EnergyAustralia

Delta electricity

Appendix G
Gas Pipeline Environmental Assessment (North Eastern Routes)

MARULAN GAS TURBINE FACILITIES

SUBMISSIONS RESPONSE & PREFERRED PROJECT REPORT

VOLUME 2 | APPENDICES | May 2009

URS

CLIENTS | PEOPLE | PERFORMANCE

EnergyAustralia

Marulan Gas Pipeline

Environmental Assessment of North Eastern Route Option

April 2009

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

Contents

Table Index

Figure Index

Appendices

1. Introduction

1.1 Background

Delta Electricity (Delta) and EnergyAustralia are seeking project approval to construct two separate gas turbine facilities, side by side on a site adjacent to the existing TransGrid Marulan 330/132kV Switchyard site, near Brayton.

The proposed facilities are subject to Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Environmental assessments for the facilities have been prepared in accordance with Part 3A.

The environmental assessments prepared by Delta and EnergyAustralia have addressed the environmental aspects of each gas turbine facility (referred to as 'the facilities' for the purpose of this report) individually, as well as their cumulative impacts. Other than in a general sense, the construction of a pipeline to connect the facilities to the Moomba to Sydney gas pipeline was not addressed in the environmental assessments.

An environmental assessment of the impacts of proposed gas pipeline route options was prepared in March 2009. This considered the potential impacts of the options known as the 'Eastern route' and 'Western route', and minor alternatives to those options. It was prepared as part of the preferred project report for the facilities. Subsequent to this report, an alternative route in the northern part of the pipeline corridor was identified. This option is known as the North Eastern route option. The relationship between these options is shown in Figure 1.1.

1.2 Purpose and scope of this report

This report has been prepared as an addendum to the Environmental Assessment of Pipeline Options (GHD, March 2009). It provides an environmental assessment of the key impacts of the North Eastern route option.

The report provides:

- Information on the North Eastern route option;
- An assessment of the potential environmental impacts of the pipeline with a focus on the key environmental issues, including recommended mitigation measures to minimise the potential impacts identified;
- Measures proposed to manage other environmental issues (mainly issues relating to construction of the pipeline); and
- Recommended mitigation measures.

Key potential environmental issues relating to construction of the pipeline are considered to be ecology and heritage.

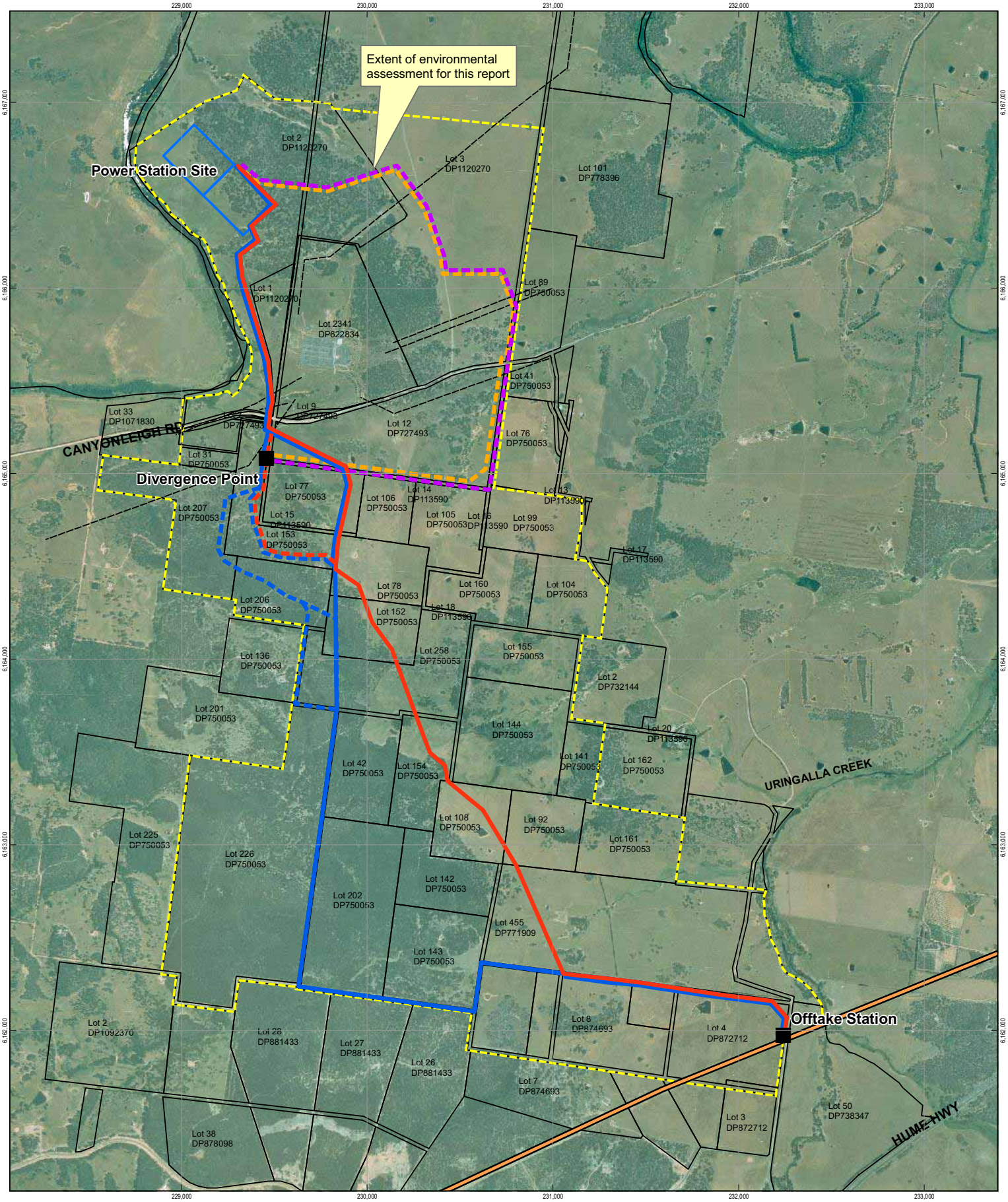
An ecological assessment of the pipeline option has been undertaken by GHD, and a cultural heritage assessment has been undertaken by Navin Officer.

A summary of the results of these assessments is provided in Sections 3.1 and 3.2 of this report. The full assessments are included in Appendices A and B.

The report also considers the potential land use and infrastructure issues associated with the pipeline options, and other potential environmental issues, relating to construction of the pipeline.

The report considers the nature of these potential issues (including identification of any sensitive receivers) and how these issues will be managed during construction, providing a framework for mitigation, management and monitoring.

This report considers the portion of the North Eastern route up to the boundary of the site for the proposed facilities. The impacts of development on this site were considered by the environmental assessments for the facilities.



1 Eastern Route
2 Eastern Route using Lot 153 Alternative
3 Western Route
4 Western Route using Lot 153 Alternative
North-eastern Route Alternative A (using Lot 12 DP727493, Crown Public Road & Lot 3 DP1120270)
North-eastern Route Alternative B (using Lot 14 DP113590, Crown Public Road & Lot 3 DP1120270)

Powerline
Power Station Site
Moomba Sydney Gas Pipeline
Gas Pipeline Corridor
Cadastre

1:19,000 (at A3)
0 125 250 500 750 1,000
Metres

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

N

EnergyAustralia
Delta electricity
GHD
CLIENTS | PEOPLE | PERFORMANCE

Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number 21-17633
Revision A
Date 27 APR 2009

Pipeline Route Options

Figure 1.1

G:\21\17633\CADD\GIS\MapDocuments\Z047_NorthEasternAlternative_.mxd

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

2. Description of the North Eastern route

2.1 Purpose of the north eastern route

The purpose of this route option is to overcome possible technical issues associated with the confluence of electricity transmission lines and the proximity of the TransGrid switchyard, on the eastern and Western routes, which cross Canyonleigh Road and head directly north to the site of the proposed facilities.

Two alternatives for the North Eastern route are considered, known as alternative A (shown in orange in Figure 2.1) and alternative B (shown in purple).

The alternatives are described below and summarised in Table 2.1.

2.2 Description of the north eastern route

2.2.1 Overview

The North Eastern route commences approximately 200 metres south of Canyonleigh travelling east, then north easterly from the eastern and western routes to Canyonleigh Road. After crossing Canyonleigh Road, the route travels north to north westerly mainly through Lot 3 DP1120270, before it enters the facilities' site. A description of the two alternatives is provided below.

Note: The western boundary of Lot 2 DP1120270 (the facilities site) delineates the extent of this assessment of this pipeline route. West of this point the assessment of the pipeline route forms part of the separate facilities' site assessment.

2.2.2 Description of alternative A (shown in orange)

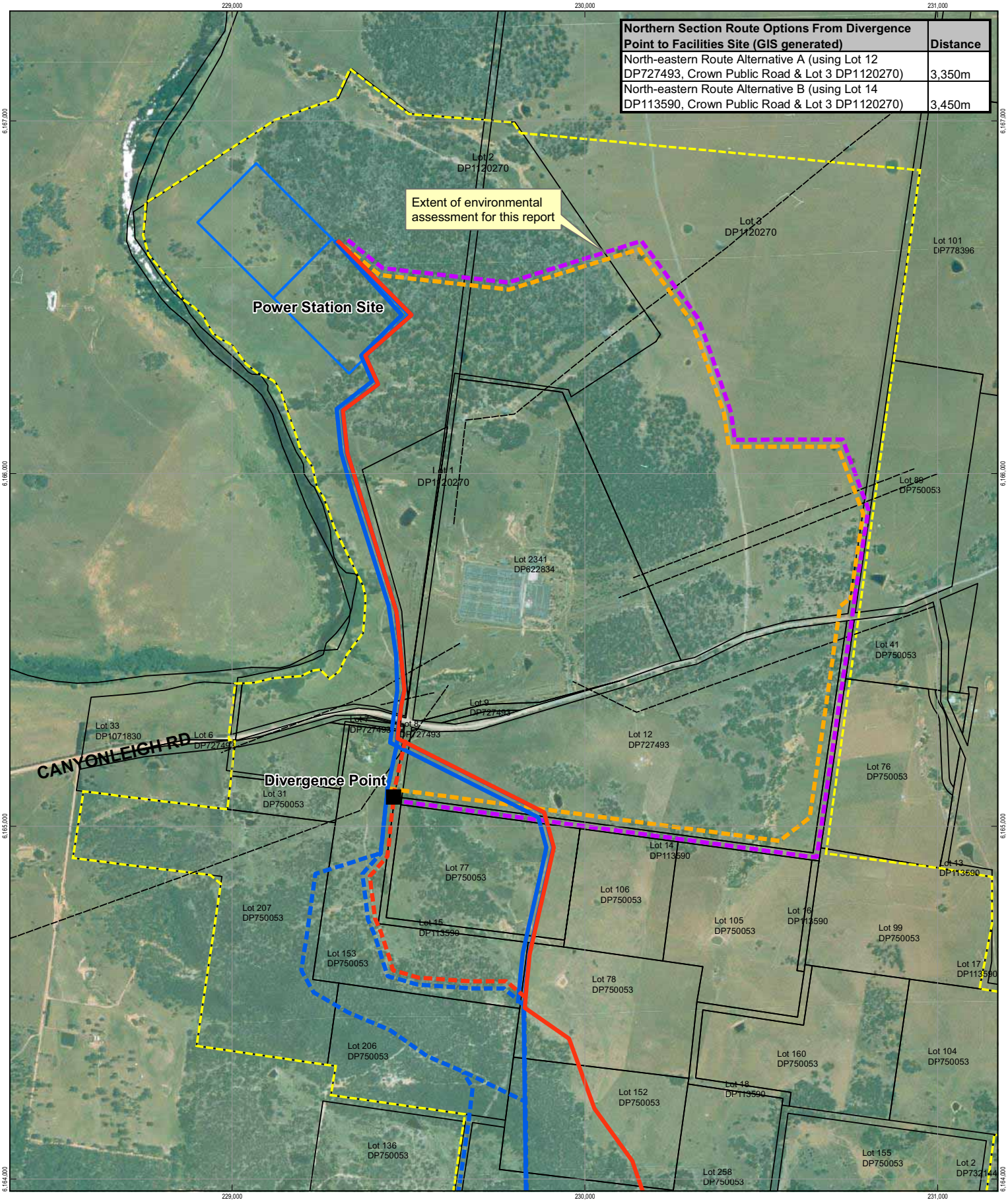
This route alternative travels directly east from the divergence point (shown on Figure 2.1)) within Lot 12 DP727493, alongside its southern boundary for approximately 1,100 metres. It then turns directly north and travels alongside the eastern boundary of Lot 12 DP727493 for a distance of approximately 650 metres to Canyonleigh Road. After crossing Canyonleigh Road the route continues north within a Crown Public Road for approximately 300 metres, then leaves the Crown Public Road and heads north westerly for a distance of approximately 1,300 metres within Lot 3 DP1120270 to the facilities' site western boundary. Total distance approximately 3,350 meters

2.2.3 Description of alternative B (shown in purple)

This route is very similar to alternative A. It runs parallel to alternative A from the divergence point at Lot 12 DP 727493, and travels wholly within Lot 14 DP113590 (Closed road) for 1,200 metres, where it turns directly north and travels in a parallel direction to alternative A, remaining within Lot 14 DP DP113590 (Closed road) for approximately 660 metres to Canyonleigh Road. After crossing Canyonleigh Road the route follows the same alignment as alternative A for approximately 1,590 metres to the facilities' site western boundary. Total length approximately 3,450 metres.

Table 2.1 North Eastern route alternatives

Alternative	Approximate length of option (metres)	Easement area (20 metre wide easement)	Number of private landowners on route
A	3,350	6.7 hectares	2
B	3,450	6.9 hectares	2



1 Eastern Route
2 Eastern Route using Lot 153 Alternative
3 Western Route
4 Western Route using Lot 153 Alternative
North-eastern Route Alternative A (using Lot 12 DP727493, Crown Public Road & Lot 3 DP1120270)
North-eastern Route Alternative B (using Lot 14 DP113590, Crown Public Road & Lot 3 DP1120270)

Moomba Sydney Gas Pipeline
Powerline
Power Station Site
Gas Pipeline Corridor
Cadastre

1:10,000 (at A3)
0 62.5 125 250 375 500
Metres

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

N

EnergyAustralia
Delta electricity
GHD
CLIENTS | PEOPLE | PERFORMANCE

Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number 21-17633
Revision A
Date 27 APR 2009

North Eastern Route Options

Figure 2.1

G:\21\17633\CADD\GIS\MapDocuments\Z049_NorthEasternRouteOptions.mxd

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

Data Source: NSW Department of Lands: Cadastral - 17/03/2009. Created by: qjchung, Bahambly, bahambly, cwilson

3. Assessment of potential impacts

3.1 Ecology

3.1.1 Existing environment

Flora

Approximately 112 plant species were recorded during the field surveys undertaken for the ecological assessment (refer Appendix A).

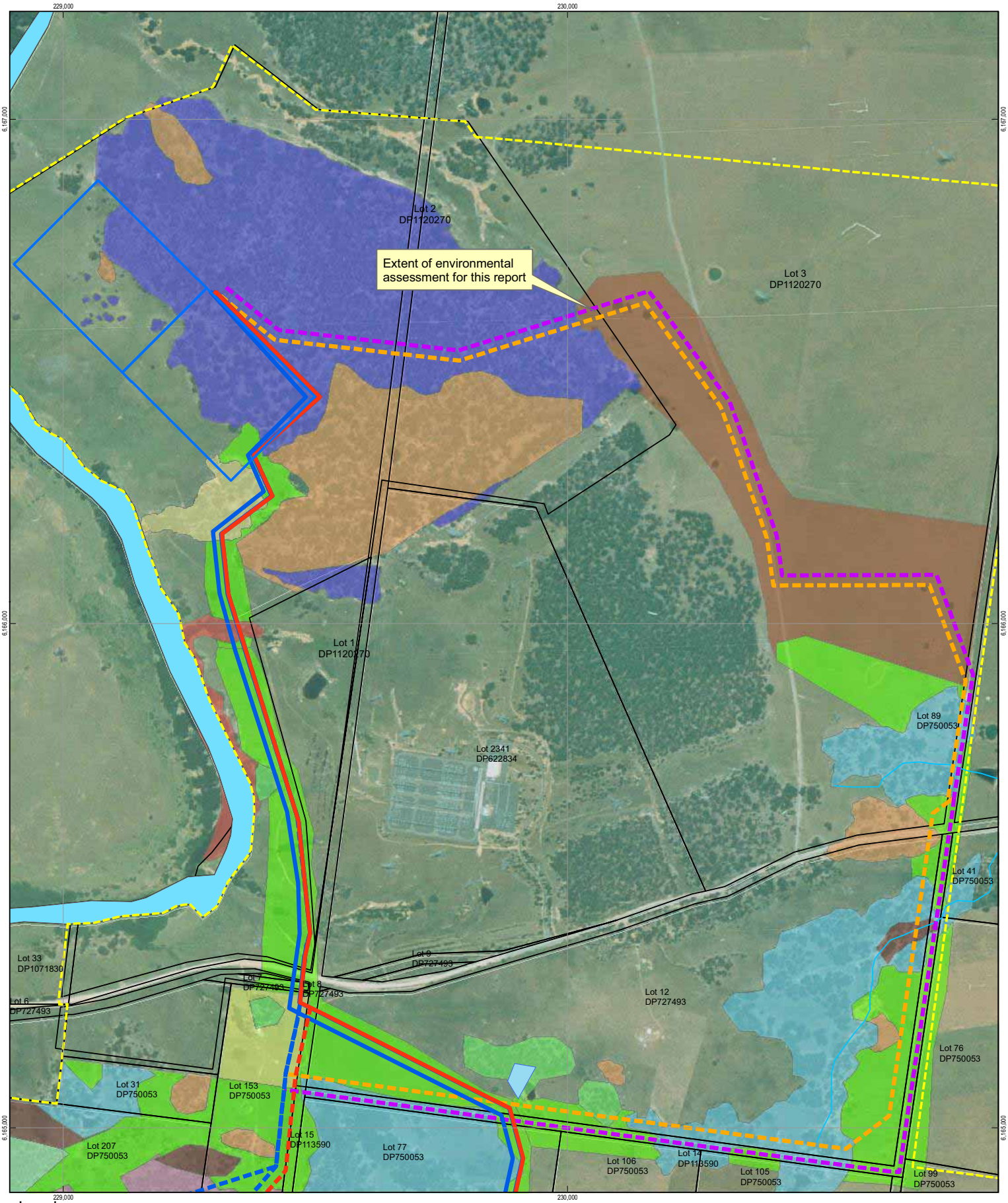
The following vegetation communities were identified within the study area (as shown in Figure 3.1):

- Riverbank Forest;
- Eastern Tablelands Dry Forest;
- Frost Hollow Grassy Woodland;
- Tablelands Grassy Box Gum Woodland;
- Candlebark Gully Forest;
- Native Pasture; and
- Modified or Disturbed Land.

Threatened flora species

The desktop literature review indicated that 34 threatened plant species (listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) have been previously recorded or are predicted to occur in the study area. None of these species were identified during field surveys. However, the study area contains suitable habitat for a number of threatened plants including:

- Buttercup Doubletail (*Diuris aequalis*);
- Camden Woollybutt (*Eucalyptus macarthurii*);
- Hoary Sunray (*Leuchochyrsum albicans* var *tricolour*);
- Few-seeded Bossiaea (*Bossieaea oglisosperma*)
- Thick-lipped Spider Orchid (*Caladenia tesselata*)
- Tallong Midge Orchid (*Genoplesium plumosum*);
- Delicate Pomaderris (*Pomaderris delicata*);
- Button Wrinklewort (*Rutidosis leptorrhynchoides*); and
- Dwarf Kerrawang (*Rulingia prostrata*).



