

Annex D

D. Flora & Fauna Assessment



Flora and Fauna Impact Assessment: Appin Area 7 Goaf Gas Drainage Project

May 2009

Report for
Cardno Forbes Rigby

Flora and Fauna Impact
Assessment: Appin Area 7 Goaf
Gas Drainage Project

Final Report

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ABBREVIATIONS

DBH	Diameter at Breast Height
DECC	NSW Department of Environment and Climate Change
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts
EP&A Act	NSW <i>Environmental Planning and Assessment Act</i> 1979
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act</i> 1999
LGA	Local Government Area
NPWS	NSW National Parks and Wildlife Service (now part of DECC)
ROTAP	Rare or Threatened Australian Plant as listed by Briggs and Leigh (1995)
SEPP	NSW State Environmental Planning Policy
TSC Act	NSW <i>Threatened Species Conservation Act</i> 1995
sp.	Species (singular)
spp.	Species (plural)
ssp.	Subspecies
var.	Variety

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1.0 SUMMARY

Biosis Research was commissioned by Cardno Forbes Rigby to conduct a terrestrial flora and fauna assessment for the proposed goaf gas drainage project for Longwalls 703-704 at Appin Mines' Area 7. The proposed project will involve the installation of goaf gas extraction plants, eight boreholes for extracting goaf gas from the mine, one downhole to convey the extracted goaf gas to the Energy developments Limited (EDL) Power Stations for re-use and associated pipelines.

The preferred location of the goaf gas extraction plant is on the property described as Lot 2 DP 576136 and is represented as Option 1 in this report. A contingency or back up extraction plant, proposed to be located on the property described as Lot 7 DP 250231 is also proposed as part of the project and is represented as Option 2 in this report (refer Figure 2).

This assessment has been carried out for determination under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Study Area supports mostly cleared paddocks with scattered trees. The only exception to this is the proposed location of Goaf Gas Extraction Plant Option 2, which supports Cumberland Plain Woodland, an Endangered Ecological Community on the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The proposal may involve clearing or modifying approximately:

- 0.16 ha of Cumberland Plain Woodland
- 1.2 ha of cleared paddocks.

No threatened plant species were recorded within the Study Area, nor is there considered to be potential habitat for any threatened flora.

The Project may involve the removal of a small area of Cumberland Plain Woodland, supporting potential foraging habitat for 14 threatened animal species listed on the TSC and/or EPBC Acts (Grey-headed Flying Fox *Pteropus poliocephalus*, Greater Broad-nosed Bat *Scoteanax rueppellii*, Eastern False Pipistrelle *Falsistrellus tasmaniensis*, Eastern Freetail-bat *Mormopterus norfolkensis*, Large-footed Myotis *Myotis macropus*, Regent Honeyeater *Anthochaera phrygia*, Swift Parrot *Lathamus discolor*, Black-chinned Honeyeater, Turquoise Parrot *Neophema pulchella*, Powerful Owl *Ninox strenua*, Barking Owl *Ninox connivens*, White-bellied Sea-eagle *Haliaeetus leucogaster*, Cattle Egret *Ardea ibis* and Rainbow Bee-eater *Merops ornatus*), however the impacts to these species are likely to be negligible.

Impact Assessments following the Part 3A Guidelines under the EP&A Act were carried out for the threatened biota listed on the TSC Act occurring or with potential habitat in the Study Area. These assessments concluded that the proposal would have a minor impact, given that a relatively small area of potential habitat would be impacted and none of the threatened species were recorded during surveys of the Study Area. Further, impact assessments following the EPBC Act Significant Impact Guidelines have been prepared for threatened biota listed under the EPBC Act with potential habitat in the Study Area. It was found that the proposed project would not have a significant impact on threatened biota. A Referral for Matters of National Significance (EPBC Act) is not considered necessary for any threatened biota within the Study Area.

The following mitigation measures are proposed to minimise any potential disturbances from the proposal on the ecological values of the Study Area:

- adjustment of the location of access tracks to avoid native trees and significant habitat features such as trees with hollows, where required;
- trees with hollows should be retained and protected, with no drilling within the critical root zone (extending to 2 m beyond the drip line) of the trees;
- where possible, proposed boreholes, pipelines and access tracks have been located within existing cleared areas;
- sediment and erosion control measures should be implemented on all sites to prevent erosion during and after construction;
- any chemicals used on site will be taken off site after use and disposed of appropriately;
- machinery and vehicles should be washed down prior to use on site to avoid the transmission of weed seed or disease into intact areas of native vegetation;
- Goaf Gas Extraction Plant Option 1 located on the property described as Lot 2 DP 576136 is the preferred option, as this location supports cleared paddocks and would not result in impacts to flora and fauna habitats. The development of Goaf Gas Extraction Plant Option 2 located on the property described as Lot 7 DP 250231 will result in the removal of approximately 0.16 ha of Cumberland Plain Woodland, an EEC on the EPBC and TSC Acts, and habitat for a number of threatened fauna species.
- A suitably qualified ecologist should be on site during the construction of Goaf Gas Extraction Plant Option 2 (if this option is utilised) and/or the drilling of the MRD borehole from this location, to ensure impacts to significant habitat features are minimised.

- The site of Option 2 (if this option is utilised) should be rehabilitated with Cumberland Plain Woodland after the cessation of goaf gas drainage to replace any cleared vegetation.

2.0 INTRODUCTION

Biosis Research was commissioned by Cardno Forbes Rigby to conduct a terrestrial flora and fauna assessment for the proposed goaf gas drainage project for Longwalls 703-704 at Appin Mines' Area 7 (Figure 1). The project will involve the installation of goaf gas extraction plants (of which there are two options), eight boreholes to extract the goaf gas from the mine, one downhole to convey the extracted goaf gas to the EDL Power Stations for re-use and associated pipelines (Figure 2).

The preferred location of the goaf gas extraction plant is on the property described as Lot 2 DP 576136 and is represented as Option 1 in this report. A contingency or back up extraction plant, proposed to be located on the property described as Lot 7 DP 250231 is also proposed as part of the project and is represented as Option 2 in this report (refer Figure 2).

This assessment has been carried out for determination under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) with reference to threatened biota listed on the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2.1 Aims

The specific aims of this assessment are to:

- conduct a literature review and database search for the locality;
- undertake targeted field surveys for habitat of threatened terrestrial flora and fauna, populations or ecological communities that are listed on the TSC Act and the EPBC Act and have been identified as potentially occurring in the locality;
- provide an assessment of the habitat values of the site;
- undertake impact assessments for threatened biota listed on the TSC and/or EPBC Acts following the guidelines for threatened species assessment under Part 3A of the EP&A Act (DEC & DPI 2005) and the EPBC Act Significant Impact Guidelines (DEH 2006); and,
- Provide recommendations to minimise the environmental impacts of the proposal.

2.2 Definitions

The following terms are used frequently throughout the report:

- **The proposal** is the development, activity or action proposed. In this case the proposal is the installation of eight goaf gas extraction boreholes, one downhole to convey the extracted goaf gas to the EDL Power Stations for reuse in electricity generation and the installation of a preferred goaf gas extraction plant on the property described as Lot 2 DP 576136 and a contingency or back up extraction plant on the property described as Lot 7 DP250231 if this is required.
- **Subject site** is defined in *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC 2004b) and means the area directly affected by the proposal. In this case, the subject site is the combination of the eight boreholes, one downhole, the easements of the surface pipeline reticulation system and both goaf gas extraction plant locations (refer Figure 2).
- **Study Area** is defined in DECC (2004b) as the subject site and any additional areas that are likely to be affected by the proposal, either directly or indirectly.
- **Abundance** means a quantification of the population of the species or community.
- **Regional** means the area defined within the applicable IBRA Bioregion (Thackway and Cresswell 1995), i.e., The Sydney Basin Bioregion.
- **Local population** is defined in DECC (2004b) as the population of a species within the Study Area.
- **Local occurrence** is used in reference to endangered ecological communities and is defined in (DEWHA 2004) as the community that occurs within the Study Area.
- **Locality** is the area within a 10 kilometre radius of the Study Area.
- **Threatened biota** refers to threatened species, populations and ecological communities as listed on the TSC Act and EPBC Act.

2.3 The Proposal

BHPBIC proposes to drain the goaf gas from Longwalls 703-704 within Appin Area 7, west of the township of Appin (Figure 1). Goaf gas is the accumulation of coal seam methane in the area of collapsed rock strata associated with the

extraction of coal by the longwall mining method (Cardno Forbes Rigby 2008). If unmanaged this gas could enter the ventilation system within the mine and cause operational and safety issues underground. As such BHPBIC will use the proposed plant to draw the goaf gas to the surface and resolve these issues (Cardno Forbes Rigby 2008).

BHPBIC propose to drain the goaf gas by installing a series of boreholes between the goaf and the surface. The goaf gas will be drawn up the boreholes by extraction plant/s drawing goaf gas from multiple boreholes connected by a pipeline reticulation system located on the surface (refer Figure 2) (Cardno Forbes Rigby 2008).

2.3.1 Potential Impacts of the Proposal

The disturbance footprint of each borehole drilling site comprises of approximately 30 x 40 metre compound. Installation of the surface pipeline reticulation system will involve a 650 mm wide trench dug to a depth of approximately 1400 mm. The goaf gas extraction plants may require disturbance to approximately 0.16 ha of Cumberland Plain Woodland, which represents approximately 0.01% of the occurrence of this plant community in the locality.

Direct impacts that may apply to this proposal and will therefore be considered in this assessment include:

- vegetation clearance; and,
- the removal of potential habitat.

Indirect impacts that may apply to this proposal include:

- the potential for erosion; and,
- increased human activity within or adjacent to sensitive habitat areas.

Section 5.0 discusses the specific potential impacts associated with the proposal and the proposed amelioration measures. Direct impacts are usually unavoidable while indirect impacts are usually mitigated through amelioration measures.

2.4 The Study Area

The study area is located south west of Sydney between Douglas Park and Menangle (refer Figure 1) within the Wollondilly Local Government Area (LGA).

The Study Area generally supports cleared paddocks, with scattered patches of native vegetation in varying condition, mostly along road edges and creeklines. The current land use is agricultural, with cattle, goats and ponies grazing within the cleared paddocks.

2.4.1 Geology, Soils and Topography

The soil landscape of the study area is mapped at a 1:100,000 scale by (Hazelton *et al.* 1990) as Blacktown (map unit bt), which is described as gently undulating rises on Wianamatta Group Shale.

2.5 Planning Approvals

The proposal has been declared as a Major Project under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and State Environmental Planning Policy (Major Projects) 2005.

The EP&A Act was amended in June 2005 to reform the land-use planning and development assessment and approval system, particularly as it relates to major infrastructure and other significant development. In the new Part 3A, the Act provides a single assessment and approval regime for all major infrastructure and other projects previously undertaken under Part 4 and/or Division 4 of Part 5 of the EP&A Act. The new Part applies to major State government infrastructure projects, development that was previously classified as State significant development and other projects, plans or programs declared by the Minister for Planning.

3.0 METHODS

3.1 Taxonomy

The plant taxonomy (method of classification) used in this report follows Harden (1992, 1993, 2000, 2002), Fairley and Moore (2000), Robinson (2003) and subsequent advice from the National Herbarium of NSW. In the body of this report plants are referred to by their scientific names only. Common names where available have been included in the Appendices.

Names of vertebrates follow the Census of Australian Vertebrates maintained by Department of Environment, Heritage, Water Resources and the Arts (DEWHA). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only. Common and scientific names are included in the Appendices.

3.2 Legislation

Federal and State Acts and Policies that haven been considered in this report with regard to terrestrial flora and fauna are listed below:

- Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act);
- NSW *Threatened Species Conservation Act* 1995 (TSC Act);
- NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act); and,
- State Environmental Planning Policy (SEPP) 44 – Koala Habitat.

3.3 Literature and Database Review

A list of documents used to prepare this report is located in *References*. Records of threatened species, populations and communities were obtained from the Department of Environment and Climate Change (DECC) *Atlas of NSW Wildlife* within a 10 km radius of the Study Area.

Potential occurrences of threatened species, populations and communities listed on the EPBC Act were obtained from the Department of the Environment, Water, Heritage and the Arts (DEWHA) *EPBC Online Database* within a 10 km radius of the Study Area. Database searches were conducted in September 2008.

3.4 Field Survey

The Study Area was inspected on the 8 April 2009. The general condition of the site was assessed and observations of flora and fauna and plant communities were made (as detailed below). During the site visit the weather was warm and sunny.

This study was by design a habitat assessment, therefore does not include trapping, spotlighting, active searching, call playback techniques or vegetation quadrat sampling.

3.4.1 Flora

Information recorded during the flora survey included: location (GPS), photograph, community structure and composition, the presence of threatened plants and ecological communities (or their potential habitat), fire history, condition (Section 3.4.2), plant species list and habitat description.

A compiled plant species list for the Study Area was entered into the NSW Flora Information System (Viridans 2003) and is included in Appendix 1.

3.4.2 Vegetation Condition Assessment

Vegetation condition was assessed according to the degree to which it resembles relatively natural, undisturbed vegetation. Vegetation was assessed as being in Good, Moderate or Poor condition or Disturbed according to the following criteria:

- **species composition** (species richness, degree of weed invasion);
- **vegetation structure** (representation of each of the original layers of vegetation); and,
- **resilience** (This is the capacity of a site for natural regeneration. This is primarily linked to the degree to which the natural soil profile of the area has been disturbed).

The categories of vegetation conditions are as follows:

Good: containing a high number of indigenous species; no weeds present or weed invasion restricted to edges and track margins; vegetation community contains original layers of vegetation; vegetation layers (ground, shrub, canopy etc.) are intact, or if modified, natural soil profile remains intact;

Moderate: containing a moderate number of indigenous species; moderate level of weed invasion; weeds occurring in isolated patches or scattered throughout;

one or more of original layers of vegetation are modified; vegetation layers (ground, shrub, canopy etc.) are largely intact, or if modified, natural soil profile remains intact; able to be regenerated to Good condition with minimal level of management;

Poor: containing a low number of indigenous species; high level of weed invasion; weeds occurring in dense patches or scattered throughout; one or more of the original layers of vegetation are highly modified; one or more original vegetation layers (ground, shrub, canopy etc.) are modified or missing, but natural soil profile intact; able to be regenerated to Moderate or Good condition with substantial management; and,

Disturbed: highly modified landscape containing few or no indigenous species; exotic species dominant; original native vegetation layers removed; natural soil profile disturbed; unable to be regenerated to natural condition; requires a high input of resources to achieve restoration goals.

3.4.3 Fauna

The fauna survey was undertaken as a habitat based assessment. Animal species using the site were surveyed by undertaking active searching and listening, as well as recording incidental observations.

3.4.4 Fauna Habitat Assessment

The three categories used to evaluate habitat value were Good, Moderate or Poor, as detailed below:

Good: ground flora containing a high number of indigenous species; vegetation community structure, ground, log and litter layer intact and undisturbed; a high level of breeding, nesting, feeding and roosting resources available; a high richness and diversity of native animal species.

Moderate: ground flora containing a moderate number of indigenous species; vegetation community structure, ground log and litter layer moderately intact and undisturbed; a moderate level of breeding, nesting, feeding and roosting resources available; a moderate richness and diversity of native fauna.

Poor: ground flora containing a low number of indigenous species, vegetation community structure, ground log and litter layer disturbed and modified; a low level of breeding, nesting, feeding and roosting resources available; a low richness and diversity of native fauna.

Other habitat features such as the value of the study area as a habitat corridor, the presence of remnant communities or unusual ecological plant community structure were also used to assess habitat quality.

3.5 Limitations

Some plant species that occur in the locality are annuals (completing their life cycle within a single season) and are present only in the seed bank for much of the year. Other plant species are perennial but are inconspicuous unless flowering. Further, some animal species are migratory and therefore may not be present during the certain seasons. However, as the assessment of impact is based on the presence or absence of suitable habitat for threatened flora and fauna (which is adequate to satisfy the requirements of the EP&A Act), such species are taken into account during the assessment even though they may not be conspicuous during the survey.

4.0 RESULTS

4.1 Plant Communities

The vegetation of the region has been mapped by NPWS (2002b). The majority of the study area is mapped as cleared. Shale Sandstone Transition Forest (High and Low Sandstone Influence) is mapped as adjoining the study area.

Field surveys revealed most of the study area to support cleared paddocks, with scattered remnant trees occurring in some areas and a small patch of regrowth Cumberland Plain Woodland occurring at the proposed Goaf Gas Extraction Plant Option 2 Location. A description of the cleared paddocks and Cumberland Plain Woodland based on the field surveys of the study area is provided below. Shale Sandstone Transition Forest was not surveyed as part of the field assessment, as it was not recorded in the study area and will not be impacted by the proposal. Therefore this plant community is not included in the descriptions below.

