resources for this species or to disrupt foraging, roosting and/or breeding of this species (were it to occur in the Project site).

The Atlas of NSW Wildlife (DEC, 2006a) indicates the Beach Stone-curlew has not been recorded in the region (i.e. Newcastle, Port Stephens and Lake Macquarie 1:100,000 map sheets). The Beach Stone-curlew was not recorded by the Project survey (Avifauna Research and Services, 2006).

Given the above, the Project would be unlikely to affect the lifecycle of the Beach Stone-curlew (if this species were to occur in the Project site).

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

Habitat for the Beach Stone-curlew includes sheltered areas in mangroves, estuaries or sand areas which are surrounded by short grass or scattered shrubs (DEC, 2005e). Foraging habitat is principally intertidal areas of beaches, estuaries or mangroves (*ibid*.).

Given the habitat requirements of the Beach Stone-curlew, limited potential habitat for this species occurs within the Project site. Therefore a significant area of known (or potential) habitat would not be disturbed for the Project.

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

The Beach Stone-curlew is predominantly found around the north coast of Australia, from mid-north Western Australia around to north-eastern NSW (DEC, 2005e). The Beach Stone-curlew is also rarely recorded on ocean beaches in NSW (*ibid*.).

Considering the above, the Project site is located toward the southern known distribution of the Beach Stone-curlew and may represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. The Project infrastructure may potentially create a barrier for low flying birds. This may potentially restrict movement between habitat for the Beach Stone-curlew (if the species were to occur in the area).

However, existing industrial development in the immediate area of the Project (including PWCS Kooragang Island Terminal to the north and Blue Circle Southern Cement and Origin Energy to the east) is likely to already present a barrier to wildlife movement, including the Beach Stone-curlew. Therefore, there is unlikely to be any significant change in the habitat connectivity for the Beach Stone-curlew due to the Project.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.10 Red-backed Button-quail (*Turnix maculosa*)

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

The Red-backed Button-quail is a small ground-dwelling, cryptic bird which typically breed in dense grass near water (DEC, 2005f; NPWS Scientific Committee, 2005). Nests are made in a shallow depression and are lined with leaf litter and grass (DEC, 2005f). The ecology of the red-backed Button-quail is poorly known, however, the species is nocturnal and crepuscular and forages seeds and insects (NPWS Scientific Committee, 2005).

Threats to the Red-backed Button-quail include loss of habitat due to inappropriate grazing and burning regimes which destroy ground vegetation or encourage the growth of woody weeds in grassland areas (NPWS Scientific Committee, 2005). Other threats include drainage of coastal wetlands for agriculture and urban development, and trampling of habitat by livestock and feral pigs (*ibid*.).

Vegetation in the Project site and surrounds offers known and potential foraging, roosting and breeding habitat resources for the Red-backed Button-quail. The Project would involve the disturbance of a portion of potential habitat resources for this species and has the potential to disrupt foraging, roosting and breeding in these areas.

The Atlas of NSW Wildlife (DEC, 2006a) indicates the Red-backed Button-quail has not been recorded in the region (i.e. Newcastle, Port Stephens and Lake Macquarie 1:100,000 map sheets). Similarly, the Red-backed Button-quail was not recorded by the Project survey (Avifauna Research and Services, 2006). However, the HBOC recorded the Red-backed Button-quail west of the Delta access road near the Project disturbance area on 2 February 2006 (Section 3.7.2 of the Project EA).

The disturbance of a portion of the habitat for the Red-backed Button-quail is unlikely to disrupt the lifecycle such that a local viable population of this species would be placed at risk given the localised nature of the Project site disturbance and the availability of habitat proximal to the Project disturbance areas) which would minimise the potential for impacts on the Red-backed Button-quail beyond the limits of the Project disturbance area.

Notwithstanding, a number of measures have been developed for the Project to minimise potential impacts on avifauna including:

- *Vegetation Clearance Protocol* – A Vegetation Clearance Protocol would be developed for the Project and would include details of the delineation of areas to be cleared of vegetation, pre-clearance surveys, identification of fauna management strategies and specific procedures relating to vegetation clearance.
- *Pre-clearance Surveys* – Vegetation Pre-clearance Surveys would be undertaken to identify and survey potential nesting/breeding habitat for the Red-backed Button-quail. The surveys would include observations to determine completion of nesting activities (ie. young have left the nest and the nest is no longer used for nesting).

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

Habitat for the Red-backed Button-quail includes grasslands and woodlands in warm temperate areas in which moderate summer rain falls (DEC, 2005f). This species prefer habitat near water, including sedgelands near creeks, swamps and springs and wetlands (NPWS Scientific Committee, 2005).

Known habitat for the Red-backed Button-quail is located near the Project disturbance area (i.e. west of the Delta access road). Potential habitat has the potential to be disturbed by the Project. A number of mitigation measures are proposed as part of the Project in relation to the management of habitat for the Red-backed Button-quail (Section F4.2). Based on the above (i.e. small amount of habitat disturbance and availability of proximal habitat external to the Project disturbance areas), it is considered that the Project would not have a significant impact on the locally available habitat for the Red-backed Button-quail.

Notwithstanding, a number of measures have been developed for the Project to minimise potential impacts on avifauna including:

- *Vegetation Clearance Protocol* – A Vegetation Clearance Protocol would be developed for the Project and would include details of the delineation of areas to be cleared of vegetation, pre-clearance surveys, identification of fauna management strategies and specific procedures relating to vegetation clearance.
- *Pre-clearance Surveys* – Vegetation Pre-clearance Surveys would be undertaken to identify and survey potential nesting/breeding habitat for the Red-backed Button-quail. The surveys would include observations to determine completion of nesting activities (ie. young have left the nest and the nest is no longer used for nesting).

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

The Red-backed Button-quail is found in the Philippines, eastern Indonesia, Papua New Guinea, Australia and the Solomon Islands (DEC, 2005f). The species distribution within Australia is largely coastal and sub-coastal from the Kimberley region in Western Australia though the Northern Territory and Queensland to northern New South Wales (*ibid*.).

Considering the above, the Project site is located toward the southern known distribution of the Red-backed Button-quail and may represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. The Project infrastructure may potentially create a barrier for ground-dwelling birds. This may potentially restrict movement between habitat for the Red-backed Button-quail.

However, existing industrial development in the immediate area of the Project (including PWCS Kooragang Island Terminal to the north and Blue Circle Southern Cement and Origin Energy to the east) is likely to already present a barrier to wildlife movement, including the Red-backed Button-quail. Therefore, there is unlikely to be any significant change in the habitat connectivity for the Red-backed Button-quail due to the Project.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.11 Threatened Frogs (Excluding the Green and Golden Bell Frog)

This evaluation is for threatened frogs listed under the TSC Act and/or EPBC Act which have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a).

This evaluation specifically does not include consideration the Green and Golden Bell Frog. An individual evaluation for the Green and Golden Bell Frog is provided in Section F3.2.1.

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

The Atlas of NSW Wildlife (DEC, 2006a) indicates that two frog species listed as threatened under the TSC Act and/or EPBC Act (i.e. Wallum Froglet [*Crinia tinnula*] and Red-crowned Toadlet [*Pseudophryne australis*]) have been recorded within 20 km of the Project site (Attachment F-M).

Most frogs require damp conditions or aquatic habitat for breeding (Robinson, 1998). The Wallum Froglet is thought to exclusively inhabit acid paperbark swamps in wallum country (*ibid*.). The habitat of the Red-crowned Toadlet appears to be confined to Hawkesbury Sandstone where it may be found beside ephemeral creeks, gutters and soaks and under rocks/logs (Robinson, 1998).

There is no suitable habitat for the Wallum Froglet located in the Project site. The Red-crowned Toadlet is also unlikely to use the Project site as it appears to be confined to Hawkesbury Sandstone (Robinson, 1998). Therefore, the Project would not involve the disturbance of habitat resources for the Red-crowned Toadlet or Wallum Froglet.

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

As discussed above, the Wallum Froglet is thought to exclusively inhabit acid paperbark swamps in wallum country and the habitat of the Red-crowned Toadlet appears to be confined to Hawkesbury Sandstone (Robinson, 1998).

No known or potential habitat for these species occurs within the Project site. Therefore a significant area of known (or potential) habitat would not be disturbed for the Project.

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

The Wallum Froglet is distributed along the coast from south-eastern Queensland to northern NSW (Robinson, 1998). Hence, the Project site is located at the southern distribution of the Wallum Froglet and may represent a distributional limit for this species.

The Red-crowned Toadlet is restricted to the Hawkesbury Sandstone of the Sydney Basin (Robinson, 1998). Hence, the Project site is located at the northern distribution of the Red-crowned Toadlet and may represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

The habitat requirements of the Wallum Froglet and the Red-crowned Toadlet are described above. As previously established, no known or potential habitat for these species occurs within the Project site and surrounds.

No known or potential habitat for these species occurs within the Project site, therefore an area of known (or potential) habitat is unlikely to become isolated from currently interconnecting areas of habitat for these species.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.12 Migratory Turtles

This evaluation considers the migratory turtles listed under the EPBC Act which have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a).

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

The Atlas of NSW Wildlife (DEC, 2006a) indicates that four turtles listed as migratory under the EPBC Act (i.e. Loggerhead Turtle [*Caretta caretta*], Green Turtle [*Chelonia mydas*], Hawksbill Turtle [*Eretmochelys imbricate*] and Flatback Turtle [*Natator depressus*]) have been recorded in the region (Attachment F-M).

Turtles are aquatic except for brief periods when females come ashore to lay eggs (Allen and Steene, 1996). Female turtles will migrate over long distances to breeding sites (*ibid*.). Most turtles forage on jellyfish, tunicates, sponges, soft corals, crabs, squid and fishes (except adult Green Turtles which prefer sea grasses and algae) (*ibid*.). World-wide, threats to migratory turtles include hunting for meat and for oils used for medication and in the cosmetic industry and accidental drowning in trawl nets (*ibid*.).

The south arm of the Hunter River offers potential foraging habitat resources for migratory turtles. Any disturbance to migratory turtle habitat in the Hunter River would be done as part of dredging activities. The NSW Maritime Authority holds a development consent (DA-134-3-2003-i) granted by the Minister on 9 August 2005 for the Extension of Shipping Channels within the Port of Newcastle (including dredging, excavation, treatment and disposal of sediments from the south arm of the Hunter River) (the Port Consent). The dredging of the south arm of the Hunter River adjoining to and on the Project site is not assessed in this EA and does not form part of this Project. This dredging is authorised for the purposes of the EP&A Act by the Port Consent (Section 3 of the Project EA).

Notwithstanding, the Project would include several measures to minimise disturbance to the marine environment in the south arm of the Hunter River including the water management strategies described in Section 2 of the Project EA. The primary design goal of the Project water management system is that of no discharge to the Hunter River during operation of the Project. Temporary erosion and sediment controls (e.g. silt fences and sediment control structures) would be installed prior to the commencement of construction activities. A silt curtain would be used during construction of the shipping berth batters, wharf structure and during piling operations.

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

As previously described, the south arm of the Hunter River offers potential foraging habitat resources for migratory turtles. Any disturbance to migratory turtle habitat in the Hunter River would be done as part of dredging activities. The NSW Maritime Authority holds a development consent (DA-134-3-2003-i) granted by the Minister on 9 August 2005 for the Port Consent. The dredging of the south arm of the Hunter River adjoining to and on the Project site is not assessed in this EA and does not form part of this Project. This dredging is authorised for the purposes of the EP&A Act by the Port Consent (Section 3 of the Project EA).

Notwithstanding, the Project would include several measures to minimise disturbance to the marine environment in the south arm of the Hunter River including the water management strategies described in Section 2 of the Project EA. The primary design goal of the Project water management system is that of no discharge to the Hunter River during operation of the Project. Temporary erosion and sediment controls (e.g. silt fences and sediment control structures) would be installed prior to the commencement of construction activities. A silt curtain would be used during construction of the shipping berth batters, wharf structure and during piling operations.

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

Within NSW, the Green Turtle and Hawksbill Turtle are distributed along the length of the coast. Given this, the Project site is located within the known distribution of these migratory species and does not represent a distributional limit for this species.

The Loggerhead Turtle are generally founding tropical and warm temperate waters off the Australian coast but are occasionally recorded as far south as Sydney (DEC, 2005g). Given this, the Project site is located at the southern distribution of the Loggerhead Turtle and may represent a distributional limit for this species.

Within NSW, the Flatback Turtle has been recorded from just north of Batemans Bay to near Newcastle, and as such the Project site is located at its northern distribution and may represent a distributional limit for this species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Any disturbance to migratory turtle habitat connectivity in the Hunter River would be done as part of dredging activities. The NSW Maritime Authority holds a development consent (DA-134-3-2003-i) granted by the Minister on 9 August 2005 for the Port Consent. The dredging of the south arm of the Hunter River adjoining to and on the Project site is not assessed in this EA and does not form part of this Project. This dredging is authorised for the purposes of the EP&A Act by the Port Consent (Section 3 of the Project EA).

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.13 Non-migratory Birds

This evaluation considers the non-migratory birds listed as threatened under the TSC Act/EPBC Act which have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a).

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

Twenty-seven non-migratory birds listed as threatened under the TSC Act/EPBC Act have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a) (Attachment F-M). A list of these species is provided in Attachment F-M.

Vegetation and aquatic habitat in the Project site and surrounds offers potential foraging, roosting and breeding habitat resources for some threatened, non-migratory birds. The Project would involve the disturbance of a portion of potential habitat resources (i.e. ponds and associated vegetation) for threatened, non-migratory birds and may disrupt foraging, roosting and breeding.

The disturbance of a portion of the habitat for threatened, non-migratory birds is unlikely to disrupt the lifecycle such that a local viable population of a threatened non-migratory bird species would be placed at risk given:

- the localised nature of the Project site disturbance;
- the implementation of the Project mitigation measures (Section F4.2 and Section 4 of the Project EA) which would minimise the potential for impacts on non-migratory birds beyond the limits of the Project disturbance area; and
- occurrence of proximal known and potential habitat to the Project site.

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

Potential habitat for threatened, non-migratory birds is located in the Project disturbance areas (e.g. Deep Pond) and would be disturbed by the Project. However, most of the potential habitat for threatened non-migratory birds in the area would not be disturbed by the Project.

Nearby occurrences of potential habitat for non-migratory birds includes Kooragang NR.

A number of mitigation and compensatory measures are proposed as part of the Project in relation to the management of habitat for threatened, non-migratory birds including shorebirds (Sections F4.2). Based on the above (i.e. small amount of habitat disturbance and availability of proximal habitat external to the Project disturbance areas), it is considered that the Project would not have a significant impact on the locally available habitat for threatened, non-migratory birds.

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

The Project site may be at the distributional limit for the following threatened non-migratory birds: Wompoo Fruit-Dove (*Ptilinopus magnificus*) and the Gang-gang Cockatoo (*Callocephalon fimbriatum*).

The Project site is located within the known distribution of the other non-migratory species which were considered and therefore does not represent a distributional limit for these species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. The Project infrastructure may potentially create a barrier for low flying birds.

However, existing industrial development in the immediate area of the Project (including PWCS Kooragang Island Terminal to the north and Blue Circle Southern Cement and Origin Energy to the east) is likely to already present a barrier to wildlife movement, including low-flying non-migratory birds. Therefore, there is unlikely to be any significant change in the habitat connectivity for non-migratory birds due to the Project.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.14 Migratory Birds

This evaluation considers the migratory birds listed under the EPBC Act which have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a).

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

Eighty-one migratory birds listed under the EPBC Act have been recorded by the Atlas of NSW Wildlife (DEC, 2006a) (Attachment F-M).

Migratory shorebirds use roost sites during high tide when their foraging habitat is covered by water (Straw, 1999). Roost sites are typically located close to foraging areas which allows migratory shorebirds birds to conserve energy and build up fat reserves (*ibid*.).

Vegetation and aquatic habitat in the Project site and surrounds offers known and potential foraging, roosting and breeding habitat resources for migratory birds. The Project would involve the disturbance of a portion of known and potential habitat resources (i.e. ponds and associated vegetation) for migratory birds and may disrupt foraging, roosting and breeding in these areas.

The disturbance of a portion of the habitat for migratory birds is unlikely to disrupt the lifecycle such that a viable population of a migratory species would be placed at risk given:

- the localised nature of the Project site disturbance;
- the implementation of the Project mitigation measures (Section F4.2 and Section 4 of the Project EA) which would minimise the potential for impacts on the migratory birds beyond the limits of the Project disturbance area; and
- occurrence of proximal known and potential habitat to the Project site which would not be disturbed by the Project (nearby occurrences of protected habitat for migratory birds includes Kooragang NR and Hexham Swamp NR [NPWS, 1998]).

Notwithstanding the above, the Project compensatory measures would aid the creation, enhancement and ongoing management of shorebird habitat which is expected to benefit existing populations (Section F4.3).

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

Potential habitat for migratory birds is located in the Project disturbance areas (e.g. Deep Pond) and a portion would be disturbed for the Project. However, as previously mentioned, nearby occurrences of habitat for migratory birds includes Kooragang NR.

Based on the small amount of habitat disturbance and the availability of proximal habitat external to the Project disturbance areas, it is considered that the Project would not have a significant impact on the locally available habitat for migratory birds. A number of mitigation and compensatory measures are proposed as part of the Project in relation to the management of shorebird habitat (Sections F4.2 and F4.3).