Legend

Pipelines

- 1 Eastern Route
- 2 Eastern Route using Lot 153 Alternative
- 3 Western Route
- 4 Western Route using Lot 153 Alternative
- North-eastern Route Alternative A (using Lot 12 DP727493, Crown Public Road & Lot 3 DP1120270)
- North-eastern Route Alternative B (using Lot 14 DP113590, Crown Public Road & Lot 3 DP1120270)
- dams
- Plant Footprint
- Land Ownership
- Drainage lines
- Gas Pipeline Corridor
- Marulan_site

Vegetation Communities

- Stringybark/ Black Sheoak forest
- Candlebark Gully Forest
- Argyle Apple Forest
- Cabbage Gum / Stringybark Forest
- Scribbly Gum woodland
- Box- Gum Woodland EEC
- Snow Gum / Apple Box Woodland
- River She-oak Forest
- Acacia Scrub
- Red Stringybark Forest
- Garden
- Native Grassland
- Snow Gum/Candlebark/Applebox Woodland
- Red Gum Woodland
- Tableland Hills Grassy Woodland
- Frost Hollow Grassy Woodland
- Riverbank Forest
- Grassland
- Unclassified

1:7,000 (at A3)

0 37.5 75 150 225 300

Metres

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

N

EnergyAustralia

Delta electricity

GHD

CLIENTS | PEOPLE | PERFORMANCE

Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number 21-17633
Revision C
Date 21 APR 2009

Vegetation Communities

Figure 3.1

G:\21\17633\CADD\GIS\MapDocuments\Z039_ACVeg_Map_EnviroAssessmentReport.mxd

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

Targeted surveys throughout winter and spring did not detect any of these species. A number of these species are either large or easily identifiable in the field, or were surveyed for during their known flowering times, it is considered unlikely that any of these species occur within the study area. Other threatened flora with the potential to occur within the study area are cryptic and difficult to identify outside their known flowering period, including:

- Buttercup Doubletail (flowers October to December)
- Hoary Sunray (flowers spring to summer)
- Thick-lipped Spider Orchid (flowers September to November)

Further targeted surveying during these species flowering times is recommended to ensure they are not significantly impacted by the proposal.

Endangered ecological communities

Tablelands Grassy Box Gum Woodland qualifies as the endangered ecological community (EEC) White Box, Yellow Box, Blakely's Red Gum Grassy Woodland (Box-Gum Woodland) EEC. This EEC is listed under both the TSC Act and the EPBC Act, however is defined based on slightly different criteria. Patches of Yellow Box trees exist on Lot 12 adjacent to snow gum woodland, and in association with cabbage gum and within Lot 3. All three patches constitute both TSC Act listed Box-Gum Woodland and EPBC Act listed Box-Gum Woodland.

Fauna

During the field surveys, 8 mammals, 42 species of birds, two frogs and one reptile were recorded.

The habitat assessment identified the following key habitat types across the study area:

- Forest and woodland; and
- Other habitat resources – included hollow-bearing trees and stags, reasonable amounts of standing and fallen dead timber and rock outcrops.

The predatory red fox (*Vulpes vulpes*) was sighted within the study area. It is expected that the cat (*Felis catus*), the feral dog (*Canis lupus*) and wild pig (*Sus scrofa*) would also occupy the study area.

The majority of the study area is stocked with sheep and domestic cattle and moderate numbers of rabbits were noted. These species may compete with native herbivores and may suppress growth of palatable native herbs and grasses.

Vegetation within the study area occurs as scattered patches in a mosaic with native pasture, and with larger connected patches occurring along the gully on the eastern half of Lot 12 and into Lot 3. This connectivity will facilitate the movement of native birds, some reptiles, arboreal mammals and potentially small terrestrial mammals. Smaller patches isolated by surrounding pasture and farm structures will support open country bird species and a more limited suite of native reptiles and mammals. Land to the north and east features a matrix of patchy open woodland and grassland. These areas have similar habitat value to the study area and will combine to form a large area of habitat suitable for open country and woodland species. Connectivity is good to the south for approximately two kilometres but then is limited by the Hume Highway.

The Wollondilly River is within 300 metres of the study area. The riparian corridor features stretches of intact riparian forest alternating with willow (*Salix* spp.) infestations and cleared agricultural land. The

riparian zone provides a near-continuous habitat corridor for aquatic species, waterfowl and semi-aquatic, frogs, reptiles and mammals.

Threatened fauna species

No threatened fauna were identified during the two-day survey.

The desktop review indicates the potential presence of a further 33 threatened fauna species listed under the TSC Act as Wildlife Atlas records in the locality, and/or the EPBC Act and predicted to occur in the local area.

A total of 11 species were considered to have a high likelihood of occurrence within the study area based on the presence of suitable foraging and roosting habitat and recent records in the local area:

- Gang-gang Cockatoo *(Callocephalon fimbriatum);*
- Speckled Warbler (*Pyrrholaemus saggitatus);*
- Diamond Firetail *(Stagonopleura guttata*);
- Powerful Owl (*Ninox strenua*);
- Hooded Robin *(Melanodryas cucullate*);
- Eastern False Pipistrelle *(Falsistrellus tasmaniensis*);
- Eastern Freetail Bat (*Mormopterus norfolkensis*);
- Little Bentwing-bat *(Miniopterus australis);* and
- Greater Broadnosed Bat *(Scoteanax ruepellii).*
- Eastern Bentwing-bat *(Miniopterus schreibersii oceanensis*); and
- Large-footed Myotis *(Myotis macropus).*

Another three threatened species are considered to have the potential to occur:

- Black-chinned Honeyeater (*Melithreptus gularis gularis*);
- Turquoise Parrot (*Neophema pulchella*); and
- Striped Legless Lizard (*Delma impar*).

A further five species may utilise habitats within the study area on an occasional or opportunistic basis:

- Large-eared Pied Bat *(Chalinolobus dwyeri);*
- Brown Treecreeper *(Climacteris picumnus);*
- Swift Parrot *(Lathamus discolour);*
- Regent Honeyeater *(Xanthomyza phrygia);*
- Barking Owl *(Ninox connivens);*
- Masked Owl *(Tyto noaehollandiae*); and
- Spotted-tailed Quoll *(Dasyurus maculatus).*

Aquatic and riparian habitat

Aquatic and riparian habitat of the study area includes ephemeral drainage lines and a number of wetlands and farm dams that fall within the Wollondilly River sub-catchment of the Hawkesbury catchment. The closest proximity to perennial waterways occur at the divergence point, where it passes approximately 300 metres of the Wollondilly River and at the south-eastern limit of the route, where it passes to within approximately one kilometre of Uringalla Creek.

The gas pipeline route crosses one drainage line at two points. This feature is an intermittent, channel confined, chain of ponds that flows east towards Uringalla Creek. It passes through a patch of Candlebark Gully forest at the proposed gas pipeline intersection and has intact riparian vegetation in good condition along this portion of its length. Riparian vegetation is continuous with a patch of intact native vegetation that extends for many hundreds of metres to the north, south and west. There was no surface water at the proposed pipeline crossing point at the time of the field survey. There is an artificial dam across the drainage line approximately 50 metres upstream of this point

The drainage line would have moderate riparian or aquatic habitat value. It contains surface water, which in places supports reed beds and other wetland habitat resources. Riparian habitat directly intersecting the route is remote from perennial streams. It may support an aquatic community after heavy or prolonged rain but would only contain species that are amphibious at some point in their life cycle. There is no habitat for threatened aquatic fauna potentially occurring in the region. The proposed crossing point was dry at the time of the field survey and rarely (if ever) hold water due to the dam upstream. This reach would have very limited aquatic habitat value.

The dams across the study area contain near-permanent water in areas of cleared grassland/farmland. These would provide important refuges and breeding habitat for native frogs as well as native fish, crustaceans and aquatic invertebrates. A number of these dams provided nocturnal refuge and foraging habitat for waterfowl including the Pacific Black Duck and Australian Grebe, as observed during field surveys. The dams have limited cover of aquatic and semi-aquatic vegetation and are surrounded by cleared grassland. Dams may provide foraging habitat for microbats potentially including *Myotis macropus* (Large-footed Myotis).

3.1.2 Impact assessment

Threatened flora species

The route would not directly impact any known populations of threatened flora species, although habitat for Buttercup Doubletail and Button Wrinklewort may be removed. An assessment of impacts on threatened flora was undertaken. The assessment determined that the route is unlikely to significantly adversely affect potential habitat for these two species within the study area.

Threatened fauna species

Construction of the pipeline would result in the temporary removal of foraging habitat for the Diamond Firetail, Turquoise Parrot, and marginal sheltering habitat for the Striped Legless Lizard. It would also affect habitat adjacent to the forest used by the, Gang-gang Cockatoo, Speckled Warbler and Powerful Owl. An assessment of impacts on threatened fauna was conducted. The assessment determined that the route is unlikely to significantly adversely affect potential habitat for threatened birds, the Striped Legless Lizard, Spotted Quoll or microchiropteran bats. Construction of the pipeline would not result in

the removal of significant habitat for any of these species, as the majority of the route would be located within cleared land, and significant areas of habitat for these species exists within the study area.

Endangered Ecological Communities

Construction of the pipeline would involve clearing of TSC Act and EPBC Act listed EEC Box Gum Woodland (refer Table 3.1). An assessment of impacts on the EEC was undertaken. The assessment determined that if no canopy trees associated with this community are removed and if canopy trees associated with this community are avoided where possible, and appropriate re-establishment of native grassland is conducted then a significant impact on these communities is unlikely.

Vegetation clearing and construction impacts

Flora

Initial clearing may impact on connectivity and further isolate vegetation within an already fragmented landscape. As summarised in Table 3.1, the route would impact on native and introduced pasture, and patches of Frost Hollow Grassy Woodland, Cabbage Gum / Stringybark Forest, Box Gum Woodland, Candlebark Gully Forest and Eastern Tablelands Dry Forest. Although an initial area of between 1.9 hectares (alternative A) and 1.73 hectares (alternative B) of native vegetation would be impacted, only 0.35 hectares (Alternative A) to 0.32 hectares (Alternative B) would remain permanently modified.

Table 3.1 Approximate clearance of each vegetation type

Route Option	Vegetation type	Approximate area of initial clearance of 20 metres (hectares)	Rehabilitated modified 6 metre corridor (hectares)
Alternative A	Native Pasture	2.17	N/A – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.
	Cabbage Gum / Stringybark Forest	1.64	0.3
	Box-Gum Woodland EEC	0.09	0.025
	Candlebark Gully Forest	0.08	0.024
	Frost Hollow Grassy Woodland	0.09	
	Exotic Grassland	2.64	N/A – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.
	TOTAL **Woodland / Forest** **Grassland (native and exotic)**	**1.90** **4.81**	**0.35** N/A – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.

Route Option	Vegetation type	Approximate area of initial clearance of 20 metres (hectares)	Rehabilitated modified 6 metre corridor (hectares)
Alternative B	Native Pasture	2.59	N/A – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.
	Cabbage Gum / Stringybark Forest	1.71	0.3
	Candlebark Gully Forest	0.02	0.02
	Exotic Grassland	2.73	N/A – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.
	TOTAL		
	Woodland / Forest	**1.73**	**0.32**
	Grassland (native and exotic)	**5.32**	NA – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.

Note: There is some flexibility with pipeline route design over short distances in areas containing native vegetation. The final pipeline route may be adjusted to avoid Box-gum Woodland, mature trees and other important habitat features in some instances. Low impact construction techniques would be used in sensitive areas where engineering and safety constraints allow, reducing the pipeline construction footrpint to a width of 10 metres. Therefore the final extent of vegetation clearing as a result of pipeline construction is likely to be less than that estimated in Table 3.1 above. Further, it may be possible to avoid impacts on Box-gum Woodland entirely by positioning the final pipeline route in adjacent areas of non-EEC vegetation. Since the final position and extent of the construction footprint was not available at the time of this assessment the precautionary principal was applied, resulting in the conservative estimates of vegetation clearing included in Table 3.1.

Fauna

A considerable abundance and diversity of native bird species occupy the study area, with the potential for impacts as a result of the removal of native vegetation and other habitat resources. However, the majority of these species are mobile, widespread and common. In addition, there are large quantities of equivalent habitat and resources in the study area and so it is likely that any impact on local populations of native birds would be minor.

Arboreal mammals occur in areas of Eastern Tablelands Dry Forest and may be impacted by the proposal, in particular, by the potential loss of hollow-bearing trees. Similarly, hollow-dependent microchiropteran bats are likely to occur within the study area, and the loss of trees with hollows, spouts and decorticating bark may impact these species should they be present. However, large stands of native vegetation will be retained within the study area and not impacted by the proposal.

Construction of the pipeline may directly impact active wombat burrows, which would need to be identified and any resident wombats carefully relocated.

A moderate diversity and abundance of native frogs and reptiles are considered likely to occupy the study area. Species recorded during field surveys were widespread and common. It is likely that individuals would be killed or displaced during clearing, particularly species that burrow or shelter beneath woody debris. The loss of habitat is likely to have a minor impact on local populations of these species given the large areas of native vegetation and other resources in the vicinity of the study area.

There would be moderate, ongoing impacts on fauna using adjacent areas of habitat during construction associated with noise and other disturbances. Impacts are likely to be minor as construction would only occur during daylight hours and would be temporary. There are already disruptive human activities in the vicinity of the study area associated with agriculture. Larger, more mobile fauna currently occupying the study area are likely to be adapted to these disturbances. There would be impacts upon smaller, less mobile fauna in the immediate vicinity of the route.

Riparian and aquatic habitat

Construction of the gas pipeline would not directly affect the Wollondilly River, Uringalla Creek, any dams or any other permanent surface water features.

The proposed pipeline construction would involve direct impacts to an ephemeral drainage lines at two proposed crossing points. Trenching at drainage line crossings would directly disturb the bank and channel and any associated vegetation and habitat resources. This would result in direct impacts to a 20 metre wide corridor at the drainage line crossing. Pipeline construction would involve the removal of intact riparian vegetation, including mature Candlebark and Acacia spp. trees.

The construction footprint at these crossings would be remediated and replanted with native understorey species. A six metre wide strip would be permanently modified through the removal of overstorey vegetation (if present).

Construction would only occur when these features are dry, and would be unlikely to result in direct impacts on in stream or down stream aquatic or wetland fauna. Pipeline construction would involve the removal of intact riparian vegetation, including mature Candlebark and *Acacia* spp. trees.

Habitat values associated with the channel and understorey vegetation are likely to return to their pre-disturbance state in the short to medium term. Habitat values associated with mature trees would be permanently lost within the six metre modified pipeline corridor. Loss of these mature trees may reduce bank stability and further degrade riparian habitat through erosion and sedimentation. Appropriate erosion prevention/mitigation measures would be implemented in these locations to ameliorate these effects.

Portions of the drainage line feature serious gully erosion at present. Post-construction remediation and bank stabilisation may lessen the severity of erosion in some locations.

EPBC Act

EPBC Act listed threatened species with the potential to occur within the study area include:

- Striped Legless Lizard (*Delma impar*);
- Spotted-tailed Quoll (*Dasyurus maculatus*);
- White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- Button Wrinklewort (*Rutidosis leptorhynchoides*);
- Hoary Sunray (*Leuchochrysum albicans var tricolour*);
- Tallong Midge Orchid (*Genoplesium plumosum*);
- Buttercup Doubletail (*Diuris aequalis*);

- Thick-lipped Spider Orchid (*Caladenia tesselata*); and
- Swift Parrot (*Lathamus discolour*).

These species were assessed using relevant Significant Impact Criteria. The assessment concluded that the route is unlikely to have a significant impact on these species.

Offsets

Although impacts associated with the gas pipeline route would be substantially mitigated, construction would result in the temporary removal of 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and permanent modification of approximately 0.35 hectares (Alternative A) to 0.32 hectares (Alternative B) of native vegetation through the removal of understorey vegetation. To compensate for this loss, an offset package has been developed which is discussed in detail in the Preferred Project Report. This provides an offset for the entire proposed gas pipeline route as well as the proposed facilities' site. This proposed offset includes improvements such as weed management (including the control of noxious weeds such as serrated tussock), exclusion of grazing, and rehabilitation of degraded areas as necessary.

Based on the provision of the offset, biodiversity values within the proposed offset area would be maintained and improved.

3.2 Cultural heritage

3.2.1 Existing environment

A search of the DECC Aboriginal Heritage Information Management System (AHIMS) database indicated that two Aboriginal sites have been previously recorded in the study area. There are no heritage listed historic items within the study area.

Ten Aboriginal sites comprising of isolated artefacts and stone artefact scatters were identified in the study area by Biosis Research in 2008. Two landforms were also identified as having potential to contain further Aboriginal archaeological sites.

No historical heritage sites were identified.

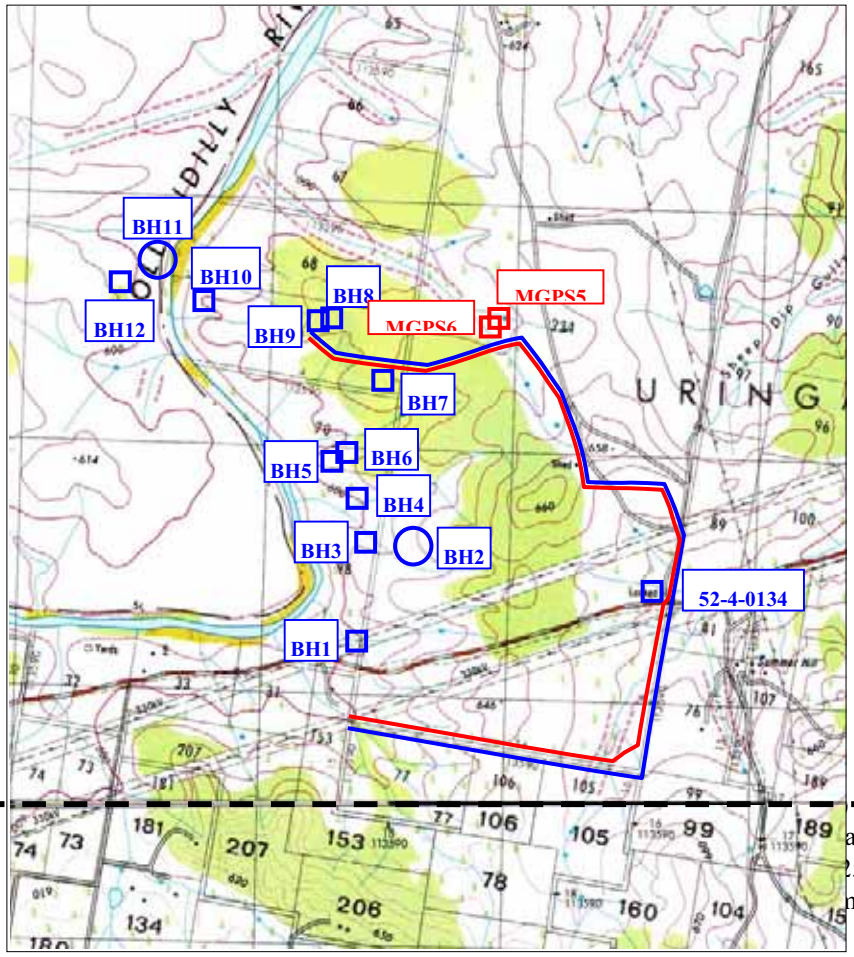
Two Aboriginal sites comprising of a low density artefact scatter (MGPS6) and an isolated find (MGPS5) were identified within the study area during the field survey undertaken for the cultural heritage assessment.

Sites MGPS 5 and 6 are located adjacent to the northern section of the route.

Site MGPS5 consisted of an isolated artefact situated in the northernmost section of the study area. The site comprises only a single quartz artefact on the crest of a small ridgeline.

Site MGPS6 consisted of a low density scatter of artefacts situated in the northernmost section of the study area. The site comprises two quartz lithic artefacts on the crest of a small ridgeline.

Figure 3.2 – Location of Aboriginal Sites along the North Eastern alternative routes



and
ares) in
25,000
n] 2nd

Map showing locations of previously recorded sites (blue squares) and landforms (blue circles), and sites recorded during current investigation (red squares) in relation to current study area (solid blue [A] and red [B] lines) (extract from 1:25,000 topographic maps Canyonleigh 8928-IV-N [top] & Wingello 8928-4-S [bottom] 2nd Editions, CMA).