4.1.1 Cleared Paddocks

The majority of the study area supported cleared paddocks with little or no resilience, having been pasture improved and grazed for many years (Plate 1). The cleared paddocks within the study area supported grazing animals such as cattle, goats and Welsh ponies. A series of boreholes, pipelines and the Goaf Gas Extraction Plant Option 1 Location occurs within the cleared paddocks of the study area.

Dominant species recorded in cleared paddocks include pasture grasses such as *Paspalum dilatatum*, *Pennisetum clandestinum* and *Setaria gracilis*. Weed species recorded within the paddock areas included *Chloris gayana*, *Verbena bonariensis*, *Sida rhombifolia*, *Senecio madagascariensis*, *Cynodon dactylon* and *Plantago lanceolata*. Scattered exotic shrubs were also recorded in the cleared paddocks including *Olea europaea* subsp. *cuspidata* and *Rubus fruticosus*. Native species such as the canopy trees *Eucalyptus moluccana*, *E. tereticornis*, the small tree *Acacia parramattensis* and the shrub *Bursaria spinosa* were also recorded in scattered patches within the cleared paddocks in the study area (Plate 2). Planted trees along fence lines within cleared paddock areas included *Allocasuarina littoralis* and *Lophostemon confertus*.

Cleared paddocks within the study area were considered to be in a Disturbed condition, given the extensive ongoing disturbances such as grazing, weed invasion, vegetation clearance and rubbish dumping. The absence of all natural structural layers and heavily reduced native species diversity suggests a lack of natural resilience in the cleared paddocks of the study area.

4.1.2 Cumberland Plain Woodland

A small patch of regrowth Cumberland Plain Woodland was recorded in the area proposed for the Goaf Gas Extraction Plant Option 2 Location (Plate 3). This area supported mostly canopy trees of *Eucalyptus tereticornis* and *E. moluccana*, most of which were relatively young regrowth to a maximum of 15 m in height. Two larger remnant trees of *Eucalyptus tereticornis* to 25 m in height and approximately 75 m DBH were recorded in this area (Plate 4). The small tree layer was sparse, supporting scattered young regrowth *Eucalyptus tereticornis*. The shrub layer was also sparse, supporting few scattered *Bursaria spinosa*, with *Olea europaea* subsp. *cuspidata* and *Ligustrum lucidum* also occurring. The ground layer was dominated by exotic grasses such as *Paspalum dilatatum*, *Setaria gracilis*, with native species *Dichondra repens*, *Themeda australis* and *Aristida ramosa* also occurring.

The Cumberland Plain Woodland in the study area was considered to be in Poor condition given the altered structure and low native species diversity. This area is, however, likely to have some natural resilience given the presence of a tree canopy and native species in the shrub and ground layers persisting despite the overall dominance of exotics.

Cumberland Plain Woodland is listed as an Endangered Ecological Community on both the TSC and EPBC Acts. There is also a preliminary determination (listed January 23 2009) to list Cumberland Plain Woodland as a critically endangered ecological community on the TSC Act.

4.2 Flora

A total of 45 plant species were recorded in the Study Area, including 18 (40%) native species and 27 (60%) exotic species. A list of plant species recorded in the Study Area is provided in Appendix 1.

4.2.1 Noxious Weeds

The following exotic species recorded in the study area are listed as Noxious Weeds on the Noxious Weeds Act 1993:

- *Rubus fruticosus* - The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
- *Opuntia* sp. - The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.

4.2.2 Threatened Flora

A total of 23 threatened plant species listed on the TSC and/or the EPBC Acts have been either previously recorded or have potential habitat within the locality (Table 1). The distribution of threatened plants derived from DECC Atlas of NSW Wildlife are illustrated in Figure 4.

No threatened plant species were recorded within the Study Area, nor is there considered to be potential habitat for any threatened flora.

Table 1: Threatened flora within 10 km of the Study Area

Key: 1) Listed on the EPBC Act as Critically Endangered (CE), Endangered (E) or Vulnerable (V)
2) Listed on the TSC Act as Endangered (E1) or Vulnerable (V)
3) For explanation of ROTAP codes see Appendix 2.

Species	EPBC Act ¹	TSC Act ²	ROTAP ³	Habitat	Potential Habitat
<i>Acacia bynoeana</i> Bynoe's Wattle	V	E1	3V	<i>Acacia bynoeana</i> is found in central eastern NSW, in the following catchment regions – Hawkesbury/Nepean, Hunter/Central Rivers, Southern Rivers, and Sydney Metropolitan. More specifically it is found from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra (DEC 2005a). It seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and recently burnt patches (DEC 2005a). It grows in sandy clay soils often containing ironstone gravels (Fairley 2004). Main vegetation types include heath or dry sclerophyll forest on sandy soils (DEC 2005a). Associated overstorey species include <i>Corymbia gummifera</i> , <i>Corymbia maculata</i> , <i>Eucalyptus parramattensis</i> , <i>Banksia serrata</i> and <i>Angophora bakeri</i> (DEC 2005a). Flowering period is mainly summer.	No
<i>Caladenia tessellata</i> Tessellated Spider Orchid	V	E1	3V	<i>Caladenia tessellata</i> is found in the following Catchment Management Regions Sydney Metropolitan, Southern Rivers, Hawkesbury/Nepean, and Hunter/Central Rivers. Currently known from three disjunct areas: Braidwood on southern tablelands, Ulladulla on the south coast and three populations in Wyong area on the Central Coast (DEC 2005c). It is generally found in grassy, dry sclerophyll forests/woodland, particularly those associated with clay loam, or sandy soils. However, there is one population at Braidwood in lowland on stony soil (DEC 2005c). This species only grows in very dense shrubbery in coastal areas (Bishop 1996). Flowers appear between September and November, but generally late September or early October in extant southern populations (DEC 2005c).	No
<i>Callistemon linearifolius</i>	-	V	2Ri	Occurs chiefly from Georges River to the Hawkesbury River where it grows in dry sclerophyll forest (Harden 2002), open forest, scrubland (Fairley and Moore 2000) or woodland on sandstone. Found in damp places, usually in gullies (Robinson 1994). Flowers in Spring.	No
<i>Cryptostylis hunteriana</i>	V	V	3V	This species typically grows in swamp-heath on sandy soils chiefly in coastal districts (Harden 1993) but has also been recorded on steep bare hillsides (Bishop	No

Species	EPBC Act ¹	TSC Act ²	ROTAP ³	Habitat	Potential Habitat
Leafless Tongue Orchid				<p>1996). This species does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by <i>Eucalyptus sclerophylla</i>, <i>E. sieberi</i>, <i>Corymbia gummifera</i> and <i>Allocasuarina littoralis</i>; appears to prefer open areas in the understorey of this community and is often found in association with the <i>Cryptostylis subulata</i> (DEC 2005d).</p> <p>It occurs in the following Catchment Management Regions Hawkesbury/Nepean, Hunter/Central Rivers, Northern Rivers and Southern Rivers.</p>	
<i>Cynanchum elegans</i> White-flowered Wax Plant	E	E1	3Ei	<p>Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. The species has been recorded as far west as Merriwa in the upper Hunter River valley. Catchment Management Regions include Hawkesbury/Nepean, Hunter/Central Rivers, Northern Rivers, Southern Rivers and Sydney Metropolitan (DEC 2005v).</p> <p><i>Cynanchum elegans</i> usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; <i>Leptospermum laevigatum</i>, <i>Banksia integrifolia</i> subsp. <i>integrifolia</i>; <i>Eucalyptus tereticornis</i> open forest and woodland; <i>Corymbia maculata</i> open forest and woodland; and <i>Melaleuca armillaris</i> scrub to open scrub (DEC 2005v). Flowering occurs between August and May, with a peak in November. Flower abundance on individual plants varies from sparse to prolific (DEC 2005v).</p>	No
<i>Diuris lanceolata</i> Snake Orchid	E	-	-	<p>Grows in moist grassy areas, among shrubs in sclerophyll forest and heath; coast and tablelands (Harden 1993).</p>	No
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	-	V	2K	<p>Located in the Hawkesbury/Nepean, Hunter/Central Rivers/and Sydney Metropolitan catchment authority region - from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South (DEC 2005e).</p> <p><i>Epacris purpurascens</i> var. <i>purpurascens</i> grows in Dry Sclerophyll forests, scrub and swamps (Harden 1992). Specifically this species is thought to require wet heath vegetation (T. James pers. comm.).</p> <p>Characteristically found in a range of habitat types, most of which have a strong shale soil influence. These include ridge top drainage depressions supporting wet heath within or adjoining shale cap communities (including Shale Sandstone Transition Forest, Turpentine Ironbark Margin Forest, Stringybark/Scribbly Gum Woodland and Scribbly Gum/Grey Gum/Red Bloodwood Woodland). Also occurs in riparian zones draining into Sydney Sandstone Gully Forest, shale lenses within sandstone habitats and colluvial areas overlying or adjoining sandstone or tertiary alluvium (NPWS 2002d).</p>	No
<i>Eucalyptus benthamii</i> Nepean River Gum	V	V	2Vi	<p>Known from two main locations: Bents Basin and Kedumba Valley. A few scattered individuals are recorded from other sites on the sandy alluvial flats of the Kedumba/Cox/Nepean River system. Occurs only in wet open forest on sandy alluvial soils along valley floors at an elevation of 140-750 m. The soils are shallow to moderately deep and are well drained alluvial</p>	No

Species	EPBC Act ¹	TSC Act ²	ROTAP ³	Habitat	Potential Habitat
				sands and gravels along stream channels, small terraces and alluvial flats (NPWS 2000a). Restricted but locally abundant (Harden 1991). ROTAP; 2Vi	
<i>Grevillea parviflora</i> ssp. <i>parviflora</i> Small-flower Grevillea	V	V	-	<p>Located in Hawkesbury/Nepean, Hunter/Central Rivers and Sydney Metropolitan Catchment. Sporadically distributed throughout the Sydney Basin with the main occurrence centred in Picton, Appin, Wedderburn and Bargo. Northern populations are found in the Lower Hunter Valley. To the west of Sydney, small populations occur at Kemps Creek & Voyager Point (DEC 2005f).</p> <p><i>Grevillea parviflora</i> ssp. <i>parviflora</i> grows on sandy clay loam soils, often with ironstone gravels. Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine-grained sandstones (NPWS 2002a).</p> <p><i>Grevillea parviflora</i> subsp. <i>parviflora</i> is found on crests, upper slopes or flat plains in both low-lying areas and on higher topography.</p> <p>The plant prefers open habitat conditions with the largest populations in open woodland and along exposed roadside areas (NPWS 2002a).</p> <p><i>G. parviflora</i> subsp. <i>parviflora</i> has been recorded in a range of vegetation types from heath and shrubby woodland to open forest. Canopy species vary greatly with community type but generally are species that favour soils with a strong lateritic influence including <i>Eucalyptus fibrosa</i>, <i>E. parramattensis</i>, <i>Angophora bakeri</i> and <i>Eucalyptus sclerophylla</i> (NPWS 2002a)..</p> <p>Flowering has been recorded between July to December as well as April-May (NPWS 2002a).</p>	No
<i>Gyrostemon thesioides</i>	-	E1	2K	<p>Within NSW, has only ever been recorded at three sites, to the west and south of Sydney, near the Colo, Georges and Nepean Rivers. The most recent sighting was of a single male plant near the Colo River within Wollemi National Park. The species has not been recorded from the Nepean and Georges Rivers for 90 and 30 years respectively, despite searches. Also occurs also in Western Australia, South Australia, Victoria and Tasmania. Grows on hillsides and riverbanks and may be restricted to fine sandy soils (DEC 2005g).</p>	No
<i>Leucopogon exolasius</i> Woronora Beard-heath	V	V	2V	<p>Occurs in Hawkesbury/Nepean and Sydney Metropolitan Catchment (DEC 2005w), restricted to the Woronora and Grose Rivers (Harden 1991). The plant occurs in woodland on sandy alluvium and rocky sandstone hillsides near creeks, and on low nutrient soils (Powell 2007). Flowering occurs in August and September (Harden 1991). Associated species include <i>Eucalyptus piperita</i> and <i>E. sieberi</i> and the shrubs <i>Pultenaea flexilis</i>, <i>Leptospermum trinervium</i> and <i>Dillwynia retorta</i> (Powell 2007).</p>	No
<i>Melaleuca deanei</i> Dean's Melaleuca	V	V	3R	<p><i>Melaleuca deanei</i> occurs in Catchment Management Regions Hawkesbury/Nepean, Southern Rivers, and Sydney Metropolitan. Distinctly it occurs in the Kuring-gai/Berowra and Holsworthy/Wedderburn areas. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas (DEC 2005i).</p> <p>The species grows in wet heath on sandstone (Harden 1991) and Dry Sclerophyll Forests.</p>	No

Species	EPBC Act ¹	TSC Act ²	ROTAP ³	Habitat	Potential Habitat
				Flowers appear in summer but seed production appears to be small and consequently the species exhibits a limited capacity to regenerate(DEC 2005i).	
<i>Persicaria elatior</i> Tall Knotweed	V	V	3V	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance (DEC 2005j).	No
<i>Persoonia bargoensis</i> Bargo Geebung	V	E1	2V	Found in the Sydney Metropolitan and Hawkesbury/Nepean Catchment Authority Regions. Restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau. Its entire range falls between Picton, Douglas Park, Yanderra, Cataract River and Thirlmere (DEC 2005k). <i>P. bargoensis</i> grows in woodland to dry sclerophyll forest on sandstone and clayey laterite on heavier, well drained, loamy, gravelly soils of the Hawkesbury Sandstone and Wianamatta Shale (NPWS 2000b). More specifically, <i>P. bargoensis</i> seems to prefer the interfaces between shale-derived soils such as the Blacktown Soil Landscape, the complex soils of the Mittagong Formation (Lucas Heights Soil Landscape), and the underlying sandstone (Hawkesbury and Gynea Soil Landscapes). Some of the vegetation in which <i>P. bargoensis</i> occurs can be recognised as the endangered Shale/Sandstone Transition Forest (NPWS 2000b). This species seems to benefit from the reduced competition and increased light available on disturbance margins including roadsides (DEC 2005k). Flowering occurs mainly in summer but can extend into autumn (NPWS 2000b).	No
<i>Persoonia hirsuta</i> Hairy Geebung	E	E1	3Ki	Occurs from Gosford to Royal NP and in the Putty district from Hill Top to Glen Davis where it grows in woodland to dry sclerophyll forest on sandstone (Harden 2002) or rarely on shale (NSW Scientific Committee 1998). Two subspecies are recognised, <i>P. hirsuta</i> ssp. <i>hirsuta</i> (Gosford to Berowra and Manly to Royal NP) and <i>P. hirsuta</i> ssp. <i>evoluta</i> (Blue Mountains, Woronora Plateau and Southern Highlands). Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone and shale-sandstone transition areas (DEC 2005l).	No
<i>Persoonia nutans</i> Nodding Geebung	E	E1	2Ei	Occurs in Hawkesbury/Nepean and Sydney Metropolitan Catchment. Restricted to the Cumberland Plain between Richmond in the north and Macquarie Fields in the south. Core distribution occurs within the Penrith LGA, and to a lesser extent, Hawkesbury LGA. Small populations also occur in the Liverpool, Campbelltown, Bankstown and Blacktown LGAs (DEC 2005m). Confined to aeolian and alluvial sediments and occurs in a range of sclerophyll forest and woodland vegetation communities with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland (DEC 2005m). <i>P. nutans</i> also occurs on Shale/Gravel Transition Forest and Cooks River Castlereagh Ironbark Forest (Conservation 2005).	No