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

The Project site may be at the distributional limit for the following migratory birds: Garganey (*Anas querquedula*), Royal Albatross (*Diomedea epomophora*), Northern Giant-Petrel (*Macronectes halli*), Black Petrel (*Procellaria parkinsoni*), Asian Dowitcher (*Limnodromus semipalmatus*), Buff-breasted Sandpiper (*Tryngites subruficollis*), Varied Triller (*Lalage leucomela*), Yellow Wagtail (*Motacilla flava*), and the Northern Shoveler (*Anas clypeata*).

The Project site is located within the known distribution of the other migratory species which were considered and therefore does not represent a distributional limit for these species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Migratory birds are highly mobile. For example, migratory shorebirds use geographical routes called 'flyways' (i.e. broad corridors) for migrating. Australia is near the southern end of the East Asian–Australasian Flyway which stretches from the breeding grounds of Siberia and Alaska, southwards through Asia, to the non-breeding grounds of Australia and New Zealand (DEH, 2005b).

The Kooragang NR is within the East Asian–Australasian Flyway. The Project is not likely to impact significantly on Kooragang NR and/or the East Asian–Australasian Flyway. The Project is also unlikely to modify habitat connectivity for migratory birds including shorebirds given their mobility.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.15 Threatened Terrestrial Mammals (Excluding Bats)

This evaluation considers the terrestrial mammals (excluding bats) listed as threatened under the TSC Act/EPBC Act which have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a).

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

Four threatened terrestrial mammals have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a) *viz*. Spotted-tailed Quoll (*Dasyurus maculatus*), Brush-tailed Phascogale (*Phascogale tapoatafa*), Yellow-bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolcensis*) and Long-nosed Potoroo (*Potorous tridactylus*) (Attachment F-M).

Vegetation and aquatic habitat in the Project site and surrounds offers limited potential foraging, roosting and breeding habitat resources for threatened terrestrial mammals. For example, the Project site does not contain suitable habitat for arboreal fauna as there are no hollow-bearing trees and connectivity with forested habitat in the surrounding area is lacking (Connell Hatch, 2006a). Notwithstanding, the Project would involve the disturbance of a portion of potential habitat resources for some threatened terrestrial mammals and may disrupt foraging, roosting and breeding (were these species to occur in the Project site).

The disturbance of a portion of the potential habitat for threatened terrestrial mammals is unlikely to disrupt the lifecycle such that a local viable population of a threatened terrestrial mammal species would be placed at risk given the localised nature of the Project site disturbance and occurrence of proximal known and potential habitat to the Project site.

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

As described above, limited potential habitat for threatened terrestrial mammals is located in the Project disturbance areas and would be disturbed for the Project. A number of mitigation measures are proposed as part of the Project in relation to the management of threatened species habitat (Section F4.2). Based on the above (i.e. limited amount of potential habitat and mitigation measures), it is considered that the Project would not have a significant impact on the locally available habitat for the threatened terrestrial mammals considered here.

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

The Project site is located within the known distribution of the threatened terrestrial mammals which were considered and therefore does not represent a distributional limit for these species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. The Project infrastructure may potentially create a barrier for threatened terrestrial mammals (e.g. gliders) (if present in the Project site or surrounds).

However, existing industrial development in the immediate area of the Project (including PWCS Kooragang Island Terminal to the north and Blue Circle Southern Cement and Origin Energy to the east) is likely to already present a barrier to wildlife movement, including threatened terrestrial mammals. Therefore, there is unlikely to be any significant change in the habitat connectivity for the threatened terrestrial mammals due to the Project.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.16 Threatened Bats

This evaluation considers the bats listed as threatened under the TSC Act/EPBC Act which have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a).

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

Nine threatened bats have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a) (Attachment F-M).

Vegetation and aquatic habitat in the Project site and surrounds offers limited potential foraging, roosting and breeding habitat resources for threatened bats. For example, the Project site does not contain suitable habitat for arboreal fauna as there are no hollow-bearing trees and connectivity with forested habitat in the surrounding area is lacking (Connell Hatch, 2006c).

The Project would involve the disturbance of a portion of potential foraging habitat resources for threatened bats and may disrupt foraging (were these species to occur in the Project site).

The disturbance of a portion of the habitat for threatened bats is unlikely to disrupt the lifecycle such that a local viable population of a threatened bat species would be placed at risk given the localised nature of the Project site disturbance and occurrence of proximal known and potential habitat to the Project site.

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

As described above, limited potential habitat for threatened bats is located in the Project disturbance areas and would be disturbed by the Project. A number of mitigation measures are proposed as part of the Project in relation to the management of habitat for threatened bats (Section F4.2). Based on the above (i.e. limited amount of potential habitat and mitigation measures), it is considered that the Project would not have a significant impact on the locally available habitat for threatened bats.

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

The Project site may be near the southern distributional limit for the Little Bentwing-bat (*Miniopterus australis*). However, the Project site is located within the known distribution of the other threatened bat species which were considered and therefore does not represent a distributional limit for these species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. The Project infrastructure may potentially create a barrier for some threatened bats.

However, existing industrial development in the immediate area of the Project (including PWCS Kooragang Island Terminal to the north and Blue Circle Southern Cement and Origin Energy to the east) is likely to already present a barrier to wildlife movement, including threatened bats. Therefore, there is unlikely to be any significant change in the habitat connectivity for threatened bats due to the Project.

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.6.17 Threatened Marine Mammals

This evaluation considers the marine mammals listed as threatened under the TSC Act/EPBC Act which have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a).

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

Four threatened marine mammals have been recorded within 20 km of the Project site by the Atlas of NSW Wildlife (DEC, 2006a) *viz*. Dugong (*Dugong dugon*), New Zealand Fur-seal (*Arctocephalus forsteri*), Southern Right Whale (*Eubalaena australis*) and Humpback Whale (*Megaptera novaeangliae*) (Attachment F-M).

The south arm of the Hunter River is likely to offer only limited potential foraging habitat resources for some of the threatened marine mammals considered here (e.g. New Zealand Fur-seal). The preferred habitat of Dugongs is seagrass in shallow water (Allen and Steene, 1996) of which a small amount occurs in the south arm of the Hunter River. Other threatened marine mammals (e.g. Southern Right Whale and Humback Whale) are unlikely to enter the Hunter River.

Any disturbance to threatened marine mammal habitat in the Hunter River would be done as part of dredging activities. The NSW Maritime Authority holds a development consent (DA-134-3-2003-i) granted by the Minister on 9 August 2005 for the Port Consent. The dredging of the south arm of the Hunter River adjoining to and on the Project site is not assessed in this EA and does not form part of this Project. This dredging is authorised for the purposes of the EP&A Act by the Port Consent (Section 3 of the Project EA).

Notwithstanding, the Project would include several measures to minimise disturbance to the marine environment in the south arm of the Hunter River including the water management strategies described in Section 2 of the Project EA. The primary design goal of the Project water management system is that of no discharge to the Hunter River during operation of the Project. Temporary erosion and sediment controls (e.g. silt fences and sediment control structures) would be installed prior to the commencement of construction activities. A silt curtain would be used during construction of the shipping berth batters, wharf structure and during piling operations.

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

As previously described, the south arm of the Hunter River offers limited potential foraging habitat resources for threatened marine mammals. Any disturbance to threatened marine mammal habitat in the Hunter River would be done as part of dredging activities. The NSW Maritime Authority holds a development consent (DA-134-3-2003-i) granted by the Minister on 9 August 2005 for the Port Consent. The dredging of the south arm of the Hunter River adjoining to and on the Project site is not assessed in this EA and does not form part of this Project. This dredging is authorised for the purposes of the EP&A Act by the Port Consent (Section 3 of the Project EA).

Notwithstanding, the Project would include several measures to minimise disturbance to the marine environment in the south arm of the Hunter River including the water management strategies described in Section 2 of the Project EA. The primary design goal of the Project water management system is that of no discharge to the Hunter River during operation of the Project. Temporary erosion and sediment controls (e.g. silt fences and sediment control structures) would be installed prior to the commencement of construction activities. A silt curtain would be used during construction of the shipping berth batters, wharf structure and during piling operations.

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

The Project site is located within the known distribution of the threatened marine mammals which were considered and therefore does not represent a distributional limit for these species.

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

The Project is unlikely to affect any of the current disturbance regimes operating at the Project site and surrounds, including flooding flows and fire. As explained in Section F4.2, the potential for the Project to alter the natural flow regime in the area of the Project rail infrastructure (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography. Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing conditions.

There is unlikely to be any change to the current fire regime due to the Project because several fire control measures would be implemented as described in Section F4.2.

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

Any disturbance to threatened marine mammal habitat connectivity in the Hunter River would be done as part of dredging activities. The NSW Maritime Authority holds a development consent (DA-134-3-2003-i) granted by the Minister on 9 August 2005 for the Port Consent. The dredging of the south arm of the Hunter River adjoining to and on the Project site is not assessed in this EA and does not form part of this Project. This dredging is authorised for the purposes of the EP&A Act by the Port Consent (Section 3 of the Project EA).

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

There is no critical habitat as listed on the NPWS Critical habitat register (NPWS, 2006) or DEH Register of Critical Habitat (2006b) located in the Project site or surrounds.

F3.7 SEPP 44 – KOALA HABITAT PROTECTION

In response to a state-wide decline of Koala populations, the Department of Urban Affairs and Planning (now DoP) gazetted the SEPP No. 44 – Koala Habitat Protection (SEPP 44) in January 1995.

The policy aims to "*encourage the conservation of proper management of areas of natural vegetation that provide habitat for Koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline*."

In order to determine whether SEPP 44 applies to the Project, it is necessary to consider the following points:

(1) *Does the subject land occur in a Local Government Area identified in Schedule 1?*

The Project and surrounds are located within the Newcastle Local Government Area which is listed within Schedule 1 of SEPP 44.

(2) *Is the landholding to which the DA applies greater than 1 hectare in area?*

The Project Application area is larger than 1 hectare in area.

(3) *Is the land potential Koala habitat? That is, does the site "contain areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component?*"

One unidentified *Eucalyptus* spp. was recorded by the Project surveys (Appendix E of the EA). Similarly, the River Red Gum (*Eucalyptus camaldulensis*) is present as landscape plantings. Therefore it is considered that the Project site does not provide potential Koala habitat.

(4) *Is there core Koala habitat on the subject land and is there a requirement for the preparation of a Plan of Management for the identified core Koala habitat?*

SEPP 44 describes core Koala habitat as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (i.e. females with young) and recent sightings of and historical records of, a population.

A database search has revealed that koalas have not been recorded within the Project site (DEC, 2006a). The closest record is 27 km north-east of the Project site[10] (DEC, 2006a). Given this, it is unlikely that any Koala currently uses the Project site.

The Project site does not fall within the definition of core Koala habitat. The study area does not have a resident population of Koalas and there are no recent records of a population occurring in the area. Hence, there is no requirement for the preparation of a Plan of Management.

Based on the above, it is concluded that the provisions of SEPP 44 do not apply.

[10] This record has an accuracy of 1 km (NPWS, 2006).

F4 DISCUSSION

Potential impacts of the Project on fauna and proposed mitigation measures are outlined in Sections F4.1 and F4.2, respectively.

F4.1 POTENTIAL IMPACTS

The likelihood of the Project having a significant effect on relevant threatened and migratory fauna species is assessed in Section F3.6. Based on the evaluations presented in Section F3.6, it is considered that the Project is unlikely to have a significant effect on any threatened fauna listed under the TSC Act and EPBC Act or species which are listed as migratory under the EPBC Act. The impact of the Project on threatened fauna is not considered to be significant from a local or regional perspective.

Presented below is an assessment of the potential impacts of the Project on fauna. In considering these potential impacts, it is relevant to note the condition and context of the Project site.

- The Project site is situated on land zoned Zone 4(b) (Port and Industry), 5(a) (Special Uses Zone - Arterial Road) and an unzoned area (Hunter River) under the Newcastle LEP. The Kooragang NR located approximately 1 km to the north of the Project site provides protected habitat for threatened fauna, as it is on land zoned 8(a) (National Parks) by the Newcastle LEP.
- The Project rail infrastructure would be constructed on land which is part of the KIWEF which is owned by the RLMC. The KIWEF is licensed as a Solid Waste Class 2 landfill under EPL 6437, issued under the POEO Act.
- The ecosystem in the Project site can be considered to be dynamic as the landuse history of the site is such that much of the original vegetation has been covered by fill. Embankments, excavations and changed hydrological conditions have created the conditions for wetlands and marshes of varying conservation values.

Overall the ecosystem processes operating in the Project site are considered to be sub-optimal. However, the Project site provides habitat for threatened and migratory fauna.

Potential impacts of the Project on fauna have been assessed in terms of threatening processes as follows.

Clearing of native vegetation – Clearing of native vegetation is classified as a Key Threatening Process under the TSC Act and can lead to destruction of habitat. Alteration of habitat can result in direct loss of habitat as well as isolation of habitat through creation of barriers to movement between populations. The Project is likely to reduce the available habitat for those species that use the Project site (Section F3.1.2; Attachment F-F).

The landuse history of the Project site has meant that much of the original vegetation has been covered, or disturbed by, landfilling/reclamation activities. Notwithstanding, the Project site and surrounds provide (to varying degrees) opportunities for foraging, breeding, nesting, predator avoidance and movement between wetland areas for fauna, thus promoting genetic diversity and facilitating dispersal/migration. In areas, these opportunities would potentially be reduced as a result of habitat disturbance associated with the Project.

Isolation of habitat through creation of barriers is likely to have implications for the Green and Golden Bell Frog (NPWS, undated in DEC, 2005a). The Project rail infrastructure corridor has the potential to impede on the movement/dispersal of the Green and Golden Bell Frog between the areas north and south of the Project rail infrastructure corridor (Figure F-4). Records of the occurrence of the local population of this species indicate that it is predominantly located to the north of the Project rail infrastructure corridor, however it is also recorded on the southern side (Figure F-4). However, the Green and Golden Bell Frog exhibits strong migration tendencies (including the ability to move several kilometres) and will traverse roads and other unfavourable surfaces to reach desired habitat (NPWS, undated in DEC, 2005a). It is reasonable to assume that unfavourable surfaces would include railway embankments. Further, as discussed in Section F4.2 below, mitigating features have been incorporated into the design of the relevant Project elements to minimise the potential for barrier effects to occur.

The construction of the Project northern rail spur has the potential to impact on shorebirds which use the southern end of Deep Pond as known habitat would be disturbed during construction. The potential impact on shorebirds has been considered in the threatened species evaluations presented in Section F3.6. Relevant mitigation measures to be implemented as part of the Project are described in Section F4.2.

Clearing of vegetation would also occur as part of the construction of the Project elements in the coal storage area (Figure F-2). This includes the loss of habitat provided by the existing Big Pond. Where relevant, potential impacts associated with the loss of Big Pond are considered in the threatened species evaluation (Section F3.6).

The loss of Big Pond was assessed by the BPHOS Report (Department of Commerce, 2005) and this is discussed further in Section F4.3.

Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands - Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is also listed as a Key Threatening Process under the TSC Act. The destruction and alteration of wetlands is described as a threat by the Draft Recovery Plan for the Green and Golden Bell Frog (DEC, 2005a). Alteration to wetlands can also impact on shorebirds. As discussed above, Big Pond would be infilled as part of the construction of the Project coal storage area. The construction of the northern rail spur would involve the disturbance of shorebird habitat in the southern end of Deep Pond.

It should be noted that the existing flow regimes across the Project site are highly modified (i.e. not natural), however the potential for the Project to alter the existing flow regime in the area of the Project rail infrastructure corridor (i.e. across the KIWEF site) would be minimised by the installation of culverts under the rail embankments at low points in the existing topography (Section F4.2). Culverts would allow surface waters to continue to flow across the site in a similar manner to the existing condition.

Introduced Species – Potential exists for introduced fauna species to be attracted to the Project site through increased refuge and scavenging areas. These factors could increase the concentration of introduced fauna in and around the Project site. Predation by feral animals such as foxes is thought to be a threat to the Green and Golden Bell Frog (NPWS, undated in DEC, 2005a). Relevant mitigation measures are presented in Section F4.2 below.

Traffic Mortality – Traffic movements associated with the construction and operation of the Project have the potential to increase the incidence of mortality of fauna caused by traffic. Road mortality is listed as a Key Threatening Process listed under Schedule 3 of the TSC Act that may impact on the Green and Golden Bell Frog (NPWS, undated in DEC, 2005a).

Noise Emissions – The Project construction and operation would result in noise emissions. Project noise emissions are assessed in Appendix A of the Project EA. Noise emissions have the potential to disrupt the routine activities of fauna (e.g. shorebirds/Australasian Bittern). One of the noise sources would be trains using the Project rail infrastructure corridor which has the potential to impact on shorebirds which use the southern end of Deep Pond.

Numerous studies have been undertaken on the effects of noise on wildlife (e.g. Algers *et al.*, 1978 in Richard Heggie Associates, 1997; Allaire, 1978; Ames, 1978; Busnel, 1978; Lynch and Speake, 1978; Shaw, 1978; Streeter *et al.*, 1979; Poole, 1982 in Richard Heggie Associates, 1997). The studies generally indicate that many species are well adapted to human activities and habituate to noise. It is relevant to note that the existing records of fauna across the Project site and surrounds coincide with the operation of the existing Kooragang Island mainline and the KIWEF. It is considered that the impact of noise generated by the Project on the fauna of the Hunter Estuary Wetlands would be minimal. Notwithstanding this, to meet the stringent noise impact assessment criteria under the NSW Industrial Noise Policy (EPA, 2000), comprehensive noise mitigation and management measures would be implemented as part of the Project design. These controls on Project noise emissions have been designed to meet relevant human intrusive and amenity criteria and are described in Appendix A of the Project EA.