3.2.2 Impact assessment

Two Aboriginal sites, MGPS5 and MGPS6, are located within the vicinity of the route and may be impacted by construction of the pipeline. No heritage sites are located within the vicinity of the route.

3.3 Land use and infrastructure issues

3.3.1 Zoning

The gas pipeline route would be located within the Goulburn Mulwaree local government area (LGA) (the section south of Canyonleigh Road) and the Upper Lachlan LGA.

The relevant local environmental plans are the *Goulburn Mulwaree Local Environmental Plan 2009* (for that portion of the route within the Goulburn Mulwaree LGA) and the *Mulwaree Local Environmental Plan 1995* (for that portion within the Upper Lachlan LGA). The route is located within Zone No. RU2 (Rural Landscape) of the Goulburn Mulwaree LEP and within Zone 1a (General Rural) of the Mulwaree LEP. Pipelines are permissible within these zones with development consent.

3.3.2 Existing environment

Land use

The area surrounding the route is rural in nature. Much of the land in the immediate vicinity of the route has been cleared with some pasture improvement for sheep and cattle grazing.

Alternative A is located mainly in private property used for rural purposes. North of Canyonleigh Road, the route is mainly located within Arthursleigh Farm (Lot 18 DP 1056592), which is owned by the University of Sydney.

Alternative B is located mainly within a Closed Road, a Crown Public Road and Arthursleigh Farm.

The nearest dwelling is located approximately 350 metres east of the route.

Infrastructure

Infrastructure in the vicinity of the route includes Canyonleigh Road and unformed Crown Public Roads (paper roads). Canyonleigh Road is an unsealed gravel road that provides access to rural properties and the TransGrid switchyard.

The pipeline would cross Canyonleigh Road, two 330kV, one 132kV and one 500kV transmission line easements. The transmission line easements incorporate lattice towers and timber poles, which enter and leave the TransGrid switchyard located on the northern side of Canyonleigh Road.

Due to the rural nature of the locality it is considered that there would be minimal other services located along the route. Nonetheless, there may be underground infrastructure such as Telstra/ Optus cables, electric power conduits/cables and water mains located within Canyonleigh Road. The proposed gas pipeline route may also traverse private irrigation/water pipes associated with the rural properties. All underground infrastructure would be identified during detailed design.

3.3.3 Impact assessment

Rural uses

As mentioned above, the route would mainly pass through land used for grazing. The construction of the pipeline could potentially impact on the use of land for grazing and agriculture. Pasture within the pipeline easement would be cleared as a result of topsoil stripping during construction. Construction of the trench may temporarily restrict access for livestock and farming activities to parts of the properties.

Once constructed, it is anticipated that there would be no impacts on agricultural activities during operation of the pipeline. The pipeline would be laid at a sufficient depth so as not to affect cultivation, grazing of livestock and normal farming activities over the pipeline easement.

Residential

The proposed gas pipeline route is located in a rural area and its construction would not require the demolition or removal of any houses. Environmental management measures would be implemented during construction as outlined in the construction environmental management plan (refer section 3.5) to minimise the potential for impacts with respect to air quality, noise and traffic.

Once operational, the presence of the gas pipeline may result in restrictions being imposed on the future construction of residential premises in the immediate vicinity for safety reasons, however, as the minimum lot size for subdivisions specified by the LEPs (existing and proposed) is 100 hectares, this is unlikely to be a significant issue.

Infrastructure

The route would cross Canyonleigh Road. Construction of the crossing of Canyonleigh Road would be carried out in consultation with Council. It would be undertaken either by boring, without direct impact on the usage of the road, or by trenching involving the construction a side track and/or use of steel plates and traffic control.

There may also be underground services located within, and in close proximity to, the Canyonleigh Road reserve. Excavation for the proposed gas pipeline could impact on underground services.

3.4 Other environmental issues

Construction activities, particularly excavation, have the potential to lead to other environmental issues and impacts, including:

- Impacts to water quality mainly as a result of erosion, sedimentation and disturbance of drainage lines;
- Noise generation during construction;
- Impacts to air quality mainly as a result of dust generation; and
- Traffic and access impacts, particularly as a result of the disturbance of local roads.

These issues are described below. Potential impacts would be managed mainly through the implementation of standard construction environmental management methods as outlined by a construction environmental management plan. Management measures are described in section 3.5.

In terms of sensitive receivers, it is noted that the nearest residential property is approximately 350 metres west of these route options at its closest point within Lot 107 DP750053 . There is a residence

approximately 60 metres west of the commencement point of this route option, which has been purchased by the proponent and is no longer occupied or used as residence.

3.4.1 Water quality

The proposed gas pipeline construction would involve direct impacts to an ephemeral drainage lines at two proposed crossing points.

There is the potential for secondary impacts associated with the disturbance of soils. Disturbance to surface stability could lead to erosion, sediment transportation, siltation and contamination of offsite waters, especially during high rainfall events. During trenching for the construction of the pipeline, any rainfall that does not readily absorb into the ground surface would drain across the surface of the ground as runoff, potentially eroding and transporting sediment loads from the construction areas into adjoining drainage lines and contaminating the creeks and waterways of the catchment area. It is possible that sediment from trenching could contaminate groundwater if there is groundwater present and the trenches intersect the water table. Mitigation measures described in section 3.5 would minimise the risk of these secondary impacts on soils and surface water quality.

There are also several farm dams located in close proximity to the proposed gas pipeline route. These dams are located in areas of cleared grassland and contain near-permanent water.

Another potential minor risk would be the spillage of hydrocarbons from construction vehicles, which could contaminate the surface water and local waterways.

Typical construction activities and sources of potential impacts include:

- Earthworks undertaken immediately prior to rainfall periods;
- Work areas that have not been stabilised;
- Stripping of topsoil, particularly in advance of construction works;
- Works within drainage paths;
- Stockpiling of excavated materials;
- Storage and transfer of construction oils, fuels and chemicals; and
- Maintenance of plant and equipment.

3.4.2 Noise

The proposed gas pipeline route passes through a sparsely populated rural area consisting predominantly of large rural properties and pasture. Noise in the vicinity of the route is generated by traffic, farm machinery and equipment, livestock, and the switchyard.

Several activities would be undertaken during construction of the pipeline that would result in an increase in noise levels in the area. However, construction of the pipeline would be undertaken progressively, in stages. This would ensure that any noise impacts would be of short duration at any one location. There are no schools or hospitals in the vicinity of the proposed gas pipeline route and the only sensitive noise receivers are two residential dwellings associated with the rural properties, with the closest being approximately 350 metres from the route. It is anticipated that noise impacts would be minimal.

3.4.3 Air quality

The main potential air quality issue in relation to construction of the pipeline would be dust during excavation of the pipeline trench. The following activities have the potential to generate dust:

- Construction traffic travelling along gravel roads;
- Removal of vegetation;
- Excavation works;
- Stockpiling of soil for replacement; and
- Erosion of bare soil prior to re-establishment of vegetation.

As only short sections of trench would be excavated at any one time, the affects of any dust generated would be localised and would be managed through the implementation of standard environmental management practices during construction.

Occasional venting of limited gas volumes would be necessary for maintenance activities at the offtake station at the commencement of the gas pipeline and at the facilities' site. Such maintenance venting is not expected to have a significant impact on air quality in the locality, as only a small amount of gas would be released and this would be quickly dispersed.

Blowdown of the full pipeline content would not be permitted except in the unlikely event of an extreme emergency, which is typically outside the control of the pipeline operator.

3.4.4 Traffic and access

As noted by the environmental assessment for the Marulan Gas Turbine Facilities (prepared for EnergyAustralia and Delta by URS) the regional road network is dominated by the Hume Highway, which runs between Sydney and Melbourne. Canyonleigh Road is located in the study area. The pipeline route would cross this road. Canyonleigh Road connects with Brayton Road to the west. Brayton Road provides access to the town of Marulan, and the Hume Highway.

Brayton Road is a 6.5 metre wide sealed road from Marulan to the junction with Canyonleigh Road. Initially Canyonleigh Road is a 5.5 metre wide sealed road but as the distance away from Brayton Road increases the road changes to a gravel surface. In the vicinity of the gas pipeline route, Canyonleigh Road provides access to the facilities' site and the TransGrid Switchyard. It also provides access to rural properties and Arthursleigh farm.

Temporary access to the pipeline right-of-way for construction purposes at other locations may be required which would be identified during construction planning and would generally utilise existing roadways and farm tracks that cross the pipeline route.

As noted above, construction of the crossing of Canyonleigh Road would be carried out in consultation with Council. It would be undertaken either by boring, without direct impact on the usage of the road, or by trenching involving the construction a side track and/or use of steel plates and traffic control. The pipeline route would need to cross the access to Arthursleigh farm (known as 'University Road'). Detours would be set up at these locations to ensure that access is maintained.

If any property fences need to be removed for construction, temporary fences/gates would be installed, and the fences would be reinstated to their original condition at the conclusion of construction. University Road would be upgraded and maintained by the proponent as the primary access to the facilities.

The long term operating workforce would generate very little traffic activity in the local area. There would be only occasional traffic accessing the gas pipeline as required for maintenance purposes. Generally, maintenance crews would consult with landowners to use internal property tracks and roads to access any areas of the pipeline that require maintenance.

3.5 Recommended mitigation measures

To ameliorate the potential environmental impacts identified in sections 3.1 to 3.4, a number of mitigation measures are recommended.

3.5.1 Ecology

Construction techniques

Low-impact construction techniques would be used through ecologically sensitive sections of the route where engineering and safety constraints allow. This would involve the use of smaller excavators and stockpiling of materials and fill away from the immediate excavation area. Low-impact construction techniques would restrict direct construction impacts to a corridor of 10 metres. This would reduce the overall extent of native vegetation and habitat resources removed.

Pre-clearance survey

A detailed pre-clearance survey by a qualified ecologist would be required prior to construction. This would involve:

- Diurnal searches for birds, nests and roosts;
- Active searches for reptiles, including checking of woody debris and rocks/outcrops within the construction footprint,
- Active searches for micro bats, including checking under exfoliating bark; and
- Nocturnal surveys, including stag-watching of identified habitat trees, specifically focusing on observing use of trees by micro bats.

This survey would focus on locating individuals, and especially roosts of threatened species.

If nests or nestlings of threatened species are observed within, or close to, the route then construction would be postponed until the nestlings have hatched and fully-fledged. If construction constraints mean that this delay is not practicable then DECC would be consulted to determine if relocating the species is acceptable.

Tree fauna management

The construction environmental management plan would detail procedures for fauna management including the following:

- Trees would be monitored for fauna before and during clearing operations;
- Trees with resident fauna would be avoided as far as is practicable;
- Hollow-bearing trunks and branches would be carefully sawn and placed intact in adjacent areas of native vegetation; and
- Replacement habitat, such as nest boxes, would be provided where habitat trees are to be removed.

Ground-dwelling fauna management

The construction environmental management plan would include the following:

- Engage a suitably qualified ecologist to identify active wombat burrows that may be impacted by the route;
- Advise on suitable precautions to be exercised during excavation in and around wombat burrows; and
- Engage a suitably qualified ecologist to identify and re-locate any reptiles sheltering in rocky areas outcrops that would be directly impacted by the route.

Groundcover clearance protocol

A groundcover clearance protocol would be incorporated into the construction environmental management plan including the following:

- Remove large woody debris and rock fragments using excavator grabs or manual handling if practicable;
- Place intact large woody debris and rock fragments within adjacent areas of intact vegetation;
- Scrape and stockpile leaf litter and topsoil separately from deeper fill material; and
- Reuse leaf litter and topsoil in remediation works.

Riparian/aquatic habitat management

The two drainage line crossings would be classed as ecologically sensitive sections of the route. Low-impact construction techniques would be used, as described above.

Geomorphic features associated with drainage lines (i.e. channels, banks) would be reinstated to their original condition once the trench is backfilled. Banks would be reinforced with geotextile fabric (or equivalent) and replanted with native understorey vegetation immediately after construction to reduce the potential for erosion and habitat degradation.

Construction through or in the vicinity of drainage lines would only occur when these features are dry. This would reduce the potential for impacts on aquatic or wetland fauna and for secondary impacts due to erosion and sedimentation.

Measures to mitigate impacts on water and air quality would further reduce the potential for impacts on riparian and aquatic ecosystems and habitat.

Timing of construction works

Where feasible, construction works would aim to be conducted in areas of forest and woodland to avoid the breeding season of threatened species identified at the site. Details of any timing of works would be outlined in the CEMP for the site.

Site management

The following mitigation measures are recommended in order to minimise operational impacts:

- Setting maximum speed limits during construction within the study area to reduce the risk of fauna road fatalities;
- Limit vehicular and personnel entry into adjacent remnant vegetation during construction through appropriate marking of operational areas;

- Regularly monitoring the condition of surrounding native vegetation, in accordance with the management plans developed for the proposed pipeline, to ensure that areas of remnant vegetation are not impacted upon during the construction; and
- Implementing and enforcing putrescible waste hygiene measures to reduce the likelihood of foxes, dogs and cats being attracted into the area.

Phytophthora management

Hygiene measures to prevent the introduction or spread of the pathogen would be incorporated into the construction environmental management plan.

Remediation

The original topsoil would be retained and stockpiled to assist in remediation of land along the route. All supplementary plantings would use indigenous native species of local provenance. It is recommended that fallen timber within the route be relocated to areas of intact vegetation adjacent to the study area.

The health of revegetated areas would be monitored closely and supplementary watering supplied as appropriate. Revegetated areas would be monitored for weed infestation and any infestations actively managed to minimise further weed spread.

Weed and pest management

To limit the spread of weeds into adjoining remnant vegetation all construction areas would be temporarily fenced. Stockpiles of fill or vegetation would not be placed in areas of adjoining remnant vegetation but instead within existing cleared areas.

It is recommended that the following measures be incorporated into the construction environmental management plan:

- Perform a baseline weed survey to assess the extent and severity of weed infestation in extant native vegetation within the study area pre and post construction;
- Incorporate control measures to limit the spread of weed propagules downstream of the study area;
- During construction undertake maintenance of silt fences and other mitigation measures to isolate runoff; and immediately rehabilitate disturbed vegetation to limit the potential for colonisation by weeds;
- During construction areas of vegetation that would not be cleared would be fenced, restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill would not be placed in areas of remnant vegetation but instead in adjacent cleared areas;
- Following construction, cleared areas would be revegetated with indigenous native vegetation to limit the potential for colonisation by weeds;
- During operations monitor and control noxious weed species in line with legislative obligations;
- Ensure refuse is adequately disposed of to avoid attracting vermin and other pest species;
- Perform ongoing monitoring of weed infestation on and adjoining the study area using the baseline weed survey.

3.5.2 Cultural heritage

Where possible, disturbance to archaeological sites MGPS5 and MGPS6 would be avoided. If impact to these sites cannot be avoided, then the artefacts would be collected or relocated away from the area of impact.

3.5.3 Land use and infrastructure

Rural uses

The gas pipeline would be laid in stages to ensure that only small sections of the right of way/easement are disturbed at anyone time. The topsoil would be replaced as soon as possible at the conclusion of each section. The topsoil would contain the original seed bank and rootstock of the pasture and, as such, the pasture may regrow unaided in many instances. However, as required, pasture seed and fertiliser compatible with the surrounding pasture would be re-sown to rehabilitate the area over the pipeline.

Once it has been rehabilitated, the land above the pipeline route would be able to be returned to grazing and normal agricultural activities without the need for any further mitigation measures.

Residential

Potential impacts of the gas pipeline generally relate to construction issues such as noise, air quality, traffic and access. Mitigation measures in relation to these issues are described in Section 3.5.4.

Infrastructure

Access to the gas pipeline route and the suitability of local roads would be considered during the further assessments that would be undertaken to confirm the traffic and access arrangements to the facilities' site.

Measures relating to construction traffic management are described in the following section.

Detailed services searches would be undertaken during detailed design to identify and locate underground services located in the road reserve. The gas pipeline design would aim to ensure that services are not impacted. Should impacts to underground services be unavoidable, consultation with the service provider would be undertaken and the services would be relocated prior to construction.

Prior to construction within the electricity easements the relevant electricity provider would be consulted to establish clearances required from the transmission lines and any restrictions on construction machinery. The gas pipeline would be cathodically protected to ensure that the electricity transmission lines do not induce currents on the pipeline once it is operational.

3.5.4 Environmental management

Water quality

Construction phase impacts would be managed by the implementation of standard environmental management measures as defined in the construction environmental management plan. Such measures would significantly decrease the likelihood of adverse environmental impacts.

The construction environmental management plan would include a construction soil and water management plan detailing construction phase stormwater management strategies in accordance with

Landcom Soil and Construction, Managing Urban Stormwater (Landcom, 4th edition, 2004). These would include amongst others:

- General site practices and responsibilities;
- Material management practices;
- Stockpile practises;
- Topsoil practices; and
- Erosion control practices (earth sediment basins, straw bales, sediment fences, turbidity barriers, stabilised site accesses, diversions and catch drains).

The trenching would be undertaken progressively, in stages, to minimise the time that disturbed land is exposed and ensure that spoil stockpiling is kept to a minimum. The stockpiles would be established in an appropriate manner and sediment fencing would be installed to ensure that no sediment is able to enter receiving waters through rainwater runoff.

In the case where a trench would have to intersect the water table, a groundwater management plan would be prepared. The water table would be intercepted and water extracted from the site in accordance with the groundwater management plan. It is expected that construction areas would be rehabilitated and proposed stormwater controls would provide best practice management of potential erosion scour and sediment transport from the site during wet weather events.

Noise

A construction environmental management plan would be prepared. This would include the following mitigation measures:

- Where practical, machines would be switched off when not in use;
- Machines found to produce excessive noise compared to normal industry expectations would be removed from the site or stood down until repairs or modifications can be made;
- Haulage and delivery trucks would be fitted with appropriate mufflers and be in good working order;
- Construction hours would be limited to DECC guidelines; and
- A community liaison person would be appointed to communicate with potentially affected residents and to actively respond in the event complaints are received.

Air quality

A dust control plan detailing measures to control the potential for dust generation would form part of the construction environmental management plan. Measures would target dust generation by vehicle movements and excavation works. Typical mitigation measures would include:

- Ensuring exposure time of uncovered surfaces is minimised;
- Watering of gravel roads during the construction period;
- Covering stockpiles and loads; and
- Site management controls.

Traffic

A construction traffic management plan would be prepared as part of the construction environmental management plan. It would be prepared in consultation with road authorities to minimise the potential for construction traffic impact on the surrounding road network and disruptions within roads and road reserves. The plan would include measures to ensure public safety and access is maintained, and that disruptions are minimised as far as possible.

The plan would include measures such as the use of one-way traffic and appropriate fencing, provision of detour routes, signs and traffic control measures that would be installed.

A condition survey of local roads would be undertaken prior to construction commencing.

Appendix A

Addendum flora and fauna report for Marulan gas pipeline

CLIENTS | PEOPLE | PERFORMANCE

EnergyAustralia

Addendum Flora and Fauna Report for Marulan Gas Pipeline Route

Proposed North Eastern Route Option

April 2009

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

Contents

Table Index

Figure Index

Appendices

1. Introduction

1.1 Background and location

This report is provided as an Addendum to the *Marulan Gas Pipeline Route: Ecological Impact Assessment of the Proposed Western Route Option Report* produced by GHD in February 2009. This Addendum focuses on two additional pipeline route options referred to as the "north eastern route option A & B" that would adjoin the western route at the divergence point shown on Figure 1. The north eastern route commences approximately 200 metres south of Canyonleigh travelling east, then north easterly from the eastern and western routes to Canyonleigh Road. After crossing Canyonleigh Road, the route travels north to north westerly mainly through Lot 3 DP1120270, before it enters the Facilities' site. Two alternatives A & B are described below.