Species	EPBC Act ¹	TSC Act ²	ROTAP ³	Habitat	Potential Habitat
				<p>In Castlereagh Scribbly Gum Woodlands it is found in open woodland with dominant overstorey species being <i>Angophora bakeri</i>, <i>Eucalyptus sclerophylla</i> and <i>Melaleuca decora</i>.</p> <p>The Agnes Banks Woodlands have a similar array of tree species, with the addition of <i>Banksia serrata</i> and <i>Banksia aemula</i> (Conservation 2005).</p> <p><i>Persoonia nutans</i> is found on the Agnes Banks and Berkshire Park soil landscapes. Drainage appears to influence the distribution of <i>P. nutans</i> as the species is more common on the deeper sands at Agnes Banks. At other locations on the Cumberland Plain it occurs on low rises as opposed to swales or other low lying areas (Conservation 2005).</p>	
<p><i>Pomaderris brunnea</i></p> <p>Rufous Pomaderris</p>	V	V	2V	<p><i>Pomaderris brunnea</i> is found in a very limited area around the Nepean and Hawkesbury Rivers, including the Bargo area. Occurs in the Central West, Hawkesbury/Nepean, Hunter/Central Rivers Catchments.</p> <p>Occurs on clay & alluvial soils (Fairley and Moore 1995), in moist woodland or forest of flood plains and creek lines (DEC 2005n). In the Hawkesbury/Nepean region, the species is known to be associated with Dry sclerophyll forests (Cumberland, Upper Riverina, Sydney Coastal, Sydney Hinterland, Sydney Sand Flats), Coastal Floodplain Wetlands and Coastal Valley Grassy Woodlands (DEC 2005n).</p> <p>Flowers appear in September and October.</p>	No
<p><i>Pterostylis saxicola</i></p> <p>Sydney Plains Greenhood</p>	E	E1	2E	<p>Restricted to western Sydney between Freemans Reach in the north and Picton in the south (Hawkesbury/Nepean and Sydney Metropolitan Catchment) (DEC 2005x).</p> <p>Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The plant communities above the shelves where <i>Pterostylis saxicola</i> occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils (DEC 2005x).</p> <p>All species of <i>Pterostylis</i> are deciduous and die back to fleshy, rounded underground tuberoids.</p> <p>The time of emergence and withering has not been recorded for this species, however flowering occurs from October to December and may vary due to climatic conditions. The above ground parts of the plant wither and die following seed dispersal and the plant persists as a tuberoid until the next year (DEC 2005x).</p>	No
<p><i>Pultenaea aristata</i></p> <p>Prickly Bush-pea</p>	V	V	2V	<p>Restricted to the Woronora Plateau, a small area between Helensburgh, south of Sydney, and Mt Keira above Wollongong. The species occurs in either dry sclerophyll woodland or wet heath on sandstone. Flowering has been recorded in winter and spring (DEC 2005p).</p>	No
<p><i>Pultenaea pedunculata</i></p> <p>Matted Bush-pea</p>	-	E1	-	<p>Restricted to the Cumberland Plain and near Merimbula where it grows in dry sclerophyll forest and disturbed sites (Harden 2002). In western Sydney it occurs in three locations: within industrial and residential areas at Villawood and Prestons, and north-west of Appin between the Nepean River and Devines Tunnel No. 2 (NPWS 2002c). Associated with Hawkesbury/Nepean, Southern Rivers and Sydney Metropolitan Catchment areas.</p>	No

Species	EPBC Act ¹	TSC Act ²	ROTAP ³	Habitat	Potential Habitat
				It occurs in clay or sandy clay soils (Blacktown soil landscape) on Wianamatta shale, close to localised patches of Tertiary alluvium (Liverpool) or the shale/sandstone influence (west of Appin) (DEC 2005q). At all sites there is a lateritic influence in the soil with characteristic ironstone gravels present (DEC 2005q). This species is known to occur in remnants of Cooks River Clay Plain Scrub Forest (James <i>et al.</i> 1999).	
<i>Syzygium paniculatum</i> Magenta Lilly Pilly	V	V	3Ri	Subtropical and littoral rainforest on sandy soils or stabilised dunes near the sea (Harden 1991). Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities (DEC 2005t). The species occurs in the following Catchment Authority Regions - Hunter/Central Rivers, Hawkesbury/Nepean, Sydney Metropolitan, and Southern Rivers.	No
<i>Thelymitra</i> sp. Kangaloon	CE	-	-	<i>Thelymitra</i> sp. Kangaloon is a terrestrial orchid endemic to New South Wales, and is known from three locations near Robertson in the Southern Highlands. The swamp habitat in which the species occurs has an extent of occurrence of 300 km ² and an area of occupancy of 10 km ² . The three swamps are Butlers Swamp, Stockyard Swamp and Wildes Meadow Swamp, and are all located above what is known as the Kangaloon aquifer. It flowers in late October and early November. The species grows amongst tall sedges and rushes in seasonally swampy sedgeland on grey silty clay loam at 600-700 m above sea level (Threatened Species Listing Advice 2008).	No
<i>Thesium australe</i> Austral Toad-flax	V	V	3Vi	Found in very small to large populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. <i>Thesium australe</i> is a root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass (DEC 2005u). It is often found in damp sites in association with <i>Themeda australe</i> , but also found on other grass species at inland sites (G. Leonard pers. obs.). Occurs on clay soils in grassy woodlands or coastal headlands (James <i>et al.</i> 1999).	No

4.3 Fauna Habitats

Woodland

Woodland occurred in the vicinity of the Goaf Gas Extraction Plant Option 2 location to the east of the Hume Highway. Regenerating *Eucalyptus tereticornis*, dominates the upper canopy in this area and supply direct (foliage, nectar, exudates) and indirect food (arthropods) for a range of vertebrates. Two large *E. tereticornis* which are likely to contain hollows were observed in this area adjacent to a fence line. These potentially provide nesting and roosting habitat for a range of common birds, microbats and arboreal mammals. The understory

and shrub vegetation are relatively open and dominated by grasses with a poor layer of leaf litter and fallen branches.

The Woodland habitat is considered to be in poor - moderate condition within the study area. Threatened fauna that may utilise these habitats include nomadic nectivorous species such as the Grey-headed Flying-fox *Pteropus poliocephalus* Swift Parrot *Lathamus discolor* and Regent Honeyeater *Xanthomyza Phrygia* and highly mobile species that may forage in the vicinity of the area such as threatened microbats and birds of prey.

Cleared Areas

The majority of the study area has been previously cleared for grazing, and dominated by exotic pasture grasses. Generally these areas would provide few habitat opportunities for native fauna. Species more likely to inhabit these areas include introduced and domestic animals and natives tolerant of disturbance or favouring edge/ecotone habitat. A few scattered trees were present in the vicinity of the study area providing foraging resources for common native birds.

Cleared areas are considered to be in Poor condition, with the ground flora containing a low number of indigenous species and little woodland structure and few resources available for native fauna.

Waterbodies (Dams)

A number of farm dams were observed in the vicinity of the proposed surface pipeline reticulation system, none of which will be directly impacted, however; the dams near the western sections of the surface pipeline reticulation system are downslope of the proposed pipeline. These dams lack dense vegetation on the banks, nevertheless they may provide habitat for common native amphibians, waterfowl and insects.

4.4 Fauna

4.4.1 Significant Fauna

A total of 50 threatened and/or migratory animal species or their habitat have been previously recorded within the locality (DECC Atlas of NSW Wildlife (Figure 5) and DEWHA EPBC Online Database (Table 2).

No threatened fauna were recorded during the current survey. However, the Study Area contains potential habitat for 14 threatened or migratory species listed on the TSC or EPBC Acts.

Table 2: Terrestrial fauna listed on the TSC Act or EPBC Act that may occur in the locality

Scientific Name	Common Name	EPBC Act	TSC Act (NSW)	Habitat	Potential habitat
Amphibians					
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E1	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC (NSW Government 2008). The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks (NPWS 1999c; White and Pyke 1996), although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 6 weeks to develop, feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species (DECC 2005a).	No
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	V	Occurs in wet and dry sclerophyll forests associated with sandstone outcrops between 280 and 1000 m on the eastern slopes of the Great Dividing Range (Barker <i>et al.</i> 1995). Prefers rock flowing streams, but individuals have also been collected from semi-permanent dams with some emergent vegetation (Barker <i>et al.</i> 1995). Forages both in the tree canopy and on the ground, and has been observed sheltering under rocks on high exposed ridges during summer. It is not known from coastal habitats.	No
<i>Litoria raniformis</i>	Southern Bell Frog	V	E1	In NSW the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral swamps or billabongs with an abundance of bulrushes and other emergent vegetation along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Outside the breeding season animals disperse away from the water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks (Robinson 1993; DEC 2005s).	No, unlikely to occur this far north.
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Prefers hanging swamps on sandstone shelves adjacent to perennial non-flooding creeks (Daly 1996; Recsei 1996). Can also occur within shale outcrops within sandstone formations. In the southern part of its range can occur in wet and dry forests, montane sclerophyll woodland and montane riparian woodland (Daly 1996). Individuals can be found around sandy creek banks or foraging along ridge-tops during or directly after heavy rain. Males often call from burrows located in sandy banks next to water (Barker <i>et al.</i> 1995).	No

Scientific Name	Common Name	EPBC Act	TSC Act (NSW)	Habitat	Potential habitat
<i>Mixophyes balbus</i>	Stuttering Frog	V	E1	This species is usually associated with mountain streams, wet mountain forests and rainforests (Barker <i>et al.</i> 1995). It rarely moves very far from the banks of permanent forest streams, although it will forage on nearby forest floors. Eggs are deposited in leaf litter on the banks of streams and are washed into the water during heavy rains (Barker <i>et al.</i> 1995).	No
<i>Pseudophryne australis</i>	Red-crowned Toadlet	-	V	Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breeds within small ephemeral creeks that feed into larger semi-perennial streams. After rain these creeks are characterised by a series of shallow pools lined by dense grasses, ferns and low shrubs (Thumm and Mahony 1997).	No
Birds					
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	M	-	A migratory species that is generally sedentary in Australia, although immatures and some adults are dispersive (Marchant and Higgins 1993). Found in terrestrial and coastal wetlands; favouring deep freshwater swamps, lakes and reservoirs; shallow coastal lagoons and saltmarshes. It hunts over open terrestrial habitats. Feeds on birds, reptiles, fish, mammals, crustaceans and carrion. Roosts and makes nest in trees (Marchant and Higgins 1993).	Yes
<i>Apus pacificus</i>	Fork-tailed Swift	M	-	Almost exclusively aerial (foraging and roosting). Breed in Asia (Higgins 1999).	No, overfly only
<i>Hirundapus caudacutus</i>	White-throated Needletail	M	-	An aerial species found in feeding concentrations over cities, hilltops and timbered ranges. Breed in Asia (Pizzey and Knight 1997).	No, overfly only
<i>Ardea alba</i>	Great Egret	M	-	Terrestrial wetlands, estuarine and littoral habitats and moist grasslands. Inland, prefer permanent waterbodies on floodplains; shallows of deep permanent lakes (either open or vegetated), semi-permanent swamps with tall emergent vegetation and herb dominated seasonal swamps with abundant aquatic flora. Also regularly use saline habitats including mangrove forests, estuarine mudflats, saltmarshes, bare salt pans, shallows of salt lakes, salt fields and offshore reefs. Breeding requires wetlands with fringing trees in which to build nests including mangrove forest, freshwater lakes or swamps and rivers (Marchant and Higgins 1990).	No
<i>Ardea ibis</i>	Cattle Egret	M	-	Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands (Marchant and Higgins 1990).	Yes
<i>Burhinus grallarius</i>	Bush Stone-curlew	-	E1	Lightly timbered open forest and woodland, or partly cleared farmland with remnants of woodland, with a ground cover of short sparse grass and few or no shrubs where fallen branches and leaf litter are present (Marchant and Higgins 1993).	No

Scientific Name	Common Name	EPBC Act	TSC Act (NSW)	Habitat	Potential habitat
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	-	V	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests (Higgins 1999). Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest (Forshaw and Cooper 1981). In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas (Shields and Crome 1992). It requires tree hollows in which to breed (Gibbons and Lindenmayer 1997).	No
<i>Calyptrorhynchus lathamii</i>	Glossy Black-cockatoo	-	V	Inhabits forest with low nutrients, characteristically with key Allocasuarina species. Tends to prefer drier forest types (NPWS 1999b). Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead (Higgins 1999).	No, no preferred foraging trees were observed in the study area.
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	-	E1	Found in swamps, mangroves and mudflats. Can also occur in dry floodplains and irrigated lands and occasionally forages in open grassy woodland. Nests in live or dead trees usually near water (Pizzey and Knight 1997).	No
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	-	V	Lives in eucalypt woodlands, especially areas of relatively flat open woodland typically lacking a dense shrub layer, with short grass or bare ground and with fallen logs or dead trees present (Traill and Duncan 2000).	No
<i>Monarcha melanopsis</i>	Black-faced Monarch	M	-	A migratory species found during the breeding season in damp gullies in temperate rainforests. Disperses after breeding into more open woodland (Pizzey and Knight 1997).	No
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M	-	Migratory species that occurs in coastal forests, woodlands and scrubs during migration. Breeds in heavily vegetated gullies (Pizzey and Knight 1997).	No
<i>Rhipidura rufifrons</i>	Rufous Fantail	M	-	Migratory species that prefers dense, moist undergrowth of tropical rainforests and scrubs. During migration it can stray into gardens and more open areas (Pizzey and Knight 1997).	No

Scientific Name	Common Name	EPBC Act	TSC Act (NSW)	Habitat	Potential habitat
<i>Anthochaera phrygia</i>	Regent Honeyeater	E	E1	<p>A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests (NPWS 1999d; Pizzey and Knight 1997).</p> <p>Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises : <i>E. microcarpa</i>, <i>E. punctata</i>, <i>E. polyanthemos</i>, <i>E. moluccana</i>, <i>Corymbia robusta</i>, <i>E. crebra</i>, <i>E. caleyi</i>, <i>Corymbia maculata</i>, <i>E. mckieana</i>, <i>E. macrorhyncha</i>, <i>E. laevopinea</i> and <i>Angophora floribunda</i>. Nectar and fruit from the mistletoes <i>A. miquelii</i>, <i>A. pendula</i>, <i>A. cambagei</i> are also eaten during the breeding season</p> <p>(DECC 2005b). Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks. Also nest in mistletoe haustoria.</p> <p>An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female (DECC 2005b).</p>	Yes
<i>Grantiella picta</i>	Painted Honeyeater	-	V	Found mainly in dry open woodlands and forests, where it is strongly associated with mistletoe (Higgins <i>et al.</i> 2001). Often found on plains with scattered eucalypts and remnant trees on farmlands.	No
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	-	V	Found mostly in open forests and woodlands dominated by box and ironbark eucalypts (Higgins <i>et al.</i> 2001). It is rarely recorded east of the Great Dividing Range (Higgins <i>et al.</i> 2001).	Yes
<i>Merops ornatus</i>	Rainbow Bee-eater	M	-	Usually occurs in open or lightly timbered areas, often near water. Nest in embankments, including banks of creeks and rivers, in sand dunes, in quarries and in roadside cuttings. Breeding occurs from November to January. It has complex migratory movements in Australia. NSW populations migrate north for winter (Higgins 1999).	Yes
<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	-	V	This species occurs in eucalypt and cypress woodlands on the hills and tablelands of the Great Dividing Range. They prefer woodlands with a grassy understorey, often on ridges or gullies (Blakers <i>et al.</i> 1984; NSW Scientific Committee 2008a). The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. They forage on the ground and in the understorey for arthropods and seeds (Blakers <i>et al.</i> 1984; NSW Scientific Committee 2008a). Home ranges vary from 6-12 hectares (NSW Scientific Committee 2008a).	No
<i>Stagonopleura guttata</i>	Diamond Firetail	-	V	Found in a range of habitat types including open eucalypt forest, mallee and acacia scrubs (Pizzey and Knight 1997). Often occur in vegetation along watercourses (Higgins <i>et al.</i> 2006).	No
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	-	V	This species lives in a wide range of temperate woodland habitats, and a range of woodlands and shrublands in semi-arid areas (Traill and Duncan 2000).	No

Scientific Name	Common Name	EPBC Act	TSC Act (NSW)	Habitat	Potential habitat
<i>Lathamus discolor</i>	Swift Parrot	E	E1	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects (Forshaw and Cooper 1981). The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW (Shields and Crome 1992). This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability (Pizzey and Knight 1997).	Yes
<i>Neophema pulchella</i>	Turquoise Parrot	-	V	Occurs in open woodlands and eucalypt forests with a ground cover of grasses and understorey of low shrubs (Morris 1980). Generally found in the foothills of the Great Divide, including steep rocky ridges and gullies (Higgins 1999). Nest in hollow-bearing trees, either dead or alive; also in hollows in tree stumps. Prefer to breed in open grassy forests and woodlands, and gullies that are moist (Higgins 1999).	Yes
<i>Rostratula australis</i>	Australian Painted Snipe	VM	E1	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, ephemeral or permanent, although they have been recorded in brackish waters (Marchant and Higgins 1993).	No
<i>Gallinago hardwickii</i>	Latham's Snipe	M	-	Typically found on wet soft ground or shallow water with good cover of tussocks. Often found in wet paddocks, seepage areas below dams (Pizzey and Knight 1997).	No
<i>Ninox connivens</i>	Barking Owl	-	V	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country (Pizzey and Knight 1997). Territories range from 30 to 200 ha (DEC 2005b).	Yes
<i>Ninox strenua</i>	Powerful Owl	-	V	Occupies wet and dry eucalypt forests and rainforests. Can occupy both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas (Debus and Chafer 1994b; Debus and Chafer 1994a). Large mature trees with hollows at least 0.5 m deep are required for nesting (Garnett 1992). Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials (Gibbons and Lindenmayer 1997). Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm (Gibbons and Lindenmayer 1997). Has a large home range of between 450 and 1450 hectares (DEC 2005o).	Yes
Invertebrates					
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	-	E1	Most likely restricted to Cumberland Plain, Castlereagh Woodlands and boundaries between River-flat Forest and Cumberland Plain Woodland. It is normally found beneath logs, debris and amongst accumulated leaf and bark particularly at the base of trees. May also use soil cracks for refuge (NPWS 1999a).	No, ground cover contains insufficient leaf litter
Mammals					