Project Lights – The beams of light produced by the headlights of the trains using the Project infrastructure have the potential to affect the behaviour of some fauna species, particularly birds, which may become disturbed. This potential impact includes areas where the beams of light from the trains sweep across the surface of ponds and wetland areas. Other lights associated with the Project include overhead lighting of the coal storage area combined stacker/reclaimers, train unloading station and wharf facilities and shiploaders, and other mobile vehicle-mounted lights (e.g. work vehicles on-site). It is relevant to note that the existing records of fauna across the Project site and surrounds coincide with the operation of the existing Kooragang Island mainline and the KIWEF.

The Visual Assessment presented in Appendix H of the Project EA concluded that the potential impact of night lighting would be negligible given the presence of numerous light emitting sources in the local, sub-regional and regional settings. With the implementation of the relevant mitigation measures described in Section 4.2, it is considered that the potential impacts of Project lighting on fauna would be minimal.

Powerlines – No overhead powerlines would be installed at the Project site as part of the Project.

Fencing – The perimeter of the Project coal storage area and wharf facilities would each be fenced for security purposes. The Project rail corridor would also be fenced either side, including the inside of the rail loops. Fencing currently surrounds the area which would become the Project coal storage area. The fencing would be expected to have minimal impact on wildlife movement, however fauna management would be considered during the design and maintenance of security fencing. This may include flagging tape (or similar deterrent) being placed at regular locations along the top of fencing when in close proximity to ponds utilised by birds.

Fire – Coal stockpiles have the potential to self-heat, giving rise to smoldering fires (i.e. spontaneous combustion). In addition, accidental fires may occur (e.g. fires associated with the transport, storage and usage of fuels and chemicals). However, the frequency of fires would be reduced through the use of the Project controls described in Section F4.2. Therefore, it is considered unlikely that the Project would result in a significant change in the frequency of fires.

Dredging – The NSW Maritime Authority holds a development consent (DA-134-3-2003-i) granted by the Minister on 9 August 2005 for the Port Consent. The dredging of the south arm of the Hunter River adjoining to and on the Project site is not assessed in this EA and does not form part of this Project. This dredging is authorised for the purposes of the EP&A Act by the Port Consent (Section 3.6.1 of the Project EA).

Potential Impacts on the Hunter Estuary Wetlands - It is considered that the Project would not significantly impact on the fauna of the Hunter Estuary Wetlands. As discussed above, although the Project would increase the existing level of noise, which has the potential to disrupt the routine activities of shorebirds, it is considered that the impact of noise generated by the Project on the fauna of the Hunter Estuary Wetlands would be minimal. As stated above, the Fauna Assessment does not consider the potential impacts of dredging on the Hunter Estuary Wetlands.

F4.2 MITIGATION MEASURES – FLORA AND FAUNA MANAGEMENT PLAN

Although the Project would avoid or minimise direct impacts on threatened species and associated habitats wherever possible, several measures have been developed to mitigate unavoidable impacts of the Project on fauna. These mitigation measures would be detailed in a Flora and Fauna Management Plan (FFMP) as described below.

The FFMP would be prepared prior to Project construction and would include management measures to be undertaken during construction and operation, including a Vegetation Clearance Protocol (VCP), Threatened Species Management Protocol (TSMP), landscape plantings, pest management measures, on-site amphibian chytrid fungus management measures, rail culvert modification and fauna monitoring programmes. Further details regarding these management measures are provided below.

Vegetation Clearance Protocol

The FFMP would include a VCP to minimise the potential impacts of vegetation clearance on fauna. During construction, vegetation immediately adjoining the Project disturbance areas would be delineated and clearly marked to minimise the potential for accidental damage during construction. The VCP would also include a pre-clearance survey, identification of fauna management strategies and specific procedures for vegetation clearance.

Threatened Species Management Protocol

A TSMP would be developed as a component of the FFMP to facilitate the implementation of threatened species management strategies to minimise potential impacts on threatened fauna species.

Green and Golden Bell Frogs found in the Project site during construction or operation would be removed from the direct disturbance area and placed in adjacent suitable habitat in accordance with the *Hygiene Protocol for the Control of Disease in Frogs* (NPWS, 2001) which recommends best-practice procedures for handling frogs and suggests strategies for minimising the potential of spreading amphibian chytrid fungus.

Landscape Plantings

Landscape (amenity) plantings would be established on available areas of land between the coal storage area and Cormorant Road (Figure F-2). These landscape plantings would comprise of locally indigenous species in order to provide some potential habitat for local native fauna.

Pest Management Measures

A clean, rubbish-free environment would be mandated to discourage scavenging and reduce the potential for further colonisation of the Project site by non-endemic fauna (e.g. introduced rodents and foxes).

Fox control strategies would be implemented because predation by foxes is a threat to the Green and Golden Bell Frog (NPWS, undated in DEC, 2005a), Freckled Duck (Smith *et al*., 1995) and the Australasian Bittern.

Amphibian Chytrid Fungus Management

Amphibian chytrid fungus is known to be already present on Kooragang Island (Section 3.7.2 of the Project EA). However, management measures would be implemented to minimise the further spread of amphibian chytrid fungus, including potentially new strains of the fungus, into the Project site. Project personnel would be trained in site hygiene management in accordance with the *Hygiene Protocol for the Control of Disease in Frogs* (NPWS, 2001) which recommends best-practice procedures for handling frogs and suggests strategies for minimising the potential of spreading amphibian chytrid fungus. This would include disinfecting tyres and wheels of vehicles brought into the Project site that have been exposed to mud and are to be used in areas in close proximity to potential frog habitat.

Mobile plant that is brought to the Project site during construction activities would be inspected prior to entering the site and would not be permitted to enter the site if it is not adequately clean (i.e. free of soil and/or organic matter).

Project personnel access to Green and Golden Bell Frog habitat located outside the Project disturbance area would be restricted to minimise any further spread of amphibian chytrid fungus.

Rail Culverts Suitable for Green and Golden Bell Frog Movements

The design of rail culverts would include relevant specifications to facilitate the migration/dispersal of the Green and Golden Bell Frog to minimise the potential that frogs located to the south of the Project rail infrastructure are isolated from the rest of the population to the north. An example of rail culverts which are suitable for use by the Green and Golden Bell Frog are culverts which are around 1 m wide and 1 m high. So-called 'frog underpasses' have previously been used successfully for a large housing development in Woonona, NSW (White, pers. comm., 2006).

Suitable habitat for Green and Golden Bell Frogs would be established at the 'frog underpasses' in order to encourage the frogs to use them. Habitat creation would include selective planting of plants preferred by the species (e.g. Cumbungi) and placing piles of rocks to provide protection from predators in strategic places such as either end of (or within) 'frog underpasses'. Pond areas would also be established at either end of the 'frog underpasses'.

Habitat Replacement at Deep Pond

Habitat in the form of shallow areas for foraging shorebirds would be created during the construction of the northern rail spur embankment, if required to be installed when the Project is fully developed to 66 Mtpa, by modifying the design of the embankment batter slopes to have a gentle toe gradient (i.e. in the submerged zone of the batter slope). This would result in the creation of shallow areas suitable for shorebirds in Deep Pond. The specifications of this initiative would be detailed in the FFMP.

In addition, where practicable, construction of the northern rail spur embankment (if necessary) in the vicinity of Deep Pond would be timed to avoid migratory shorebird usage (i.e. May to August).

Project Lights

The potential impact on fauna caused by the headlights of the trains using the Project rail infrastructure would be minimised by the selective placement of lighting screens in areas where there is an increased potential for interaction with fauna (e.g. where beams of light from the trains would sweep across the surface of Deep Pond). This would also screen the light emitted from the ground-level lighting which would be installed along the rail infrastructure corridor.

Fire

The potential for a change in the frequency of fires due to the Project would be reduced through the use of water sprays and prudent stockpile management. A 2 ML fire services tank would also be installed for emergency fire fighting situations. An Emergency Response Plan and Spontaneous Combustion Management Plan would be prepared for the Project and would describe hazard (i.e. fire) preventative and mitigation measures (Section 5 of the Project EA).

Water Management

The Project would include several measures to minimise disturbance to the marine environment in the south arm of the Hunter River including the water management strategies described in Section 2 of the Project EA. The primary design goal of the Project water management system is that of no discharge to the Hunter River during operation of the Project. Temporary erosion and sediment controls (e.g. silt fences and sediment control structures) would be installed prior to the commencement of construction activities. A silt curtain would be used during construction of the shipping berth batters, wharf structure and during piling operations.

Fauna Monitoring

Monitoring of the Green and Golden Bell Frog, Australasian Bittern and shorebirds would be undertaken in the area surrounding the Project annually for the duration of the Project. The objective of monitoring would be to collect up-to-date information on the use of the Project site and surrounds by fauna. Monitoring data for the Green and Golden Bell Frog would be provided to university institutions undertaking relevant research on the Green and Golden Bell Frog (Section F4.4).

F4.3 COMPENSATORY MEASURES

Existing Compensatory Habitat

Offsets have already been proposed by the NSW government for the development of Big Pond by the Department of Commerce as part of the BPHOS Report (Department of Commerce, 2005). The BPHOS Report proposes to enhance and create compensatory habitats in the Kooragang NR to offset the proposed development of Big Pond (Department of Commerce, 2005).

The proposed compensatory areas are at Ash Island (located on Kooragang Island) and at the Tomago Wetlands (located north of the Hunter River north arm) (Figure F-1). The aim of the BPHOS Report is to modify land of low habitat value to create land with high values particularly for resident and migratory shorebirds.

Other offsets funded by the NSW government for potential impacts on Big Pond include the modifications of the Stockton Sand Spit, diurnal roost improvement at Smith Island and Sandy Island, the artificial roost at Fullerton Cove East, pond construction at Ash Island and reintroduction of tidal flows at Tomago (Straw, 1999; 2000).

In essence, Big Pond is a wetland area that was artificially created and has been manipulated as a foraging habitat for shorebirds (Straw, 1999). Originally, Big Pond was part of an intertidal mangrove area which was cut off from tidal influence when Moscheto Creek was blocked by a railway and then bunded to create land suitable for industrial use (Straw, 1999). Shorebirds ceased to use Big Pond when water flows to the wetland were blocked by an extension of PWCS in 1994 (*ibid*.). In order to make Big Pond attractive again to shorebirds, PWCS constructed a weir so that water levels could be manipulated but this was subsequently removed (*ibid*.).

No waterbirds or threatened avian species were observed during the survey at Big Pond during the Project surveys conducted during summer 2005-2006 (Avifauna Research and Services, 2006). This is most likely because Big Pond has since evolved from a brackish/saline open wetland with extensive mudflats and shallows to a largely freshwater wetland dominated by sedge and reeds as well as some open areas of mudflats or grass (Avifauna Research and Services, 2006).

The offsets funded by the NSW government address the potential impacts of the development of Big Pond.

Kooragang Wetland Rehabilitation Project Environmental Management Plan

A financial contribution would be made to Kooragang Wetland Rehabilitation Project (KWRP) towards updating its Environmental Management Plan (EMP) to incorporate the details of the proposed habitat creation initiatives outlined below, where relevant to lands managed by the KWRP. This would include a consultation programme and input from relevant independent experts.

Habitat Creation

Habitat creation for the Green and Golden Bell Frog and shorebirds/saltmarsh would be funded as part of the Project.

A financial contribution would be made towards current or future projects which involve habitat creation for the Green and Golden Bell Frog on RLMC-owned lands within the KWRP or alternate suitable lands in the Kooragang NR. Habitat creation would be located on the perimeter of existing habitat areas to provide suitable habitat into which the existing Green and Golden Bell Frog population can expand. This habitat creation would also create an opportunity to research the performance of alternative types of habitat enhancement.

Habitat creation initiatives for the Green and Golden Bell Frog would include construction of two habitat ponds of similar scale and detail to existing ponds where the Green and Golden Bell Frogs have been recorded on the KIWEF site (i.e. Pond C) (Attachment F-H). This is consistent with the recovery strategies (i.e. *habitat rehabilitation/restoration and/or regeneration* and *monitoring*) identified by the DEC to help recover the Green and Golden Bell Frog (DEC, 2005h).

Mangroves in the Hunter Estuary have been expanding at the expense of the Coastal Saltmarsh Endangered Ecological Community (EEC) and, in some areas (e.g. Ash Island), mangroves have been removed to enhance habitat for Coastal Saltmarsh EEC and shorebirds. A financial contribution would be made to an organisation such as the KWRP for the removal of up to 6 ha of mangroves from coastal saltmarsh habitat. A financial contribution would also be made towards the construction of a flow control structure to minimise the potential for mangrove propagules to enter areas reserved for saltmarsh. Alternatively, these initiatives may also be applied to lands within the Kooragang NR. These works are expected to enhance habitat for shorebirds as well as provide habitat for the Coastal Saltmarsh EEC.

In addition, habitat in the form of shallow areas for foraging shorebirds would be created during the construction of the northern rail spur embankment, if required to be installed when the Project is fully developed to 66 Mtpa, by modifying the design of the embankment batter slopes to have a gentle toe gradient (i.e. in the submerged zone of the batter slope). This would result in the creation of shallow areas suitable for shorebirds in Deep Pond. The specifications of this initiative would be detailed in the FFMP.

No habitat enhancement or creation works would be conducted on land subject to SEPP 74 (Newcastle Port and Employment Lands) (Section 3.3.3 of the Project EA).

F4.4 ECOLOGICAL INITIATIVES

Two additional ecological initiatives would be implemented for the Project including financial contributions towards research and exhibitions promoting conservation awareness.

Contribution to Research

A financial contribution would be given to the University of Newcastle, or other appropriately recognised research body, to fund research into the Green and Golden Bell Frog. The focus of research would be to expand existing knowledge of factors affecting the species which may be used to actively improve the strength of the population of Green and Golden Bell Frogs on Kooragang Island.

This is consistent with one of the recovery strategies (i.e. *research: general biological and ecological studies*) identified by the DEC to help recover the Green and Golden Bell Frog (DEC, 2005h).

Contribution to Hunter Wetlands Centre

A financial contribution would be given to the Hunter Wetlands Centre towards an annual exhibition regarding the Green and Golden Bell Frog and migratory shorebirds. The exhibition would include an update on the progress and the effectiveness of the habitat enhancement initiatives conducted as part of the compensatory measures of the Project. This would also provide an opportunity for a representative undertaking the university-based research described above to explain the progress/findings of the research to the interested public.

This is consistent with one of the recovery strategies (i.e. *community and land-holder liaison/awareness and/or education*) identified by the DEC to help recover the Green and Golden Bell Frog (DEC, 2005h).

F5 REFERENCES

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ATTACHMENT F-A

GREEN AND GOLDEN BELL FROG SURVEY LOCATIONS

Proposed Coal Unloader
Kooragang Island
Seasonal Ecological Investigations

NOTE: Display at A3

FIGURE 2.1
GREEN AND GOLDEN BELL FROG
SURVEY LOCATIONS

ATTACHMENT F-B

AUSTRALASIAN BITTERN SURVEY SITES

Proposed Coal Unloader
Kooragang Island
Seasonal Ecological Investigations

FIGURE 3.1
AUSTRALASIAN BITTERN
SURVEY SITES

ATTACHMENT F-C

SHOREBIRD STUDY AND HABITAT ASSESSMENT STUDY SITE
INCLUDING AREA D AND BIG POND (AREA A)

Figure 1: Study site including Area D and Big Pond (Area A)

ATTACHMENT F-D

FAUNA RECORDS FROM THE SURROUNDING REGION

Attachment F-D
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Amphibians					
Adelotus brevis	Tusked Frog	•			
Crinia signifera	Common Eastern Froglet	•	•		
Crinia tinnula	Wallum Froglet	•	•		
Lechriodus fletcheri	Fletcher's Frog	•			
Limnodynastes dumerilii	Eastern Banjo Frog	•			
Limnodynastes ornatus	Ornate Burrowing Frog	•			
Limnodynastes peronii	Brown-striped Frog	•			
Limnodynastes tasmaniensis	Spotted Grass Frog	•	•		
Mixophyes fasciolatus	Great Barred Frog	•			
Mixophyes iterates	Giant Barred Frog	•			
Paracrinia haswelli	Haswell's Frog	•			
Pseudophryne australis	Red-crowned Toadlet	•			
Pseudophryne bibronii	Brown Toadlet	•			
Pseudophryne coriacea	Red-backed Toadlet	•			
Pseudophryne sp.		•			
Uperoleia fusca	Dusky Toadlet	•			
Uperoleia laevigata	Smooth Toadlet	•			
Uperoleia rugosa	Wrinkled Toadlet	•			
Uperoleia sp.		•			
Uperoleia tyleri	Tyler's Toadlet	•			
Litoria aurea	Green and Golden Bell Frog	•			
Litoria caerulea	Green Tree Frog	•			
Litoria dentata	Bleating Tree Frog	•			
Litoria ewingii	Brown Tree Frog	•			
Litoria fallax	Eastern Dwarf Tree Frog	•			
Litoria freycineti	Freycinet's Frog	•			
Litoria gracilenta	Dainty Green Tree Frog	•			
Litoria jervisiensis	Jervis Bay Tree Frog	•			
Litoria latopalmata	Broad-palmed Frog	•			
Litoria lesueuri	Lesueur's Frog	•			
Litoria littlejohni	Littlejohn's Tree Frog	•			
Litoria nasuta	Rocket Frog	•			
Litoria pearsoniana/phyllochroa	Pearson's Green Tree Frog/Leaf-green Tree Frog	•			
Litoria peronii	Peron's Tree Frog	•			
Litoria phyllochroa	Leaf-green Tree Frog	•			
Litoria tyleri	Tyler's Tree Frog	•			
Litoria verreauxii	Verreaux's Tree Frog	•			
Reptiles					
Caretta caretta	Loggerhead Turtle	•			
Chelonia mydas	Green Turtle	•			
Eretmochelys imbricata	Hawksbill Turtle	•			
Natator depressus	Flatback Turtle	•			
Chelodina longicollis	Snake-necked Turtle	•			
Oedura robusta	Robust Velvet Gecko	•			
Saltuarius swaini	Southern Leaf-tailed Gecko	•			