This route alternative travels directly east from the divergence point (shown on Figure 1) within Lot 12 DP727493, alongside its southern boundary for approximately 1,100 metres. It then turns directly north and travels alongside the eastern boundary of Lot 12 DP727493 for a distance of approximately 650 metres to Canyonleigh Road. After crossing Canyonleigh Road the route continues north within a Crown Public Road for approximately 300 metres, then leaves the Crown Public Road and heads north westerly for a distance of approximately 1,300 metres within Lot 3 DP1120270 to the Facilities' site western boundary. Total distance approximately 3,350 meters

Alternative B runs parallel to alternative A from the divergence point at Lot 12 DP 727493, and travels wholly within Lot 14 DP113590 (Closed road) for 1,200 metres, where it turns directly north and travels in a parallel direction to alternative A, remaining within Lot 14 DP DP113590 (Closed road) for approximately 660 metres to Canyonleigh Road. After crossing Canyonleigh Road the route follows the same alignment as alternative A for approximately 1,590 metres to the Facilities' site western boundary. Total length approximately 3,450 metres.

The north eastern route was only surveyed in detail up to the edge of the Facilities' Site assessed in the URS (2008) report. Construction beyond this point coincides with the proposed access road corridor that has been assessed by URS as part of the Facilities' Site construction footprint (URS, 2008).

1.2 Scope of Report

The proposed pipeline is subject to approval under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as a "Major Project", the consent authority being the Minister for Planning. The Facilities' Site has also been offered "Critical Infrastructure" status under Section 75C of the EP&A Act.

This Addendum has been prepared as a technical document to support the Environmental Assessment (EA), and addresses the environmental assessment requirements, which state that the EA must include a 'flora and fauna impact assessment in accordance with the NSW Department of Environment and Climate Change (DECC) *Guidelines for Threatened Species Assessment* (DEC, 2005). This Report assesses the ecological impacts of the proposed construction and operation of the proposed north eastern route option, with due consideration of relevant Commonwealth and State legislation (see Section 3), as well as relevant guidelines, including:

- *Guidelines for Threatened Species Assessment* (DEC/DPI, 2005), with regard to the nature and content of this report; and

- *Threatened Biodiversity Survey and Assessment: Draft Guidelines for Developments and Activities* (DECC, 2004). The field surveys completed for this assessment, as described in Chapter 3, have been designed and implemented to comply with the requirements recommended in these guidelines where applicable.

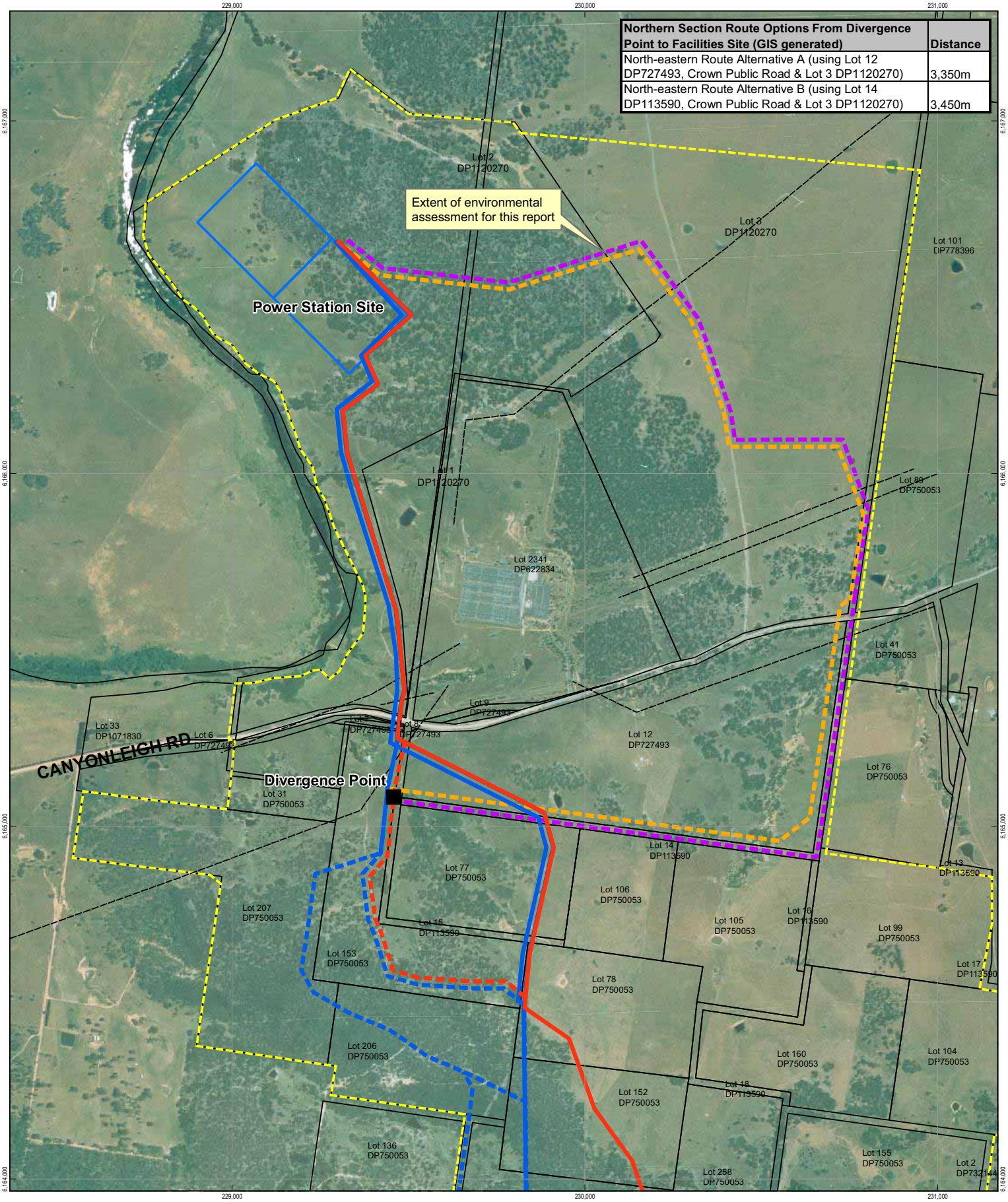
The DEC/DPI (2005) guidelines identify important factors that must be considered by proponents and consultants when assessing potential impacts on threatened species, populations, or ecological communities, or their habitats for development applications assessed under Part 3A. The principles outlined in these guidelines and addressed in the current assessment are as follows:

- 'Maintain or improve' biodiversity values (i.e. there is no net impact on threatened species or native vegetation);
- Conserve biological diversity and promote ecologically sustainable development;
- Protect areas of high conservation value (including areas of critical habitat);
- Prevent the extinction of threatened species;
- Protect the long-term viability of local populations of a species, population or ecological community; and
- Protect aspects of the environment that are matters of national environmental significance.

This assessment assumes a 20 metre corridors of impact along the proposed north eastern route option only ("the study area"), and is designed to provide information and analysis to demonstrate that feasible alternatives have been considered, that the project has been designed to be consistent with the principles outlined above, and where there would be impacts, that adequate mitigation measures and biodiversity offsets would be implemented.

Details as to site characteristics (geology, soils, topography, hydrology and climate) and legislative framework are provided in the *Marulan Gas Pipeline Route: Ecological Impact Assessment of the Proposed Western Route Option Report* produced by GHD (February 2009) and are not replicated here.

A detailed assessment of the proposed Facilities' Site was not undertaken for this report; instead GHD relied on previous surveys conducted by URS for the Facilities' Site (URS 2008). GHD did, however, conduct a walk over of the proposed route through the Facilities' Site, to identify any important habitat features such as hollow-bearing trees.



1 Eastern Route
2 Eastern Route using Lot 153 Alternative
3 Western Route
4 Western Route using Lot 153 Alternative
North-eastern Route Alternative A (using Lot 12 DP727493, Crown Public Road & Lot 3 DP1120270)
North-eastern Route Alternative B (using Lot 14 DP113590, Crown Public Road & Lot 3 DP1120270)

Moomba Sydney Gas Pipeline
Powerline
Power Station Site
Gas Pipeline Corridor
Cadastre

1:10,000 (at A3)
0 62.5 125 250 375 500
Metres

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

N

EnergyAustralia

Delta electricity

GHD
CLIENTS | PEOPLE | PERFORMANCE

Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number 21-17633
Revision A
Date 27 APR 2009

North Eastern Route Options

Figure 1

G:\21\17633\CADD\GIS\MapDocuments\Z049_NorthEasternRouteOptions.mxd

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

Data Source: NSW Department of Lands: Cadastral - 17/03/2009. Created by: qjchung, Bahambly, bahambly, cwilson

2. Methods

2.1 Literature Review

The following documentation was reviewed prior to the conduct of the field investigations:

- NSW NPWS Wildlife Atlas database (July 2008 – 10 km radius search for TSC Act listed flora and fauna, centred on the site. The NSW Bungonia and Crookwell CMA sub-regions were searched for Endangered Ecological Communities);
- EPBC online Protected Matters Database (July 2008 – to a 10 km radius);
- URS, 2008 *Biodiversity Impact Assessment, Gas Turbine Facilities Project, Marulan, NSW* including the list of target threatened species provided by DECC in the EARs for that project; and
- PB, 2005 Big Hill Gas Turbine Baseline Ecological Surveys.

2.2 Field Surveys

A two-day / one-night field survey was undertaken which included targeted flora and fauna surveys on the 9 and 10 of March 2009. Data collected during this survey was used in conjunction with information gained on previous surveys to assess other proposed route alternatives. Survey locations are shown on Figure 2. Survey methodology is described below and survey effort detailed in Table 1.

Table 1 Survey Effort

Task	Technique	Person Hours / Number undertaken for North eastern route alternative	Person Hours / Number for total surveys conducted within study area
FLORA			
Flora Inventory	Quadrats	6 quadrats	24 quadrats throughout the study area
Targeted Searches for Threatened Flora	Random Meander	2 random meanders along the length of the north eastern route alternative 3 random meanders within patches of Box Gum Woodland EEC	10 random meanders along the length of the proposed pipeline route alternatives and surrounds
FAUNA			
Bird Survey	Diurnal Bird Counts	Two people conducting two 40 min searches over one morning 2.7 person hours	Two people conducting two 40 min searches over 7 mornings 18.7 person hours
Reptiles and Amphibians	Active Searches	Incidentally throughout two day survey ~ 4 person hours	Incidentally through out 10 survey days ~ 20 person hours
Bats	Anabat Harp Traps	N/A – relied on data previously collected by GHD and URS	Two Anabats out each night of surveys

Task	Technique	Person Hours / Number undertaken for North eastern route alternative	Person Hours / Number for total surveys conducted within study area
			10 Anabat nights Two harp traps over one night
Forest Owls and threatened arboreal fauna	Call Play Back	Conducted over one night for approximately one hour	Conducted each surveys night for approximately one hour ~ 7 survey hours
Arboreal and other nocturnal fauna	Spotlighting	Two people spotlighting for approximately two hours over one survey night ~4 person hours	Two people spotlighting for approximately two hours each survey night ~12 person hours

2.2.1 Flora Survey

Flora surveys were consistent with the DECC guidelines (DEC 2004). All vascular plants (i.e. not mosses, lichens or fungi) observed were recorded on appropriate pro-forma field data sheets.

Plant specimens not readily identifiable in the field were collected and subsequently identified using standard botanical texts and where required were compared with voucher specimens held in the National Herbarium of New South Wales Online Reference Collection. Structural vegetation communities were described according to classifications made by Specht (1970). Plant identifications were made according to nomenclature in Harden (1990, 1991, 1992, and 1993). Plant specimens which were difficult to identify (either insufficient sample collected or buds/fruiting bodies were not available at the time of the survey) were submitted to the NSW National Herbarium for identification.

The field survey included six 20 metre x 20 metre quadrats. A 'random meander' survey was also performed over the whole route and its immediate vicinity to detect threatened flora species and to define the boundaries of vegetation communities. Random meanders were also performed throughout areas thought to be endangered ecological communities (EECs) with all plants observed within each 'patch' recorded.

Plant species were recorded on appropriate pro forma field data sheets. The location of field survey quadrats and significant species, habitat and communities were captured with a handheld GPS unit. The location of the vegetation survey quadrats are shown in Figure 2.

2.2.2 Fauna Survey

Targeted fauna surveys were generally consistent with the DECC guidelines (DEC 2004). The survey design was based on the likelihood of threatened species identified in the literature review occurring on site and the initial habitat assessment. Methods included diurnal bird counts, active searches, nocturnal call playback, spotlighting, leaf litter searches, opportunistic observations and track and scat analysis. All observations were recorded on appropriate pro forma field data sheets.

Weather during the field survey was predominately warm and dry (BOM, 2009) and there was no light spill from human sources, however, the moon was full. Traffic along the local roads was very light with less than one vehicle movement per hour. Conditions throughout the survey were suitable for the

detection of small nocturnal fauna. No rain fell during the survey period; however, there was standing water in farm dams and wetlands across the site. A summary of survey effort for the project is provided in Table 1 above and is discussed below.

Diurnal Bird Counts

Diurnal bird counts consisted of area searches through habitat on site. Two 40-minute searches were conducted at dawn by two people over approximately one hectare for each search. Opportunistic observations of bird species were recorded throughout the duration of all surveys on the site. Species were identified by visual observation and call and were documented along with numbers of individuals, behaviour, breeding activity and habitat type on pro forma data sheets.

Trees were also scanned for nests, whitewash (guano deposits) and roosts throughout the study area and their locations captured with a handheld GPS unit.

Active Searches

Active searches for frogs and reptiles were performed within and adjacent to the study area focussing on wetlands and suitable substrate. Banks and streamsides were systematically searched and semi-aquatic vegetation was visually scanned. Shelter sites were carefully lifted and replaced, trunks and decorticating bark were scanned, rock crevices were searched, leaf litter was raked and visual scanning of vegetation for active and foraging specimens was undertaken. Frogs were identified by sight and by call.

Call Playback

Call playback was performed for approximately one hour targeting the squirrel glider (*Petaurus norfolcensis)*, yellow-bellied glider (*Petaurus australis*), sooty owl (*Tyto tenebricosa),* masked owl (*Tyto novaehollandiae*), barking owl (*Ninox connivens)* and powerful owl (*Ninox strenua)*.

Call playback included at least five minutes broadcasting and ten minutes listening for each species per night plus additional listening and spotlighting at the beginning and end of the call playback period.

Spotlighting

Spotlighting surveys were performed during and after call playback and involved walking one kilometre transects for one hour. Approximately two hours of additional, opportunistic spotlighting in areas of interest or of high activity was performed, either on foot or from a vehicle.

Fauna Habitat Assessment

An assessment of the quality of habitats present for native fauna was made across the entire study area. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. Indicative habitat criteria for targeted threatened species (i.e. recorded in the TSC and EPBC Act searches) were identified prior to fieldwork. Criteria were based on information provided in TSC Act species profiles, field notebooks and the knowledge and experience of GHD field ecologists. Habitat assessments assists in the compilation of a comprehensive list of fauna that are predicted within the vicinity of the study area, rather than relying solely on single event surveys that are subject to seasonal limitations and may only represent a snapshot of assemblages present.

The locations and quantitative descriptions of significant habitat features were captured with a handheld GPS unit.

Ground Debris Searches

Ground debris searches were undertaken incidentally during the entire survey period while traversing the study area. These included active searches for scats, tracks, burrows or other traces.

Opportunistic Observations

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. Survey effort was concentrated on suitable areas of habitat throughout the course of the flora survey, for instance fallen timber was scanned for reptiles and paddock trees and dams were scanned for roosting birds.

2.3 Staff Qualifications

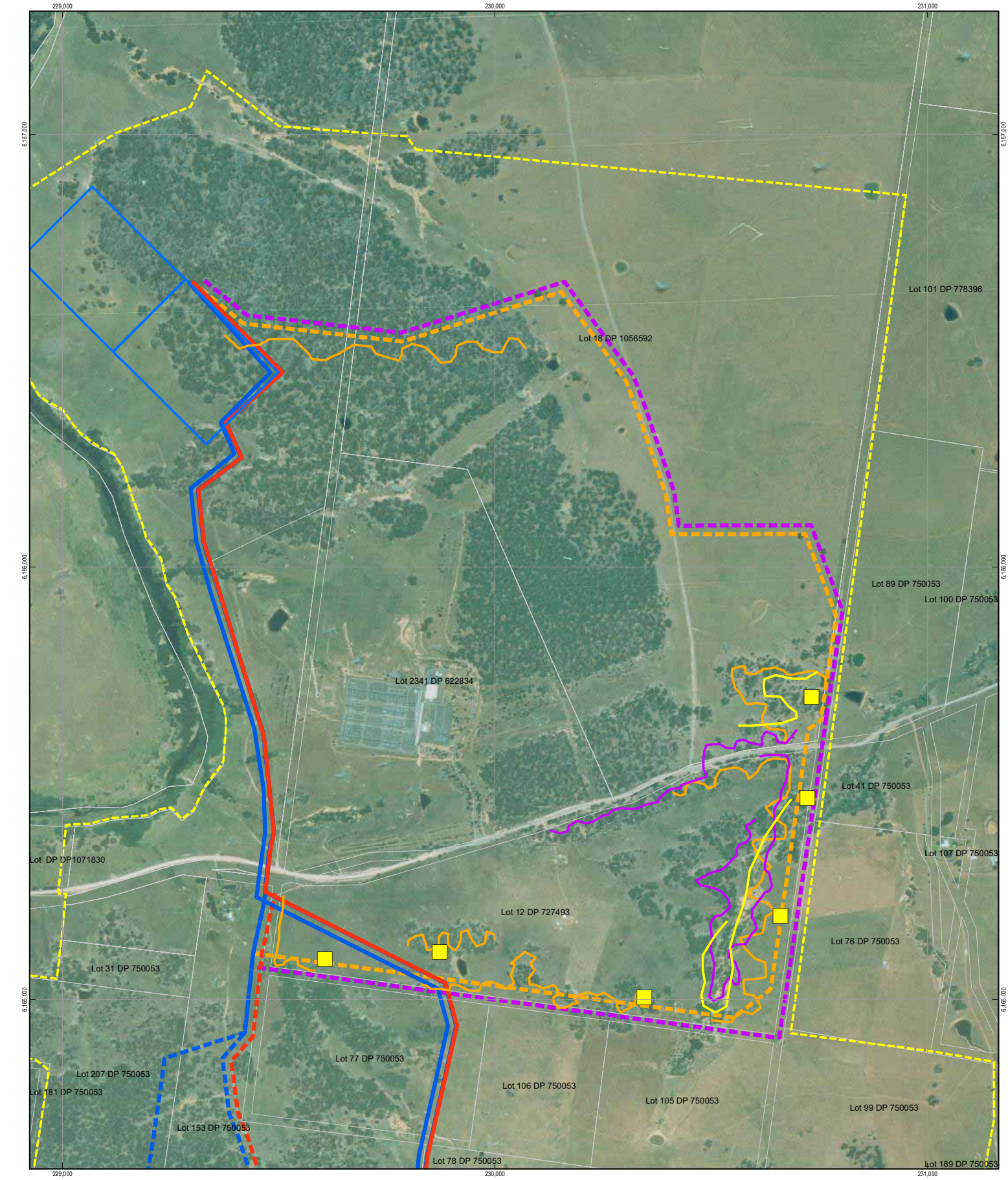
Field surveys were undertaken by Ben Harrington and Vanessa Keyzer. Staff qualifications and experience are presented in Table 2 below.

Table 2 GHD Ecology Personnel and Qualifications

Name	Position / Project Role	Qualifications	Relevant Experience
Ben Harrington	Fauna Ecologist / field surveys and reporting	Master of Science Bachelor of Science, Macquarie University	5+ years
Vanessa Keyzer	Flora Ecologist / field surveys and reporting	Bachelor of Social Science, UNE	8+ years
Natasha Witting	Senior Ecologist / technical review and QA	Bachelor of Science (Environmental Science), Griffith University Bachelor of Science (Environmental Science) Ecology (Hons1), Griffith University	10 years + experience

2.4 Survey Limitations

It is possible that some species utilise the study area but were not detected during the survey period. These species are likely to include flora species that flower after rainfall as well as annual, ephemeral or cryptic species that are difficult to detect or identify when not in flower, fauna species which are inactive during cooler months, and migratory or nomadic species that occur on a seasonal basis. Some fauna species are also mobile and transient in their use of resources and it is likely that not all species (resident or transitory) were recorded during the survey period. The habitat assessment conducted for the study area allows for the identification of habitat resources for such species to determine their likely occurrence. As such, the survey was designed to provide an overall assessment of the ecological values of the study area in order to predict potential impacts of the proposal. Surveys were generally consistent with the DECC draft survey guidelines (DEC 2004), and were modified where relevant. Also, a detailed assessment of the proposed Facilities' Site was not undertaken for this report, instead GHD relied on previous surveys and vegetation mapping conducted by URS for the Facilities' Site (URS 2008).