Scientific Name	Common Name	EPBC Act	TSC Act (NSW)	Habitat	Potential habitat
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	-	V	Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Will often nest in tree hollows, but can also construct its own nest (Turner and Ward 1995). Because of its small size it is able to utilise a range of hollow sizes including very small hollows (Gibbons and Lindenmayer 1997). Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5ha area over a 5 month period (Ward 1990).	No
<i>Dasyurus maculatus maculatus</i>	Spotted-tailed Quoll (southeastern mainland)	E	V	Occurs along the east coast of Australia and the Great Dividing Range (Belcher <i>et al.</i> 2008). Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests (Dickman and Read 1992). Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas (NPWS 1999k). Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage (Edgar and Belcher 1995). 70% of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact vegetation through which to forage (NPWS 1999e). The home range of a female is between 180 – 1000 ha, while males have larger home ranges of between 2000 – 5000 ha. Breeding occurs from May to August (Belcher <i>et al.</i> 2008).	No
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	V	E1	Occurs along the Great Dividing Range south to the Shoalhaven, and also occurs in the Warrumbungles and Mt Kaputar. Habitats range from rainforest to open woodland. It is found in areas with numerous ledges, caves and crevices, particularly where these have a northerly aspect. Individuals defend a specific rock shelter, emerging in the evening to forage on grasses and forbs, as well as browse in drier months. Home sizes range from 2-30 ha (Eldridge and Close 1995).	No
<i>Mormopterus norfolkensis</i>	Eastern Freetail Bat	-	V	Distribution extends east of the Great Dividing Range from southern Queensland to south of Sydney. Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph poles. Foraging generally occurs within a few kilometres of roosting sites (Churchill 2008; Hoyer <i>et al.</i> 2008).	Yes
<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot	E	E1	Prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burn from time to time (Braithwaite 1995). A mosaic of post fire vegetation is important for this species (Maxwell <i>et al.</i> 1996).	No

Scientific Name	Common Name	EPBC Act	TSC Act (NSW)	Habitat	Potential habitat
<i>Petaurus australis</i>	Yellow-bellied Glider	-	E2	Restricted to tall native forests in regions of high rainfall along the coast of NSW. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide shelter and nesting hollows. Critical elements of habitat include sap-site trees, winter flowering eucalypts, mature trees suitable for den sites and a mosaic of different forest types (NPWS 1999f). Live in family groups of 2-6 individuals which commonly share a number of tree hollows. Family groups are territorial with exclusive home ranges of 30-60 ha. Very large expanses of forest (>15,000ha) are required to conserve viable populations (Goldingay 2008)	No
<i>Petaurus norfolcensis</i>	Squirrel Glider	-	V	Sparsely distributed along the east coast and immediate inland areas as far west as Coonabarabran (DEC 1999) in the northern part of the state and as far west as Tocumwal along the southern border of the state (NSW Government 2008). Generally occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range. Require abundant hollow bearing trees and a mix of eucalypts, banksias and acacias (Van der Ree and Suckling 2008). Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked (Menkhorst <i>et al.</i> 1988). They live in family groups of 2-10 individuals and maintain home ranges of 0.65 and 10.5 hectares, varying according to habitat quality and food resource availability (Quin 1995; Goldingay and Jackson 2004).	No
<i>Phascolarctos cinereus</i>	Koala	-	V	In NSW the Koala mainly occurs on the central and north coasts with some populations in the western region (DEC 2005h). Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally (Martin <i>et al.</i> 2008). Primary feed trees include <i>Eucalyptus robusta</i> , <i>E. tereticornis</i> , <i>E. punctata</i> , <i>E. haemastoma</i> and <i>E. signata</i> (Department of Planning 1995). They are solitary with varying home ranges. In high quality habitat home ranges may be 1-2 ha and overlap, while in semi-arid country they are usually discrete and around 100ha (Martin <i>et al.</i> 2008).	No
<i>Potorous tridactylus</i>	Long-nosed Potoroo	V	V	Occurs from Queensland to Victoria, normally within 50km of the coast (Claridge <i>et al.</i> 2007). Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy. Known to eat fungi, arthropods, fleshy fruit, seeds and plant tissue. It is solitary and sedentary, but tends to aggregate in small groups. It has two breeding seasons, one in late winter-early spring and the other in late summer. (Johnston 2008). This species appears to benefit from a lack of recent disturbance (Claridge <i>et al.</i> 2007).	No

Scientific Name	Common Name	EPBC Act	TSC Act (NSW)	Habitat	Potential habitat
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies (camps), commonly in dense riparian vegetation. Bats commute daily to foraging areas, usually within 15 km of the day roost (Tidemann 1995) although some individuals may travel up to 70 km (Augee and Ford 1999).	Yes
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley. Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands. Roosts include rock overhangs, caves, Fairy Martin nests and mines, in colonies of between three and 40. Forages on small, flying insects below the forest canopy. Likely that it hibernates during the cooler months. Females give birth in November, and young are independent by late February (Churchill 2008; Hoyer and Schulz 2008).	No, no roosting habitat present
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	-	V	Distribution extending east of the Great Dividing Range throughout the coastal regions of NSW, from the Queensland border to the Victorian border. Prefers wet high-altitude forests. Apparently hibernates in winter. Roosts in tree hollows and sometimes in buildings and caves, in colonies of between 3 and 80. Often change roosts every night. Forages for beetles, bugs and moths below or near the canopy in forests with an open structure, or along trails. Has a large foraging range, up to 136 ha (Churchill 2008; Law <i>et al.</i> 2008). Records show movements of up to 12 km between roosting and foraging sites (Menkhorst and Lumsden 1995).	Yes
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing Bat	-	V	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometers to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways (Churchill 2008; Hoyer and Hall 2008).	No, no roosting habitat present
<i>Myotis macropus (adversus)</i>	Large-footed Myotis	-	V	Scattered, mainly coastal distribution extending to South Australia along the Murray River. Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to water bodies, ranging from rainforest streams to large lakes and reservoirs. They catch aquatic insects and small fish with their large hind claws, and also catch flying insects ((Richards <i>et al.</i> 2008)).	Yes

Scientific Name	Common Name	EPBC Act	TSC Act (NSW)	Habitat	Potential habitat
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	-	V	Occurs along the Great Dividing Range, up to 1200m, and in coastal areas. Occurs in woodland and rainforest, but prefers open habitats or natural or human-made openings in wetter forests. Often hunts along creeks or river corridors. Flies slowly and directly at a height of 30m or so to catch beetles and other large, flying insects. Also known to eat other bats and spiders. Roosts in hollow tree trunks and branches (Churchill 2008; Richards <i>et al.</i> 2008).	Yes
Reptiles					
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	V	E1	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer (Webb 1996; Webb and Shine 1998).	No
<i>Varanus rosenbergi</i>	Rosenberg's Goanna	-	V	This species is a Hawkesbury/Narrabeen sandstone outcrop specialist (Wellington and Wells 1985). Occurs in coastal heaths, humid woodlands and both wet and dry sclerophyll forests (Cogger 1992).	No

Key: 1) Listed on the TSC Act as Endangered (E), Vulnerable (V); 2) Listed on the EPBC Act as Endangered (E) or Vulnerable (V) or covered under migratory provisions (M) on the EPBC Act

Table 3: Species that are proposed to be listed on the TSC Act as vulnerable which may occur in the locality

Scientific Name	Common Name	Habitat	Potential habitat
<i>Glossopsitta pusilla</i>	Little Lorikeet	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes (NSW Scientific Committee 2008b).	Yes
<i>Daphoenositta chrysoptera</i>	Varied Sitella	Inhabit a wide variety of dry Eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia (Higgins and Peter 2002). Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in paperbarks or mature Eucalypts with hollows.	No
<i>Petroica boodang</i>	Scarlet Robin	In NSW this species inhabits open forests and woodlands from the coast to the inland slopes (Higgins and Peter 2002). Breeding occurs in ridges or slopes of drier eucalypt forests and woodlands with an open grassy or shrubby understorey (NSW Scientific	No

Scientific Name	Common Name	Habitat	Potential habitat
		Committee 2009b).	
<i>Hieraaetus morphnoides</i>	Little Eagle	Most abundant in lightly timbered areas with open areas nearby. Often recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. May nest in farmland, woodland and forest in tall trees [Marchant, 1993 #165].	Yes
<i>Petroica phoenicia</i>	Flame Robin	In NSW this species breeds in upland moist forests and woodlands often on ridges or slopes with an open understorey. In winter migrates to lowland habitats of the inland slopes and plains. (NSW Scientific Committee 2009a)	No

5.0 IMPACT ASSESSMENT

5.1 Predicted Impacts

Generally the impacts of the proposal would result in disturbance to a highly modified landscape, which provides limited habitat potential for native flora and fauna. Cleared, pasture improved paddocks with scattered trees are the dominant habitat type that will be impacted by the proposal. Scattered trees in the landscape will be avoided by the proposed works.

The exception to this is the proposed location of Goaf Gas Extraction Plant Option 2, which would have the greatest impact of the overall proposal. The potential installation of an extraction plant and the drilling of the MRD borehole from this location would require the clearing of approximately 0.16 ha of Cumberland Plain Woodland in Poor condition. In terms of impacts to flora and fauna, Goaf Gas Extraction Plant Option 1 would be the preferred option, as this Plant is located within a cleared paddock area dominated by exotic pasture grasses and *Rubus fruticosus*, and would not require clearing of any areas of native vegetation.

The disturbance footprint of each borehole drilling site comprises a 30 m x 40 m compound. Further, disturbance for the surface pipeline reticulation system will require disturbance to 650 mm width due to the pipeline easements. Given that the boreholes and pipelines are located within cleared paddocks, there are not likely to be any indirect impacts on any flora or fauna habitats.

Impacts associated with the proposal include:

- Disturbance to 0.16 ha of Cumberland Plain Woodland at the Goaf Gas Extraction Plant Option 2 location.
- Disturbance to 1.2 ha of cleared paddocks, identified as an unnatural landscape, at the Goaf Gas Extraction Plant Option 1 location and all boreholes and pipelines.

Indirect impacts are likely to be minor, as the patch impacted is small and isolated and already completely impacted by edge effects. The potential indirect impacts associated with the proposal include (in the absence of adequate amelioration measures):

- the potential for erosion during and after construction at all sites; and,
- increased human activity.

5.2 Proposed Amelioration Measures

The following measures have been recommended in order to ameliorate the impacts of the proposal:

- adjustment of the location of sections of the surface pipeline reticulation system to avoid native trees and significant habitat features such as trees with hollows, where required;
- trees with hollows should be retained and protected, with no drilling within the critical root zone (extending to 2 m beyond the drip line) of the trees;
- where possible, proposed boreholes, pipelines and access tracks have been located within existing cleared areas;
- sediment and erosion control measures should be implemented on all sites to prevent erosion during and after construction;
- any chemicals used on site will be taken off site after use and disposed of appropriately;
- machinery and vehicles should be washed down prior to use on site to avoid the transmission of weed seed or disease into intact areas of native vegetation;
- the location of Goaf Gas Extraction Plant Option 1 is the preferred option, as this location supports cleared paddocks and would not result in impacts to flora and fauna habitats. The development of Goaf Gas Extraction Plant Option 2 and the drilling of the MRD borehole from this location would result in the removal of approximately 0.16 ha of Cumberland Plain Woodland, an EEC on the EPBC and TSC Acts, and habitat for a number of threatened animal species.
- a suitably qualified ecologist should be on site during the construction of Goaf Gas Extraction Plant Option 2 if this option is utilised, to minimise impacts to significant habitat features;
- The site of Option 2 (if this option is utilised) should be rehabilitated with local native species characteristic of Cumberland Plain Woodland after the cessation of goaf gas drainage to replace any cleared vegetation.

5.3 Part 3A Guidelines for Threatened Species Assessment (EP&A Act)

The impacts of the proposal on threatened biota listed under the TSC Act have been undertaken following the Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act (DEC & DPI 2005). Where threatened biota is **recorded** within a Study Area, an impact assessment is required under the EP&A Act. When threatened biota is **not recorded** during a survey, the presence of potential habitat for this species is used to determine the need to undertake an impact assessment under the EP&A Act. Where there is no potential habitat in the Study Area for threatened biota, there is unlikely to be any impact on these species and therefore they are not required to be considered further.

The impact assessments included in Appendix 4 incorporate a consideration of the predicted impacts and amelioration measures as outlined in Sections 5.1 and 5.2 respectively.

5.3.1 Endangered Ecological Communities

The Study Area supports one Endangered Ecological Community listed under the TSC Act, Cumberland Plain Woodland. Impacts to this plant community would occur if Goaf Gas Extraction Plant Option 2 and the drilling of the MRD borehole from this location were undertaken and would involve clearing of a small, isolated regrowth patch in poor condition. Approximately 0.16 ha of Cumberland Plain Woodland would need to be cleared for the construction of Goaf Gas Extraction Plant Option 2 and the drilling of the MRD borehole, if this option is utilised.

An assessment of impact under Part 3A of the EP&A Act has been undertaken for Cumberland Plain Woodland (Appendix 4).

5.3.2 Flora

No threatened flora were recorded in the study area. Further, the habitats in the study area are not considered to provide potential habitat for any threatened plant species listed on the TSC Act. Therefore, impact assessments under Part 3A of the EP&A Act are not considered necessary for threatened plant species.

5.3.3 Fauna

No threatened fauna were recorded during the current survey. However, there is potential habitat (mostly opportunistic foraging resources) for 11 species listed under the TSC Act and two species that are preliminary determinations to be

listed under Schedule 2 of the TSC Act. Where there is potential habitat (foraging or breeding resources) for a threatened species in the Study Area, further consideration must be given to the potential impact of the proposal on these species.

The proposal may significantly impact threatened species by causing any of the following situations to arise:

- death or injury of individuals;
- loss or disturbance of limiting foraging resources; and
- loss or disturbance of limiting breeding resources.

Limiting resources are specialised habitat components that species are dependent on for their ongoing survival. Such limiting resources are predominantly associated with specialised breeding habitats (such as tree hollows or suitable nest/maternity roost sites) that occur at low densities, with high levels of competition from a range of species. However for some species, limiting resources include specialised foraging habitats that have a restricted distribution.

Impact assessments have been carried out for 13 species in Appendix 4. The impacts described are specific to the proposed location of Goaf Gas Extraction Plant Option 2, which would involve clearing of a small area of Cumberland Plain Woodland, which may provide some opportunistic foraging habitat for threatened species. Given the highly disturbed nature of the study area, it is not considered to contain potential habitat for the remaining species, therefore, impact assessments have not been carried out for these species. No threatened animal species have potential habitat within the remainder of the study area and as such, if the Goaf Gas Extraction Plant Option 1 is developed then the impacts are likely to be less than stated.

5.3.4 Conclusions of the Impact Assessments

The impact assessments (Appendix 4) concluded that the proposal is likely to have a minor impact on threatened biota, as listed on the TSC Act, provided recommended ameliorative measures are adhered to.

5.3.5 Key Thresholds

The Part 3A Guidelines of the EP&A Act (DEC & DPI 2005) set out a number of key thresholds which need to be addressed to justify the impacts of the proposal on threatened species, populations or ecological communities. The key thresholds are (DEC & DPI 2005):

- whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts, will maintain or improve biodiversity values;
- whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community;
- whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction; and,
- whether or not the proposal will adversely affect critical habitat.

Based on the impact assessments following the Part 3A Guidelines of the EP&A Act for Threatened Species Assessment (Appendix 4), the proposal is unlikely to reduce the long-term viability of, accelerate the extinction of and/or adversely affect critical habitat for threatened species and/or populations within the Study Area (Table 4).

Maintenance of Biodiversity Values

Given that a total of 0.16 ha of highly degraded regrowth native vegetation, that provides limited potential habitat for a number of threatened species, may be impacted by the proposal, some biodiversity values of the locality will be lost. The loss of biodiversity values can be minimised by incorporating the proposed amelioration measures detailed in Section 5.2, particularly measures to avoid and protect significant habitat features and to include suitable rehabilitation for any impacts to Cumberland Plain Woodland and fauna habitat after the removal of the Project infrastructure. Provided that the amelioration measures detailed in Section 5.2 are implemented, the proposal is likely to maintain the biodiversity values of the locality.