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Lialis burtonis	Burton's Snake-lizard	•			
Pygopus lepidopodus	Common Scaly-foot	•	•		
Anomalopus swansoni	Punctate Worm-skink	•	•		
Calyptotis ruficauda	Red-tailed Calyptotis	•			
Carlia tetradactyla	Southern Rainbow-skink	•	•		
Cryptoblepharus virgatus	Cream-striped Shinning-skink	•			
Ctenotus robustus	Robust Ctenotus	•	•		
Ctenotus taeniolatus	Copper-tailed Skink	•	•		
Cyclodomorphus gerrardii	Pink-tongued Lizard	•			
Cyclodomorphus michaeli	Mainland She-oak Skink	•			
Egernia major	Land Mullet	•			
Egernia mcpheei	Eastern Crevice Skink	•			
Egernia striolata	Tree Skink	•			
Eulamprus heatwolei	Yellow-bellied Water-skink	•			
Eulamprus quoyii	Eastern Water-skink	•	•		
Eulamprus sp.	Unidentified eulamprus	•			
Eulamprus tenuis	Barred-sided Skink	•			
Hemiergis decresiensis	Three-toed Earless Skink	•			
Lampropholis amicula	Friendly Sunskink	•			
Lampropholis delicata	Dark-flecked Garden Sunskink	•	•		
Lampropholis guichenoti	Pale-flecked Garden Sunskink	•			
Lampropholis sp.	Unidentified grass skink	•			
Lygisaurus foliorum	Tree-base Litter-skink	•			
Morethia boulengeri	South-eastern Morethia Skink	•			
Saiphos equalis	Three-toed Skink	•	•		
Saproscincus mustelinus	Weasel Skink	•	•		
Tiliqua rugosa	Shingle-back	•			
Tiliqua scincoides	Eastern Blue-tongue	•			
Amphibolurus muricatus	Jacky Lizard	•			
Physignathus lesueurii	Water Dragon	•			
Pogona barbata	Bearded Dragon	•			
Rankinia diemensis	Mountain Dragon	•			
Varanus varius	Lace Monitor	•	•		
Ramphotyphlops nigrescens	Blackish Blind Snake	•			
Ramphotyphlops proximus	Proximus Blind Snake	•			
Ramphotyphlops sp.	blind snake	•			
Ramphotyphlops wiedii	Brown-snouted Blind Snake	•			
Morelia spilota	Carpet / Diamond Python	•			
Morelia spilota spilota	Diamond Python	•			
Morelia spilota variegata	Carpet Python	•			
Dendrelaphis punctulata	Common Tree Snake	•			
Cacophis krefftii	Southern Dwarf Crowned Snake	•			
Cacophis squamulosus	Golden-crowned Snake	•			
Cryptophis nigrescens	Eastern Small-eyed Snake	•			
Demansia psammophis	Yellow-faced Whipsnake	•			

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Furina diadema	Red-naped Snake	•			
Hemiaspis signata	Black-bellied Swamp Snake	•			
Hoplocephalus bitorquatus	Pale-headed Snake	•			
Hoplocephalus stephensii	Stephens' Banded Snake	•			
Notechis scutatus	Tiger Snake	•			
Pseudechis porphyriacus	Red-bellied Black Snake	•			
Pseudonaja textilis	Eastern Brown Snake	•			
Vermicella annulata	Bandy-bandy	•			
Hydrophis elegans	Elegant Seasnake	•			
Pelamis platurus	Yellow-bellied Seasnake	•			
Birds					
Dromaius novaehollandiae	Emu	•			
Alectura lathami	Australian Brush-turkey	•		•	
Callipepla californica(I)	California Quail	•			
Coturnix pectoralis	Stubble Quail	•			
Coturnix ypsilophora	Brown Quail	•		•	•
Coturnix chinensis	King Quail	•	•		
Anseranas semipalmata	Magpie Goose	•	•	•	
Dendrocygna eytoni	Plumed Whistling-Duck	•		•	
Dendrocygna arcuata	Wandering Whistling-Duck	•		•	•
Cygnus atratus	Black Swan	•		•	•
Stictonetta naevosa	Freckled Duck	•		•	•
Tadorna tadornoides	Australian Shelduck	•		•	
Malacorhynchus membranaceus	Pink-eared Duck	•	•	•	•
Chenonetta jubata	Australian Wood Duck	•		•	•
Anas platyrhynchos(I)	Mallard	•		•	•
Anas superciliosa	Pacific Black Duck	•	•	•	•
Anas rhynchotis	Australasian Shoveler	•	•	•	•
Anas gracilis	Grey Teal	•		•	•
Anas castanea	Chestnut Teal	•	•	•	•
Anas querquedula	Garganey	•			
Aythya australis	Hardhead	•		•	•
Oxyura australis	Blue-billed Duck	•		•	•
Biziura lobata	Musk Duck	•		•	•
Anas clypeata	Northern Shoveler				•
Eudyptula minor	Little Penguin	•	•		
Diomedea epomophora	Royal Albatross	•			
Diomedea exulans	Wandering Albatross	•	•		
Phoebetria fusca	Sooty Albatross	•			
Thalassarche chlororhynchos	Yellow-nosed Albatross	•		•	
Thalassarche melanophrys	Black-browed Albatross	•		•	
Thalassarche cauta	Shy Albatross	•			
Macronectes giganteus	Southern Giant-Petrel	•			
Macronectes halli	Northern Giant-Petrel	•			
Daption capense	Cape Petrel	•			
Halobaena caerulea	Blue Petrel		•		

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Pachyptila desolata	Antarctic Prion		•		
Pachyptila turtur	Fairy Prion	•	•	•	
Pterodroma macroptera	Great-winged Petrel	•			
Pterodroma solandri	Providence Petrel	•	•		
Pterodroma leucoptera leucoptera	Gould's Petrel	•			
Procellaria parkinsoni	Black Petrel	•			
Procellaria westlandica	Westland Petrel	•			
Pterodroma cervicalis	White-necked Petrel	•			
Calonectris leucomelas	Streaked Shearwater	•			
Puffinus pacificus	Wedge-tailed Shearwater	•		•	
Puffinus bulleri	Buller's Shearwater	•	•		
Puffinus gavia	Fluttering Shearwater	•		•	
Puffinus huttoni	Hutton's Shearwater	•			
Puffinus assimilis	Little Shearwater	•			
Puffinus griseus	Sooty Shearwater	•			
Puffinus tenuirostris	Short-tailed Shearwater	•		•	
Puffinus carneipes	Flesh-footed Shearwater	•			
Oceanites oceanicus	Wilson's Storm-Petrel	•			
Pelagodroma marina	White-faced Storm-Petrel	•	•		
Pelecanoides urinatrix	Common Diving-Petrel	•			
Tachybaptus novaehollandiae	Australasian Grebe	•		•	•
Poliocephalus poliocephalus	Hoary-headed Grebe	•		•	•
Podiceps cristatus	Great Crested Grebe	•	•	•	•
Ephippiorhynchus asiaticus	Black-necked Stork	•		•	•
Threskiornis molucca	Australian White Ibis	•		•	•
Threskiornis spinicollis	Straw-necked Ibis	•		•	•
Plegadis falcinellus	Glossy Ibis	•		•	
Platalea regia	Royal Spoonbill	•		•	•
Platalea flavipes	Yellow-billed Spoonbill	•		•	•
Botaurus poiciloptilus	Australasian Bittern	•		•	•
Ixobrychus minutus	Little Bittern	•			
Ixobrychus flavicollis	Black Bittern	•		•	
Nycticorax caledonicus	Nankeen Night Heron	•		•	•
Butorides striata	Striated Heron	•	•	•	•
Bubulcus ibis	Cattle Egret	•	•	•	•
Ardea pacifica	White-necked Heron	•		•	•
Ardea alba	Great Egret	•		•	•
Egretta intermedia	Intermediate Egret	•	•	•	•
Egretta novaehollandiae	White-faced Heron	•		•	•
Egretta garzetta	Little Egret	•		•	•
Egretta sacra	Eastern Reef Egret	•			
Fregata ariel	Lesser Frigatebird	•			
Pelecanus conspicillatus	Australian Pelican	•		•	•
Morus serrator	Australasian Gannet	•	•	•	
Sula leucogaster	Brown Booby	•			

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Phalacrocorax melanoleucos	Little Pied Cormorant	•		•	•
Phalacrocorax sulcirostris	Little Black Cormorant	•		•	•
Phalacrocorax varius	Pied Cormorant	•	•	•	•
Phalacrocorax carbo	Great Cormorant	•	•	•	•
Anhinga melanogaster	Darter	•	•	•	•
Falco cenchroides	Australian Kestrel	•		•	•
Falco longipennis	Australian Hobby	•		•	•
Falco berigora	Brown Falcon	•		•	•
Falco hypoleucos	Grey Falcon	•			
Falco subniger	Black Falcon	•		•	•
Falco peregrinus	Peregrine Falcon	•		•	•
Pandion haliaetus	Osprey	•		•	•
Aviceda subcristata	Pacific Baza	•	•	•	
Lophoictinia isura	Square-tailed Kite	•			•
Hamirostra melanosternon	Black-breasted Buzzard	•			
Elanus axillaris	Black-shouldered Kite	•		•	•
Milvus migrans	Black Kite	•		•	•
Haliastur sphenurus	Whistling Kite	•	•	•	•
Haliastur indus	Brahminy Kite	•		•	•
Haliaeetus leucogaster	White-bellied Sea-Eagle	•		•	•
Circus approximans	Swamp Harrier	•		•	•
Circus assimilis	Spotted Harrier	•		•	•
Accipiter novaehollandiae	Grey Goshawk	•	•	•	
Accipiter fasciatus	Brown Goshawk	•		•	•
Accipiter cirrocephalus	Collared Sparrowhawk	•		•	•
Erythrotriorchis radiatus	Red Goshawk	•			
Aquila audax	Wedge-tailed Eagle	•		•	•
Hieraaetus morphnoides	Little Eagle	•		•	•
Gallirallus philippensis	Buff-banded Rail	•		•	•
Lewinia pectoralis	Lewin's Rail	•		•	
Porzana pusilla	Baillon's Crake	•		•	
Porzana fluminea	Australian Crake	•		•	•
Porzana tabuensis	Spotless Crake	•		•	•
Porphyrio porphyrio	Purple Swamphen	•	•	•	•
Gallinula tenebrosa	Dusky Moorhen	•	•	•	•
Gallinula ventralis	Black-tailed Native-hen				•
Fulica atra	Eurasian Coot	•	•	•	•
Turnix varius	Painted Button-quail	•			
Turnix pyrrhothorax	Red-chested Button-quail	•			
Burhinus grallarius	Bush Stone-curlew	•			
Haematopus longirostris	Pied Oystercatcher	•		•	•
Haematopus fuliginosus	Sooty Oystercatcher	•		•	•
Himantopus himantopus	Black-winged Stilt	•	•	•	•
Cladorhynchus leucocephalus	Banded Stilt	•		•	•
Recurvirostra novaehollandiae	Red-necked Avocet	•	•	•	•
Vanellus tricolor	Banded Lapwing	•	•	•	

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Vanellus miles	Masked Lapwing	•		•	•
Erythrogonys cinctus	Red-kneed Dotterel	•		•	•
Pluvialis fulva	Pacific Golden Plover	•	•	•	•
Pluvialis squatarola	Grey Plover	•		•	•
Charadrius ruficapillus	Red-capped Plover	•	•	•	•
Charadrius bicinctus	Double-banded Plover	•	•	•	•
Charadrius mongolus	Lesser Sand Plover	•	•	•	•
Charadrius leschenaultii	Greater Sand Plover	•		•	
Charadrius veredus	Oriental Plover	•		•	
Pluvialis dominica	Lesser Golden Plover	•			
Elseyornis melanops	Black-fronted Dotterel	•	•	•	•
Rostratula benghalensis	Painted Snipe (Australian subspecies)	•		•	•
Irediparra gallinacea	Comb-crested Jacana	•	•	•	
Gallinago hardwickii	Latham's Snipe	•		•	•
Limnodromus semipalmatus	Asian Dowitcher	•			
Limosa limosa	Black-tailed Godwit	•	•	•	•
Limosa haemastica	Hudsonian Godwit	•			
Limosa lapponica	Bar-tailed Godwit	•	•	•	•
Numenius minutus	Little Curlew	•		•	•
Numenius phaeopus	Whimbrel	•		•	•
Numenius madagascariensis	Eastern Curlew	•	•	•	•
Tringa stagnatilis	Marsh Sandpiper	•	•	•	•
Tringa nebularia	Common Greenshank	•	•	•	•
Tringa glareola	Wood Sandpiper	•		•	•
Xenus cinereus	Terek Sandpiper	•	•	•	•
Actitis hypoleucos	Common Sandpiper	•		•	•
Heteroscelus brevipes	Grey-tailed Tattler	•	•	•	•
Heteroscelus incanus	Wandering Tattler	•		•	•
Arenaria interpres	Ruddy Turnstone	•	•	•	•
Calidris tenuirostris	Great Knot	•	•	•	•
Calidris canutus	Red Knot	•	•	•	•
Calidris alba	Sanderling	•		•	
Calidris ruficollis	Red-necked Stint	•	•	•	•
Calidris minuta	Little Stint	•			
Calidris subminuta	Long-toed Stint				•
Calidris melanotos	Pectoral Sandpiper	•		•	•
Calidris acuminata	Sharp-tailed Sandpiper	•	•	•	•
Calidris ferruginea	Curlew Sandpiper	•	•	•	•
Calidris fuscicollis	White-rumped Sandpiper	•			
Limicola falcinellus	Broad-billed Sandpiper	•	•	•	•
Tryngites subruficollis	Buff-breasted Sandpiper	•		•	•
Philomachus pugnax	Ruff	•		•	•
Stiltia isabella	Australian Pratincole				•
Larus pacificus	Pacific Gull	•			
Larus dominicanus	Kelp Gull	•		•	

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Larus novaehollandiae	Silver Gull	•		•	•
Sterna nilotica	Gull-billed Tern	•		•	•
Sterna caspia	Caspian Tern	•		•	•
Sterna bergii	Crested Tern	•	•	•	•
Sterna striata	White-fronted Tern	•	•	•	
Sterna hirundo	Common Tern	•	•	•	•
Sterna paradisaea	Arctic Tern	•			
Sterna albifrons	Little Tern	•	•	•	•
Sterna nereis	Fairy Tern		•		
Sterna fuscata	Sooty Tern	•	•		
Chlidonias hybrida	Whiskered Tern	•		•	•
Chlidonias leucopterus	White-winged Black Tern	•		•	•
Anous stolidus	Common Noddy	•			
Procelsterna cerulea	Grey Ternlet	•			
Gygis alba	White Tern	•			
Stercorarius pomarinus	Pomarine Skua	•		•	
Stercorarius parasiticus	Arctic Skua	•		•	
Stercorarius longicaudus	Long-tailed Skua	•			
Stercorarius skua	Great Skua	•			
Columba livia[(I)]	Rock Dove	•		•	•
Columba leucomela	White-headed Pigeon	•		•	
Streptopelia chinensis[(I)]	Spotted Turtle-Dove	•		•	•
Macropygia amboinensis	Brown Cuckoo-Dove	•		•	•
Chalcophaps indica	Emerald Dove	•		•	
Phaps chalcoptera	Common Bronzewing	•		•	•
Phaps elegans	Brush Bronzewing	•			
Ocyphaps lophotes	Crested Pigeon	•		•	•
Leucosarcia melanoleuca	Wonga Pigeon	•		•	
Geopelia placida	Peaceful Dove	•		•	
Geopelia humeralis	Bar-shouldered Dove	•		•	•
Ptilinopus magnificus	Wompoo Fruit-Dove	•	•	•	
Ptilinopus superbus	Superb Fruit-Dove	•			
Ptilinopus regina	Rose-crowned Fruit-Dove	•	•	•	
Lopholaimus antarcticus	Topknot Pigeon	•		•	•
Calyptorhynchus lathami	Glossy Black-Cockatoo	•		•	
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	•		•	•
Callocephalon fimbriatum	Gang-gang Cockatoo	•			
Eolophus roseicapillus	Galah	•		•	•
Cacatua tenuirostris	Long-billed Corella	•		•	•
Cacatua sanguinea	Little Corella	•		•	
Cacatua galerita	Sulphur-crested Cockatoo	•		•	
Nymphicus hollandicus	Cockatiel	•		•	
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	•		•	
Glossopsitta concinna	Musk Lorikeet	•		•	
Glossopsitta pusilla	Little Lorikeet	•		•	
Barnardius zonarius	Australian Ringneck	•			