Legend

- Bird Survey
- Random Meander
- Spotlighting
- 20m x 20m Vegetation Quadrat

Pipelines

- 1 Eastern Route
- 2 Eastern Route using Lot 153 Alternative
- 3 Western Route
- 4 Western Route using Lot 153 Alternative
- North-eastern Route Alternative A (using Lot 12 DP727493, Crown Public Road & Lot 3 DP1120270)
- North-eastern Route Alternative B (using Lot 14 DP113590, Crown Public Road & Lot 3 DP1120270)
- Plant Footprint
- Land Ownership

1:8,000 (at A3)
0 25 50 100 150 200
Metres

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

N

EnergyAustralia

Delta electricity

GHD

CLIENTS | PEOPLE | PERFORMANCE

Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number 21-17633
Revision C
Date 21 APR 2009

North-eastern Route Survey Effort

Figure 2

G:\21\17633\CADD\GIS\MapDocuments\Z040_SurveyLocations.mxd

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

3. Results

3.1 Flora

3.1.1 Flora Species

One hundred and twelve species of flora were recorded within the study area (north eastern route alternative only) of which 34 were introduced species.

3.1.2 Vegetation Communities

Eastern Tablelands Dry Forest

This was the dominant vegetation community across the study area. Patches of this vegetation were dominated by stringybark eucalypts (*Eucalyptus agglomerata, Eucalyptus eugenoides*), cabbage gum (*Eucalyptus amplifolia*), and silvertop ash (*Eucalyptus sieberi*) (see Figure 3). The understorey was dominated by native grasses such as kangaroo grass (*Themeda australis*) and wire grasses (*Aristida calycina* var. *calycina, Aristida racemosa* var. *speciosa*). This community also contained occasional silver banksia (*Banksia marginata*), violet kunzea (*Kunzea parviflora*), Parramatta green wattle (*Acacia parramattensis*) and urn heath (*Melichrus urceolatus*). Other species present included weeping meadow grass (*Microlaena stipoides*), sheep sorrel (*Acetosella vulgaris*), carrot weed (*Cotula australis*), stinking pennywort (*Hydrocotyle laxiflora*) and serrated tussock (*Nassella trichotma*).

Frost Hollow Grassy Woodland

This community was dominated by snow gum (*Eucalyptus pauciflora*), and/or apple box (*Eucalyptus bridgesiana*) and contained a grassy understorey dominated by kangaroo grass and wire grasses. Other occasionally occurring species in this community golden moths (*Diuris chryseopsis*), violet kunzea, and the weeds serrated tussock and canary grass (*Phalaris aquatica*).

Tablelands Grassy Box Gum Woodland

Patches of yellow box occurred adjacent to apple box or in conjunction with cabbage gum within a number of locations within the study area (see Figure 3). The understorey was a mix of native grasses and native and introduced herbs and forbs.

Candlebark Gully Forest

A small patch of candlebarks occurred within the northern portion of the gully on Lot 12 which had an understorey of weeping meadow grass, stinking pennywort (*Hydrocotyle laxiflora*) and bracken fern (*Pteridium esculentum*).

Native Pasture

Native pasture occurred throughout the study area both on Lot 12 and within the Arthursleigh property. Native pasture was dominated by either kangaroo grass or wire grasses, with occasional stands of serrated tussock. Other grasses present included wallaby grasses (*Austrodanthonia tenuior, Austrodanthonia racamosa* var *racamosa)*, spear grass (*Austrostipa* spp.), weeping meadow grass (*Microlaena stipoides),* plume grass (*Dichlachne micrantha*). Other pasture species included clover (*Trifolium* spp.), cats ear (*Hypochaeris radicata*), sheep sorrel, plantain (*Plantago lanceolata*) and

fleabane (*Conyza* sp). These areas would once have supported woodland and have been cleared of canopy trees for agriculture.

Modified or Disturbed Land

This community refers to areas of exotic grassland that occurred between woodland patches on the Arthursleigh property in association with native pasture. These areas were dominated by introduced species, notably serrated tussock and fleabane. These areas were heavily grazed, making identification of species difficult.

3.1.3 Threatened Flora Species

No threatened flora were identified during the survey, however, the study area provided habitat for a number of threatened flora species (see Table 10):

- Buttercup doubletail (*Diuris aequalis*);
- Camden woollybutt (*Eucalyptus macarthurii*);
- Hoary sunray (*Leuchochyrsum albicans* var *tricolour*);
- Few-seeded bossiaea (*Bossieaea oglisosperma*)
- Thick-lipped spider orchid (*Caladenia tesselata*)
- Tallong midge orchid (*Genoplesium plumosum*);
- Delicate pomaderris (*Pomaderris delicata*);
- Button wrinklewort (*Rutidosis leptorrhynchoides*); and
- Dwarf kerrawang (*Rulingia prostrata*).

A number of these species are easily identifiable in the field (camden woolly butt, few-seeded bossiaea, delicate pomaderris and dwarf kerrawang) and as targeted surveys did not detect them in the study area, they can be reliably considered unlikely to occur. Surveys are likely to have identified the presence of Tallong midge orchid (flowers late summer / early autumn) and button wrinkelwort (flowers December to March), if they occurred as surveys were conducted during these species' likely flowering period. Other threatened flora with the potential to occur within the study area are cryptic and difficult to identify outside their known flowering period including:

- Buttercup doubletail (flowers October to December);
- Hoary sunray (flowers spring to summer); and
- Thick-lipped spider orchid (flowers September to November).

Further targeted surveying during these species flowering times is recommended to ensure they are not significantly impacted by the proposal.

3.1.4 Endangered Ecological Communities

Yellow box occurred in patches adjacent to snow gum woodland, and in association with cabbage gum on Lot 12 and within the Arthursleigh property (see Figure 3). This community qualifies as the endangered ecological community (EEC) *White Box, Yellow Box, Blakely's Red Gum Grassy Woodland* (Box-Gum Woodland) EEC. This EEC is listed under both state and federal legislation, however, is defined based on slightly different criteria in each. Under federal legislation (EPBC Act) the patch must

be in “reasonable condition” and support at least 12 native non-grass species in the ground layer, or be greater than two ha in size if otherwise. State legislation (TSC Act) only requires the presence of relevant canopy species (i.e. yellow box, white box or Blakely’s red gum). All three patches constitute TSC Act Box-Gum woodland due to the presence of yellow box.

None of the patches identified during the survey met the criteria for EPBC Act listing EEC notably due to their small size and limited numbers of non-grass natives in the understorey (see Table 3 and Table 4).

Table 3 Commonwealth Listing Advice criteria for assessing Box Gum Woodland EEC

Criteria	Description	Does the site meet the criteria?
1	Does the site contain or previously have contained white box, yellow box or Blakely’s red gum?	Yes, a number of sites contain yellow box
2	Does the site have a predominately native understorey?	Yes. Areas where yellow box occur have a predominately native understorey.
3	Is the patch 0.1 ha or greater in size?	The two patches on Lot 12 are not greater than 0.1 ha in size. The patch that extends from the northern boundary of Lot 12 into the Arthusleigh property is greater in size than 0.1 ha.
4	Are there 12 or more native understorey species present (excluding grasses)?	No. No individual patch of yellow box contained 12 or more non-grass native understorey species (see flora species list in Appendix 1).
5	Is the site in “reasonable” condition? (i.e. at least one of the understorey species will be an important species (e.g. grazing-sensitive, regionally significant or uncommon species; such as kangaroo grass or orchids) in order to indicate a reasonable condition).	No. The patch north of the Frost Hollow Woodland is relatively degraded and contained patches of the noxious weed serrated tussock. The other areas all contained occasional tussocks of kangaroo grass.
6	Where sites do not meet does the site meet criteria 4 and 5, is the patch two ha or greater in size?	No. Areas of scattered yellow box do not meet this criterion.
7	If yes, than does the patch have an average of 20 or more mature trees per hectare or is there natural regeneration of dominant overstorey Eucalypts?	NA

Table 4 NSW TSC Act criteria for the determination of Box Gum Woodland EEC

Criteria	Description	Does woodland in the study area meet the criteria?
1	Does the site fall within the area defined in the NPWS Scientific Determination for Box Gum Woodland EEC?	Yes.
2	Are characteristic trees white box, yellow box or Blakely's cabbage gum present (or likely to have been present) at the site?	Yes, yellow box is present at a number of locations (see Figure 3).
3	Is the site mainly grassy?	Yes, sites containing yellow box have a mainly grassy understorey.
4	Do any of the listed characteristic species occur?	Yes. (See NPWS Scientific determination and species list http://www.environment.nsw.gov.au/determinations/BoxgumWoodlandEndComListing.htm)
5	If the site is degraded, is there potential for assisted regeneration of the overstorey or understorey?	Yes, there is potential for assisted regeneration in all areas containing yellow box.

One other EEC, natural temperate grassland of the southern tablelands (NSW and ACT), is predicted to occur within the study area (DEWHA, 2008), however the guidelines for identifying this community require that an area historically did not contain canopy trees and this is unlikely to be the case within the study area. Open grassland areas within the study area are the result of clearing for agriculture and would have contained woodland vegetation prior to clearance.

3.1.5 Noxious Weeds

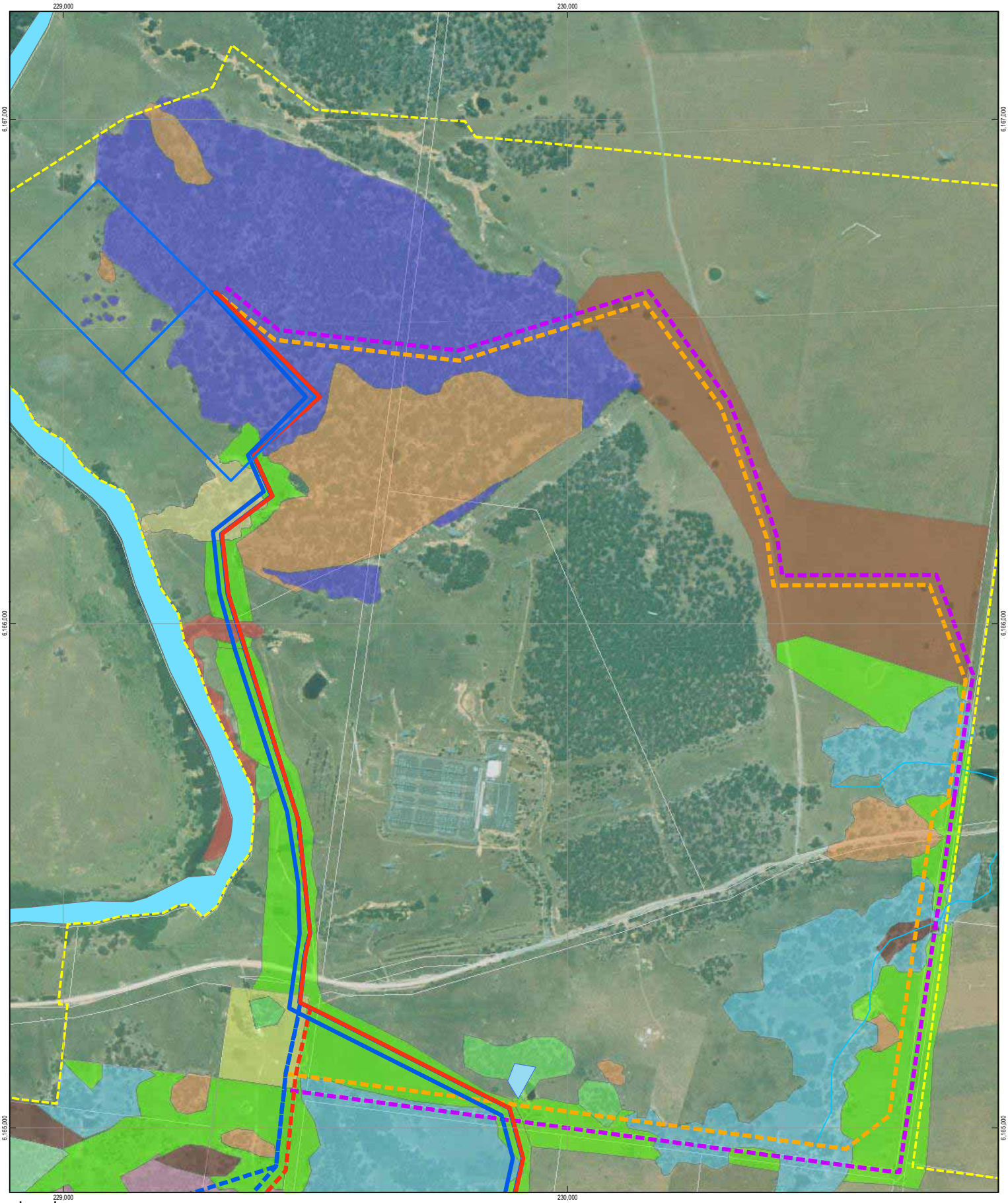
The *Noxious Weeds Act 1993* provides for the declaration of noxious weeds in local government areas. Landowners and occupiers must control noxious weeds according to the control category specified in the Act. Public authorities must control noxious weeds according to the control category to the extent necessary to prevent their spread to adjoining land.

The study area contains nine species declared as noxious weeds in Goulburn-Mulwarree LGA as shown in Table 5 below. These species were scattered throughout the study area. Blackberry was particularly prominent within the gully on Lot 12, and serrated tussock occurred through out the study area. Other species occurred in areas of pasture.

Table 5 Noxious weeds present in the study area

Common name	Scientific name	Control category
African love grass	*Eragrostis curvula*	4
Blackberry	*Rubus fruticosus*	4
Fireweed	*Senecio madagascarensis*	4
Lantana	*Lantana* spp.	4
Onion grass	*Romulea* spp.	5
Scotch thistle	*Onopordum* spp.	4
Serrated tussock	*Nasella trichotoma*	4
Prickly pear	*Opuntia* spp.	4
Briar rose	*Rosa rubignosa*	4

For Category 4: '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'. For Category 5: 'the requirements in the *Noxious Weeds Act 1993* for a notifiable weed must be complied with'.



Legend

Pipelines
- 1 Eastern Route
- 2 Eastern Route using Lot 153 Alternative
- 3 Western Route
- 4 Western Route using Lot 153 Alternative
- North-eastern Route Alternative A (using Lot 12 DP727493, Crown Public Road & Lot 3 DP1120270)
- North-eastern Route Alternative B (using Lot 14 DP113590, Crown Public Road & Lot 3 DP1120270)

Vegetation Communities

Label
- Stringybark/ Black Sheoak forest
- Candlebark Gully Forest
- Argyle Apple Forest
- Cabbage Gum / Stringybark Forest
- Scribbly Gum woodland
- Box- Gum Woodland EEC
- Snow Gum / Apple Box Woodland
- River She-oak Forest
- Acacia Scrub
- Red Stringybark Forest
- Garden
- Native Grassland
- Snow Gum/Candlebark/Applebox Woodland
- Red Gum Woodland
- Tableland Hills Grassy Woodland
- Frost Hollow Grassy Woodland
- Riverbank Forest
- Grassland
- Unclassified
- Land Ownership
- Plant Footprint
- Gas Pipeline Corridor
- Drainage lines
- dams

1:7,000 (at A3)

0 35 70 140 210 280

Metres

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

N

EnergyAustralia

Delta electricity

GHD

CLIENTS | PEOPLE | PERFORMANCE

Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Job Number 21-17633
Revision C
Date 21 APR 2009

Vegetation Communities

Figure 3

G:\21\17633\CADD\GIS\MapDocuments\Z039_ACVeg_Map.mxd

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

Data Source: NSW Department of Lands: Cadastral - 17/03/2009. Created by: qjchung

3.2 Fauna

3.2.1 Fauna Species

Birds

Bird species were common throughout the study area but were most notable within gully areas. Forty-two species were identified during the two-day survey, with overall surveys identifying over 80 species of bird.

Relevant habitat types for birds included:

- Native pasture which provides habitat for open country species such as the Australian magpie (*Gymnorhina tibicen*), little raven (*Corvus coronoides*), willie wagtail (*Rhipidura leucophrys*) and yellow-rumped thornbill (*Acanthiza chrysorrhoa*);
- Dry forest and woodland which provides habitat for species such as the white-throated treecreeper (*Cormobates leucophaea*), striated thornbill (*Acanthiza lineata*), white-eared honeyeater (*Sericornis frontalis*), dusky woodswallow (*Artamus cyanopterus*) and common bronzewing (*Neochmia temporalis*);
- Shrubby areas of Parramatta green wattle and blackberry which provide habitat for small birds such as superb fairy-wren (*Malurus cyaneus*) and grey fantail (*Rhipidura fuliginosa*);
- Gully ponds and farm dams which provide habitat for waterbirds including Pacific black duck (*Anas superciliosa*) and Australian wood duck (*Chenonetta jubata*); and
- A broad range of habitat for predatory species such as raptors and owls.

Mammals

Native ground-dwelling mammals observed included macropods such as the eastern grey kangaroo (*Macropus giganteus*) and wallaroo (*Macropus robustus)*. Common wombats (*Vombatus ursinus*), including some active burrows, were recorded within the site.

Arboreal mammals, such as the common brushtail possum (*Trichosurus vulpecula*) and sugar glider *(Petaurus breviceps*), were noted within the study area. The common ringtail possum (*Pseudochreirus peregrinus*) is also likely to be present at the site. Exotic species included the rabbit (*Oryctolagus cuniculus*), European hare *(Lepus europaeus*) and the red fox (*Vulpes vulpes*).

A number of microbats had been previously identified within the locality by GHD (2008), and based on these surveys the study area is likely to provide habitat for: southern forest bat (*Vespadelus regulus*), little forest bat (*Vespadelus vulturnus*), gould's wattle bat (*Chalinolobus gouldii*) and the chocolate wattled bat (*Chalinobolus morio*). Field surveys conducted by URS in 2006 and 2007 noted large numbers of 11 species of microbats within the Proposed Marulan Gas Turbine Facility site (URS, 2008) including the four species identified by GHD (above) the TSC Act listed eastern falsistrelle (*Falsistrellus tasmaniensis*) and eastern bentwing bat (*Miniopterus schreibersii oceanensis*).

Reptiles and Amphibians

Diurnal reptiles were relatively sparse. Sunskink species (*Lampropholis* spp.) were recorded at a number of locations. Jacky lizards (*Amphibolurus muricatus*) have been recorded during previous surveys (GHD 2008) and are likely to be present within the study area.

The time of year precluded hearing or seeing many amphibians, however, the common eastern froglet (*Crinia signifera*) and striped marsh frog (*Limnodynastes peronii*) were heard calling in ponds and dams across the study area. Other species previously recorded in the locality by GHD include whistling tree frog (*Litoria verreauxii),* spotted marsh frog (*Limnodynastes tasmaniensis*), dusky toadlet (*Uperoleia fusca*), smooth toadlet (*Uperoleia laevigata*), and beeping toadlet (*Crinia parainsignifera*), and these species are all considered likely to utilise the study area.

3.2.2 Fauna Habitat

Habitat assessments were conducted across the entire study area to assess the potential presence of native fauna (and especially threatened species) not directly observed during the surveys, as well as determine the conservation significance of fauna habitats.

Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species previously recorded in the study area. Important habitat resources are mapped on Figure 4.

Forest and Woodland

Woodland and forest at the site was relatively intact and contained healthy, mature trees. There was good structural diversity with a mix of mature eucalypts and stags and evident recruitment of juveniles and seedlings. These areas supported a diversity of native birds and arboreal mammals.

Acacia was abundant within the gully at the eastern end of Lot 12. This stratum would be important for forest bird species, and the sugar glider, providing shelter, nectar and sap.