Table 4: Assessment of Key Thresholds

Threatened Biota	Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts, will maintain or improve biodiversity values.	Will the proposal reduce the long-term viability of a local population of the species, population or EEC?	Will the proposal accelerate the extinction of the species, population or EEC or place it at risk of extinction?	Will the proposal adversely affect critical habitat?
Endangered Ecological Communities				
Cumberland Plain Woodland	Likely to maintain biodiversity values	Unlikely	Unlikely	No
Threatened Fauna				
Grey-headed Flying Fox	Likely to maintain biodiversity values	Unlikely	Unlikely	No
Microchiropteran Bats (Greater Broad-nosed Bat, Eastern False Pipistrelle, Eastern Freetail-bat, Large-footed Myotis)	Likely to maintain biodiversity values	Unlikely	Unlikely	No
Regent Honeyeater and Swift Parrot	Likely to maintain biodiversity values	Unlikely	Unlikely	No
Black-chinned honeyeater, Turquoise Parrot, Little Lorikeet, Little Eagle	Likely to maintain biodiversity values	Unlikely	Unlikely	No
Forest Owls (Powerful Owl and Barking Owl)	Likely to maintain biodiversity values	Unlikely	Unlikely	No
Migratory bird species (White-bellied Sea-eagle, Cattle Egret and Rainbow Bee-eater.	Likely to maintain biodiversity values	Unlikely	Unlikely	No

5.4 Commonwealth Significance Impact Criteria (EPBC Act)

Under the Commonwealth EPBC Act, if the proposal has the potential to have an adverse impact on threatened biota listed on the Act, the proposal must be referred to the Federal Minister for the Environment for further consideration. The Significant Impact Criteria (DEH 2006) are used to assess the likelihood of impact.

The address of Significant Impact Criteria included in Appendix 5 incorporates a consideration of the predicted impacts and amelioration measures as outlined in Sections 5.1 and 5.2 respectively.

5.4.1 Endangered Ecological Communities

The Study Area supports one Endangered Ecological Community listed under the EPBC Act, Cumberland Plain Woodland. Impacts to this plant community would occur if Goaf Gas Extraction Plant Option 2 were to be developed and this would involve clearing of a small, isolated regrowth patch in poor condition.

Approximately 0.16 ha of Cumberland Plain Woodland would need to be cleared for the construction of Goaf Gas Extraction Plant Option 2.

An assessment of impact under the EPBC Act has been undertaken for Cumberland Plain Woodland (Appendix 5).

5.4.2 Flora

No threatened plant species, or their habitat, are considered to occur within the Study Area. Therefore, impact assessments under the EPBC Act are not required for any threatened plant species.

5.4.3 Fauna

The Study Area contains potential habitat for three threatened species and three migratory species listed on the EPBC Act.

Assessments of the Significance Impact Criteria have been prepared for these species in Appendix 5 and have concluded that the proposal is unlikely to have a significant impact on any matter of National environmental significance. Thus a referral under the EPBC Act is not recommended. Potential habitat for the remaining species does not occur within the Study Area therefore Assessments of Significance are not required for these species.

5.4.4 Conclusions of the Significant Impact Criteria Assessments

The proposal may result in impact to approximately 0.16 ha of Cumberland Plain Woodland and habitat for threatened fauna. This represents approximately 0.01% of the local distribution of this plant community.

The Significant Impact Criteria Assessments under the EPBC Act (Appendix 5) found that the proposal is not likely to have a significant impact on threatened species, endangered ecological communities or their habitats, as listed on the EPBC Act, provided recommended ameliorative measures are adhered to.

6.0 CONCLUSION

The proposal may involve clearing or modifying approximately 0.16 ha of poor condition Cumberland Plain Woodland and 1.2 ha of Cleared Paddocks. Cumberland Plain Woodland is an EEC, listed on the TSC Act and EPBC Act. No threatened plant species or their potential habitats were recorded within the Study Area.

The proposal may remove or modify a small area of potential foraging habitat for 14 threatened or migratory species listed on the TSC Act and/or the EPBC Act, and two species preliminary listed under Schedule 2 of the TSC Act.

Impact Assessments following the Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act (DEC & DPI 2005) and Significant Impact Guidelines under the EPBC Act (DEH 2006) were carried out for threatened biota occurring or with potential habitat in the Study Area. It was found the impacts of the proposal are likely to be minor.

A number of amelioration measures are recommended in Section 5.2 to reduce the potential impacts of the proposal on flora and fauna of the locality.

PLATES



Plate 1: Cleared paddocks



Plate 2: Regrowth *Acacia parramattensis* within cleared paddock

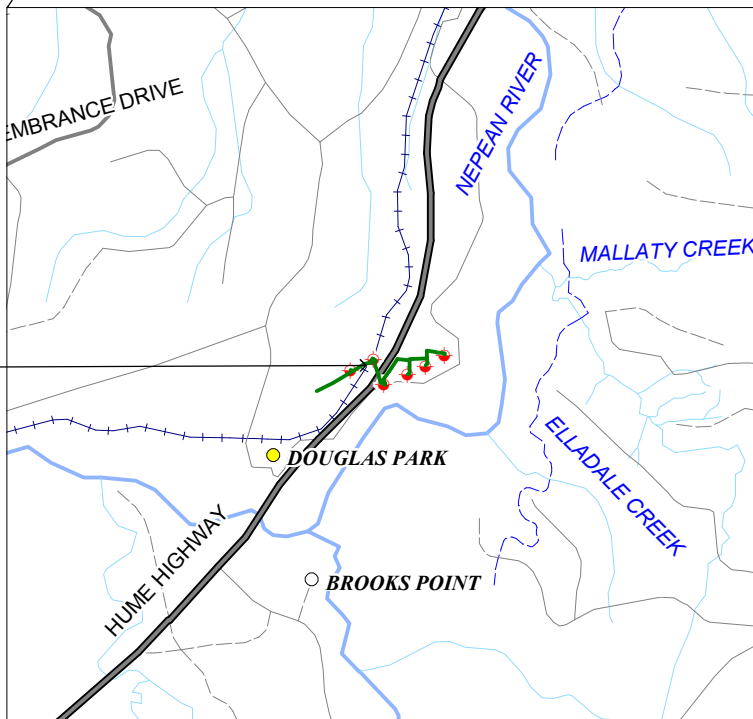


Plate 3: Regrowth Cumberland Plain Woodland in Poor Condition



Plate 4: Large remnant *Eucalyptus tereticornis* with hollows within Cumberland Plain Woodland

FIGURES



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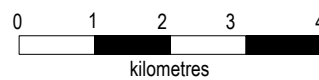
Figure 1: Location of the Study Area in a regional context.

Date: 08 May 2009

Checked by: RBR | File number: S5310

Location: 5000\5300s\5310\Mapping\S5310 F1 Locality.WOR

Scale:



Legend

Survey Area

- Well Location
- Downhole Location

Proposed Gas Pipeline

- Pipeline
- Goaf Plant

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Figure 2: The Proposal

Date: 15 May 2009
Checked by: SEW File number: S5309
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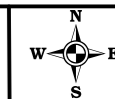
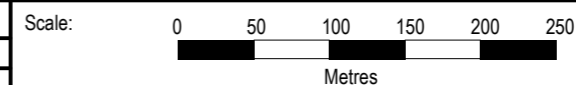
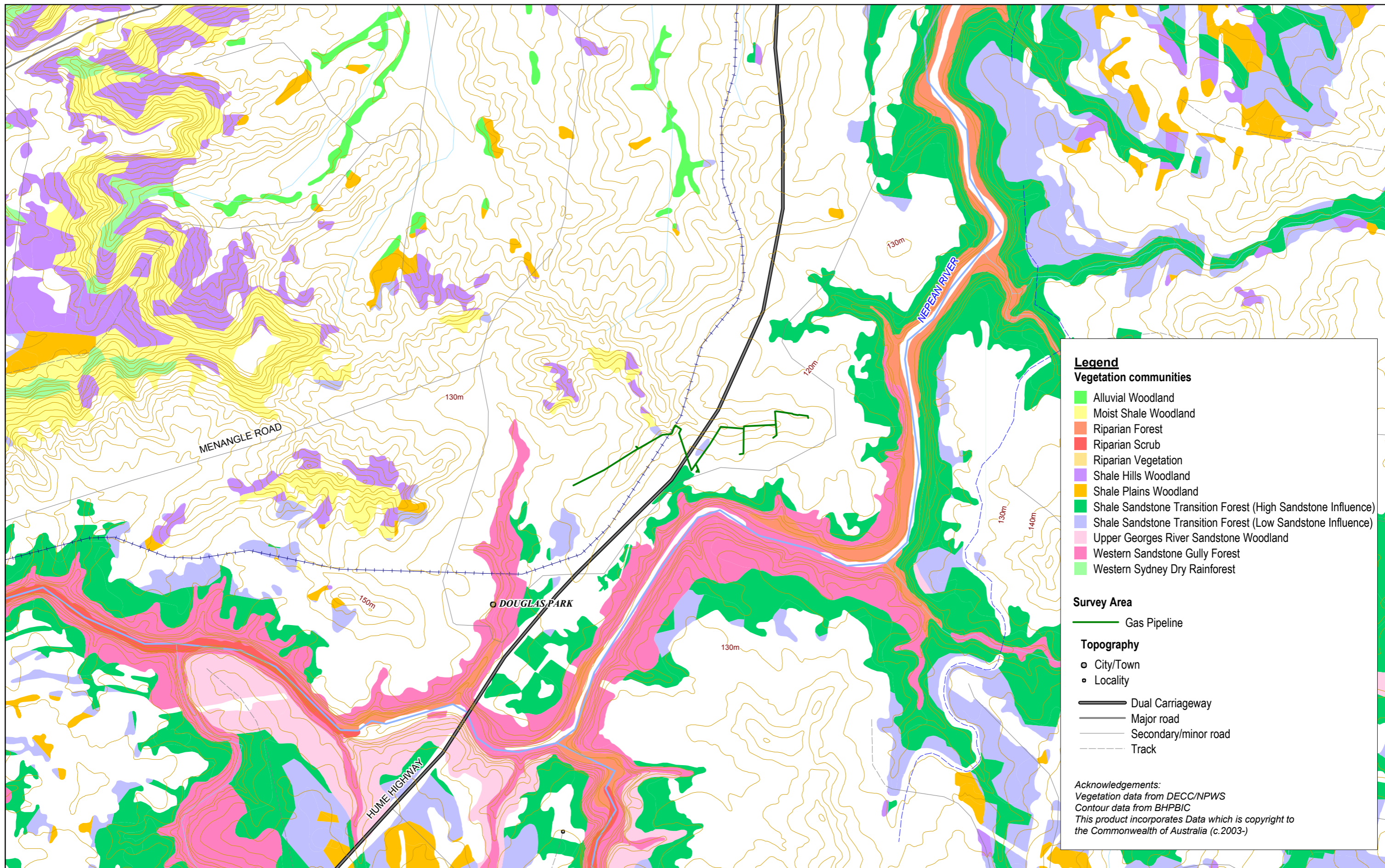


Figure 2: The Proposal



Legend

Vegetation communities

- Alluvial Woodland
- Moist Shale Woodland
- Riparian Forest
- Riparian Scrub
- Riparian Vegetation
- Shale Hills Woodland
- Shale Plains Woodland
- Shale Sandstone Transition Forest (High Sandstone Influence)
- Shale Sandstone Transition Forest (Low Sandstone Influence)
- Upper Georges River Sandstone Woodland
- Western Sandstone Gully Forest
- Western Sydney Dry Rainforest

Survey Area

- Gas Pipeline

Topography

- City/Town
- Locality
- Dual Carriageway
- Major road
- Secondary/minor road
- Track

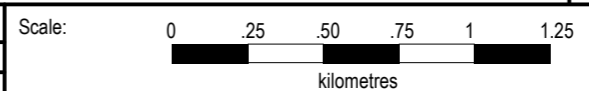
*Acknowledgements:
Vegetation data from DECC/NPWS
Contour data from BHPBIC
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Figure 3: Plant communities within the vicinity of the study area

Date: 08 May 2009

Checked by: SEW File number: S5309

Location: P:\5000\5300s\5309\Mapping\S5309 F3 Veg.WOR



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Figure 3: Plant communities within the vicinity of the study area

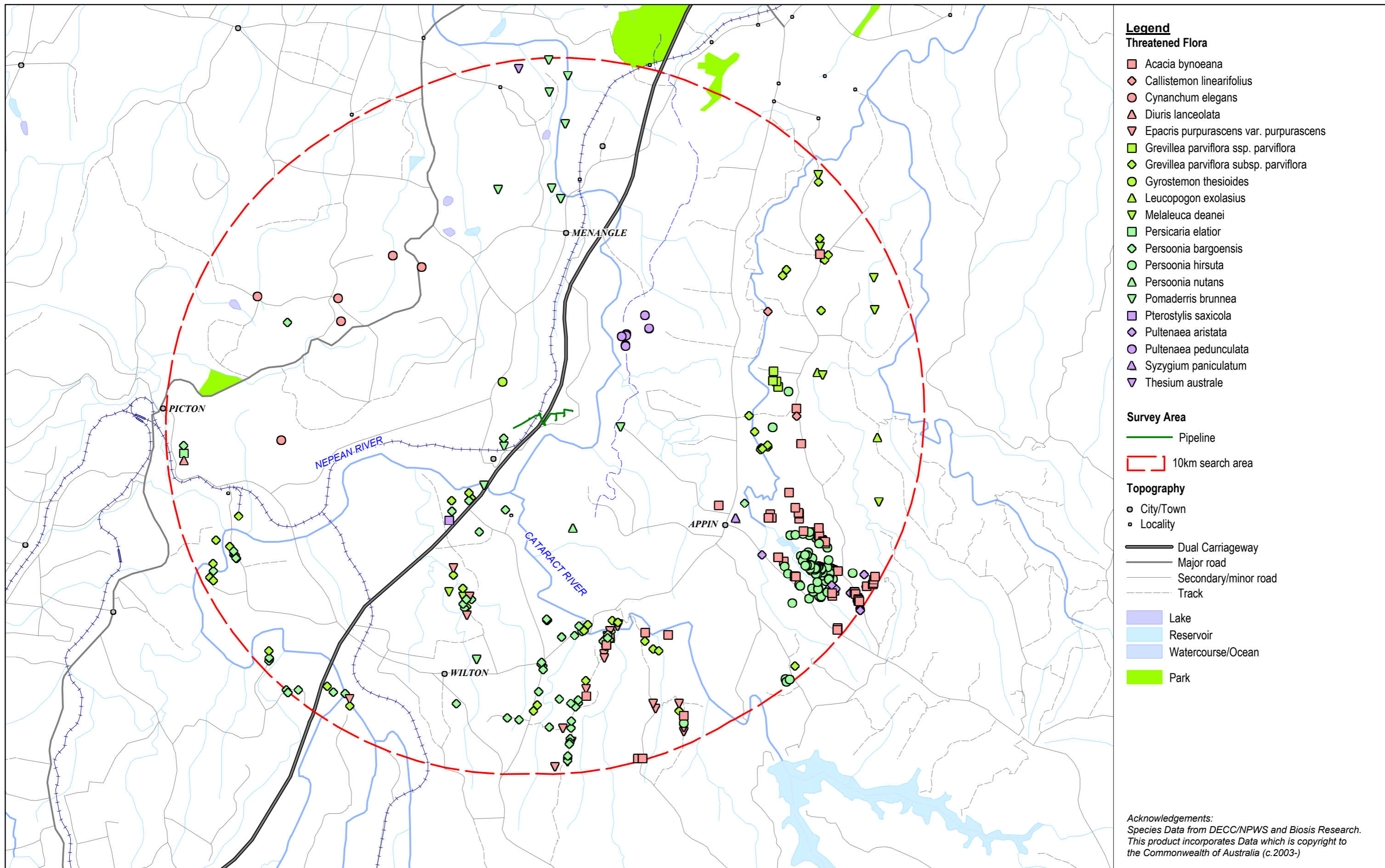


Figure 4 : Threatened flora, listed on the TSC and EPBC Act, within 10km of the Study Area

Figure 4 : Threatened flora, listed on the TSC and EPBC Act, within 10km of the Study Area

Date: 08 May 2009
 Checked by: SEW
 File number: S5309
 Location: P:\5000\5300s\5309\Mapping\S5309 F4 Flora.WOR