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Platycercus elegans	Crimson Rosella	•		•	
Platycercus adscitus eximius	Eastern Rosella	•		•	•
Psephotus haematonotus	Red-rumped Parrot	•	•	•	•
Neophema pulchella	Turquoise Parrot	•			
Lathamus discolor	Swift Parrot	•		•	
Pezoporus wallicus	Ground Parrot		•		
Alisterus scapularis	Australian King-Parrot	•		•	
Aprosmictus erythropterus	Red-winged Parrot	•			
Cuculus saturatus	Oriental Cuckoo	•		•	
Cuculus pallidus	Pallid Cuckoo	•		•	
Cacomantis variolosus	Brush Cuckoo	•		•	
Cacomantis flabelliformis	Fan-tailed Cuckoo	•		•	•
Chalcites osculans	Black-eared Cuckoo	•			
Chalcites basalis	Horsfield's Bronze-Cuckoo	•	•	•	•
Chalcites lucidus	Shining Bronze-Cuckoo	•	•	•	•
Scythrops novaehollandiae	Channel-billed Cuckoo	•		•	•
Eudynamys scolopacea	Common Koel				•
Centropus phasianinus	Pheasant Coucal	•		•	
Tyto tenebricosa	Sooty Owl	•			
Tyto novaehollandiae	Masked Owl	•	•	•	
Tyto alba	Barn Owl	•		•	•
Tyto capensis	Grass Owl	•			•
Ninox strenua	Powerful Owl	•	•	•	
Ninox connivens	Barking Owl	•			
Ninox boobook	Southern Boobook	•		•	
Podargus strigoides	Tawny Frogmouth	•		•	
Eurostopodus mystacalis	White-throated Nightjar	•		•	
Aegotheles cristatus	Australian Owlet-nightjar	•			
Hirundapus caudacutus	White-throated Needletail				•
Apus pacificus	Fork-tailed Swift	•		•	
Eurystomus orientalis	Dollarbird	•		•	•
Dacelo novaeguineae	Laughing Kookaburra	•		•	•
Todiramphus macleayii	Forest Kingfisher	•		•	
Todiramphus sanctus	Sacred Kingfisher	•	•	•	•
Todiramphus pyrrhopygia	Red-backed Kingfisher	•			
Alcedo azurea	Azure Kingfisher	•		•	
Merops ornatus	Rainbow Bee-eater	•	•	•	
Pitta versicolor	Noisy Pitta	•		•	
Menura novaehollandiae	Superb Lyrebird	•		•	
Cormobates leucophaea	White-throated Treecreeper	•		•	•
Climacteris picumnus	Brown Treecreeper	•		•	
Malurus lamberti	Variegated Fairy-wren	•		•	•
Malurus cyaneus	Superb Fairy-wren	•		•	•
Stipiturus malachurus	Southern Emu-wren	•	•	•	
Pardalotus punctatus	Spotted Pardalote	•		•	
Pardalotus striatus	Striated Pardalote	•		•	

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Pyrrholaemus sagittatus	Speckled Warbler	•			
Sericornis citreogularis	Yellow-throated Scrubwren	•		•	
Sericornis frontalis	White-browed Scrubwren	•	•	•	•
Sericornis magnirostra	Large-billed Scrubwren	•			
Smicrornis brevirostris	Weebill	•		•	
Gerygone mouki	Brown Gerygone	•		•	
Gerygone levigaster	Mangrove Gerygone	•		•	•
Gerygone fusca	Western Gerygone	•		•	
Gerygone olivacea	White-throated Gerygone	•	•	•	•
Acanthiza pusilla	Brown Thornbill	•		•	
Acanthiza reguloides	Buff-rumped Thornbill	•		•	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	•		•	•
Acanthiza nana	Yellow Thornbill	•		•	•
Acanthiza lineata	Striated Thornbill	•		•	•
Lichenostomus chrysops	Yellow-faced Honeyeater	•		•	•
Lichenostomus leucotis	White-eared Honeyeater	•		•	
Lichenostomus melanops	Yellow-tufted Honeyeater	•	•	•	
Lichenostomus fuscus	Fuscous Honeyeater	•		•	
Lichenostomus penicillatus	White-plumed Honeyeater	•		•	
Meliphaga lewinii	Lewin's Honeyeater	•	•	•	
Manorina melanophrys	Bell Miner	•		•	
Manorina melanocephala	Noisy Miner	•	•	•	•
Entomyzon cyanotis	Blue-faced Honeyeater	•		•	•
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subsp.)	•			
Melithreptus brevirostris	Brown-headed Honeyeater	•		•	
Melithreptus lunatus	White-naped Honeyeater	•	•	•	
Philemon citreogularis	Little Friarbird	•			
Philemon corniculatus	Noisy Friarbird	•	•	•	•
Plectorhyncha lanceolata	Striped Honeyeater	•		•	
Anthochaera chrysoptera	Little Wattlebird	•		•	•
Anthochaera carunculata	Red Wattlebird	•		•	•
Xanthomyza phrygia	Regent Honeyeater	•		•	
Lichmera indistincta	Brown Honeyeater	•	•	•	•
Phylidonyris pyrrhoptera	Crescent Honeyeater	•			
Phylidonyris novaehollandiae	New Holland Honeyeater	•	•	•	
Phylidonyris niger	White-cheeked Honeyeater	•	•	•	
Glyciphila melanops	Tawny-crowned Honeyeater	•	•	•	
Acanthorhynchus tenuirostris	Eastern Spinebill	•	•	•	
Myzomela sanguinolenta	Scarlet Honeyeater	•	•	•	•
Epthianura albifrons	White-fronted Chat	•	•	•	•
Eopsaltria australis	Eastern Yellow Robin	•	•	•	•
Melanodryas cucullata	Hooded Robin	•			
Microeca fascinans	Jacky Winter	•		•	•
Petroica rosea	Rose Robin	•		•	
Petroica phoenicea	Flame Robin	•			

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Petroica boodang	Scarlet Robin	•			
Petroica goodenovii	Red-capped Robin	•			
Orthonyx temminckii	Logrunner	•	•		
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subsp.)	•		•	
Pomatostomus superciliosus	White-browed Babbler	•			
Psophodes olivaceus	Eastern Whipbird	•		•	•
Cinclosoma punctatum	Spotted Quail-thrush	•	•		
Daphoenositta chrysoptera	Varied Sittella	•		•	
Pachycephala pectoralis	Golden Whistler	•		•	
Pachycephala rufiventris	Rufous Whistler	•		•	•
Colluricincla harmonica	Grey Shrike-thrush	•	•	•	•
Oreoica gutturalis	Crested Bellbird	•			
Falcunculus frontatus	Eastern Shrike-tit	•	•	•	
Rhipidura rufifrons	Rufous Fantail	•		•	•
Rhipidura albiscapa	Grey Fantail	•		•	•
Rhipidura leucophrys	Willie Wagtail	•	•	•	•
Dicrurus bracteatus	Spangled Drongo	•		•	•
Monarcha trivirgatus	Spectacled Monarch	•			
Monarcha melanopsis	Black-faced Monarch	•		•	
Grallina cyanoleuca	Magpie-lark	•	•	•	•
Myiagra rubecula	Leaden Flycatcher	•		•	
Myiagra cyanoleuca	Satin Flycatcher	•		•	
Myiagra inquieta	Restless Flycatcher	•		•	•
Cracticus torquatus	Grey Butcherbird	•		•	•
Cracticus nigrogularis	Pied Butcherbird	•		•	•
Gymnorhina tibicen	Australian Magpie	•	•	•	•
Strepera graculina	Pied Currawong	•		•	
Strepera versicolor	Grey Currawong	•			
Artamus leucorynchus	White-breasted Woodswallow	•		•	•
Artamus personatus	Masked Woodswallow	•			
Artamus superciliosus	White-browed Woodswallow	•		•	•
Artamus cyanopterus	Dusky Woodswallow	•		•	•
Coracina tenuirostris	Cicadabird	•		•	
Coracina novaehollandiae	Black-faced Cuckoo-shrike	•	•	•	•
Coracina papuensis	White-bellied Cuckoo-shrike	•		•	
Coracina maxima	Ground Cuckoo-shrike	•			
Lalage leucomela	Varied Triller	•			
Lalage tricolor	White-winged Triller	•		•	•
Sphecotheres vieilloti	Australasian Figbird	•			•
Oriolus sagittatus	Olive-backed Oriole	•		•	
Corvus orru	Torresian Crow	•		•	•
Corvus tasmanicus	Forest Raven	•			
Corvus coronoides	Australian Raven	•	•	•	•
Corcorax melanorhamphos	White-winged Chough	•		•	
Ailuroedus crassirostris	Green Catbird	•			

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Sericulus chrysocephalus	Regent Bowerbird	•	•	•	
Ptilonorhynchus violaceus	Satin Bowerbird	•		•	
Zoothera lunulata	Bassian Thrush	•	•	•	
Zoothera sp.	Unidentified ground thrush	•			
Turdus merula(I)	Eurasian Blackbird	•			
Sturnus vulgaris(I)	Common Starling	•		•	•
Acridotheres tristis(I)	Common Myna	•		•	•
Cheramoeca leucosterna	White-backed Swallow	•		•	
Hirundo neoxena	Welcome Swallow				•
Petrochelidon ariel	Fairy Martin	•		•	•
Petrochelidon nigricans	Tree Martin	•		•	•
Zosterops lateralis	Silvereye	•		•	•
Acrocephalus australis	Australian Reed-Warbler	•			
Acrocephalus stentoreus	Clamorous Reed-Warbler				•
Megalurus timoriensis	Tawny Grassbird	•		•	•
Megalurus gramineus	Little Grassbird	•	•	•	•
Cincloramphus mathewsi	Rufous Songlark	•		•	•
Cincloramphus cruralis	Brown Songlark	•		•	•
Cisticola exilis	Golden-headed Cisticola	•	•	•	•
Mirafra javanica	Horsfield's Bushlark	•		•	
Alauda arvensis(I)	Eurasian Skylark				•
Dicaeum hirundinaceum	Mistletoebird	•		•	•
Cinnyris jugularis	Olive-backed Sunbird	•			
Passer domesticus(I)	House Sparrow	•		•	•
Motacilla flava	Yellow Wagtail	•		•	•
Anthus australis	Australian Pipit	•			•
Stagonopleura bella	Beautiful Firetail	•			
Stagonopleura guttata	Diamond Firetail	•			
Neochmia temporalis	Red-browed Finch	•	•	•	•
Neochmia modesta	Plum-headed Finch	•			
Taeniopygia guttata	Zebra Finch	•	•	•	•
Taeniopygia bichenovii	Double-barred Finch	•		•	
Lonchura punctulata	Nutmeg Mannikin	•		•	
Lonchura castaneothorax	Chestnut-breasted Mannikin	•		•	•
Carduelis carduelis(I)	European Goldfinch	•		•	•
Numida meleagris (I)	Helmeted Guineafowl	•			
Mammals					
Ornithorhynchus anatinus	Platypus	•			
Tachyglossus aculeatus	Short-beaked Echidna	•	•		
Dasyurus maculatus	Spotted-tailed Quoll	•			
Dasyurus viverrinus	Eastern Quoll	•			
Dasyuridae sp.	Unidentified dasyurid	•			
Antechinus flavipes	Yellow-footed Antechinus	•			
Antechinus stuartii	Brown Antechinus	•	•		
Antechinus swainsonii	Dusky Antechinus	•			
Antechinus sp.	Unidentified antechinus	•			

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Phascogale tapoatafa	Brush-tailed Phascogale	•	•		
Planigale maculata	Common Planigale	•			
Sminthopsis murina	Common Dunnart	•			
Isoodon/Perameles sp.	Unidentified bandicoot	•			
Isoodon macrourus	Northern Brown Bandicoot	•	•		
Perameles nasuta	Long-nosed Bandicoot	•			
Phascolarctos cinereus	Koala	•			
Vombatus ursinus	Common Wombat	•			
Petaurus australis	Yellow-bellied Glider	•			
Petaurus breviceps	Sugar Glider	•			
Petaurus norfolcensis	Squirrel Glider	•	•		
Petaurus sp.	Glider	•			
Petauroides volans	Greater Glider	•			
Pseudocheirus peregrinus	Common Ringtail Possum	•			
Acrobates pygmaeus	Feathertail Glider	•	•		
Trichosurus arnhemensis	Northern Brushtail Possum	•			
Trichosurus caninus	Mountain Brushtail Possum	•			
Trichosurus vulpecula	Common Brushtail Possum	•			
Trichosurus sp.	Brushtail Possum	•			
Potorous tridactylus	Long-nosed Potoroo	•			
Macropus giganteus	Eastern Grey Kangaroo	•			
Macropus parryi	Whiptail Wallaby	•			
Macropus robustus	Euro	•	•		
Macropus rufogriseus	Red-necked Wallaby	•			
Macropus sp.	Kangaroo	•			
Petrogale penicillata	Brush-tailed Rock-wallaby	•			
Wallabia bicolor	Swamp Wallaby	•			
Pteropus poliocephalus	Grey-headed Flying-fox	•			
Pteropus scapulatus	Little Red Flying-fox	•			
Pteropus sp.	Flying-fox	•			
Rhinolophus megaphyllus	Eastern Horseshoe-bat	•	•		
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	•			
Chaerephon jobensis	Northern Freetail-bat		•		
Mormopterus loriae	Little Northern Freetail-bat	•			
Mormopterus norfolkensis	Eastern Freetail-bat	•			
Mormopterus planiceps	Southern Freetail-bat	•			
Tadarida australis	White-striped Freetail-bat	•			
Mormopterus sp.	Mastiff-bat	•			
Mormopterus sp.[(1)]	Undescribed mastiff-bat	•			
Kerivoula papuensis	Golden-tipped Bat	•			
Miniopterus australis	Little Bentwing-bat	•	•		
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	•	•		
Nyctophilus geoffroyi	Lesser Long-eared Bat	•			
Nyctophilus gouldi	Gould's Long-eared Bat	•	•		
Nyctophilus sp.	Long-eared Bat	•			
Chalinolobus dwyeri	Large-eared Pied Bat	•			

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Chalinolobus gouldii	Gould's Wattled Bat	•	•		
Chalinolobus morio	Chocolate Wattled Bat	•	•		
Falsistrellus tasmaniensis	Eastern False Pipistrelle	•			
Myotis macropus	Large-footed Myotis	•			
Scoteanax rueppellii	Greater Broad-nosed Bat	•			
Scotorepens orion	Eastern Broad-nosed Bat	•			
Vespadelus darlingtoni	Large Forest Bat	•	•		
Vespadelus pumilus	Eastern Forest Bat	•			
Vespadelus regulus	Southern Forest Bat	•			
Vespadelus sp.	Unidentified eptesicus	•			
Vespadelus vulturnus	Little Forest Bat	•	•		
Pseudomys novaehollandiae	New Holland Mouse	•	•		
Hydromys chrysogaster	Water-rat	•	•		
Melomys cervinipes	Fawn-footed Melomys	•			
Mus musculus(I)	House Mouse	•			
Rattus fuscipes	Bush Rat	•			
Rattus lutreolus	Swamp Rat	•			
Rattus norvegicus(I)	Brown Rat	•			
Rattus rattus(I)	Black Rat	•			
Rattus sp.(I)	Rat	•			
Dugong dugon	Dugong	•			
Arctocephalus forsteri	New Zealand Fur-seal	•			
Arctocephalus pusillus doriferus	Australian Fur-seal	•			
Arctocephalus sp.	Unidentified fur-seal	•			
Neophoca cinerea	Australian Sea-lion	•			
Hydrurga leptonyx	Leopard Seal	•			
Canis lupus(I)	Dingo, domestic dog	•			
Canis lupus familiaris(I)	Domestic Dog	•			
Vulpes vulpes(I)	Red Fox	•			
Felis catus(I)	Cat	•			
Lepus capensis(I)	Brown Hare	•			
Oryctolagus cuniculus(I)	Rabbit	•			
Equus caballus(I)	Horse	•			
Sus scrofa(I)	Pig	•			
Bos Taurus(I)	European cattle	•			
Capra hircus(I)	Goat	•			
Ovis aries(I)	Sheep (feral)	•			
Delphinus delphis	Common Dolphin	•			
Dolphin sp.	Unidentified dolphin	•			
Feresa attenuata	Pygmy Killer Whale	•			
Globicephala macrorhynchus	Short-finned Pilot Whale	•			
Peponocephala electra	Melon-headed Whale	•			
Stenella attenuata	Pantropical Spotted Dolphin	•			
Stenella coeruleoalba	Striped Dolphin	•			
Tursiops aduncus	Long-beaked Bottle-nosed Dolphin	•			
Tursiops truncatus	Bottlenose Dolphin	•			
Mesoplodon grayi	Gray's Beaked Whale	•			

Attachment F-D (Continued)
Fauna Records from the Surrounding Region

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Mesoplodon layardii	Strap-toothed Beaked Whale	•	•		
Physeter macrocephalus	Sperm Whale	•			
Kogia breviceps	Pygmy Sperm Whale	•			
Eubalaena australis	Southern Right Whale	•			
Balaenoptera acutorostrata	Dwarf Minke Whale	•			
Megaptera novaeangliae	Humpback Whale	•			

1 Nomenclature for species in accordance with Clayton *et al*. (2006).

2 DEC Atlas of NSW Wildlife records (Newcastle [9232], Port Stephens [9332] and Lake Macquarie [9231] 1:100,000 map sheets)