Only a few hollow bearing trees and old-aged emergents were recorded within the study area. Habitat trees are plotted on Figure 4 and discussed in greater detail below.

Stringybark species present within the study area are nectar-bearing and would provide a food resource for native fauna, including nectar feeding birds and arboreal mammals. These stringybark species are autumn and winter-flowering and may provide seasonal nectar resources for the swift parrot and regent honeyeater. Local populations of gang-gang cockatoo feed on stringybark flowers and fruits during their annual winter-feeding migrations. This species has been recorded within adjacent forest areas during previous surveys (GHD Surveys 18/19 September 2008; URS, 2008).

The site is likely to provide foraging habitat for large forest owls and their prey species (e.g. arboreal and terrestrial mammals). Some of the hollow-bearing trees within the study area were large enough to support breeding owls, such as the powerful owl (*Ninox strenua*), which had been previously recorded along Wollumbi Rd to the south of the study area (GHD, 2009) .Notably, there are large tree hollows in the vicinity of the proposed pipeline crossing of the drainage line in Lot 12 which may provide potential nest sites for forest owls (refer Figure 4).

Grassy understorey associated within woodland habitat would provide suitable foraging habitat for native herbivorous mammals. This would also provide shelter and foraging habitat for small terrestrial animals including native invertebrates, reptiles and mammals.

Other Habitat Resources

The DEC (2004) survey guidelines identify “special habitats” (e.g. water bodies, rocky outcrops and cliffs) that are likely to support specific fauna assemblages. These resources may be significant for threatened species. Tree hollows are important for native fauna as diurnal or nocturnal shelter sites, for rearing

young, for feeding, for thermoregulation, and to facilitate ranging behaviour and dispersal. An estimated 15% of all terrestrial vertebrate fauna in Australia are dependent upon tree hollows and for many of these species the relationship is obligate i.e. no other habitat resource represents an adequate substitute (Gibbons and Lindenmayer, 2002). Accordingly, the field survey included a targeted survey of specific habitat resources in addition to the assessment of the communities described above.

Forest and woodland along the north eastern route option is mature but contained relatively few hollow-bearing trees (see Figure 4). The larger patch of woodland surrounding the Facilities site contains a higher concentration of hollow-bearing trees (URS, 2008) than areas south of Canyonleigh Rd. Due to the paucity of hollow-bearing trees within the study area, trees that do contain hollows are likely to be an important resource for native fauna within this part of the proposed pipeline route, particularly south of Canyonleigh Road. Arboreal fauna identified during spotlighting surveys were identified in trees with hollows or in adjacent trees.

Hollow-bearing trees may provide suitable diurnal roost sites for tree-roosting microbats including the threatened eastern freetail bat (*Mormopterus norfolkensis*), little bent-wing bat (*Miniopterus australis*), eastern bent-wing bat (*Miniopterus schreibersii oceanensis*), greater broad-nosed bat (*Scoteanax rueppellii*) and eastern falsistrelle (*Falsistrellus tasmaniensis*) which have previously been recorded within the study area (URS, 2008). They are also likely to support native parrots including the sulphur-crested cockatoo (*Cacatua galerita),* yellow-tailed black-cockatoo (*Calyptorhynchus funereus*) and threatened parrot species such as the gang-gang cockatoo observed during previous field surveys. Larger hollows may provide nest sites for threatened forest owls such as the powerful owl (*Ninox strenua*) and masked owl (*Tyto novaehollandiae*).

No *Allocasuarina* occurred along the north eastern route option. *Allocasuarina* is an important food resource for the threatened glossy black cockatoo (*Calyptorhynchus lathami)* and there is important habitat for the species to the south west along the southern portions of the gas pipeline route options (refer GHD, 2009a, 2009b). The lack of this resource along the north eastern route option means that this portion of the study area is less likely to be important habitat for this species.

The study area contains reasonable amounts of standing and fallen dead timber, which will provide important shelter and foraging resources for native invertebrates, reptiles and small terrestrial mammals.

There are numerous large, significant rock outcrops throughout the proposed north eastern route alternative. Outcrops contain cracks and fissures, and large boulders and fragments. These areas are likely to provide habitat for reptiles and possibly small mammals. No caves or overhangs were present within the study area and thus the site is unlikely to provide diurnal roost sites for cave-dependent microbats.

Exotic Species

The predatory red fox (*Vulpes vulpes*) was sighted within the study area. It is expected that the cat (*Felis catus*), the feral dog (*Canis lupus*) and wild pig (*Sus scrofa*) would also occupy the study area. The presence of these predators and competitors reduces the likelihood of some native animals occurring at the site.

Patch Sizes and Connectivity

Vegetation within the study area occurs as scattered patches in a mosaic with native pasture, and with larger connected patches occurring along the gully on the eastern half of Lot 12 and into the Arthursleigh property. This larger patch has excellent connectivity with native vegetation to the north. It supports

healthy local populations of a range of native birds, mammals and reptiles and may support patch-size dependant species such as the threatened speckled warbler. This connectivity will also facilitate the movement of native birds, some reptiles, arboreal mammals and potentially small terrestrial mammals. Smaller patches isolated by surrounding pasture and farm structures will support open country bird species and a more limited suite of native reptiles and mammals. Land to the north and east features a matrix of patchy open woodland and grassland. These areas have similar habitat value to the study area and will combine to form a large area of habitat suitable for open country and woodland species. Connectivity is good to the south for approximately two kilometres but then is limited by the Hume Highway. Other connectivity exists within the landscape via “stepping stone” habitat. Patches of isolated habitat that act as links between larger patches that can be traversed by mobile fauna such as larger birds and macropods

The Wollondilly River is within 300 metres of the northern portion of the study area. The riparian corridor features stretches of intact riparian forest alternating with willow (*Salix* spp.) infestations and cleared agricultural land. The riparian zone provides a near-continuous habitat corridor for aquatic species, waterfowl and semi-aquatic, frogs, reptiles and mammals.

3.2.3 Threatened Fauna Species

No threatened fauna were identified during the two-day survey. The desktop review indicates the potential presence of 33 threatened fauna species listed under the TSC Act as Wildlife Atlas records in the locality (10 km radius), and/or the EPBC Act and predicted to occur in the local area. The full list of threatened fauna, including their conservation status, habitat requirements, previous records and likelihood of occurrence is presented in Table 9 of Appendix C. A review of the specific habitat requirements of these species, and the habitat present within the study area allowed a number of these species to be eliminated as having low likelihood of occurrence within the study area.

A number of threatened species were recorded during previous surveys by GHD and URS. Three threatened bird species (gang-gang cockatoo, diamond firetail and hooded robin) and two threatened microbats (eastern false pipistrelle and eastern bent-wing bat) were recorded near the proposed gas turbine Facilities’ site during 2007 (URS, 2008). An additional four threatened fauna species (powerful owl, greater broad-nosed bat, eastern bent-wing bat and little bent-wing bat) were recorded less than two km to the northwest in 2005 (GHD, 2009; PB, 2005). Woodland and forest in the study area provides suitable habitat for these species. GHD also recorded the glossy-black cockatoo, powerful owl and speckled warbler (GHD, 2009).

Thus, based on the presence of suitable foraging and roosting habitat and recent records in the local area, a total of eleven threatened species were considered to have a high likelihood of occurrence at the site

- gang-gang cockatoo *(Callocephalon fimbriatum);*
- speckled warbler (*Pyrrholaemus saggitatus);*
- diamond firetail *(Stagonopleura guttata*);
- powerful owl (*Ninox strenua*);
- hooded robin *(Melanodryas cucullate*);
- eastern false pipistrelle *(Falsistrellus tasmaniensis*);

- eastern freetail bat (*Mormopterus norfolkensis*);
- little bentwing-bat *(Miniopterus australis);* and
- greater broadnosed bat *(Scoteanax ruepellii).*
- eastern bentwing-bat *(Miniopterus schreibersii oceanensis*); and
- large-footed myotis *(Myotis macropus).*

Another three threatened species are considered to have the potential to occur:

- black-chinned honeyeater (*Melithreptus gularis gularis*);
- turquoise parrot (*Neophema pulchella*);
- striped legless lizard (*Delma impar*).

A further seven threatened species may utilise habitats within the study area on an occasional or opportunistic basis:

- large-eared pied bat *(Chalinolobus dwyeri);*
- brown treecreeper *(Climacteris picumnus);*
- swift parrot *(Lathamus discolour);*
- regent honeyeater *(Xanthomyza phrygia);*
- barking owl *(Ninox connivens);*
- masked owl *(Tyto noaehollandiae*); and
- spotted-tailed quoll *(Dasyurus maculatus).*

3.3 Aquatic and Riparian Habitat

Aquatic and riparian habitat of the study area includes ephemeral drainage lines and a number of wetlands and farm dams that fall within the Wollondilly River sub-catchment of the Hawkesbury catchment. The proposed North Eastern gas pipeline route is unlikely to disrupt or impact any perennial water bodies but is proposed to cross an ephemeral drainage line at two points. The closest proximity to perennial waterways occur at the divergence point from the Eastern and Western Route Options, where it passes approximately 300m of the Wollondilly River and at the south-eastern limit of the route, where it passes to within approximately one kilometre of Uringalla Creek. All of the abovementioned ephemeral drainage lines are channel confined streams which would form a chain of shallow ponds after heavy or prolonged rainfall. All of the drainage lines are unnamed first or second order tributaries of the Wollondilly River, Paddys River or Uringalla Creek.

The North Eastern Route crosses one drainage line at two points. This feature is an intermittent, channel confined, chain of ponds that flows east towards Uringalla Creek. It passes through a patch of Candlebark Gully forest at the proposed pipeline intersection and has intact riparian vegetation in good condition along this portion of its length. Riparian vegetation is continuous with a patch of intact native vegetation that extends for many hundreds of metres to the north, south and west. There was no surface water at the proposed pipeline crossing point at the time of the field survey. There is an artificial dam across the drainage line approximately 50 metres upstream of this point, and ponded surface water upstream of this point. This artificial obstruction means that the construction footprint would only contain surface water after extremely heavy or prolonged rainfall.

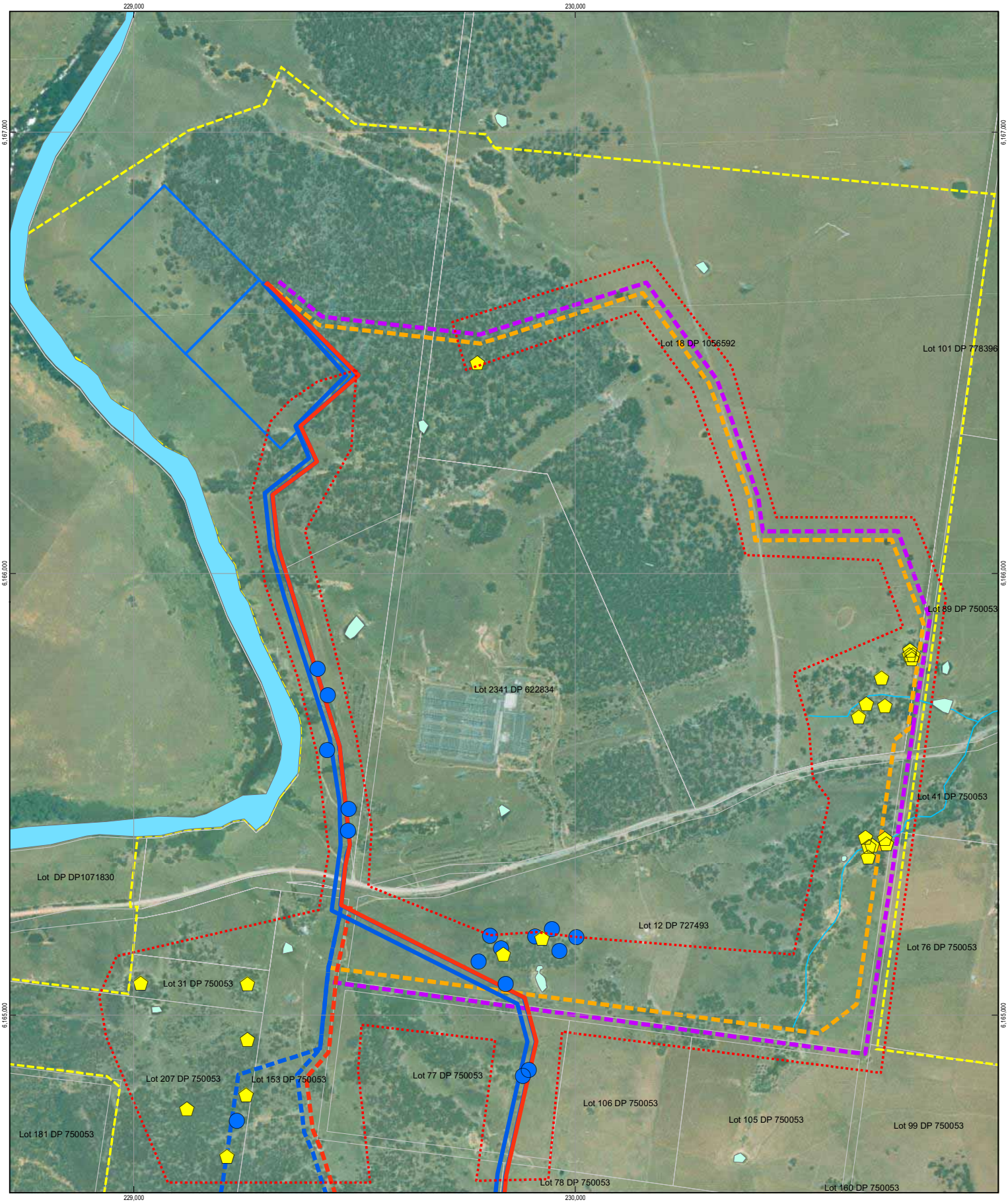
The drainage line contained occasional ponds of surface water downstream, as is typical of this type of drainage line, despite the dam upstream. This would suggest that local surface water flows are important and probably also some contribution from groundwater flows, which would be nearer the surface in the vicinity of the drainage depression. These ponds are likely to be larger during periods of prolonged or very heavy rainfall. The channel contains small areas of aquatic and semi aquatic vegetation in the immediate vicinity of these small pools, including a large cumbungi (*Phragmites australis*) reed bed immediately downstream to the east of the proposed pipeline crossing. The downstream channel features slight gully erosion and weed infestation but was overall was in near-natural condition. The areas upstream are in moderate condition, with moderate to severe gully erosion, moderate environmental weed infestation and no discernible sources of pollution in the catchment.

Based on the characteristics described above the drainage line to be crossed by the North Eastern Route would have moderate riparian or aquatic habitat value. It contains surface water, which in places supports reed beds and other wetland habitat resources. However these are probably too limited in extent to support threatened wetland species such as Australian painted snipe (*Rostratula australis*) and Australasian bittern (*Botaurus poiciloptilus*). These species are mainly associated with extensive natural wetlands. Riparian habitat directly intersecting the north eastern route is remote from perennial streams. It may support an aquatic community after heavy or prolonged rain but would only contain species that are amphibious at some point in their life cycle (i.e. species which are able to traverse dry land to reach aquatic habitat). These species would include native macroinvertebrates, frogs, reptiles and crustaceans but probably not fish or molluscs unless stocked by humans. There is no habitat for any other species of threatened aquatic fauna potentially occurring in the region. The proposed pipeline crossing point was dry at the time of the field survey and rarely (if ever) hold water due to the dam upstream. This reach would have very limited aquatic habitat value.

The Wollondilly River flows through the study area to within 300 m of the far western portion of the proposed gas pipeline route, north of Canyonleigh Road. The Wollondilly River is permanent and would support a diverse aquatic ecological community and a diverse range of wetland birds, frogs and reptiles. It features relatively intact riparian vegetation of River Oak with only slight to moderate degradation by erosion, grazing and weed infestation. The geomorphology is in very good condition. The river contains intact channel and bedrock confined reaches, pools, riffles, large woody debris, gravel beds and other structural features. The Wollondilly River will not be directly impacted by the proposed gas pipeline.

The dams across the study area contain near-permanent water in areas of cleared grassland/farmland. These would provide important refuges and breeding habitat for native frogs as well as native fish, crustaceans and aquatic invertebrates (although fish and macroinvertebrates were not sampled during the GHD surveys). A number of these dams provided nocturnal refuge and foraging habitat for waterfowl including the pacific black duck as observed during field surveys. They have limited cover of aquatic and semi-aquatic vegetation and are surrounded by cleared grassland. Accordingly they are unlikely to support shelter-dependant wetland birds such as Australian Painted Snipe and Australasian Bittern. Wetlands within the study area are also unlikely to support the open water species blue-billed duck (*Oxyura australis*) and freckled duck (*Stictonetta naevosa*) as they prefer large, permanent wetlands with dense fringing vegetation. Dams may provide foraging habitat for microbats potentially including large-footed myotis (*Myotis macropus*).

No dams will be directly impacted by the proposed gas pipeline.



Legend

Pipelines

- 1 Eastern Route
- 2 Eastern Route using Lot 153 Alternative
- 3 Western Route
- 4 Western Route using Lot 153 Alternative
- North-eastern Route Alternative A (using Lot 12 DP727493, Crown Public Road & Lot 3 DP1120270)
- North-eastern Route Alternative B (using Lot 14 DP113590, Crown Public Road & Lot 3 DP1120270)
- Habitat Tree
- Rock Outcrop
- Limit of Habitat Assessment
- Plant Footprint
- Land Ownership
- Drainage lines
- Dams

1:8,000 (at A3)

0 40 80 160 240 320

Metres

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

N

EnergyAustralia

Delta electricity

GHD

CLIENTS | PEOPLE | PERFORMANCE

Delta Electricity and EnergyAustralia
Marulan Gas Turbines Facilities

Habitat Features

Job Number	21-17633
Revision	C
Date	21 APR 2009

Figure 4

G:\21\17633\CADD\GIS\MapDocuments\Z039_ACHabitat_Features.mxd

Data Source: NSW Department of Lands: Cadastral - 17/03/2009. Created by: qjchung

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

4. Impact Evaluation

4.1 Flora

4.1.1 Vegetation clearance and construction impacts

The proposed north eastern route alternative would result in the initial removal / modification of approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of woodland habitat as well as approximately 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of cleared pasture. The majority of the route would be rehabilitated resulting in the final permanent modification of approximately 0.35 hectares (Alternative A) to 0.32 hectares (Alternative B) of native vegetation. Note that the extent of vegetation clearing is calculated only up to the edge of the facility site assessed in the URS (2008) report. Vegetation clearing beyond this point coincides with the proposed access road corridor and was included in the vegetation clearing calculations for the Facilities' site construction footprint (URS, 2008).

Table 6 Vegetation clearance required for north eastern route

Route Option	Vegetation type	Approximate area of initial clearance of 20 metres (hectares)	Rehabilitated modified 6 metre corridor (hectares)
Alternative A	Native Pasture	2.17	N/A – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.
	Cabbage Gum / Stringybark Forest	1.64	0.3
	Box-Gum Woodland EEC	0.09	0.025
	Candlebark Gully Forest	0.08	0.024
	Frost Hollow Grassy Woodland	0.09	
	Exotic Grassland	2.64	N/A – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.
	TOTAL		
	Woodland / Forest	**1.90**	**0.35**
	Grassland (native and exotic)	**4.81**	NA – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.
Alternative B	Native Pasture	2.59	N/A – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.
	Cabbage Gum /	1.71	0.3

Route Option	Vegetation type	Approximate area of initial clearance of 20 metres (hectares)	Rehabilitated modified 6 metre corridor (hectares)
	Stringybark Forest		
	Candlebark Gully Forest	0.02	0.02
	Exotic Grassland	2.73	N/A – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.
	TOTAL		
	Woodland / Forest	**1.73**	**0.32**
	Grassland (native and exotic)	**5.32**	N/A – no permanent modification since rehabilitated corridor is equivalent to pre-disturbance state.