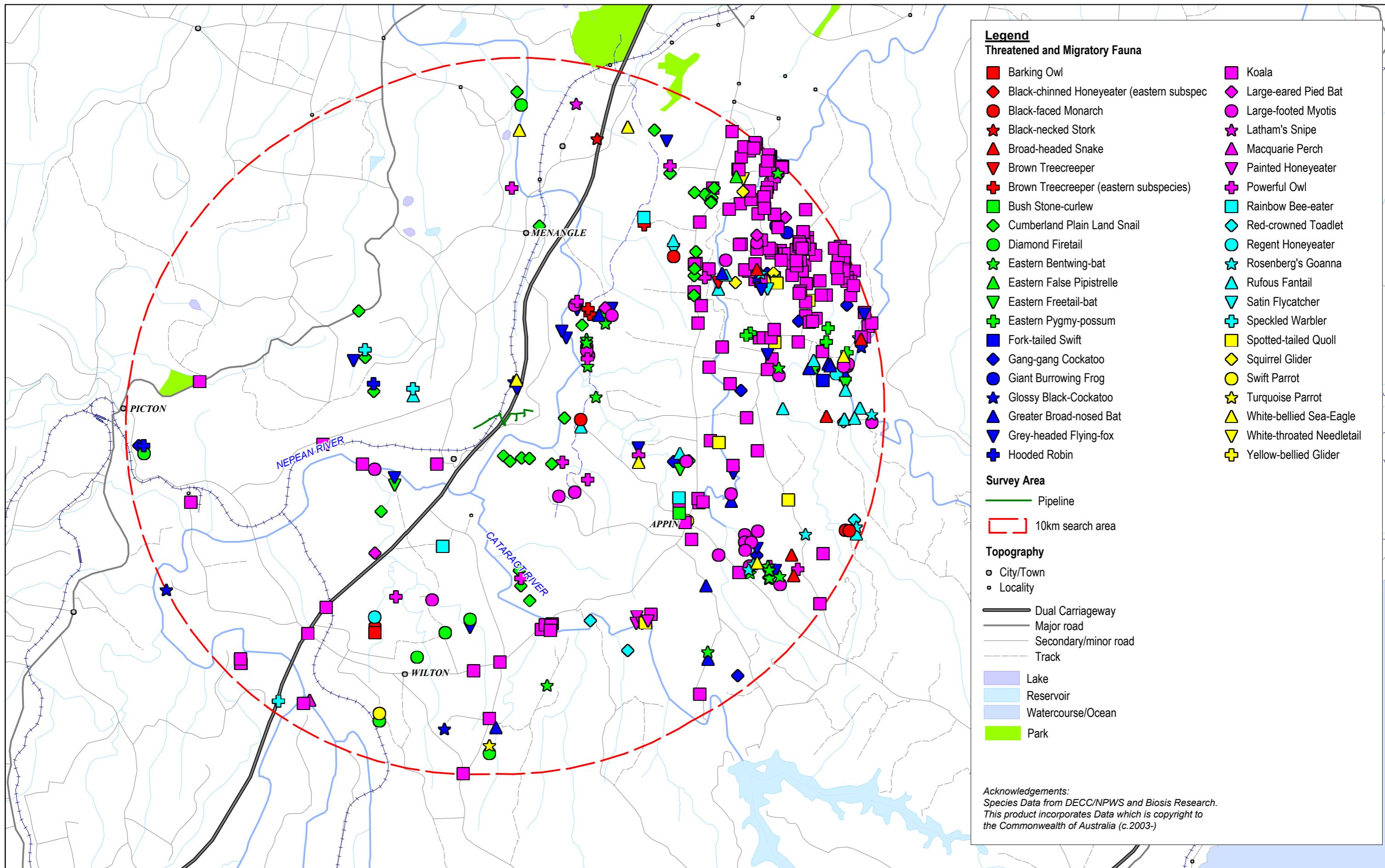


Figure 5: Threatened fauna within 10km of the study Area

Figure 5: Threatened fauna within 10km of the study Area

APPENDICES

APPENDIX 1

Flora Results

Plant species recorded in the study area

Family		Scientific Name	Common Name
Monocotyledons			
Cyperaceae			
	*	<i>Cyperus spp.</i>	
Poaceae			
		<i>Aristida ramosa var. ramosa</i>	
		<i>Austrodanthonia spp.</i>	
		<i>Bothriochloa spp.</i>	
	*	<i>Chloris gayana</i>	Rhodes Grass
	*	<i>Cynodon dactylon</i>	Common Couch
		<i>Eragrostis leptostachya</i>	Paddock Lovegrass
		<i>Microlaena stipoides var. stipoides</i>	Weeping Grass
	*	<i>Paspalum dilatatum</i>	Paspalum
	*	<i>Pennisetum clandestinum</i>	Kikuyu Grass
	*	<i>Phalaris spp.</i>	
	*	<i>Setaria gracilis</i>	Slender Pigeon Grass
	*	<i>Sporobolus indicus var. capensis</i>	Parramatta Grass
		<i>Themeda australis</i>	Kangaroo Grass
Dicotyledons			
Apiaceae			
	*	<i>Foeniculum vulgare</i>	Fennel
Asclepiadaceae			
	*	<i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush
Asteraceae			
		<i>Calotis cuneifolia</i>	Purple Burr-Daisy
	*	<i>Cirsium vulgare</i>	Spear Thistle
	*	<i>Conyza spp.</i>	
	*	<i>Hypochaeris radicata</i>	Catsear
	*	<i>Senecio madagascariensis</i>	Fireweed
	*	<i>Sonchus oleraceus</i>	Common Sowthistle
Brassicaceae			
	*	<i>Brassica spp.</i>	
Cactaceae			
	*	<i>Opuntia spp.</i>	
Campanulaceae			
		<i>Wahlenbergia gracilis</i>	Sprawling or Australian Bluebell
		<i>Wahlenbergia stricta ssp. stricta</i>	
Casuarinaceae			
		<i>Allocasuarina littoralis</i>	Black Sheoak
Convolvulaceae			
		<i>Dichondra repens</i>	Kidney Weed
Euphorbiaceae			
	*	<i>Ricinus communis</i>	Castor Oil Plant
Fabaceae (Mimosoideae)			
		<i>Acacia parramattensis</i>	Parramatta Wattle
		<i>Acacia saligna</i>	Golden Wreath Wattle
Fabaceae (Faboideae)			
	*	<i>Trifolium repens</i>	White Clover

Family		Scientific Name	Common Name
Malvaceae			
	*	<i>Modiola caroliniana</i>	Red-flowered Mallow
	*	<i>Sida rhombifolia</i>	Paddy's Lucerne
Myrtaceae			
		<i>Eucalyptus moluccana</i>	Grey Box
		<i>Eucalyptus spp.</i>	
		<i>Eucalyptus tereticornis</i>	Forest Red Gum
		<i>Lophostemon confertus</i>	Brush Box
Oleaceae			
	*	<i>Ligustrum lucidum</i>	Large-leaved Privet
	*	<i>Olea europaea ssp. africana</i>	
Phytolaccaceae			
	*	<i>Phytolacca octandra</i>	Inkweed
Pittosporaceae			
		<i>Bursaria spinosa ssp. spinosa</i>	Sweet Bursaria
Plantaginaceae			
	*	<i>Plantago lanceolata</i>	Lamb's Tongues
Rosaceae			
	*	<i>Rubus fruticosus</i>	Blackberry complex
Verbenaceae			
	*	<i>Verbena bonariensis</i>	Purpletop

Note - * signifies exotic species

APPENDIX 2

Conservation Rating According to Briggs and Leigh (1995)

Conservation Rating According to Briggs and Leigh (1996)

Briggs and Leigh (1996) list over 5,031 species, subspecies and varieties of plants (5% of native vascular flora of Australia) that have been ranked according to their conservation status. While many of these species are contained within the schedules of various state and federal threatened species legislation (e.g. TSC Act and *EPBC* Act), and are subject to legislative provisions under those acts, a great many more do not and as a such are extraneous to statutory assessment processes.

The modified list below presents the range of codes that are, in various combinations, applied to each listed plant species.

- **1** Species only known from one collection
- **2** Species with a geographic range of less than 100km in Australia
- **3** Species with a geographic range of more than 100km in Australia
- **X** Species presumed extinct; no new collections for at least 50 years
- **E** Endangered species at risk of disappearing from the wild state if present land use and other causal factors continue to operate
- **V** Vulnerable species at risk of long-term disappearance through continued depletion.
- **R** Rare, but not currently considered to be endangered.
- **K** Poorly known species that are suspected to be threatened.
- **C** Known to be represented within a conserved area.
- **a** At least 1,000 plants are known to occur within a conservation reserve(s).
- **i** Less than 1,000 plants are known to occur within a conservation reserve(s).
- **-** The reserved population size is unknown.
- **t** The total known population is reserved.
- **+** The species has a natural occurrence overseas.

APPENDIX 3

Fauna Results

Animal species recorded in the study area

Scientific Name	Common Name	Observation Type
Birds -Native		
<i>Cracticus torquatus</i>	Grey Butcherbird	OW
<i>Grallina cyanoleuca</i>	Magpie-lark	OW
<i>Gymnorhina tibicen</i>	Australian Magpie	OW
<i>Cacatua roseicapilla</i>	Galah	OW
<i>Vanellus miles</i>	Masked Lapwing	OW
<i>Ocyphaps lophotes</i>	Crested Pigeon	OW
<i>Corvus coronoides</i>	Australian Raven	OW
<i>Rhipidura leucophrys</i>	Willie Wagtail	
<i>Hirundo neoxena</i>	Welcome Swallow	O
<i>Platycercus eximius</i>	Eastern Rosella	OW
<i>Manorina melanocephala</i>	Noisy Miner	OW

Key: O: Observed, W: Heard,

APPENDIX 4

Impact Assessment following the Guidelines for Threatened Species Assessment under Part 3A of the EP&A Act

Flora

Impact assessments are undertaken for one endangered ecological community, which may be impacted by the proposal: Cumberland Plain Woodland.

Cumberland Plain Woodland

Cumberland Plain Woodland is listed as an Endangered Ecological Community on the TSC Act. An area of approximately 0.16 ha of Cumberland Plain Woodland will be cleared as a result of the proposal if Goaf Gas Extraction Plant Option 2 is developed.

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

NA.

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

Approximately 0.16 ha will be cleared as a result of the proposal if Goaf Gas Extraction Plant Option 2 is developed. Approximately 2010 ha of Cumberland Plain Woodland has been mapped as occurring within 10 km of the study area by DECC (NPWS 2002b). The area of habitat in the Study Area to be impacted (directly and indirectly) by the proposal equates to less than 0.01% of similar habitat types in the locality and this is not considered to be a significant amount of habitat.

The proposal is not likely to have a significant effect on the habitat of the species in the locality.

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

Cumberland Plain Woodland occurs on the Cumberland Plain of western Sydney. Much of the original extent of the community has been cleared, however bushland remnants exist in an area bounded by Scheyville (north), Penrith (west), Parramatta (east) and Thirlmere (south) (NPWS 2004). The study area is near the south-western limit of distribution of Cumberland Plain Woodland.

How is the proposal likely to affect current disturbance regimes?

The proposal is not likely to alter the intensity and frequency of fire or modify any flooding flows. The proposal is not likely to affect disturbance regimes.

How is the proposal likely to affect habitat connectivity?

The removal of a small isolated patch of Cumberland Plain Woodland in poor condition is not likely to affect habitat connectivity. Currently the patch of Cumberland Plain Woodland that may be impacted is surrounded by cleared paddocks, separated from a relatively intact riparian corridor along the Nepean River by approximately 75 m of cleared farmland. The proposal will not significantly affect habitat connectivity for Cumberland Plain Woodland.

How is the proposal likely to affect critical habitat?

Under the TSC Act, the Director-General of Department of Environment and Climate Change maintains a Register of Critical Habitat. To date, no critical habitat has been declared for Cumberland Plain Woodland.

The proposal will not have an adverse effect on critical habitat (directly or indirectly).

Conclusion:

The impact of the proposal on Cumberland Plain Woodland is likely to be minor as:

- The proposal is unlikely to have a major impact on the occurrence of Cumberland Plain Woodland within the locality;
- Potential impacts to less than 0.01% of the local occurrence of Cumberland Plain Woodland is not considered to be a major amount of habitat;
- The proposal will not result in fragmentation Cumberland Plain Woodland; and,
- No critical habitat has been declared for Cumberland Plain Woodland.

Fauna

Forest Owls

The Barking Owl and Powerful Owl are listed as Vulnerable on Schedule 2 of the TSC Act and have been grouped on the basis of their similar habitat requirements.

These species inhabit woodland and/or forest habitats and are dependent upon tree hollows for nesting sites and habitat for hollow-dwelling arboreal marsupials

(possums and gliders), which comprise a large proportion of the owls' diet, (Higgins 1999). The Study Area contains potential foraging habitat only for these species, no large hollow bearing trees suitable for either species is present.

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

The Study Area contains potential foraging habitat only for these species, no large hollow bearing trees suitable for either species is present. The Proposal may remove and/or modify approximately 0.16 ha of woodland foraging habitat in poor condition. However, given these species are highly mobile, have a large home range (in the order of several hundred hectares) and the extent of potential foraging habitat within the locality and in adjacent areas it is unlikely that foraging resources in the Study Area . It is unlikely that the proposal would impact on the lifecycle of the two species of forest owls.

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

The Powerful Owl and Barking Owl have a large home range, which is in the order of several hundred hectares (Gibbons and Lindenmayer 1997). The Proposal may modify (including direct and indirect impacts) approximately 0.16 ha of potential woodland within the Study Area. The amount of potential habitat that may be modified and /or removed represents approximately 0.01% of suitable foraging habitat for these species within the locality. Given the mobility of these species and the extent of higher quality potential habitat within the locality it is unlikely that the proposal would have a significant impact on the habitats for these species in the locality.

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

The Powerful Owl has been recorded along the eastern coast of Australia from south-eastern Queensland to Victoria (Debus, 1994). Records are concentrated on the coastward side of the Great Dividing Range but in many places its distribution extends to the inland slopes, mostly within approximately 200 km of the coast.

The Barking Owls occurs in forests and woodlands in the tropical, temperate and arid zones (NPWS 2003b). Its distribution covers most of the continent excluding. the arid zones of WA, SA and the NT (Pizzey and Knight 2007).

The Study Area is not at the limit of known distribution for either species.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the Study Area.

How is the proposal likely to affect habitat connectivity?

Given the extent of potential habitat within the locality, mobility and home range of the two owl species, it is unlikely that the Proposal would result in the fragmentation or isolation of potential habitat for these species.

How is the proposal likely to affect critical habitat?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for these species.

Conclusion

The impact of the proposal on the two species of forest owl is likely to be minor as:

- The proposal is unlikely to have a major impact on the lifecycle of the forest owls;
- The proposal is unlikely to have a major impact on the composition of potential habitat for forest owls within the locality;
- The Study Area contains approximately 0.16 ha of woodland in poor condition. The amount of potentially impacted habitat, estimated to be 0.01% of the local occurrence of potential foraging habitat for this species, is not considered to be a significant amount of habitat;
- There would be no clearing of any large hollow bearing trees therefore there would be limited impact on potential habitat for these species;
- The proposal would not result in significant long-term isolation or fragmentation of habitat for this species; and,
- No critical habitat has been declared for the two forest owl species.

Woodland Birds

The Turquoise Parrot and Black-chinned Honeyeater are listed as Vulnerable under Schedule 2 of the TSC Act. The Little Lorikeet and Little Eagle are proposed to be listed as vulnerable under the Schedule 2 of the TSC Act.

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

The Proposal may remove and/or modify approximately 0.16 ha of woodland habitat in poor condition. There are minimal trees that may be removed and only two hollow bearing trees suitable for the Turquoise Parrot and Little Lorikeet. The Little Eagle is known to breed in lightly timbered areas. There were no nests of this species or other large birds of prey observed within the study area. The Black-chinned Honeyeater mostly breeds on the western slopes of the Great Dividing Range.

The study area may provide some foraging resources for these species however there are continuous areas of bushland in the locality and the may impact a small area of previously disturbed habitat (0.16 ha).

Given the extent of potential habitat for these species in the locality, the mobility of these species it is unlikely that the proposal would impact on the lifecycle of these four woodland bird species.

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

The amount of potential habitat that may be modified and /or removed represents approximately 0.01% of suitable foraging habitat for these species within the locality. Given the mobility of these species and the extent of higher quality potential habitat within the locality it is unlikely that the proposal would have a significant impact on the habitats for these species.

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

The Turquoise Parrot is distributed from south-east Queensland to North-east Victoria(Pizzey and Knight 2007).

The Black-chinned honeyeater is distributed from South-eastern South Australia to North Queensland, the Northern Territory and Western Australia (Pizzey and Knight 2007).

The Little Lorikeet is distributed for north Queensland to south-eastern South Australia (Pizzey and Knight 2007).