3 Searched using a search area of approximately 400 km^2 surrounding the Project site

(I) Introduced Species

ATTACHMENT F-E

THREATENED FAUNA RECORDED FROM THE WIDER REGION

Attachment F-E
Threatened Fauna Recorded from the Wider Region

Common Name	Scientific Name	Conservation Status		DEC Atlas of NSW Wildlife	Birds Australia	HBOC	Australian Museum	Closest DEC Atlas of NSW Wildlife record to Project	
		TSC Act[1]	EPBC Act[2]					Approximate Distance	Accuracy (km)
Amphibians									
Wallum Froglet	*Crinia tinnula*	V	-	•			•	12 km NE	0.02
Giant Barred Frog	*Mixophyes iteratus*	E	E	•				40 km SW	100
Red-crowned Toadlet	*Pseudophryne australis*	V	-	•				17 km SW	0.1
Green and Golden Bell Frog	*Litoria aurea*	E	V	•				Project site	0.1
Littlejohn's Tree Frog	*Litoria littlejohni*	V	V	•				25 km NW	10
Reptiles									
Loggerhead Turtle	*Caretta caretta*	E	E	•				23.5 km SW	0.1
Green Turtle	*Chelonia mydas*	V	V	•				6 km SE	1
Flatback Turtle	*Natator depressus*	-	V	•				30 km SW	0.1
Hawksbill Turtle	*Eretmochelys imbricata*	-	V	•				30 km SW	0.1
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	-	•				32 km NW	1
Stephens' Banded Snake	*Hoplocephalus stephensii*	V	-	•				34 km NE	1
Birds									
Magpie Goose	*Anseranas semipalmata*	V	-	•	•		•	1.5 km SW	0.1
Freckled Duck	*Stictonetta naevosa*	V	-	•	•	•		1 km NW	1
Blue-billed Duck	*Oxyura australis*	V	-	•	•	•		3 km SW	1
Royal Albatross	*Diomedea epomophora*	-	V	•				100 km S	100
Wandering Albatross	*Diomedea exulans*	E	V	•			•	59 km SE	10
Sooty Albatross	*Phoebetria fusca*	V	V	•				106 km S	100
Black-browed Albatross	*Thalassarche melanophris*	V	V	•	•			16 km S	10
Shy Albatross	*Thalassarche cauta*	V	V	•				35 km E	100
Southern Giant-Petrel	*Macronectes giganteus*	E	E	•				24 km SW	10
Northern Giant-Petrel	*Macronectes halli*	V	V	•				106 km S	100
Blue Petrel	*Halobaena caerulea*	-	V				•	Not applicable	
Providence Petrel	*Pterodroma solandri*	V	-	•			•	6 km SE	1

Attachment F-E (Continued)
Threatened Fauna Recorded from the Wider Region

Common Name	Scientific Name	Conservation Status		DEC Atlas of NSW Wildlife	Birds Australia	HBOC	Australian Museum	Closest DEC Atlas of NSW Wildlife record to Project	
		TSC Act[1]	EPBC Act[2]					Approximate Distance	Accuracy (km)
Gould's Petrel	*Pterodroma leucoptera leucoptera*	E	E	•				43 km NE	0.1
Little Shearwater	*Puffinus assimilis*	V	-	•				38 km SW	0.1
Flesh-footed Shearwater	*Puffinus carneipes*	V	-	•				39 km SW	0.1
Black-necked Stork	*Ephippiorhynchus asiaticus*	E	-	•	•	•		3 km NW	1
Australasian Bittern	*Botaurus poiciloptilus*	V	-	•	•	•		0.5 km N	1
Black Bittern	*Ixobrychus flavicollis*	V	-	•	•			1.5 km NW	0.1
Grey Falcon	*Falco hypoleucos*	V	-	•				31 km NW	0.1
Osprey	*Pandion haliaetus*	V	-	•	•	•		2 km SE	1
Square-tailed Kite	*Lophoictinia isura*	V	-	•		•		1 km N	1
Black-breasted Buzzard	*Hamirostra melanosternon*	V	-	•				11.5 km NW	10
Red Goshawk	*Erythrotriorchis radiatus*	E	V	•				78 km NW	100
Bush Stone-curlew	*Burhinus grallarius*	E	-	•				3 km E	1
Pied Oystercatcher	*Haematopus longirostris*	V	-	•	•	•		0.5 km E	1
Sooty Oystercatcher	*Haematopus fuliginosus*	V	-	•	•	•		6 km SE	0.1
Lesser Sand Plover	*Charadrius mongolus*	V	-	•	•	•	•	0.5 km S	0.1
Greater Sand Plover	*Charadrius leschenaultii*	V	-	•	•			1 km N	1
Painted Snipe (Australian subspecies)	*Rostratula benghalensis*	E	V	•	•	•		10 km SW	10
Comb-crested Jacana	*Irediparra gallinacea*	V	-	•	•		•	1 km NW	1
Black-tailed Godwit	*Limosa limosa*	V	-	•	•	•	•	0.5 km W	0.02
Terek Sandpiper	*Xenus cinereus*	V	-	•	•	•	•	1 km N	1
Great Knot	*Calidris tenuirostris*	V	-	•	•	•	•	0.5 km SE	1
Sanderling	*Calidris alba*	V	-	•	•			47 km SW	1
Broad-billed Sandpiper	*Limicola falcinellus*	V	-	•	•	•	•	1 km N	1
Little Tern	*Sterna albifrons*	E	-	•	•	•	•	1 km N	1
Sooty Tern	*Sterna fuscata*	V	-	•			•	12 km SW	10

Attachment F-E (Continued)
Threatened Fauna Recorded from the Wider Region

Common Name	Scientific Name	Conservation Status		DEC Atlas of NSW Wildlife	Birds Australia	HBOC	Australian Museum	Closest DEC Atlas of NSW Wildlife record to Project	
		TSC Act[1]	EPBC Act[2]					Approximate Distance	Accuracy (km)
Grey Ternlet	*Procelsterna cerulea*	V	-	•				106 km S	100
White Tern	*Gygis alba*	V	-	•				47 km SW	0.1
Wompoo Fruit-Dove	*Ptilinopus magnificus*	V	-	•	•		•	4.5 km SW	10
Superb Fruit-Dove	*Ptilinopus superbus*	V	-	•				4 km E	1
Rose-crowned Fruit-Dove	*Ptilinopus regina*	V	-	•	•		•	7.5 km SW	0.1
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	•	•			5 km NW	10
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	-	•				15 km SW	0.1
Turquoise Parrot	*Neophema pulchella*	V	-	•				3 km N	10
Swift Parrot	*Lathamus discolor*	E	E	•	•			0.5 km SE	1
Sooty Owl	*Tyto tenebricosa*	V	-	•				10 km SW	1
Masked Owl	*Tyto novaehollandiae*	V	-	•	•		•	5 km NW	10
Grass Owl	*Tyto capensis*	V	-	•		•		19.5 km NW	0.1
Powerful Owl	*Ninox strenua*	V	-	•	•		•	2 km E	1
Barking Owl	*Ninox connivens*	V	-	•				7.5 km SW	1
Brown Treecreeper	*Climacteris picumnus*	V	-	•	•			16.5 km NW	0.1
Speckled Warbler	*Pyrrholaemus sagittatus*	V	-	•				16.5 km NW	0.1
Black-chinned Honeyeater (eastern subsp.)	*Melithreptus gularis gularis*	V	-	•				12 km NW	0.02
Regent Honeyeater	*Xanthomyza phrygia*	E	E	•	•			7 km SW	1
Hooded Robin	*Melanodryas cucullata*	V	-	•				10 km NW	10
Grey-crowned Babbler (eastern subsp.)	*Pomatostomus temporalis temporalis*	V	-	•	•			13 km NW	0.02
Diamond Firetail	*Stagonopleura guttata*	V	-	•				32.5 km NW	0.1

Attachment F-E (Continued)
Threatened Fauna Recorded from the Wider Region

Common Name	Scientific Name	Conservation Status		DEC Atlas of NSW Wildlife	Birds Australia	HBOC	Australian Museum	Closest DEC Atlas of NSW Wildlife record to Project	
		TSC Act[1]	EPBC Act[2]					Approximate Distance	Accuracy (km)
Mammals									
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	•				13 km NE	1
Eastern Quoll	*Dasyurus viverrinus*	E	-	•				70 km SW	100
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-	•			•	6 km NW	1
Common Planigale	*Planigale maculata*	V	-	•				38 km SW	0.1
Koala	*Phascolarctos cinereus*	V	-	•				27 km NE	1
Yellow-bellied Glider	*Petaurus australis*	V	-	•				15 km NW	1
Squirrel Glider	*Petaurus norfolcensis*	V	-	•			•	2 km E	1
Long-nosed Potoroo	*Potorous tridactylus*	V	V	•				35 km NE	0.1
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V	•				63 km W	100
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	•				Project site	1
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	•				9.5 km NE	0.1
Eastern Freetail-bat	*Mormopterus norfolkensis*	V	-	•				5 km NW	1
Golden-tipped Bat	*Kerivoula papuensis*	V	-	•				26 km N	1
Little Bentwing-bat	*Miniopterus australis*	V	-	•			•	4 km SW	1
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V	-	•				0.5 km S	1
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	•				12 km SW	0.1
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	•				12.5 km NW	10
Large-footed Myotis	*Myotis adversus*	V	-	•				2 km NW	0.1
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	•				4.5 km N	0.1
Dugong	*Dugong dugon*	E	-	•				5 km SE	1
New Zealand Fur-seal	*Arctocephalus forsteri*	V	-	•				6 km SE	1

Attachment F-E (Continued)
Threatened Fauna Recorded from the Wider Region

Common Name	Scientific Name	Conservation Status		DEC Atlas of NSW Wildlife	Birds Australia	HBOC	Australian Museum	Closest DEC Atlas of NSW Wildlife record to Project	
		TSC Act[1]	EPBC Act[2]					Approximate Distance	Accuracy (km)
Australian Fur-seal	*Arctocephalus pusillus doriferus*	V	-	•				46 km SW	0.1
Australian Sea Lion	*Neophoca cinerea*	-	V	•				40.5 km SW	1
Sperm Whale	*Physeter macrocephalus*	V	-	•				36 km SW	1
Southern Right Whale	*Eubalaena australis*	V	E	•				15 km SW	0.1
Humpback Whale	*Megaptera novaeangliae*	V	V	•				4 km SE	1

ATTACHMENT F-F

FAUNA SPECIES RECORDED IN THE PROJECT SITE

Attachment F-F
Fauna Species Recorded in the Project site

Scientific Name	Common Name	BPHOS[1]	Protech Steel[2]	RLMC[3]	Umwelt[4]
Accipiter cirrhocephalus	Collared Sparrowhawk			•	
Anas castanea	Chestnut Teal		•	•	•
Anas platyrhynchos	Mallard			•	
Anas superciliosa	Pacific Black Duck			•	
Anthus australis	Australian Pipit		•		
Ardea novaehollandiae	White-faced Heron			•	
Ardea pacifica	White-necked Heron				•
Ardeola ibis	Cattle Egret			•	
Botaurus poiciloptilus	Australasian Bittern			•	
Calidris acuminata	Sharp-tailed Sandpiper			•	
Canis lupus familiaris	Dingo and Domestic Dog (feral)		•		
Chalinolobus gouldii	Gould's Wattled Bat			•	
Chalinolobus morio	Chocolate Wattled Bat			•	
Chelodina longicollis	Long-necked Tortoise			•	
Cisticola exilis	Golden-headed Cisticola		•	•	
Columba livia	Rock Dove		•	•	
Corvus coronoides	Australian Raven		•	•	
Coturnix ypsilophora	Brown Quail		•		
Crinia signifera	Common Eastern Froglet	•	•	•	
Ctenotus robustus	Robust Skink			•	
Cygnus atratus	Black Swan			•	
Egretta alba	Great Egret				•
Egretta garzetta	Little Egret			•	
Egretta intermedia	Intermediate Egret			•	
Egretta novaehollandiae	White-faced Heron		•		•
Elanus axillaris	Black-shouldered Kite		•	•	•
Elseyornis melanops	Black-fronted Dotteral	•			
Epthianura albifrons	White-fronted Chat		•		
Eulamprus quoyii	Eastern Water-skink		•		
Eulamprus tenuis	Barred-sided Skink			•	
Falco berigora	Brown Falcon	•			
Falco cenchroides	Australian Kestrel		•	•	
Fulica atra	Eurasian Coot		•		
Gallinula tenebrosa	Dusky Moorhen			•	
Gambusia holbrooki	Mosquito Fish		•		
Geopelia humeralis	Bar-shouldered Dove		•		
Gerygone levigaster	Mangrove warbler			•	
Grallina cyanoleuca	Magpie-lark		•	•	
Gymnorhina tibicen	Australian Magpie		•	•	
Haliaeetus leucogaster	White-bellied Sea-eagle			•	
Haliastur sphenurus	Whistling Kite			•	
Hemiaspis signata	Black-bellied Swamp Snake			•	
Himantopus himantopus	Black-winged Stilt			•	
Hirundo nigricans	Tree Martin	•			
Hirundo neoxena	Welcome Swallow	•	•	•	
Lampropholis delicata	Grass Skink		•	•	

Attachment F-F (Continued)
Fauna Species Recorded in the Project site

Scientific Name	Common Name	BPHOS[1]	Protech Steel[2]	RLMC[3]	Umwelt[4]
Lampropholis guichenoti	Garden Skink		•		
Larus novaehollandiae	Silver Gull			•	•
Lepus capensis	Brown Hare		•	•	
Lichmera indistincta	Brown Honeyeater				•
Limnodynastes ornatus	Ornate Burrowing Frog			•	•
Limnodynastes peronii	Brown-striped Frog		•	•	
Limnodynastes tasmaniensis	Spotted Grass Frog		•	•	•
Litoria aurea	Green and Golden Bell Frog			•	
Litoria caerulea	Green Tree Frog			•	
Litoria dentata	Bleating Tree Frog			•	
Litoria fallax	Eastern Dwarf Tree Frog		•	•	
Litoria latopalmata	Broad-palmed Frog			•	
Litoria peronii	Peron's Tree Frog			•	
Lonchura castaneothorax	Chestnut-breasted Mannikin		•		
Malurus cyaneus	Superb Fairy-wren	•	•	•	
Megalurus timoriensis	Tawny Grassbird	•			
Miniopterus australis	Little Bent-wing Bat			•	
Mormopterus norfolkensis	Eastern Freetail Bat			•	
Mormopterus sp.	Little Freetail Bat			•	
Myotis adversus	Large-footed Myotis			•	
Numenius madagascariensis	Eastern Curlew			•	
Nycticorax caledonicus	Nankeen Night Heron			•	
Nyctophilus sp.	Unidentified Long-eared Bat			•	
Oryctolagus cuniculus	European Rabbit			•	
Pelecanus conspicillatus	Pelican	•		•	•
Phalacrocorax carbo	Great Cormorant				•
Phalacrocorax melanoleucos	Little Pied Cormorant		•	•	
Phalacrocorax sulcirostris	Little Black Cormorant			•	
Platalea regia	Royal Spoonbill			•	
Porphyrio porphyrio	Purple Swamphen			•	
Pseudechis porphyriacus	Red-bellied Black Snake			•	
Pseudonaja textilis	Eastern Brown Snake			•	
Pteropus poliocephalus	Grey-headed Flying-fox			• (Tentative)	•
Recurvirostra novaehollandiae	Red-necked Avocet			•	
Rhipidura albiscapa	Grey Fantail	•			
Rhipidura leucophrys	Willie Wagtail	•	•	•	
Scoteanax rueppelii	Greater Broad-nosed Bat			•	
Scotorepens orion	Eastern Broad-nosed Bat			•	
Stagonopleura guttata	Diamond Firetail		•		
Streptopelia chinensis	Spotted Turtle-Dove		•		
Sturnus vulgaris	Common Starling		•		•
Sus scrofa	Pig			•	
Tadarida australis	White-striped Mastiff Bat			•	
Threskiornis aethiopica	Sacred Ibis			•	
Threskiornis molucca	Australian White Ibis	•	•		

Attachment F-F (Continued)
Fauna Species Recorded in the Project site

Scientific Name	Common Name	BPHOS[1]	Protech Steel[2]	RLMC[3]	Umwelt[4]
Threskiornis spinicollis	Straw-necked Ibis			•	
Tringa stagnatilis	Marsh Sandpiper			•	
Tyto alba	Barn Owl				•
Vanellus miles	Masked Lapwing		•	•	•
Vespadelus vulturnus	Little Forest Bat			•	•
Vulpes vulpes	Red Fox		•	•	
Zosterops lateralis	Silvereye		•		

1 Department of Commerce (2005) *Big Pond Habitat Offset Scheme Flora and Fauna Studies*. Prepared by GHD.

2 Protech Steel (2001) *Protech Proposed Cold Mill Facility Kooragang Island EIS*.

3 RLMC (2003) *Kooragang Port and Transport Corridor, Species Impact Statement*. Prepared by ERM.

4 Umwelt (2003b) *Terrestrial Ecology Impact Assessment Report – Proposed Extension of Shipping Channels, Port of Newcastle*. Report prepared for NSW Waterways Authority.