Note: There is some flexibility with pipeline route design over short distances in areas containing native vegetation. The final pipeline route may be adjusted to avoid Box-gum Woodland, mature trees and other important habitat features in some instances. Low impact construction techniques would be used in sensitive areas where engineering and safety constraints allow, reducing the pipeline construction footprint to a width of 10 metres. Therefore the final extent of vegetation clearing as a result of pipeline construction is likely to be less than that estimated in Table 6 above. Further, it may be possible to avoid impacts on Box-gum Woodland entirely by positioning the final pipeline route in adjacent areas of non-EEC vegetation. Since the final position and extent of the construction footprint was not available at the time of this assessment the precautionary principal was applied, resulting in the conservative estimates of vegetation clearing included in Table 6.

4.1.2 Fragmentation of vegetation

Initial clearing may impact on connectivity and further isolate vegetation within an already fragmented landscape. Linear clearings are known to favour pest species such as foxes, increase weed invasion and edge effects, and may impact on intact patch dependent species such as the speckled warbler. However, allowing native vegetation to re-colonise in these areas to a six-metre shrub and grass corridor would reduce these impacts once construction and rehabilitation is complete. Sensitive construction techniques can to some extent avoid important habitat features, which would minimise impacts as a result of fragmentation. Clearing could also be conducted in a way that avoids the proposed pipeline route remaining cleared for long periods of time (see Section 5) with remediation beginning as soon as is feasible after construction. Table 6 above summarises the initial areas of clearance for each vegetation type and the resultant six metre modified corridor. It indicates that although an initial 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation would be impacted, only 0.35 hectares (Alternative A) to 0.32 hectares (Alternative B) of bushland would remain permanently modified as a result of the proposal.

4.2 Fauna

A considerable abundance and diversity of native bird species occupy the study area and would be impacted by the removal of native vegetation and other habitat resources. The majority of these species are mobile, widespread and common. Further, there are large quantities of equivalent habitat and

resources in the locality and so it is likely that the impact on local populations of native birds would be minor.

Arboreal mammals occur in areas of Eastern Tablelands Dry Forest and may be impacted by the proposal, in particular, by the potential loss of hollow-bearing trees. Similarly, hollow-dependent microchiropteran bats are likely to occur within the study area, and the loss of trees with hollows, spouts and decorticating bark may impact these species should they be present. However, large stands of native vegetation will be retained within the study area and not impacted by the proposal.

The pipeline may directly impact active wombat burrows which would need to be identified and any resident wombats carefully relocated. The following mitigation measures outlined in Section 5 would be likely to ameliorate impacts on these species:

- Identification of active wombat burrows prior to construction; and
- The careful relocation of any wombats that may be directly impacted by the proposal.

A moderate diversity and abundance of native frogs and reptiles are likely to occupy the study area. Species recorded during field surveys were widespread and common (Cogger, 1996). It is likely that individuals would be killed or displaced during clearing, particularly species which burrow or shelter beneath woody debris. Mitigation measures outlined in Section 5 would be likely to ameliorate these impacts. These include: a pre-clearance survey and relocation of individuals where practicable, and careful removal of large woody debris and placement within adjoining areas. The loss of habitat resulting from the proposal would be likely to have a minor impact on local populations of these species given the large areas of native vegetation and other resources in the locality.

There would be moderate, ongoing impacts on fauna utilising adjacent areas of habitat during construction associated with noise, dust and other disturbances. Impacts are likely to be minor as construction would only occur during daylight hours and would be temporary. There are already disruptive human activities in the vicinity of the study area associated with agriculture. Larger, more mobile fauna currently occupying the study area are therefore likely to be adapted to these disturbances. There would be impacts upon smaller, less mobile fauna in the immediate vicinity of the proposed works.

4.3 Species and Communities of Conservation Concern

4.3.1 Threatened Flora

A number of threatened flora species have the potential to occur within the study area. Targeted surveying did not detect any of these species, however some, such as buttercup doubletail, are cryptic and can only be identified during known flowering times. Further surveys in the appropriate season would be required to determine if these species are present within the study area, and the likelihood of being impacted by the proposal.

4.3.2 Endangered Ecological Communities

One endangered ecological community (EEC) occurs in the study area: *White Gum, Yellow Box, Blakely's Red Woodland endangered ecological communities* (TSC Act).

The Project will impact a small portion of edge vegetation associated with this community. Approximately 0.082 ha of vegetation will be removed from the western edge of this community within Lot 12, which would be rehabilitated to a 6 metre corridor resulting in approximately 0.0246 ha of modified habitat. An

assessment of impacts associated with the proposed development on this EEC has been undertaken via an Assessment of Significance (see Appendix D). This assessment concluded that if mitigation measures are followed, ensuring that canopy trees associated with this community are avoided where possible, and that appropriate re-establishment of native grassland is conducted, then, in light of larger stands occurring in the locality, the proposed north eastern route would be unlikely to result in a significant impact on this community in the locality.

4.3.3 Threatened Fauna

No threatened fauna were identified during the site survey, however, the study area provides habitat for a number of threatened fauna species.

Forest Dependent Bird Species

The proposed development may impact on habitat for the following threatened forest dependent birds:

- Speckled warbler;
- Hooded robin;
- Brown treecreeper; and
- Black-chinned honeyeater.

An assessment of impacts on these threatened forest dependent birds was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for threatened birds within the study area based on the following:

- These species are mobile;
- Construction would avoid disturbing canopy trees where possible;
- Fragmentation would be temporary and would not be of a distance impassable to these species;
- Woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- Impact areas would be remediated post-construction; and
- The area of impact is small relative to the substantial alterative surrounding habitat that exists within the locality.

Large Forest Owls

The proposed development may impact on habitat for large forest owls including:

- Powerful owl;
- Masked owl; and
- Barking owl.

An assessment of impacts on these large forest owls was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for threatened birds within the study area based on the following:

- These species are highly mobile with large home ranges;
- Construction would avoid disturbing hollow-bearing trees where possible;

- Where practical, any identified breeding trees would be avoided;
- Woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- Impact areas would be remediated post-construction; and
- The area of impact is small relative to the substantial alterative surrounding habitat that exists within the locality.

Gang-gang Cockatoo

The proposed development would impact on habitat for the gang-gang cockatoo. An assessment of impacts on the gang-gang cockatoo was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for the gang-gang cockatoo within the study area based on the following:

- This species are mobile;
- This species is unlikely to utilise the site during its breeding period;
- Construction would aim to avoid disturbing hollow-bearing trees and other canopy trees where possible;
- Woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- Impact areas would be remediated post-construction; and
- The area of impact is small relative to the substantial alterative surrounding habitat that exists within the locality.

Migratory or Nomadic birds

The proposed development would impact on habitat for the migratory or nomadic swift parrot and regent honeyeater. An assessment of impacts on the swift parrot and regent honeyeater was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for the swift parrot and regent honeyeater within the study area based on the following:

- These species are highly mobile;
- These species are only likely to use the study area on a transitory basis;
- These species have known breeding sites which do not include any sites near Marulan, and the habitat at the study area is unlikely to be important habitat for either of these species;
- Woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- Impact areas would be remediated post-construction; and
- The area of impact is small relative to the substantial alterative surrounding habitat that exists within the locality.

Granivorous Birds

The proposed development would impact on habitat for the granivorous birds the diamond firetail and turquoise parrot. An assessment of impacts on the diamond firetail and turquoise parrot was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for the diamond firetail and turquoise parrot within the study area based on the following:

- These species are mobile;
- These species are only likely to use the study area on a transitory basis;
- Woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- Impact areas would be remediated post-construction; and
- The area of impact is small relative to the substantial alterative surrounding habitat that exists within the locality.

Hollow-dependent Microchiropteran Bat Species

The proposed development would impact on habitat for the hollow-dependent microchiropteran bat species:

- Eastern false pipistrelle;
- Eastern freetail bat; and
- Greater broadnosed bat.

An assessment of impacts on these bats was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for these bats within the study area based on the following:

- These species are mobile;
- Where practical, any identified roost trees would be avoided;
- Construction would aim to avoid disturbing hollow-bearing trees and other canopy trees where possible;
- Nest boxes may be installed to replace the loss of any hollow-bearing trees from the proposed north eastern route alternative;
- Woody debris would be retained and reused promoting regeneration of local native species;
- Impact areas would be remediated post-construction; and
- The area of impact is small relative to the substantial alterative surrounding habitat that exists within the locality.

Spotted-tail Quoll

The proposed development would impact on habitat for arboreal mammals including potentially the spotted-tail quoll.

An assessment of impacts on the spotted-tail quoll was conducted (Appendix D). This assessment determined that the proposed development would be unlikely to significantly adversely affect potential habitat for this species within the study area based on the following:

- These species are highly mobile with large home ranges;
- Fragmentation would be temporary and would not be of a distance impassable to this species;
- Construction would aim to avoid disturbing hollow-bearing trees and other canopy trees where possible;
- Woody debris including chipped trees and shrubs removed during construction would be retained and reused promoting regeneration of local native species;
- Impact areas would be remediated post-construction; and
- The area of impact is small relative to the substantial alterative surrounding habitat that exists within the locality.

Striped Legless Lizard

The proposed development would be unlikely to significantly adversely affect potential habitat for Striped Legless Lizard within the study area based on the following:

- This species was not identified despite targeted searches;
- This species has not been previously recorded within the locality;
- Mitigation measures include pre-clearance surveys when any reptiles identified within areas of impact would be relocated; and
- Habitat features for this species would be retained and re-instated adjacent to the development site.

4.3.4 Matters of NES

Two Matters of National Environmental Significance (MNES) are considered relevant to this proposal: spotted-tail quoll and striped legless lizard. Both the spotted-tail quoll and striped legless lizard are listed federally. These species were assessed using relevant Significant Impact Criteria (Appendix E). These assessments concluded that neither of these species would be significantly impacted by the proposal for the same reason outlined for these two species in Section 4.3.3 above.

4.4 Aquatic and Riparian Habitat

The proposed gas pipeline construction would not directly affect the Wollondilly River, Uringalla Creek, any dams or any other permanent surface water features.

The proposed gas pipeline construction would involve direct impacts to an ephemeral drainage lines at two proposed crossing points. Trenching at drainage line crossings would directly disturb the bank and channel and any associated vegetation and habitat resources. This would result in direct impacts to a 20 metre wide corridor at the drainage line crossing. Pipeline construction would involve the removal of intact riparian vegetation, including mature Candlebark and *Acacia* spp. trees. The construction footprint at these crossings would be remediated and replanted with native understorey species. A six metre wide strip would be permanently modified through the removal of overstorey vegetation (if present).

Construction would only occur when these features are dry, and would be unlikely to result in direct impacts on in stream or down stream aquatic or wetland fauna.

Habitat values associated with the channel and understorey vegetation are likely to return to their pre-disturbance state in the short to medium term. Habitat values associated with mature trees would be permanently lost within the 6 metre modified gas pipeline corridor. Loss of these mature trees may reduce bank stability and further degrade riparian habitat through erosion and sedimentation. Appropriate erosion prevention/mitigation measures would be implemented in these locations to ameliorate these effects. Portions of the drainage line feature serious gully erosion at present. Post-construction remediation and bank stabilisation may lessen the severity of erosion in some locations.

There is the potential for secondary impacts associated with the disturbance of soils. This disturbance to surface stability could lead to erosion, sediment transportation, siltation and contamination of offsite waters, especially during high rainfall events. During trenching for the construction of the pipeline, any rainfall that does not readily absorb into the ground surface would drain across the surface of the ground as runoff, potentially eroding and transporting sediment loads from the construction areas into adjoining drainage lines and contaminating the creeks and waterways of the catchment area. It is also possible that sediment from trenching could contaminate groundwater if there is groundwater present and the trenches intersect the water table. Mitigation measures described below are likely to eliminate the risk of these secondary impacts on soils and surface water quality.

4.5 Indirect and Operational Impacts

Sediments and Runoff

The Construction Environmental Management Plan (CEMP) would include safeguards and mitigation measures to minimise potential impacts from additional runoff and associated erosion and transfer of sediments. Assessment of impacts based on soils assessment and residual impacts after mitigation measures would be finalised in the detailed design stage.

Groundwater and Hydrology

Detailed design of the proposed gas pipeline and the CEMP would include safeguards and mitigation measures to minimise the impacts on surface and groundwater flow regimes.

The study area contains a number of sensitive receptors which could be impacted by changes to surface and groundwater flows, including:

- the Wollondilly River, down slope and approximately 300 metres from the pipeline route;
- two ephemeral drainage lines traversed by the pipeline route at three separate locations;
- ephemeral wetlands in grassland adjacent to the pipeline route; and
- a number of farm dams across and down slope from the pipeline route.

Assessment of impacts based on hydrological assessment and residual impacts after mitigation measures would be finalised in the detailed design stage.

4.6 Long-term Impacts

The construction phase of the proposed activity would take approximately 3 to 4 months. After construction, remediation of the pipeline route would be undertaken as described in Section 5.2.

Long-term impacts on native fauna would include the loss of ecological functions and habitat resources that take a long time to develop. These include:

- some mature hollow-bearing trees;
- feed trees, since trees must reach full sexual maturity to produce large volumes of blossom and fruit;
- structurally diverse vegetation, with a number of ecological niches, age classes and mature emergents; and
- a healthy soil seed bank, with sufficient number and diversity of propagules to allow the native vegetation to regenerate following disturbances such as bushfire.

Provided the mitigation measures outlined in Section 5 are adopted, the Project would be unlikely to result in permanent or irreversible impacts on native biodiversity. These would specifically include:

- avoidance of hollow-bearing trees and other habitat features where possible;
- where this is not possible, replacement of hollows with appropriately sized, designed and installed nest boxes in the region of the proposed north eastern route, as only a few hollow bearing trees were identified within the study area, and these are likely to be an important resource for hollow-dependent fauna;
- remediation of impacted areas;
- retention of alternative habitat immediately adjacent to the impact site; and
- an offset package which includes the retention of substantial areas of intact native vegetation.

4.7 Threatening Processes

A 'Key Threatening Process' (KTP) is defined under the TSC Act as 'a threatening process specified in Schedule 3' of the Act. A 'threatening process' is defined as 'a process that threatens, or may have the capability to threaten the survival or evolutionary development of species, populations or ecological communities'.

The following key threatening process is currently operating within the study area:

- predation by the European Red Fox.

The following processes would have operated previously, given the modified vegetation communities present within the study area:

- clearing of native vegetation;
- invasion of native plant communities by exotic perennial grasses;
- loss of hollow-bearing trees; and
- removal of dead wood and dead trees.

The proposal would directly contribute to the operation of two KTPs:

- clearing of native vegetation; and
- removal of dead wood and dead trees.

The extent of vegetation clearing required is presented in Table 6.

The proposal would remove approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Rehabilitation works associated with the Project would aim to re-instate much of this vegetation resulting in a six-metre corridor of native shrubs and ground layer species directly above the proposed pipeline. Where possible dead wood would be placed into adjacent areas prior to construction and then re-instated into the development footprint, and where practicable, dead standing trees would be avoided. These measures are detailed in Section 5.

The following KTPs may also be of relevance to the proposed activity:

- invasion and establishment of exotic vines and scramblers;
- invasion of native plant communities by exotic perennial grasses; and
- infection of native plants by *Phytophthora cinnamomi.*

Provided the soil and weed management measures outlined in Section 5 are followed, the proposed activity would not result in the operation of, or increase the impact of, any of these KTPs. The likelihood of these KTPs operating would be further minimised by the limited duration of the proposed works.

5. Mitigation

5.1 Avoidance of Impacts

5.1.1 Project Location

Where possible, direct impacts on remnant forest and woodland have been avoided by strategic placement of the pipeline route (see Figure 3). Approximately two-thirds of the proposed route falls within already cleared grazing land (see Table 6). Although an initial 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation would be impacted, less than one hectare (0.35-0.32) would remain permanently modified as a result of the proposal (see Table 6).

There is also some flexibility with route design over short distances in areas containing native vegetation. The pipeline can be adjusted to avoid hollow-bearing trees, Box-gum Woodland and other important habitat features in some instances. These features will be identified and marked prior to construction and avoided where it is practicable to reduce impacts on these resources.

5.2 Mitigation of Impacts

5.2.1 Planning

A Construction Environmental Management Plan (CEMP), Operational Environment Management Plan (OEMP) and rehabilitation plan would be developed for the construction and operation of the proposed gas pipeline and would include the mitigation measures outlined in the following sections.

Construction phase impacts would generally be managed by the implementation of standard environmental management measures as defined in the CEMP prepared for the project. Such measures would significantly decrease the likelihood of adverse environmental impacts.

5.2.2 Low Impact Construction Techniques

Low-impact construction techniques would be used through ecologically sensitive sections of the route where engineering and safety constraints allow. This would involve the use of smaller excavators and stockpiling of materials and fill away from the immediate excavation area. Low-impact construction techniques would restrict direct construction impacts to a corridor of 10 metres. This would reduce the overall extent of native vegetation and habitat resources removed.

5.2.3 Construction Techniques

A number of strategies would be incorporated into the construction of the proposed route through ecologically sensitive areas to minimise and mitigate impacts on native biota including:

- minimising vegetation clearance (as specified above);
- avoidance of disturbing key habitat features such as hollow-bearing trees where possible; and
- placing stockpiles and lay down areas in existing clearings.

These are discussed in detail in the following sections.

Geomorphic features associated with drainage lines (ie channels, banks) would be reinstated to their original condition once the trench is backfilled. Banks would be reinforced with geotextile fabric (or equivalent) and replanted with native understorey vegetation immediately after construction to reduce the potential for erosion and habitat degradation.

Construction through or in the vicinity of drainage lines would only occur when these features are dry. This would reduce the potential for impacts on aquatic or wetland fauna and for secondary impacts due to erosion and sedimentation.

5.2.4 Riparian/aquatic habitat management

Geomorphic features associated with drainage lines (i.e. channels, banks) would be reinstated to their original condition once the trench is backfilled. Banks would be reinforced with geotextile fabric (or equivalent) and replanted with native understorey vegetation immediately after construction to reduce the potential for erosion and habitat degradation.

Construction through or in the vicinity of drainage lines would only occur when these features are dry. This would reduce the potential for impacts on aquatic or wetland fauna and for secondary impacts due to erosion and sedimentation.

Measures to mitigate impacts on water and air quality, described below, would further reduce the potential for impacts on riparian and aquatic ecosystems and habitat.

5.2.5 Soil Erosion / Runoff

The CEMP would contain detailed safeguard measures to reduce soil erosion and pollutant run-off during both construction and operation phases of the Project.

The CEMP would include a construction soil and water management plan detailing construction phase stormwater management strategies in accordance with *Landcom Soil and Construction, Managing Urban Stormwater* (Landcom, 4th edition, 2004). These would include amongst others:

- General site practices and responsibilities;
- Material management practices;
- Stockpile practises;
- Topsoil practices; and
- Erosion control practices (earth sediment basins, straw bales, sediment fences, turbidity barriers, stabilised site accesses, diversions and catch drains).

The trenching would be undertaken progressively, in stages, to minimise the time that disturbed land is exposed and ensure that spoil stockpiling is kept to a minimum. The stockpiles would be established in an appropriate manner and sediment fencing would be installed to ensure that no sediment is able to enter receiving waters through rainwater runoff.

In the case where a trench would have to intersect the water table, a groundwater management plan would be prepared. The water table would be intercepted and water extracted from the site in accordance with the groundwater management plan. It is expected that construction areas would be rehabilitated and proposed stormwater controls would provide best practice management of potential erosion scour and sediment transport from the site during wet weather events.

5.2.6 Dust

Appropriate construction and operational mitigation measures would be incorporated into the final detailed design to minimise the generation of dust and associated impacts on adjacent natural environments. These are likely to include:

- setting maximum speed limits for construction and operational traffic on site to limit dust generation; and
- use of a water tanker or similar to spray unpaved roads during construction and operation where required.

5.2.7 Pre-clearance Survey for Fauna

A detailed pre-clearance survey by a qualified ecologist would be undertaken immediately prior to development of the Project. This would involve:

- diurnal searches for birds, nests and roosts;
- active searches for small mammals reptiles and frogs, including checking of woody debris within the construction footprint and relocation into adjacent habitat,
- active searches for micro bats, including checking under exfoliating bark;
- identification of active wombat burrows and the careful re-location of these species prior to construction; and
- nocturnal surveys, including stag-watching of identified habitat trees, specifically focusing on observing use of trees by micro bats.