The Little Eagle is distributed widely throughout the Australian mainland except for the heavily forested parts of the great dividing range (Marchant and Higgins 1993).

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

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the Study Area.

How is the proposal likely to affect habitat connectivity?

The proposal will not fragment any areas of existing bushland and the areas to be impacted do not form any continuous areas of foraging habitat. Given the extent of potential habitat within the locality, the mobility of these species and the minor vegetation clearing to be undertaken, it is unlikely that the Proposal would result in the fragmentation or isolation of potential habitat for these species.

How is the proposal likely to affect critical habitat?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for these species.

Conclusion

The potential impact of the proposal on these woodland birds likely to be minor as:

- The proposal is unlikely to have a major impact on the lifecycle of these four species;
- The proposal is unlikely to have a major impact on the composition of potential habitat for these species within the locality;
- The Study Area contains approximately 0.16 ha of woodland in poor condition. The amount of potentially impacted habitat, estimated to be 0.01% of the local occurrence of potential habitat for this species, is not considered to be a major amount of habitat;
- There would be no clearing of any large hollow bearing trees therefore there would be limited impact on potential habitat for these species;

- The proposal would not result in significant long-term isolation or fragmentation of habitat for this species; and,
- No critical habitat has been declared for these four woodland bird species.

Swift Parrot and Regent Honeyeater

The Regent Honeyeater and Swift parrot are listed as Endangered under Schedule 1 of the TSC Act.

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

The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW the species mostly occurs on the coast and south west slopes (DEC 2005r).

The Regent Honeyeater breeds at only three known key breeding regions: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands (DEC 2005r). However, significant breeding events have also been recorded in the winter foraging habitat of the Quorrobolong and Kurri areas of the Hunter Valley (DECC unpublished, 2007). The Study Area is not located near any of the key breeding areas for this species, however there is potential for breeding to occur. .

Therefore it is unlikely that the Study Area supports a local population of the Swift Parrot or Regent Honeyeater, however it is possible that these species utilise the woodland habitat within the Study Area to forage occasionally. This habitat type are widely distributed throughout the locality (0.16 ha). Given that these species are highly mobile and the extent of potential habitat within the locality, it is unlikely that the Regent Honeyeater and Swift Parrot would be dependant on the habitat resources within the Study Area for continued survival. Therefore it is unlikely the potential removal and/or modification of 0.16 ha of potential habitat (0.01 % of available habitat within the locality) would have a major impact on the lifecycle of these species.

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

The Regent Honeyeater has a patchy distribution throughout a large geographic range and is considered to be highly mobile occurring in temperate eucalypt woodlands and open forests (NPWS 1999d; Higgins *et al.* 2001). Most records are from box-ironbark eucalypt forests associations and wet lowland coastal forests

(NPWS 1999d; Pizzey and Knight 2007). The species is known to breed at a small number of sites containing a variety of key *Eucalyptus* spp., particularly *E. sideroxylon*, *E. melliodora* and *E. albens*, *E. robusta*, but also *E. tereticornis* and *E. moluccana* (Schedvin 1996; Webster & Menkhorst 1992; Franklin *et al.* 1989). There are particular box-ironbark woodlands, usually associated with breeding for the Regent Honeyeater, which were not observed during the survey and there are no known breeding sites within the locality.

In NSW the Swift Parrot mostly occurs on the coast and south west slopes (DEC 2005r). When migrating during the non-breeding season, the Swift Parrot can occur on the mainland in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as *Eucalyptus robusta*, *Corymbia maculata*, *C. gummifera*, *E. sideroxylon*, and *E. albens*. Commonly used lerp infested trees include *E. microcarpa*, *E. moluccana* and *E. pilularis* (DEC 2005r).

The habitat within the study area is considered to be marginal foraging habitat. Neither species were recorded during the current survey or within the Study Area but have been recorded on a few occasions within the locality. It is unlikely this proposal would have major impacts on the composition of potential habitat of these bird species. Further, given the lack of mature foraging trees within the Study Area it is unlikely to constitute prime or core habitat for this species. It is possible that these species would use the resources within the Study Area on occasion however it is unlikely to be dependant on them.

The proposal may impact 0.16 ha of potential woodland habitat. Given this represents only 0.01 % of the broader distribution of these habitats within the locality, it is unlikely that the proposal would have a significant impact on the habitats for both these species. Larger, higher quality areas of potential habitat occur within the locality and as such it is unlikely that the habitat which may be removed is important to the long-term survival of the species.

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

The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland.

The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland.

The Study Area is not at the limit of the distribution for the Regent Honeyeater or the Swift parrot.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the Study Area.

How is the proposal likely to affect habitat connectivity?

Given the extent of potential habitat within the locality, mobility and home range size of the two species, it is unlikely that the Proposal would result in the fragmentation or isolation of potential habitat for these species.

How is the proposal likely to affect critical habitat?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for the Regent Honeyeater or Swift Parrot.

Conclusion

The impacts of the proposal on the Regent Honeyeater and Swift Parrot are likely to be minor as:

- The proposal is unlikely to have a major impact on the lifecycle of these two species;
- The proposal is unlikely to have a major impact on the composition of potential habitat for the Regent Honeyeater and Swift Parrot within the locality;
- The Study Area contains approximately 0.16 ha of Woodland habitat for these species. Potential habitat within the Study Area is not considered to be prime or core habitat for the Regent Honeyeater or Swift Parrot given the lack of preferred winter flowering trees. There may be impacts to 0.01 % of the local occurrence of potential habitat for the Regent Honeyeater and Swift Parrot.
- The proposal would not result in significant long-term isolation or fragmentation of habitat for these two bird species; and,
- No critical habitat has been declared for the Regent Honeyeater or Swift Parrot.

Grey-headed Flying-fox***Pteropus poliocephalus***

The Grey-headed Flying-fox is listed as Vulnerable on Schedule 2 of the TSC Act. Potential foraging habitat for this species occurs within the woodland habitat where flowering eucalypts provide potential foraging resources.

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

This species congregates in large numbers at roosting sites (camps) in a wide range of vegetation types. Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring. Grey-headed Flying-foxes are known to travel up to 50 km from their camps to forage (NPWS 2001a). The diet of the Grey-headed Flying-fox is varied, encompassing a wide range of fruits and blossoms from both native and non-native trees (Strahan 1995).

There are no known camps within the Study Area, however there is one known Grey-headed Flying-fox camp on the Nepean River approximately 3.5 km to the north-east (DECC 2007). It is unlikely that the proposal would interfere with breeding of the Grey-headed Flying-fox at these camp sites.

The proposal would remove 0.16 ha of potential foraging habitat for this species in the form of woodland habitats containing nectar producing eucalypts. Potential habitat for the Grey-headed Flying-fox occurs in the Study Area and also in larger, continuous, higher quality stands of vegetation within the locality. The total extent of similar habitat types within the locality is 0.16 ha, meaning the area which may be cleared/modified represents 0.01 % of the potential habitat for this species within the locality.

Given the mobility of this species, the lack of camps within the Study Area and the extent of higher quality potential habitat within the locality, it is unlikely that the proposal would disrupt the lifecycle of the Grey-headed Flying-fox.

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

The proposal may directly impact 0.16 ha of potential woodland habitat. The area to be modified or cleared as part of the proposal represents 0.01 % of the broader distribution of these habitat types within the locality. This potential habitat contains flowering, nectar producing eucalypts that may provide the species with foraging opportunities. Large areas of continuous, higher quality stands of vegetation are present outside the Study Area within the locality. Given the mobility of this species, the lack of camps within the Study Area and the extent of higher quality potential habitat within the locality it is unlikely that the proposal would have a significant impact on the habitats for this species.

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

Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. The Study Area is not at the limit of the distribution for this species

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the Study Area.

How is the proposal likely to affect habitat connectivity?

The proposal may remove 0.16 ha of Grey-headed Flying-fox potential foraging habitat from within woodland habitat in the Study Area. Potential foraging habitat types are widely distributed within the locality (0.16 ha), therefore the proposal may clear 0.01 % of potential foraging habitat for this species within the locality. This species is highly mobile and is known to travel up to 50 km from their camps to forage (NPWS 2001a).

Given the mobility of this species and the extent of similar potential foraging habitat in the locality, it is unlikely that the proposal would significantly fragment or isolate any areas of potential foraging habitat or movement corridors for the Grey-headed Flying-fox.

How is the proposal likely to affect critical habitat?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for this species.

Conclusion

The impacts of the proposal on the Grey-headed Flying fox are likely to be minor as:

- The proposal is unlikely to have a major impact on the lifecycle of the Grey-headed Flying-fox;
- The proposal is unlikely to have a major impact on the composition of potential habitat for the Grey-headed Flying-fox within the locality;
- The Study Area contains approximately 0.16 ha of potential woodland habitat for this species. There may be impacts to 0.01 % of the local occurrence of potential habitat for the Grey-headed Flying fox however this

is not considered to be a major amount of habitat considering the quality of potential habitat within the locality;

- The proposal would not result in significant long-term isolation or fragmentation of habitat for this species; and,
- No critical habitat has been declared for the Grey-headed Flying fox.

Microchiropteran Bats

The Greater Broad-nosed Bat, Eastern False Pipistrelle, Eastern Freetail-bat, Eastern Bentwing Bat, and Large-footed Myotis are listed as Vulnerable on Schedule 2 of the TSC Act

The Greater Broad-nosed Bat, Eastern False Pipistrelle, Eastern Freetail-bat are hollow-roosting species. The Large-footed Myotis is a cave and hollow roosting species. These Microchiropteran bat species have been grouped on the basis of their similar habitat requirements and local recordings. The Eastern False Pipistrelle tends to fly with good manoeuvrability and forages below or within the forest canopy. The Greater Broad-nosed Bat tends to forage along gaps and edges of forests and bushland patches (Churchill 1998; Law *et al.* 2000). The Large-footed Myotis utilises mainly water sources for foraging, catching small fish and insects with its feet (Churchill 1998). Little is known of the foraging habits of the Eastern Freetail Bat (Churchill 1998).

Potential habitat for these species occurs within the Study Area in woodland habitat.

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

Factors likely to disrupt the life cycle of these bat species include the loss, disruption or modification of roost sites, which, for these species includes tree hollows bark of trees. Two hollow bearing trees were identified in the study area and these may be removed.

The Proposal may remove and /or modify approximately 0.16 ha of potential foraging habitat. These habitats are widely distributed throughout the locality. The potential removal and /or modification of potential foraging habitat for these species represents approximately 0.01 % of the available habitat within the locality.

Given the mobility of these species and extent of potential habitat in the immediate vicinity of the study area the proposal is unlikely to have a significant effect on the lifecycle of these species.

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

Potential habitat for these species occurs in the woodland habitat. The proposal may impact approximately 0.16 ha of potential habitat for these species. These habitat types are widely distributed within the locality. The potential removal and /or modification of potential habitat for Microchiropteran bats represents approximately 0.01 % of the available habitat within the locality.

Potential habitat within the study area is considered to be in poor to moderate condition. Finer scale habitat features such as abundant tree hollows and watercourses provide foraging and roosting habitat for these Bat species, have also been widely identified in the local area. Two hollow bearing trees which contain potential roosts for these species were identified and these may be impacted. These resources are abundant in adjacent areas including areas along Nepean River. Overall quality of potential foraging and roosting habitat within the greater area is unlikely to have a significant effect on potential habitat by the proposal.

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

The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. The distribution of the Greater Broad-nosed Bat is poorly known. It is restricted to east coast and adjacent Great Dividing Range from the Queensland to southern NSW (Churchill 2008).

The Study Area is not at the limit of the distribution of these species.

How is the proposal likely to affect current disturbance regimes?

The Proposal is unlikely to affect fire regimes or the natural flooding regime of the Study Area.

How is the proposal likely to affect habitat connectivity?

The woodland habitat of the study area is currently fragmented by farmland and roads. These species are all highly mobile and a small scale clearing event such as the current proposed development is unlikely to result in further fragmentation and/or isolation given that the extent of potential habitat in the local area and the mobility of these species.

How is the proposal likely to affect critical habitat?

Critical habitats are areas of land that are crucial to the survival of particular threatened species, populations or ecological communities. Under the TSC Act, the Director-General maintains a register of critical habitat. To date, no critical habitat has been declared for these species.

Conclusion

The impacts of the proposal on these bat species are likely to be minor as:

- The proposal is unlikely to have a significant impact on the lifecycle of these species;
- The proposal is unlikely to have a major impact on the composition of potential habitat for these Bat species within the locality;
- The Study Area contains approximately 0.16 ha of woodland habitat for these species. Potential impacts to 0.01% of the local occurrence of potential habitat for these Bat species is not considered to be a major amount of habitat considering the quality of potential habitat within the locality;
- The proposal would not result in significant long-term isolation or fragmentation of habitat for these four Microchiropteran Bat species; and,
- No critical habitat has been declared for these Microchiropteran Bat species.

APPENDIX 5

EPBC Act Significant Impact Criteria

Significant Impact Guidelines

The EPBC Act Significant Impact Guidelines (DEH 2006) list Significant Impact Criteria for matters of national environmental significance that should be taken into consideration to determine whether a proposal is likely to have a significant impact on threatened species, populations or ecological communities that are known to occur or potentially occur in the Study Area.

Under the EPBC Act, if the proposal has the potential to have an adverse impact on a threatened species, population or ecological community listed on the Act, the proposal must be referred to the Federal Minister for the Environment for further consideration.

Cumberland Plain Woodland

Cumberland Plain Woodland (CPW) is listed as an Endangered Ecological Community on the EPBC Act. This plant community was recorded within the study area and will be impacted by the proposal, with approximately 0.16 ha which may be impacted by the proposal.

Is the action likely to reduce the extent of a community?

The vegetation in the study area occurs within a largely cleared rural area. Vegetation mapping (NPWS 2002b) indicates that approximately 2010 ha of CPW (Shale Plains Woodland and Shale Hills Woodland) occurs within a 10 km radius of the study area. This mapping also shows the plant community generally occurs as small disturbed remnants within agricultural land and developed land. The proposal may result in direct impacts to approximately 0.16 ha of CPW. This is not likely to reduce the extent of the community.

Is the action likely to fragment or increase fragmentation of ecological community?

The removal of a small isolated patch of Cumberland Plain Woodland in poor condition is not likely to affect habitat connectivity. Currently the patch of Cumberland Plain Woodland to be impacted is surrounded by cleared paddocks, separated from a relatively intact riparian corridor along the Nepean River by approximately 75 m of cleared farmland. The proposal will not fragment or increase fragmentation of Cumberland Plain Woodland.

Is the action likely to adversely affect habitat critical to the survival of an ecological community?

‘Habitat critical to the survival of a species or ecological community’ is defined by DEH (2006) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or,
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEH 2006).

To date, there is no critical habitat listed by the Minister for the Department of the Environment, Water, Heritage and the Arts for Cumberland Plain Woodland. Further, there is currently no recovery plan for this EEC.

The potential habitat in the study area is not an area considered to be necessary for breeding, dispersal or succession; to maintain genetic diversity; or for the reintroduction of populations or recovery of the ecological community. Therefore, the proposal will not impact on habitat critical to the survival of Cumberland Plain Woodland.

Is the action likely to modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community's survival?

The proposal may result in the removal of 0.16 ha of CPW that is in Poor condition. The action is not likely to modify or destroy abiotic factors that are necessary for the survival of the remaining patches of CPW in the vicinity of the study area, as the disturbance area will be restricted to the footprint of the Goaf Gas Extraction Plant and the proposal will not involve use of any chemicals or result in disturbance to the soil profile of any nearby native vegetation. The potential disturbance of 0.16 ha of an isolated patch of CPW is not considered likely to impact on the communities' survival.

Is the action likely to cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;

The proposal may result in the removal of approximately 0.16 ha of CPW. The area directly impacted may be permanently altered, with the construction of the Goaf Gas Extraction Plant Option 2 if this option is utilised. However, other patches of CPW in the area will remain unaffected, with no additional patches

occurring within the indirectly impacted area. The proposal is not likely to cause a substantial change to other patches of CPW outside the area of direct impact.

Is the action likely to cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- assisting invasive species, that are harmful to the listed ecological community, to become established; or**
- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or**

Currently, the patch of vegetation in the study area that may be removed by the proposal is modified through weed invasion. Invasive weed species were dominant in the understorey, consisting mostly of pasture grasses which have invaded from the adjoining cleared paddocks. Given the presence of weeds in the study area, there is potential for further weed dispersal post clearing, however, given the high density of weed species in adjacent areas and the ongoing impacts from the agricultural activities in the area it is considered unlikely to further impact this EEC.

The proposal will not require the use of fertilisers, herbicides or other chemicals or pollutants.