* Introduced species

ATTACHMENT F-G

GREEN AND GOLDEN BELL FROG HABITAT SUITABILITY

LEGEND
- Study Site
- Suitable GGBF Habitat

GGBF - Green and Golden Bell Frog

SCALE 1:12,020
0 50 100 200 300 400 m

Proposed Coal Unloader
Kooragang Island
Seasonal Ecological Investigations

NOTE: Display at A3

FIGURE 3.1
GREEN AND GOLDEN BELL FROG
HABITAT SUITABILITY

ATTACHMENT F-H

GREEN AND GOLDEN BELL FROG RECORDS WITHIN STUDY AREA

Proposed Coal Unloader
Kooragang Island
Seasonal Ecological Investigations

NOTE: Display at A3

FIGURE 3.2
GREEN AND GOLDEN BELL FROG
RECORDS WITHIN STUDY AREA

ATTACHMENT F-I

AUSTRALASIAN BITTERN HABITAT AND RECORDS

Proposed Coal Unloader
Kooragang Island
Seasonal Ecological Investigations

Hamer, A. pers. comm.
19/3/2006

NOTE: Display at A3

FIGURE 4.1
AUSTRALASIAN BITTERN
HABITAT AND RECORDS

ATTACHMENT F-J

BIRD SPECIES RECORDED BY THE SHOREBIRD STUDY AND HABITAT ASSESSMENT

Attachment F-J
Bird Species Recorded by the Shorebird Study and Habitat Assessment

Common Name	Scientific Name	Deep Pond	Pond A	Ponds B, C, D, E, F, G and Deep Pond East	Pond H	Pond I	Pond K	Pond L	Big Pond
Australasian Grebe	*Tachybaptus novaehollandiae*	●		●	●	●			
Australasian Shoveler	*Anas rhynchotis*	●		●					
Australian Hobby	*Falco longipennis*	●				●			
Australian Kestrel	*Falco cenchroides*	●							
Australian Magpie	*Gymnorhina tibicen*						●		
Australian Pelican	*Pelecanus conspicillatus*	●		●	●	●	●	●	
Australian Pipit	*Anthus australis*				●	●			
Australian Raven	*Corvus coronoides*								●
Australian White Ibis	*Threskiornis molucca*	●	●	●		●	●		
Black-faced Cuckoo-Shrike	*Coracina novaehollandiae*							●	
Black-fronted Dotterel	*Elseyornis melanops*	●	●		●	●	●		
Black-tailed Godwit[1]	*Limosa limosa*	●							
Black-shouldered Kite	*Elanus axillaris*	●					●		
Black-winged Stilt	*Himantopus himantopus*	●							
Black Swan	*Cygnus atratus*	●	●	●	●	●	●	●	
Blue-billed Duck	*Oxyura australis*	●			●				
Brown Goshawk	*Accipeter fasciatus*	●					●		
Brown Quail	*Coturnix ypsilophora*	●				●			
Buff-banded Rail	*Gallirallus philippensis*	●	●		●				
Caspian Tern[1]	*Sterna caspia*	●							
Cattle Egret[1]	*Bubulcus ibis*	●							
Chestnut-breasted Mannikin	*Lonchura castaneothorax*								●
Chestnut Teal	*Anas castanea*	●	●	●	●		●	●	
Clamorous Reed Warbler[1]	*Acrocephalus sterntoreus*	●	●	●	●	●	●	●	●
Common Greenshank[1]	*Tringa nebularia*	●					●		
Common Starling	*Sturnus vulgaris*					●			●
Curlew Sandpiper[1]	*Calidris ferruginea*	●							
Darter	*Anhinga melanogaster*	●							
Double-banded Plover[1]	*Charadrius bicinctus*	●							
Dusky Moorhen	*Gallinula tenebrosa*	●	●	●	●			●	
Eurasian Coot	*Fulica atra*	●							
Fairy Martin	*Petrochelidon ariel*	●			●	●	●		
Freckled Duck	*Stictonetta naevosa*	●							
Golden-headed Cisticola	*Cisticola exilis*	●	●	●	●	●	●		●
Great Cormorant	*Phalacrocorax carbo*	●		●					
Great Egret[1]	*Ardea alba*	●							
Grey Teal	*Anas gracilis*	●	●	●	●			●	
Hardhead	*Aythya australis*	●		●	●	●			
Hoary-headed Grebe	*Poliocephalus poliocephalus*	●							

Attachment F-J (Continued)
Bird Species Recorded by the Shorebird Study and Habitat Assessment

Common Name	Scientific Name	Deep Pond	Pond A	Ponds B, C, D, E, F, G and Deep Pond East	Pond H	Pond I	Pond K	Pond L	Big Pond
Intermediate Egret	*Egretta intermedia*	●							
Little Black Cormorant	*Phalacrocorax sulcirostris*	●		●	●	●	●		
Little Egret	*Egretta garzetta*	●		●		●	●	●	
Little Grassbird	*Megalurus gramineus*	●	●	●	●	●	●		
Little Grebe	*Tachybaptus ruficollis*				●				
Little Pied Cormorant	*Phalacrocorax melanoleucos*	●		●		●	●		
Magpie-Lark	*Grallina cyanoleuca*	●				●	●		
Marsh Sandpiper[1]	*Tringa stagnatilis*	●							
Masked Lapwing	*Vanellus miles*	●	●			●	●		
Musk Duck	*Biziura lobata*	●			●		●		
Pacific Black Duck	*Anas superciliosa*	●	●	●	●	●	●	●	
Peregrine Falcon	*Falco peregrinus*	●							
Pied Cormorant	*Phalacrocorax varius*	●					●		
Pink-eared Duck	*Malacorhynchus membranaceus*	●							
Purple Swamphen	*Porphyrio porphyrio*	●	●		●	●	●	●	
Red-capped Plover	*Charadrius ruficapillus*	●							
Red-kneed Dotterel	*Erythrogonys cinctus*	●							
Red-necked Avocet	*Recurvirostra novaehollandiae*	●							
Royal Spoonbill	*Platalea regia*	●	●	●			●		
Sharp-tailed Sandpiper[1]	*Calidris acuminata*	●							
Silvereye	*Zosterops lateralis*								●
Silver Gull	*Larus novaehollandiae*	●							
Spotted Harrier	*Circus assimilis*	●							
Straw-necked Ibis	*Threskiornis spinicollis*	●							
Superb Fairy-wren	*Malurus cyaneus*								●
Swamp Harrier	*Circus approximans*	●	●		●	●	●		
Tawny Grassbird	*Megalurus timoriensis*	●			●	●			
Tree Martin	*Petrochelidon nigricans*	●			●	●			
Wandering Whistling-Duck	*Dendrocygna arcuata*	●							
Wedge-tailed Eagle	*Aquila audax*	●					●		
Welcome Swallow	*Hirundo neoxena*	●	●		●	●	●	●	
Whiskered Tern	*Chlidonias hybrida*	●							
Whistling Kite	*Haliastur sphenurus*	●				●			
White-bellied Sea-Eagle[1]	*Haliaeetus leucogaster*	●			●				
White-breasted Woodswallow	*Artamus leucorynchus*	●					●	●	●
White-faced Heron	*Egretta novaehollandiae*	●			●	●	●	●	
White-fronted Chat	*Epthianura albifrons*	●			●	●	●		●
White-winged Black Tern[1]	*Chlidonias leucopterus*	●							
Yellow-billed Spoonbill	*Platalea flavipes*	●							

Source: Avifauna Research and Services (2006)
[1] Migratory species listed under EPBC Act.

ATTACHMENT F-K

MIGRATORY SPECIES RECORDED IN THE SURROUNDING AREA

Attachment F-K
Migratory Species Recorded in the Surrounding Area

Common Name[1]	Scientific Name	Atlas Records[2]	Project Survey[3]	Australian Museum[4]	Birds Australia[4]	HBOC[4]
Loggerhead Turtle	*Caretta caretta*	•				
Green Turtle	*Chelonia mydas*	•				
Hawksbill Turtle	*Eretmochelys imbricata*	•				
Flatback Turtle	*Natator depressus*	•				
Garganey	*Anas querquedula*	•				
Royal Albatross	*Diomedea epomophora*	•				
Wandering Albatross	*Diomedea exulans*	•		•		
Sooty Albatross	*Phoebetria fusca*	•				
Southern Giant-Petrel	*Macronectes giganteus*	•				
Northern Giant-Petrel	*Macronectes halli*	•				
Providence Petrel	*Pterodroma solandri*	•		•		
Gould's Petrel	*Pterodroma leucoptera leucoptera*	•				
Black Petrel	*Procellaria parkinsoni*	•				
Westland Petrel	*Procellaria westlandica*	•				
Streaked Shearwater	*Calonectris leucomelas*	•				
Wedge-tailed Shearwater	*Puffinus pacificus*	•			•	
Sooty Shearwater	*Puffinus griseus*	•				
Short-tailed Shearwater	*Puffinus tenuirostris*	•			•	
Flesh-footed Shearwater	*Puffinus carneipes*	•				
Wilson's Storm-Petrel	*Oceanites oceanicus*	•				
Glossy Ibis	*Plegadis falcinellus*	•			•	
Cattle Egret	*Bubulcus ibis*	•	•	•	•	•
Eastern Reef Egret	*Egretta sacra*	•				
Great Egret	*Ardea alba*	•	•		•	•
Lesser Frigatebird	*Fregata ariel*	•				
Brown Booby	*Sula leucogaster*	•				
Osprey	*Pandion haliaetus*	•			•	•
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	•	•		•	•
Pacific Golden Plover	*Pluvialis fulva*	•		•	•	•
Grey Plover	*Pluvialis squatarola*	•			•	•
Double-banded Plover	*Charadrius bicinctus*	•	•	•	•	•
Lesser Sand Plover	*Charadrius mongolus*	•		•	•	•
Greater Sand Plover	*Charadrius leschenaultii*	•			•	
Oriental Plover	*Charadrius veredus*	•			•	
Painted Snipe (Australian subspecies)	*Rostratula benghalensis*	•			•	•
Latham's Snipe	*Gallinago hardwickii*	•			•	•
Asian Dowitcher	*Limnodromus semipalmatus*	•			•	•
Black-tailed Godwit	*Limosa limosa*	•	•	•	•	•
Bar-tailed Godwit	*Limosa lapponica*	•		•	•	•
Little Curlew	*Numenius minutus*	•			•	•
Whimbrel	*Numenius phaeopus*	•			•	•
Eastern Curlew	*Numenius madagascariensis*	•		•	•	•
Marsh Sandpiper	*Tringa stagnatilis*	•	•	•	•	•
Common Greenshank	*Tringa nebularia*	•	•	•	•	•
Wood Sandpiper	*Tringa glareola*	•			•	•
Terek Sandpiper	*Xenus cinereus*	•		•	•	•
Common Sandpiper	*Actitis hypoleucos*	•			•	•

Attachment F-K (Continued)
Migratory Species Recorded in the Surrounding Area

Common Name[1]	Scientific Name	Atlas Records[2]	Project Survey[3]	Australian Museum[4]	Birds Australia[4]	HBOC[4]
Ruddy Turnstone	*Arenaria interpres*	•		•	•	•
Great Knot	*Calidris tenuirostris*	•		•	•	•
Red Knot	*Calidris canutus*	•		•	•	•
Sanderling	*Calidris alba*	•			•	
Red-necked Stint	*Calidris ruficollis*	•		•	•	•
Long-toed Stint	*Calidris subminuta*	•				•
Pectoral Sandpiper	*Calidris melanotos*	•			•	•
Sharp-tailed Sandpiper	*Calidris acuminata*	•	•	•	•	•
Curlew Sandpiper	*Calidris ferruginea*	•	•	•	•	•
Broad-billed Sandpiper	*Limicola falcinellus*	•		•	•	•
Buff-breasted Sandpiper	*Tryngites subruficollis*	•			•	•
Ruff	*Philomachus pugnax*	•			•	•
Common Tern	*Sterna hirundo*	•		•	•	•
Arctic Tern	*Sterna paradisaea*	•				
Little Tern	*Sterna albifrons*	•		•	•	•
White-winged Black Tern	*Chlidonias leucopterus*	•	•		•	•
Caspian Tern	*Sterna caspia*	•	•		•	•
Common Noddy	*Anous stolidus*	•				
Pomarine Skua	*Stercorarius pomarinus*	•			•	
Arctic Skua	*Stercorarius parasiticus*	•			•	
Long-tailed Skua	*Stercorarius longicaudus*	•				
Oriental Cuckoo	*Cuculus saturatus*	•			•	
White-throated Needletail	*Hirundapus caudacutus*					•
Fork-tailed Swift	*Apus pacificus*	•			•	
Rainbow Bee-eater	*Merops ornatus*	•		•	•	
Regent Honeyeater	*Xanthomyza phrygia*	•			•	
Rufous Fantail	*Rhipidura rufifrons*	•			•	•
Spectacled Monarch	*Monarcha trivirgatus*	•				
Black-faced Monarch	*Monarcha melanopsis*	•			•	
Satin Flycatcher	*Myiagra cyanoleuca*	•			•	
Yellow Wagtail	*Motacilla flava*	•			•	•
Lesser Golden Plover	*Pluvialis dominica*	•				•
Clamorous Reed-Warbler	*Acrocephalus stentoreus*	•				•
Northern Shoveler	*Anas clypeata*					•

1 Nomenclature for species in accordance with Clayton *et al*. (2006).

2 DEC Atlas of NSW Wildlife records (Newcastle [9232], Port Stephens [9332] and Lake Macquarie [9231] 1:100,000 map sheets)

3 Recorded in the Project surveys (Avifauna Research and Services, 2006)

4 Searched using a search area of approximately 400 km^2 surrounding the Project site

ATTACHMENT F-L

PROTECTED MARINE SPECIES RECORDED IN THE SURROUNDING AREA

Attachment F-L
Protected Marine Species Recorded in the Surrounding Area

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Reptiles					
Caretta caretta	Loggerhead Turtle	•			
Chelonia mydas	Green Turtle	•			
Eretmochelys imbricata	Hawksbill Turtle	•			
Natator depressus	Flatback Turtle	•			
Hydrophis elegans	Elegant Seasnake	•			
Pelamis platurus	Yellow-bellied Seasnake	•			
Birds					
Coturnix pectoralis	Stubble Quail	•			
Anseranas semipalmata	Magpie Goose	•	•	•	
Dendrocygna arcuata	Wandering Whistling-Duck	•		•	•
Anas querquedula	Garganey	•			
Biziura lobata	Musk Duck	•		•	•
Anas clypeata	Northern Shoveler				•
Diomedea epomophora	Royal Albatross	•			
Diomedea exulans	Wandering Albatross	•	•		
Phoebetria fusca	Sooty Albatross	•			
Thalassarche chlororhynchos	Yellow-nosed Albatross	•		•	
Thalassarche melanophrys	Black-browed Albatross	•		•	
Thalassarche cauta	Shy Albatross	•			
Macronectes giganteus	Southern Giant-Petrel	•			
Macronectes halli	Northern Giant-Petrel	•			
Daption capense	Cape Petrel	•			
Halobaena caerulea	Blue Petrel		•		
Pachyptila desolata	Antarctic Prion		•		
Pachyptila turtur	Fairy Prion	•	•	•	
Pterodroma macroptera	Great-winged Petrel	•			
Pterodroma solandri	Providence Petrel	•	•		
Pterodroma leucoptera leucoptera	Gould's Petrel	•			
Procellaria parkinsoni	Black Petrel	•			
Procellaria westlandica	Westland Petrel	•			
Pterodroma cervicalis	White-necked Petrel	•			
Calonectris leucomelas	Streaked Shearwater	•			
Puffinus pacificus	Wedge-tailed Shearwater	•		•	
Puffinus bulleri	Buller's Shearwater	•	•		
Puffinus gavia	Fluttering Shearwater	•		•	
Puffinus huttoni	Hutton's Shearwater	•			
Puffinus assimilis	Little Shearwater	•			
Puffinus griseus	Sooty Shearwater	•			
Puffinus tenuirostris	Short-tailed Shearwater	•		•	
Puffinus carneipes	Flesh-footed Shearwater	•			
Oceanites oceanicus	Wilson's Storm-Petrel	•			
Pelagodroma marina	White-faced Storm-Petrel	•	•		
Pelecanoides urinatrix	Common Diving-Petrel	•			
Threskiornis molucca	Australian White Ibis	•		•	•
Threskiornis spinicollis	Straw-necked Ibis	•		•	•
Plegadis falcinellus	Glossy Ibis	•		•	

Attachment F-L (Continued)
Protected Marine Species Recorded in the Surrounding Area

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Nycticorax caledonicus	Nankeen Night Heron	•		•	•
Bubulcus ibis	Cattle Egret	•	•	•	•
Ardea pacifica	White-necked Heron	•		•	•
Ardea alba	Great Egret	•		•	•
Egretta intermedia	Intermediate Egret	•	•	•	•
Egretta garzetta	Little Egret	•		•	•
Egretta sacra	Eastern Reef Egret	•			
Fregata ariel	Lesser Frigatebird	•			
Pelecanus conspicillatus	Australian Pelican	•		•	•
Morus serrator	Australasian Gannet	•	•	•	
Sula leucogaster	Brown Booby	•			
Falco cenchroides	Australian Kestrel	•		•	•
Pandion haliaetus	Osprey	•		•	•
Haliastur sphenurus	Whistling Kite	•	•	•	•
Haliastur indus	Brahminy Kite	•		•	•
Haliaeetus leucogaster	White-bellied Sea-Eagle	•		•	•
Circus approximans	Swamp Harrier	•		•	•
Accipiter fasciatus	Brown Goshawk	•		•	•
Porzana pusilla	Baillon's Crake	•		•	
Porzana tabuensis	Spotless Crake	•		•	•
Porphyrio porphyrio	Purple Swamphen	•	•	•	•
Himantopus himantopus	Black-winged Stilt	•	•	•	•
Recurvirostra novaehollandiae	Red-necked Avocet	•	•	•	•
Pluvialis fulva	Pacific Golden Plover	•	•	•	•
Pluvialis squatarola	Grey Plover	•		•	•
Charadrius ruficapillus	Red-capped Plover	•	•	•	•
Charadrius bicinctus	Double-banded Plover	•	•	•	•
Charadrius mongolus	Lesser Sand Plover	•	•	•	•
Charadrius leschenaultii	Greater Sand Plover	•		•	
Charadrius veredus	Oriental Plover	•		•	
Pluvialis dominica	Lesser Golden Plover	•			
Rostratula benghalensis	Painted Snipe (Australian subspecies)	•		•	•
Gallinago hardwickii	Latham's Snipe	•		•	•
Limnodromus semipalmatus	Asian Dowitcher	•			
Limosa limosa	Black-tailed Godwit	•	•	•	•
Limosa lapponica	Bar-tailed Godwit	•	•	•	•
Numenius minutus	Little Curlew	•		•	•
Numenius phaeopus	Whimbrel	•		•	•
Numenius madagascariensis	Eastern Curlew	•	•	•	•
Tringa stagnatilis	Marsh Sandpiper	•	•	•	•
Tringa nebularia	Common Greenshank	•	•	•	•
Tringa glareola	Wood Sandpiper	•		•	•
Xenus cinereus	Terek Sandpiper	•	•	•	•
Actitis hypoleucos	Common Sandpiper	•		•	•
Heteroscelus brevipes	Grey-tailed Tattler	•	•	•	•
Heteroscelus incanus	Wandering Tattler	•		•	•
Arenaria interpres	Ruddy Turnstone	•	•	•	•

Attachment F-L (Continued)
Protected Marine Species Recorded in the Surrounding Area

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Calidris tenuirostris	Great Knot	•	•	•	•
Calidris canutus	Red Knot	•	•	•	•
Calidris alba	Sanderling	•		•	
Calidris ruficollis	Red-necked Stint	•	•	•	•
Calidris minuta	Little Stint	•			
Calidris subminuta	Long-toed Stint				•
Calidris melanotos	Pectoral Sandpiper	•		•	•
Calidris acuminata	Sharp-tailed Sandpiper	•	•	•	•
Calidris ferruginea	Curlew Sandpiper	•	•	•	•
Limicola falcinellus	Broad-billed Sandpiper	•	•	•	•
Tryngites subruficollis	Buff-breasted Sandpiper	•		•	•
Philomachus pugnax	Ruff	•		•	•
Stiltia isabella	Australian Praticole				•
Larus pacificus	Pacific Gull	•			
Larus dominicanus	Kelp Gull	•		•	
Larus novaehollandiae	Silver Gull	•		•	•
Sterna nilotica	Gull-billed Tern	•		•	•
Sterna caspia	Caspian Tern	•		•	•
Sterna bergii	Crested Tern	•	•	•	•
Sterna striata	White-fronted Tern	•	•	•	
Sterna hirundo	Common Tern	•	•	•	•
Sterna paradisaea	Arctic Tern	•			
Sterna albifrons	Little Tern	•	•	•	•
Sterna nereis	Fairy Tern		•		
Sterna fuscata	Sooty Tern	•	•		
Chlidonias hybrida	Whiskered Tern	•		•	•
Chlidonias leucopterus	White-winged Black Tern	•		•	•
Anous stolidus	Common Noddy	•			
Procelsterna cerulea	Grey Ternlet	•			
Gygis alba	White Tern	•			
Stercorarius pomarinus	Pomarine Skua	•		•	
Stercorarius parasiticus	Arctic Skua	•		•	
Stercorarius longicaudus	Long-tailed Skua	•			
Stercorarius skua	Great Skua	•			
Ptilinopus superbus	Superb Fruit-Dove	•			
Lathamus discolor	Swift Parrot	•		•	
Cuculus saturatus	Oriental Cuckoo	•		•	
Cuculus pallidus	Pallid Cuckoo	•		•	
Cacomantis flabelliformis	Fan-tailed Cuckoo	•		•	•
Chalcites osculans	Black-eared Cuckoo	•			
Chalcites basalis	Horsfield's Bronze-Cuckoo	•		•	
Chalcites lucidus	Shining Bronze-Cuckoo	•		•	•
Scythrops novaehollandiae	Channel-billed Cuckoo	•		•	•
Eudynamys scolopacea	Common Koel				•
Eurostopodus mystacalis	White-throated Nightjar	•		•	
Hirundapus caudacutus	White-throated Needletail				•
Apus pacificus	Fork-tailed Swift	•		•	
Eurystomus orientalis	Dollarbird	•		•	•

Attachment F-L (Continued)
Protected Marine Species Recorded in the Surrounding Area

Scientific Name	Common Name[1]	Atlas Records[2]	Australian Museum[3]	Birds Australia[3]	HBOC[3]
Todiramphus macleayii	Forest Kingfisher	•		•	
Todiramphus sanctus	Sacred Kingfisher	•	•	•	•
Merops ornatus	Rainbow Bee-eater	•	•	•	
Pitta versicolor	Noisy Pitta	•		•	
Petroica phoenicea	Flame Robin	•			
Rhipidura rufifrons	Rufous Fantail	•		•	•
Dicrurus bracteatus	Spangled Drongo	•		•	•
Monarcha trivirgatus	Spectacled Monarch	•			
Monarcha melanopsis	Black-faced Monarch	•		•	
Grallina cyanoleuca	Magpie-lark	•	•	•	•
Myiagra cyanoleuca	Satin Flycatcher	•		•	
Coracina tenuirostris	Cicadabird	•		•	
Coracina novaehollandiae	Black-faced Cuckoo-shrike	•	•	•	•
Coracina papuensis	White-bellied Cuckoo-shrike	•		•	
Corvus tasmanicus	Forest Raven	•			
Hirundo neoxena	Welcome Swallow				•
Zosterops lateralis	Silvereye	•		•	•
Acrocephalus stentoreus	Clamorous Reed-Warbler				•
Motacilla flava	Yellow Wagtail	•		•	•
Anthus australis	Australian Pipit				•
Mammals					
Dugong dugon	Dugong	•			
Arctocephalus forsteri	New Zealand Fur-seal	•			
Arctocephalus pusillus doriferus	Australian Fur-seal	•			
Neophoca cinerea	Australian Sea-lion	•			
Hydrurga leptonyx	Leopard Seal	•			

[1] Nomenclature for species in accordance with Clayton *et al*. (2006).
[2] DEC Atlas of NSW Wildlife records (Newcastle [9232], Port Stephens [9332] and Lake Macquarie [9231] 1:100,000 map sheets)
[3] Searched using a search area of approximately 400 km^2 surrounding the Project site

ATTACHMENT F-M

THREATENED SPECIES ASSESSED BY THREATENED SPECIES EVALUATIONS

Attachment F-M
Threatened Species Assessed by Threatened Species Evaluations

Evaluation	Species Included in Evaluation		Conservation Status[1]	
			TSC Act	EPBC Act
	Common Name	**Scientific Name**		
Green and Golden Bell Frog (Section F3.6.1)	Green and Golden Bell Frog	*Litoria aurea*	E	V
Australasian Bittern (Section F3.6.2)	Australasian Bittern	*Botaurus poiciloptilus*	V	-
Black-tailed Godwit (Section F3.6.3)	Black-tailed Godwit	*Limosa limosa*	V	-
Blue-billed Duck (Section F3.6.4)	Blue-billed Duck	*Oxyura australis*	V	-
Freckled Duck (Section F3.6.5)	Freckled Duck	*Stictonetta naevosa*	V	-
Grass Owl (Section F3.6.6)	Grass Owl	*Tyto capensis*	V	-
Painted Snipe (Section F3.6.7)	Painted Snipe (Australian subspecies)	*Rostratula benghalensis australis*	E	V
Masked Owl (Section F3.6.8)	Masked Owl	*Tyto novaehollandiae*	V	V
Beach Stone-curlew (Section F3.6.9)	Beach Stone-curlew	*Esacus neglectus*	E	E
Red-backed Button-quail (Section F3.6.10)	Red-backed Button-quail	*Turnix maculosa*	V	-
Threatened Frogs (Section 3.6.11)	Wallum Froglet	*Crinia tinnula*	V	-
	Red-crowned Toadlet	*Pseudophryne australis*	V	-
Migratory Turtles (Section 3.6.12)	Loggerhead Turtle	*Caretta caretta*	E	M, E
	Green Turtle	*Chelonia mydas*	V	M, V
	Hawksbill Turtle	*Eretmochelys imbricata*	-	M, V
	Flatback Turtle	*Natator depressus*	-	M, V
Non-migratory Birds (Section 3.6.13)	Magpie Goose	*Anseranas semipalmata*	V	-
	Black-browed Albatross	*Thalassarche melanophrys*	V	V
	Blue Petrel	*Halobaena caerulea*	-	V
	Black-necked Stork	*Ephippiorhynchus asiaticus*	E	-
	Black Bittern	*Ixobrychus flavicollis*	V	-
	Square-tailed Kite	*Lophoictinia isura*	V	-
	Black-breasted Buzzard	*Hamirostra melanosternon*	V	-
	Bush Stone-curlew	*Burhinus grallarius*	E	-
	Pied Oystercatcher	*Haematopus longirostris*	V	-
	Sooty Oystercatcher	*Haematopus fuliginosus*	V	-
	Comb-crested Jacana	*Irediparra gallinacea*	V	-
	Sooty Tern	*Sterna fuscata*	V	-
	Wompoo Fruit-Dove	*Ptilinopus magnificus*	V	-
	Superb Fruit-Dove	*Ptilinopus superbus*	V	-
	Rose-crowned Fruit-Dove	*Ptilinopus regina*	V	-
	Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	E
	Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	-
	Turquoise Parrot	*Neophema pulchella*	V	-
	Swift Parrot	*Lathamus discolor*	E	E
	Sooty Owl	*Tyto tenebricosa*	V	-
	Powerful Owl	*Ninox strenua*	V	-
	Barking Owl	*Ninox connivens*	V	-
	Brown Treecreeper	*Climacteris picumnus*	V	-
	Speckled Warbler	*Pyrrholaemus sagittatus*	V	-

Attachment F-M (Continued)
Threatened Species Assessed by Threatened Species Evaluations

Evaluation	Species Included in Evaluation		Conservation Status[1]	
			TSC Act	EPBC Act
	Common Name	**Scientific Name**		
Non-migratory Birds (Cont.)	Black-chinned Honeyeater (eastern subsp.)	*Melithreptus gularis gularis*	V	-
	Hooded Robin	*Melanodryas cucullata*	V	-
	Grey-crowned Babbler (eastern subsp.)	*Pomatostomus temporalis temporalis*	V	-
Migratory Birds (Section F3.6.14)	Garganey	*Anas querquedula*	-	M
	Royal Albatross	*Diomedea epomophora*	-	M, V
	Wandering Albatross	*Diomedea exulans*	E	M, V
	Sooty Albatross	*Phoebetria fusca*	V	M, V
	Southern Giant-Petrel	*Macronectes giganteus*	E	M, E
	Northern Giant-Petrel	*Macronectes halli*	V	M, V
	Providence Petrel	*Pterodroma solandri*	V	M
	Gould's Petrel	*Pterodroma leucoptera leucoptera*	E	M,E
	Black Petrel	*Procellaria parkinsoni*	-	M
	Westland Petrel	*Procellaria westlandica*	-	M
	Streaked Shearwater	*Calonectris leucomelas*	-	M
	Wedge-tailed Shearwater	*Puffinus pacificus*	-	M
	Sooty Shearwater	*Puffinus griseus*	-	M
	Short-tailed Shearwater	*Puffinus tenuirostris*	-	M
	Flesh-footed Shearwater	*Puffinus carneipes*	V	M
	Wilson's Storm-Petrel	*Oceanites oceanicus*	-	M
	Glossy Ibis	*Plegadis falcinellus*	-	M
	Cattle Egret	*Bubulcus ibis*	-	M
	Eastern Reef Egret	*Egretta sacra*	-	M
	Great Egret	*Ardea alba*	-	M
	Lesser Frigatebird	*Fregata ariel*	-	M
	Brown Booby	*Sula leucogaster*	-	M
	Osprey	*Pandion haliaetus*	V	M
	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	-	M
	Pacific Golden Plover	*Pluvialis fulva*	-	M
	Grey Plover	*Pluvialis squatarola*	-	M
	Double-banded Plover	*Charadrius bicinctus*	-	M
	Lesser Sand Plover	*Charadrius mongolus*	V	M
	Greater Sand Plover	*Charadrius leschenaultii*	V	M
	Oriental Plover	*Charadrius veredus*	-	M
	Latham's Snipe	*Gallinago hardwickii*	-	M
	Asian Dowitcher	*Limnodromus semipalmatus*	-	M
	Bar-tailed Godwit	*Limosa lapponica*	-	M
	Little Curlew	*Numenius minutus*	-	M
	Whimbrel	*Numenius phaeopus*	-	M
	Eastern Curlew	*Numenius madagascariensis*	-	M
	Marsh Sandpiper	*Tringa stagnatilis*	-	M
	Common Greenshank	*Tringa nebularia*	-	M
	Wood Sandpiper	*Tringa glareola*	-	M
	Lesser Yellowlegs	*Tringa flavipes*	-	M

Attachment F-M (Continued)
Threatened Species Assessed by Threatened Species Evaluations

Evaluation	Species Included in Evaluation		Conservation Status[1]	
			TSC Act	EPBC Act
	Common Name	**Scientific Name**		
Migratory Birds (Cont.)	Terek Sandpiper	*Xenus cinereus*	V	M
	Common Sandpiper	*Actitis hypoleucos*	-	M
	Grey-tailed Tattler	*Heteroscelus brevipes*	-	M
	Wandering Tattler	*Heteroscelus incanus*	-	M
	Ruddy Turnstone	*Arenaria interpres*	-	M
	Great Knot	*Calidris tenuirostris*	V	M
	Red Knot	*Calidris canutus*	-	M
	Sanderling	*Calidris alba*	V	M
	Red-necked Stint	*Calidris ruficollis*	-	M
	Long-toed Stint	*Calidris subminuta*	-	M
	Pectoral Sandpiper	*Calidris melanotos*	-	M
	Sharp-tailed Sandpiper	*Calidris acuminata*	-	M
	Curlew Sandpiper	*Calidris ferruginea*	-	M
	Broad-billed Sandpiper	*Limicola falcinellus*	V	M
	Buff-breasted Sandpiper	*Tryngites subruficollis*	-	M
	Ruff	*Philomachus pugnax*	-	M
	Common Tern	*Sterna hirundo*	-	M
	Arctic Tern	*Sterna paradisaea*	-	M
	Little Tern	*Sterna albifrons*	E	M
	White-winged Black Tern	*Chlidonias leucopterus*	-	M
	Caspian Tern	*Stema caspia*	-	M
	Common Noddy	*Anous stolidus*	-	M
	Pomarine Skua	*Stercorarius pomarinus*	-	M
	Arctic Skua	*Stercorarius parasiticus*	-	M
	Long-tailed Skua	*Stercorarius longicaudus*	-	M
	Oriental Cuckoo	*Cuculus saturatus*	-	M
	White-throated Needletail	*Hirundapus caudacutus*	-	M
	Fork-tailed Swift	*Apus pacificus*	-	M
	Rainbow Bee-eater	*Merops ornatus*	-	M
	Regent Honeyeater	*Xanthomyza phrygia*	E	M, E
	Rufous Fantail	*Rhipidura rufifrons*	-	M
	Spectacled Monarch	*Monarcha trivirgatus*	-	M
	Black-faced Monarch	*Monarcha melanopsis*	-	M
	Satin Flycatcher	*Myiagra cyanoleuca*	-	M
	Yellow Wagtail	*Motacilla flava*	-	M
	Lesser Golden Plover	*Pluvialis dominica*	-	M
	Clamorous Reed-Warbler	*Acrocephalus stentoreus*	-	M
	Northern Shoveler	*Anas clypeata*	-	M
Threatened Terrestrial Mammals (Section F3.6.15)	Spotted-tailed Quoll	*Dasyurus maculatus*	V	E
	Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-
	Yellow-bellied Glider	*Petaurus australis*	V	V
	Squirrel Glider	*Petaurus norfolcensis*	V	-
	Long-nosed Potoroo (SE mainland)	*Potorous tridactylus tridactylus*	V	V

Attachment F-M (Continued)
Threatened Species Assessed by Threatened Species Evaluations

Evaluation	Species Included in Evaluation		Conservation Status[1]	
			TSC Act	EPBC Act
	Common Name	**Scientific Name**		
Threatened Bats (Section F3.6.16)	Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V
	Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-
	Eastern Freetail-bat	*Mormopterus norfolkensis*	V	-
	Little Bentwing-bat	*Miniopterus australis*	V	-
	Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V	-
	Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V
	Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-
	Large-footed Myotis	*Myotis adversus*	V	-
	Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-
Threatened Marine Mammals (Section F3.6.17)	Dugong	*Dugong dugon*	E	-
	New Zealand Fur-seal	*Arctocephalus forsteri*	V	-
	Southern Right Whale	*Eubalaena australis*	V	E
	Humpback Whale	*Megaptera novaeangliae*	V	V

[1] Conservation Status
NSW *Threatened Species Conservation Act, 1995*
Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999*
V = Vulnerable
E = Endangered
M = Migratory