Is the action likely to interfere with the recovery of an ecological community?

No Recovery Plan as published by DEWHA is available for CPW. Currently the Recovery Plan for CPW is in preparation.

Conclusion

Based on the above assessment, CPW is unlikely to be significantly impacted by the proposal and, as such, a Referral under the provisions of the EPBC Act is not recommended for this ecological community.

Fauna

Endangered Species

Swift Parrot

Lathamus discolor

Is there a real chance or a possibility that the action would lead to a long-term decrease in the size of a population of a species?

The study area does not contain breeding habitat however some *E. tereticornis* which is a potential feed tree species will be removed. Given the range and mobility of this species and the small number of native flowering trees offering foraging opportunities, the Swift Parrot is unlikely to be wholly dependent upon resources within the study area. Additionally, the species has not been recorded within the study area (DECC 2008). It is therefore unlikely that the Proposal would lead to a long-term decrease in the size of a population of the Swift Parrot.

Is there a real chance or a possibility that the action will reduce the area of occupancy of the species?

The Proposal would not impact breeding sites (which exist in Tasmania only). Some winter/spring flowering potential feed trees (*Eucalyptus tereticornis*) will be removed, but these are few and not a species normally sought out by the Swift Parrot. It is possible that the trees in the study area would be used opportunistically by Swift Parrots at best, as they travel to other areas where food resources are more abundant. It is therefore unlikely that the Proposal would reduce the area of occupancy of a population of the Swift Parrot.

Is there a real chance or a possibility that the action will fragment an existing population into two or more populations?

The study area and surrounds are already fragmented. The Swift Parrot is a highly mobile, migratory, and somewhat nomadic species that ranges far and wide over eastern Australia to south-eastern Queensland. It is highly unlikely that the vegetation to be removed would be important to this species. The removal of the vegetation is unlikely to create a barrier for this species that would fragment a population.

Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?

‘Habitat critical to the survival of a species or ecological community’ is defined by DEH (2006) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEH 2006).

To date, no critical habitat for the Swift Parrot has been listed on the Register of Critical Habitat.

The potential habitat for the Swift Parrot in the study area is not likely to be critical habitat, as the species was not recorded in the study area and only a few potential feed trees were identified.

Is there a real chance or a possibility that the action will disrupt the breeding cycle of a population?

Swift Parrots breed in Tasmania. Following winter on the mainland they return to Tasmania where they breed from September to January (DEC 2005r). The study area does not contain any breeding habitat for the Swift Parrot and very limited foraging resources that would be unlikely to support Swift Parrots for longer than a brief visit. The Proposal is therefore unlikely to disrupt the breeding cycle of a population of the Swift Parrot.

Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The Proposal may directly impact approximately 0.16 ha of habitat containing foraging resources. This represents a small percentage of the distribution of similar potential habitat within the locality. The potential habitat for this species in the study area is very small, containing few possible feed trees of a species not

normally preferred by the Swift Parrot. This species is known to travel large distances in search of favoured feed trees that produce large amounts of nectar. Given the species' mobility and the low quality of potential habitat for this species in the study area, it is unlikely that the Proposal would decrease the availability or quality of habitat to the extent that the species is likely to decline.

Is there a real chance or a possibility that the action will result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat?

Potential habitat within the study area has been previously disturbed to a high degree and is subject to ongoing disturbance including weed invasion. The Proposal may remove a vegetated area that is already weed infested, but is unlikely to increase weed invasion in other parts of the study area.

Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?

The Swift Parrot, like any other parrot species in Australia, is vulnerable to Psittacine Circovirus Disease (PCD). This disease is transferred through faeces or feathers and is unlikely to be exacerbated by the proposal.

Clearing vegetation and the associated construction works have the potential to introduce or increase incidence of external diseases into vegetation or fauna populations. However, as the potential habitat for the Swift Parrot in the study area is already degraded and fragmented by existing roads and farmland, it is unlikely that the Proposal would introduce new diseases into the area which could result in the species' decline.

Is there a real chance or a possibility that the action will interfere with the recovery of the species?

The Australian Government Minister for the Department of Environment and Water Resources may make or adopt and implement recovery plans for threatened fauna, threatened flora (other than conservation dependent species) and threatened ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

There is a recovery plan for the Swift Parrot. Recovery Actions identified in the plan include:

- Action 1. Identify the extent and quality of foraging habitat;
- Action 2. Manage Swift Parrot habitat at a landscape scale;
- Action 3. Reduce the incidence of collisions;

- Action 4. Population and habitat monitoring;
- Action 5. Community education and information; and,
- Action 6. Manage the recovery process through a recovery team.

The Proposal may result in the clearing of a small amount of potential foraging habitat for the Swift Parrot. Clearing of potential habitat is identified as a threat to the recovery of the Swift Parrot in the plan, but the proposed area which may be cleared is estimated to be a small percentage of the broader distribution of potential habitat in the locality. In addition, potential habitat within the study area is considered to be of poor quality and contains no breeding sites. It is therefore unlikely that the proposal would interfere with the recovery of the Swift Parrot.

Conclusion

Based on the above assessment, the Swift Parrot is unlikely to be significantly impacted by the proposal, and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

Regent Honeyeater	<i>Xanthomyza phrygia</i>
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Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of a population of a species?

The Study Area does not contain breeding habitat however some *E. tereticornis* which is a potential feed tree species will be removed. Given the range and mobility of this species it is unlikely to be dependent upon the scarce resources within the study area. Additionally, the species has not been recorded within the study area (DECC 2008). It is therefore unlikely that the Proposal would lead to a long-term decrease in the size of a population of the Regent Honeyeater. Given the above, it is unlikely that the proposal would lead to a long-term decrease in the size of a population of the Regent Honeyeater.

Is there a real chance or a possibility that the action will reduce the area of occupancy of the species?

The Proposal would not impact breeding sites as they occur only in a few key areas where favoured trees that produce large amount of nectar grow. Some winter/spring flowering potential feed trees (*Eucalyptus tereticornis*) will be removed, but these are few and not a species normally sought out by the Regent Honeyeater. It is probable that the trees in the study area would be used opportunistically by Regent Honeyeaters at best as they travel to other areas where food resources are more abundant. It is therefore unlikely that the Proposal would reduce the area of occupancy of a population of the Regent Honeyeater.

Is there a real chance or a possibility that the action will fragment an existing population into two or more populations?

The study area and surrounds are already fragmented. The Regent Honeyeater is a highly mobile, partially nomadic species that ranges far and wide over eastern Australia from north-eastern Victoria to south-eastern Queensland. It is highly unlikely the vegetation to be removed would be important to this species. The proposal is unlikely to create a barrier for this species that would fragment a population.

Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?

‘Habitat critical to the survival of a species or ecological community’ is defined by DEH (2006) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEH 2006).

To date, no critical habitat for the Regent Honeyeater has been listed on the Register of Critical Habitat.

The potential habitat for the Swift Parrot in the study area is not likely to be critical habitat, as the species was not recorded in the study area and only a few potential feed trees were identified.

Is there a real chance or a possibility that the action will disrupt the breeding cycle of a population?

Breeding of this species is well known (Higgins *et al.* 2001) and the study area does not contain any known breeding sites. The study area also does not contain preferred foraging resources for this species, and the potential feed trees available are in low numbers. The proposal is therefore unlikely to disrupt the breeding cycle of a population of the Regent Honeyeater.

Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The Proposal may directly impact approximately 0.16 ha of habitat containing foraging resources. This represents a small percentage of the distribution of similar potential habitat within the locality. This species is very mobile and can travel large distances in search of favoured feed trees that produce large amounts of nectar. The potential habitat for this species in the study area is very small, containing few feed trees that are not considered preferred tree species by the Regent Honeyeater. Given the species' mobility and the low quality of potential habitat for this species in the study area, it is unlikely that the proposal would decrease the availability or quality of habitat to the extent that the species is likely to decline.

Is there a real chance or a possibility that the action will result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat?

Potential habitat within the study area has been previously disturbed to a high degree and is subject to ongoing disturbance including weed invasion. The proposal may remove a vegetated area that is already weed infested, but is unlikely to increase weed invasion in other parts of the study area.

Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?

Diseases have not been identified as a threat to populations of the Regent Honeyeater (DEC 2005o).

Clearing vegetation and the associated construction works have the potential to introduce or increase incidence of external diseases into vegetation or fauna populations. However, as the potential habitat for the Regent Honeyeater in the study area is already modified and fragmented by existing roads and farmland, it is unlikely that the proposal would introduce new diseases into the area which could result in the species' decline.

Is there a real chance or a possibility that the action will interfere with the recovery of the species?

The Australian Government Minister for the Department of Environment and Water Resources may make or adopt and implement recovery plans for threatened fauna, threatened flora (other than conservation dependent species) and threatened ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

There is a recovery plan for the Regent Honeyeater. Recovery Actions identified in the plan include:

- Action 1. Organisational arrangement including continued use of the Regent Honeyeater Recovery team to guide and review progress as well as close liaison with the Regent Honeyeater Recovery team, state agencies and other groups;
- Action 2. Active management including preparation of regional work plans in four key regions by Operations Groups;
- Action 3. Monitor population levels and changes in distribution;
- Action 4. Conduct research on post-breeding movements, isolation between population, habitat availability and resource use;
- Action 5. Maintain and develop community participation and awareness; and,
- Action 6. Maintain and improve captive population management.

In addition, with relation to Regent Honeyeater habitat, Objective 2 of the recovery plan states: ‘Maintain and enhance the value of Regent Honeyeater habitat at the key sites and throughout the former range’.

The Proposal may result in the clearing of a small portion of potential foraging habitat for the Regent Honeyeater. Clearing of potential habitat is identified as a threat to the recovery of the Regent Honeyeater in the plan, but the proposed area to be cleared is estimated to be a small percentage of the broader distribution of potential habitat in the locality. In addition, potential habitat within the study area is considered to be of poor quality and contains no known breeding sites. It is therefore unlikely that the proposal would interfere with the recovery of the Regent Honeyeater.

Conclusion

Based on the above assessment, the Regent Honeyeater is unlikely to be significantly impacted by the proposal, and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

Vulnerable Species

Potential habitat occurs within the Study Area for one Vulnerable animal species listed on the EPBC Act, the Grey-headed Flying-fox. There are three bird species with potential habitat listed as Migratory Species under the EPBC Act. The

potential impacts of the proposal on this species are assessed against the Significant Impact Criteria of the EPBC Act below.

Grey-headed Flying-fox

Pteropus poliocephalus

Populations of the Grey-headed Flying-fox that may occur within the Study Area are not considered important populations because:

- they are unlikely to be key source populations either for breeding or dispersal, as no camps have been recorded in the study area;
- they are unlikely to be necessary for maintaining genetic diversity, as there is no evidence that the study area contains an isolated genetic variant of this species or that the proposal would impact on the overall genetic diversity of the species; and,
- the study area is not at or near the limit of the species range which extends along the coast from Bundaberg in Queensland, south to western Victoria.

Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of an important population of a species?

The Study Area is not considered to contain an important population of the Grey-headed Flying-fox. Furthermore there are no known camps within the Study Area. However there is one known Grey-headed Flying-fox camp on the Nepean River approximately 3.5 km to the north-east (DECC 2007). The study area only represents a very small area of potential foraging habitat and it is unlikely to be wholly dependent upon resources within the Study Area. Therefore the proposal is unlikely to lead to a long-term decrease in the size of an important population.

Is there a real chance or a possibility that the action will reduce the area of occupancy of an important population of this species?

The proposal is unlikely to impact potential roost sites (camps) as there are none known to exist in the area. Some flowering eucalypts that may offer foraging opportunities may be removed. It is therefore unlikely that the proposal would reduce the area of occupancy of an important population of this species.

Is there a real chance or a possibility that the action will fragment an existing important population into two or more populations?

The Study Area and surrounds are already fragmented however the proposal will not increase this fragmentation, given the Grey-headed Flying-fox is a highly mobile species. It is considered unlikely that clearing required for the proposal would create a barrier for this species that would fragment a population.

Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?

‘Habitat critical to the survival of a species or ecological community’ is defined by DEH (2006) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal;
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- to maintain genetic diversity and long term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act (DEH 2006).

To date, no critical habitat for the Grey-headed Flying-fox has been listed on the Register of Critical Habitat.

The potential habitat for the Grey-headed Flying-fox in the Study Area is not likely to be critical habitat, as the species was not recorded in the study area and potential foraging resources for the species are low in abundance and diversity.

Is there a real chance or a possibility that the action will disrupt the breeding cycle of an important population?

The Study Area does not contain any known roosting/breeding sites. The Study Area also does not contain a diversity of foraging resources for this species, or a regular food supply. The proposal is therefore unlikely to disrupt the breeding cycle of a population of the Grey-headed Flying-fox.

Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The proposal may directly impact approximately 0.16 ha of habitat containing foraging resources. This represents a small percentage of the distribution of similar potential habitat within the locality. This species is very mobile and can travel large distances in search of food. Given the species’ mobility and the low quality of potential habitat for this species in the study area, it is unlikely that the

proposal would decrease the availability or quality of habitat to the extent that the species is likely to decline.

Is there a real chance or a possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

Potential habitat within the Study Area has been previously disturbed to a high degree and is subject to ongoing disturbance including weed invasion. The proposal will remove a vegetated corridor already weed infested, but is unlikely to increase weed invasion in other parts of the study area.

Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?

Diseases have not been identified as a threat to populations of the Grey-headed Flying-fox (NPWS 2001a).

Clearing vegetation and the associated construction works have the potential to introduce or increase incidence of external diseases into vegetation or fauna populations. However, as the potential habitat for the Grey-headed Flying Fox in the study area is already modified and fragmented by farmland and existing roads, it is unlikely that the proposal would introduce new diseases into the area which could result in the species' decline.

Is there a real chance or a possibility that the action will interfere substantially with the recovery of the species?

The Australian Government Minister for the Department of Environment may make or adopt and implement recovery plans for threatened fauna, threatened flora (other than conservation dependent species) and threatened ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). To date, there is no recovery plan for the Grey-headed Flying-fox.

The proposal may result in the clearing of potential foraging habitat for the Grey-headed Flying-fox. Although clearing of habitat is identified as a threat to the recovery of the Grey-headed Flying-fox, the proposed area which may be cleared is estimated to be a small percentage of the broader distribution of potential habitat in the locality. In addition, potential habitat within the Study Area is considered to be of poor quality and contains no recorded camps/roosting sites. For these reasons it is unlikely that the proposal would interfere with the recovery of the Grey-headed Flying-fox.

Conclusion

Based on the above assessment, the Grey-headed Flying-fox is unlikely to be significantly impacted by the proposal, and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

Migratory species

The Cattle Egret, White-bellied Sea-eagle and Rainbow Bee-eater are listed as Migratory species under the EPBC Act. These 3 species have not been recorded within the Study Area during the current survey.

For the purposes of the Act, an area of important habitat for migratory species is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species;
- habitat that is of critical importance to the species at particular life cycle stages;
- habitat utilised by a migratory species which is at the limit of the species range; and/or
- habitat within an area where the species is declining.

The Study Area contains approximately 0.16 ha of woodland habitat for these three migratory species. The proposal may modify/remove approximately 0.16 ha of potential habitat within the Study Area (which equates to less than 0.1% from the locality).

The known and/or potential habitat which may be impacted by the proposal is not considered to be an area of important habitat for the Cattle Egret, White-bellied Sea-eagle and Rainbow Bee-eater as it is:

- unlikely to support an ecologically significant proportion of the population of these species;
- unlikely to be critical to particular life cycle stages of these species;
- not located at the limit of distribution for these species; and,
- not located in area where the species is declining.

Is the action likely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for the migratory species?

The Study Area is not considered to contain an area of important habitat for the Cattle Egret, White-bellied Sea-eagle and Rainbow Bee-eater,

These species generally require terrestrial wetlands, streams, or riverbanks in which to breed. The Study Area does not contain any areas of potential breeding habitat for any of these species and only represents marginal foraging habitat.

It is unlikely that the proposal would substantially modify, destroy or isolate area of important habitat for these species.

Is the action likely to result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species?

Potential habitat within the Study Area has been previously disturbed to a high degree and is subject to ongoing disturbance including weed invasion. The proposal may remove a vegetated corridor already weed infested, but is unlikely to increase weed invasion in other parts of the study area.

Is the action likely to seriously disrupt the life cycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the migratory species?

The proposal is unlikely to seriously disrupt the life cycle of an ecologically significant proportion of a population of the Cattle Egret, White-bellied Sea-eagle and Rainbow Bee-eater.

Conclusion:

Based on the above assessment the Cattle Egret, White-bellied Sea-eagle and Rainbow Bee-eater are unlikely to be significantly impacted by the proposal and as such a Referral under the provisions of the EPBC Act is not recommended for these species.

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