This survey would focus on locating individuals, and especially roosts of threatened species.

If nests or nestlings are observed within, or close to, the development footprint then construction, then nests and/or nestlings would be carefully relocated into adjacent areas.

5.2.8 Additional seasonal surveys for threatened flora

The following threatened flora have been identified as having the potential to occur within the area of impact:

- buttercup doubletail (flowers October to December);
- hoary sunray (flowers spring to summer); and
- thick-lipped spider orchid (flowers September to November).

Further targeted surveying during these species flowering times is required to determine if they area present within the study area, and ensure they are not significantly impacted by the proposal.

5.2.9 Protection of Endangered Ecological Communities

The proposed north eastern route alternative may impact on edge vegetation associated with the EEC Box-Gum Woodland. The following measures are recommended to mitigate potential impacts on these areas:

- where possible, canopy trees should be avoided by the proposal;

- areas should be fenced to clearly demarcate the vegetation;
- areas should be rehabilitated as detailed in Section 5.2.11 Remediation below; and
- weeds should be managed both within and adjacent to areas of EEC to ensure there is no decline in quality within this communities.

If these measures are undertaken it is not expected that areas of EEC within the study area are likely to be adversely impacted by the proposal.

5.2.10 Timing of Works

Where feasible, construction works would aim to be conducted in areas of forest and woodland to avoid the breeding season of threatened species identified at the site. Details of any timing of works would be outlined in the CEMP for the site.

5.2.11 Tree Fauna Management

A plan for the management of tree dwelling fauna would be required as the proposal involves the removal of a number of mature trees including trees with hollows. Due care during clearing would be implemented to reduce direct impacts to any tree dwelling fauna species which may be utilising the area. The CEMP would detail procedures for a pre-clearance survey and fauna management including the following points:

- trees would be monitored for fauna before and during clearing operations;
- trees with resident fauna would be avoided as far as is practicable;
- hollow-bearing trunks and branches would be carefully sawn and placed intact in adjacent areas of native vegetation; and
- replacement habitat, such as nest boxes, would be provided where habitat trees are to be removed.

Any trees that show evidence of breeding by the large threatened forest owls such as the powerful owl (whitewash on a tree with suitably sized hollows) would be carefully avoided.

5.2.12 Groundcover Clearance Protocol

Groundcover substrate and especially large woody debris provides important habitat for native fauna, including threatened species. A groundcover clearance protocol would be incorporated into the CEMP which would include the following steps:

- remove large woody debris and rock fragments using excavator grabs or manual handling if practicable;
- placing intact large woody debris and rock fragments within adjacent areas of intact vegetation;
- scrape and stockpile leaf litter and topsoil separately from deeper fill material; and
- reuse leaf litter and topsoil in remediation works.

5.2.13 Site Management

The following mitigation measures would be implemented in order to minimise operational impacts of the proposed development:

- limit vehicular and personnel entry into adjacent remnant vegetation during construction through appropriate marking of operational areas;
- regularly monitor the condition of surrounding native vegetation, in accordance with the management plans developed for the proposed pipeline, to ensure that areas of remnant vegetation are not impacted upon during the construction; and
- implementing and enforcing putrescible waste hygiene measures to reduce the likelihood of foxes, dogs and cats being attracted into the area.

5.2.14 Remediation

The proposed North Eastern Route alternative would initially remove 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of intact forest and woodland habitat as well as approximately 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of cleared pasture. The majority of the route would be rehabilitated. Table 6 summarises the extent of initial clearance and the resultant areas of rehabilitation. The following methods would be utilised to rehabilitate impacted areas.

Stockpiling of original topsoil and leaf litter

The original topsoil would be retained and stockpiled to assist in remediation of the proposed north eastern route alternative. Once works are complete this would be placed back over areas of clearance to encourage natural regeneration of native plant species. Soil would be stockpiled for as short a period as practicable to avoid weeds colonising the stockpile and to avoid native seed within the stockpile from composting.

Stockpiling of wood chipped material

Trees and shrubs cleared from the construction area would be chipped and stockpiled on the edge of the construction zone for spreading over disturbed areas as part of the remediation works.

Retention and replacement of woody debris

The proposed north eastern route alternative contains fallen timber that may constitute an important habitat resource for native fauna. Woody debris in the development footprint would be carefully stockpiled within cleared areas, and then respread as part of remediation works.

Regeneration and revegetation of native flora

Remediation works would aim to encourage natural regeneration of native plant species. Natural regeneration is preferable to revegetation with tube stock, as plants that have grown naturally in an area tend to:

- grow faster;
- be healthier and more resilient;
- occur in natural appropriate niches; and
- require minimal follow up such as watering.

Canopy trees, shrubs and ground layer would be allowed to encroach to a width of six metres adjacent to the pipeline. A six-metre clearance directly above the pipeline would be allowed to regenerate with shrubs and ground layer species only. If natural regeneration does not occur within an appropriate timeframe (e.g. one year) then revegetation with tube stock would be undertaken. All plantings would

utilise indigenous native species of local provenance and seed collection would be undertaken as required.

The health of revegetated areas would be monitored closely and supplementary watering supplied as appropriate. Revegetated areas would also be monitored for weed infestation and any infestations actively managed to minimise further weed spread. Methods to enhance regeneration/revegetation would also be considered if deemed necessary.

Fencing

Some areas of native forest that would require clearance are currently grazed by sheep. In order for any regeneration/revegetation to be successful, these areas would need to be temporarily fenced until native plants are large enough to tolerate grazing. Fencing could be minimal, enough to keep stock out of the site.

5.2.15 Weed and Pest Management

A Weed and Pest management plan would be prepared as part of the Construction Environmental Management Plan and Operation Environmental Management Plan for the proposed pipeline.

The following measures would be adopted to manage environmental weeds during construction and operation of the proposed pipeline:

- perform a baseline weed survey to assess the extent and severity of weed infestation in extant native vegetation within the study area pre and post construction;
- incorporate control measures in the design of the Project to limit the spread of weed propagules downstream of the proposed pipeline;
- during construction: maintenance of silt fences and other mitigation measures to isolate runoff, and immediate rehabilitation of disturbed vegetation to limit the potential for colonisation by weeds;
- during construction, areas of vegetation that would not be cleared would be clearly marked, restricting access by construction crew and machinery to remnant vegetation. Additionally, stockpiles of fill would not be placed in areas of remnant vegetation but instead in adjacent cleared areas;
- post-construction landscaping of any open areas with indigenous native vegetation in order to limit the potential for colonisation by weeds;
- during operations monitor and control noxious weed species in line with legislative obligations;
- perform ongoing monitoring of weed infestation on and adjoining the study area, utilising the baseline weed survey of the proposed pipeline route and its surrounds.

5.2.16 Monitoring

In order to ensure remediation works are successful and that impacts on native biota are effectively mitigated, a monitoring program would be implemented. This program would include:

- monitoring of weeds especially noxious weeds;
- monitoring native regeneration success;
- monitoring plant health and planting success rates of any revegetation; and
- implementing remediation works if necessary.

Details of the monitoring program would be provided in the CEMP.

5.3 Offsetting of Impacts

Impacts on native biota arising from the proposed north eastern route alternative would be avoided where possible, and substantially mitigated where avoidance is not possible. Nevertheless the Project would result in residual impacts on native biota including the removal and modification of areas of native vegetation. These residual impacts would need to be offset to ensure that the proposed activity 'improves or maintains' biodiversity values.

A complete offset strategy for the proposed gas pipeline, as well as the Facilities' Site to the north of Canyonleigh Road, is presented in the Preferred Project Report. The areas of native vegetation that would be removed or modified through construction of the proposed north eastern route alternative are presented in Table 6. Based on these calculations, the offsets strategy presented in the Preferred Project Report should also provide biodiversity offsets for impacts upon:

- approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation including approximately 0.082 Ha of Box-Gum Woodland EEC; and
- approximately 2.5 Ha of Native Grassland.

The majority of this native vegetation would be rehabilitated to its original condition in the medium to long term, including all of the Native Grassland.

The remainder of the vegetation affected by the proposed north eastern route is exotic grassland with little biodiversity value alternative and would not require a biodiversity offset.

6. Conclusion

6.1 Key Thresholds

Pursuant to DEC (2005) assessment guidelines, development applications under Part 3A must contain a justification of the preferred option based on the following key thresholds.

Whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.

The north eastern route alternative would initially remove 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation as well as approximately 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of cleared pasture. The majority of the gas pipeline route would be rehabilitated with only 0.35 hectares (Alternative A) to 0.32 hectares (Alternative B) remaining permanently modified as a result of the proposal. Construction would include sensitive construction techniques to avoid adverse impacts to important habitat features such as hollow-bearing trees where practicable. Within the proposed north eastern route alternative, nest boxes would be installed to replace any lost hollow-bearing trees. Furthermore, substantial measures would be taken to retain and re-use:

- existing topsoil and associated seed bank;
- existing leaf litter; and
- woody debris.

These measures would allow for the natural regeneration of disturbed areas with existing native species whilst re-instating habitat features along the route. If natural regeneration is determined to be ineffective then revegetation with species of local native provenance would be undertaken. Weed management measures and fencing would furthermore protect and improve areas of impact.

Although impacts associated with the proposed gas pipeline route would be substantially mitigated, the Proponent acknowledges that the Project would result in the modification of approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of intact native vegetation and a further 2.17 to 2.59 ha of derived native grassland. To compensate for this loss, an offset package has been developed which is discussed in detail in the Preferred Project Report and provides an offset for the entire proposed gas pipeline route as well as the proposed Facilities' site. This proposed offset includes improvements such as weed management (including the control of noxious weeds such as serrated tussock), exclusion of grazing, and rehabilitation of degraded areas as necessary.

Based on the above the Project would maintain as well as improve biodiversity values within the proposed offset area.

Whether or not the proposal is likely to reduce the long-term viability of a local population of any threatened species, population or ecological community.

Although the proposal would modify habitat for a number of threatened species, these impacts are considered to be temporary (until remediation takes place), and alternative habitat would be retained within the immediate area as well as via a nearby offset site. Vegetation within the study area would only be temporarily impacted and a range of mitigation measures would be implemented to reduce impacts on native biota including endangered ecological communities. It has therefore been determined that the

proposal would not reduce the long-term viability of a local population of any threatened species, population or ecological community.

Whether or not the proposal is likely to accelerate the extinction of any species, population or ecological community or place it at risk of extinction.

The proposed development is considered unlikely to accelerate the extinction of threatened species given that:

- Vegetation clearance and loss of important habitat features would be minimised via sensitive construction techniques;
- Site remediation measures would ensure that any impacts are temporary and that connectivity of native vegetation would be restored;
- Substantial alternative habitat would be retained including a high-quality offset (discussed in the Preferred Project Report); and
- The proposed development would be highly unlikely to inhibit the movement of migratory or nomadic fauna along recognised corridors or linkages in the locality or region.

Whether or not the proposal will adversely affect critical habitat.

No listed critical habitat would be removed or adversely affected as a result of this proposal.

6.2 Summary

Where possible items of conservation concern would be avoided, for example, adverse impacts on Box-Gum Woodland EEC and important habitat features such as hollow-bearing trees. Where avoidance is impractical, detailed mitigation measures would be implemented to ameliorate impacts on native biota. However, it is recognised that the proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation, of which a six metre corridor would need to be maintained in this modified state (shrubs and ground layer species only). Although an initial 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation would be impacted, only 0.35 hectares (Alternative A) to 0.32 hectares (Alternative B) would remain permanently modified as a result of the proposal. A further 2.17 to 2.59 ha of derived native grassland would be impacted; however this would be rehabilitated to its original condition. To offset this impact (and impacts associated with the entire gas pipeline route, and the Facilities' site north of Canyonleigh Road) an offset package has been proposed and this is detailed within the Preferred Project report.

The proposed Western gas pipeline route has the potential to impact on a number of species and communities listed under the NSW TSC Act and Federal EPBC Act. Assessment to determine the significance of impacts on these species and communities was conducted, and these assessments concluded that the proposal was unlikely to result in a significant impact on any threatened species, populations or communities.

Based on the above, the Project addresses the "Avoid, Mitigate, Offset" criteria required under Part 3A and effectively meets the "improve or maintain" test.

7. References

Birds Australia Website Species Profiles http://www.birdsaustralia.com.au/birds/

BOM (2009). http://www.bom.gov.au/index.shtml Australian Government Bureau of Meteorology.

Churchill, S. (1998). *Australian Bats*. Reed New Holland, Sydney.

Cogger, H. (1992). *Reptiles and Amphibians of Australia*. Reed/ Reed New Holland.

Cropper S (1993) *Management of Endangered Plants*. CSIRO, Melbourne.

Currans, B., Ryan, T., and Gray, I. (1990). Initial investigations of koala distribution in the Upper Nepean Catchment area. (Water Board, Sydney). In *Environmental Science studies in Ecology* R. Whelan and A. Davis (Eds.) pp. 1-29. Biology Department, University of Wollongong: Wollongong.

NSW Scientific Committee (2002). *White box yellow box Blakelys Cabbage Gum woodland - Endangered ecological community determination - final*. DEC (NSW), Sydney.

DEC (2004). Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. Working Draft, Department of Environment and Climate Change (NSW).

DEC (2005). Guidelines for Threatened Species Assessment). Department of Environment and Climate Change (NSW).

DECC (2005) Department of Environment and Climate Change (NSW) Threatened Species profiles website http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.asp

DEC (2006). Identification Guidelines for Endangered Ecological Communities - White Box Yellow Box Blakely's Cabbage Gum Woodland (Box-Gum Woodland), Department of Environment and Climate Change (NSW).

DECC (2008). NPWS Wildlife Atlas data for Goulburn 1:100,000 Map Sheet. Department of Environment and Climate Change (NSW).

DEH (2006). *EPBC Act Policy Statement 1.1. Significant Impact Guidelines. Matters of National Environmental Significance. May 2006*. Commonwealth Department of the Environment, Water, Heritage & the Arts, Canberra.

DEW Threatened Species Scientific Committee (2006). *Commonwealth Listing Advice on White Box-Yellow Box-Blakely's Cabbage Gum Grassy Woodland and Derived Native Grassland*. Department of the Environment, Water, Heritage and the Arts, Canberra.

DEWHA (2008) ONLINE Protected Matters Search Tool, http://www.environment.gov.au/apps/boobook/mapservlet?app=pmst

Garnett T. S. and Crowley G. M. (2000). *The Action plan for Australian Birds,* Environment Australia, 2000.

GHD (2009) *Marulan Gas Pipeline Route: Ecological Impact Assessment for the Proposed Western Pipeline Route Option*.

Gibbons, P. and Lindenmayer, D.B. (2002). Tree hollows and wildlife conservation in Australia. CSIRO Publishing.

Harden, G. (Ed) (1990-1993). *Flora of New South Wales – Vols 1 – 4.* University of New South Wales Press, Sydney.

Keast A., Recher, H. F., Ford H. and Saunders D., (1985). *Birds of Eucalypt Forest and Woodland: Ecology, Conservation, Management,* Surrey, Beatty and Sons Pty Ltd in assoc with RAOU.

Keith, D (2004). Ocean shores to desert dunes – Native vegetation of NSW and the ACT, DEC, Hurstville NSW.

NSW Scientific Committee (March 2002). Final Determination: White Box Yellow Box Blakely's Cabbage Gum Woodland.

PB (2005). *Big Hill Gas Turbine Baseline Ecological Surveys*

Pizzey, G. (1999). The Graham P*izzey and Frank Knight Field Guide to the Birds of Australia*. Angus and Robertson, Sydney.

Simpson, K., Day, N. (1995). *Field Guide to the Birds of Australia*. Penguin Books.

Specht R.L. (1970). Vegetation. In: *The Australian environment.* (Ed. G.W. Leeper). pp. 44-67. CSIRO and Melbourne University Press, Melbourne.

Strahan, R. (2002). *The Mammals of Australia*. New Holland.

Thackway, R. & I. D. Cresswell. editors. (1995). *An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves*, Version 4.0. Australian Nature Conservation Agency, Canberra.

The Action Plan for Australian Birds 2000 Website
http://www.deh.gov.au/biodiversity/threatened/publications/action/birds2000

Tindall, D., Pennay C., Tozer M., Turner K. and Keith, D., *Native vegetation map report series No. 4*, DNR. Unpublished.

Triggs, B. (2004). *Tracks, scats and other traces. A Field Guide to Australian Mammals*. Oxford Press.

Threatened Species Scientific Committee [TSSC] (2006). *Advice to the Minister - White Box - Yellow Box - Blakely's Cabbage Gum Grassy Woodlands and Derived Native Grasslands.*

URS (2008). *Biodiversity Impact Assessment Gas Turbine Facilities Project, Marulan NSW.*

Ward, S.J. and Close, R. (2004). *Southern Sydney's urban koalas: Community research and education at Campbelltown.* Pp 44-55 in Lunney, D. and Burgin, S. (eds) Urban Wildlife: more than meets the eye. Royal Zoological Society of NSW, Mosman.

Van Dyck & Strahan (2008). *The Mammals of Australia* (3rd edn.) Reed New Holland, Sydney

White, A. (2006). *Frogfacts No 5, Green and Golden Bell Frogs*, Frog and Tadpole Study Group, Sydney, NSW.

Appendix A

Flora Species List

Table 7 Flora species identified within the study area

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	RM Lot 12	RM Yellow Box 1	RM Yellow Box 2	RM Yellow Box 3 - Arthursleigh
ADIANTACEAE	*Cheilanthes sieberi*	Mulga Fern	x	x								
AMARANTHACEAE	*Alternanthera sp**	A Joyweed							x			
ANTHERICACEAE	*Tricoryne elatior*	Yellow Autumn-lily	x	x								x
APIACEAE	*Centella asiatica*								x			
APIACEAE	*Hydrocotyle laxiflora*	Stinking Pennywort			x		x	x		x	x	
APIACEAE	*Hydrocotyle tripartita*								x			
ASTERACEAE	*Carthamus sp**	Saffron Thistle						x				
ASTERACEAE	*Cassinia aculeata*	Dolly Bush						x				
ASTERACEAE	*Cassinia arcuata*	Chinese Shrub						x				
ASTERACEAE	*Chondrilla juncea**	Skeleton Weed	x									
ASTERACEAE	*Chrysocephalum apiculatum*	Yellow Buttons		x	x					x	x	
ASTERACEAE	*Conyza sp**	Fleabane			x	x		x				
ASTERACEAE	*Euchiton sphaericus*	Cud Weed				x	x	x				
ASTERACEAE	*Gamochaeta americanum**	Cud Weed	x	x				x				
ASTERACEAE	*Hypochoeris radicata**	Cat's Ear	x	x	x	x	x	x		x	x	
ASTERACEAE	*Onorpordum sp**	A Thistle						x				

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	RM Lot 12	RM Yellow Box 1	RM Yellow Box 2	RM Yellow Box 3 - Arthursleigh
ASTERACEAE	*Vittadinia cuneata*	Fuzz Weed		x								
CARYOPHYLLACEAE	*Cerastium glomeratum**	Mouse Ear Chickweed							x			
CARYOPHYLLACEAE	*Stellaria media*	Common Chickweed						x				
CHENOPODACEAE	*Einadia nutans ssp nutans*	Climbing Saltbush						x				
CLUSIACEAE	*Hypericum grammineum*	Native St Johns Wort	x	x	x							
CONVOLVULACEAE	*Convolvulus erubescens*	Blushing Bindweed			x							
CONVOLVULACEAE	*Dichondra repens*	Kidney Weed						x				
CYPERACEAE	*Cyperus difformis*			x								
CYPERACEAE	*Cyperus gracilis*							x				
CYPERACEAE	*Fimbristylis dichotoma*	Common Fringe Sedge	x	x								
CYPERACEAE	*Lepidosperma gunni*		x								x	
DENNSTAEDTIACEAE	*Pteridium esculentum*	Bracken		d								
ERIACEAE	*Astroloma humifusum*	Native Cranberry	x	x	x	x				x		
ERIACEAE	*Brachyloma daphnoides*				x				x			
ERIACEAE	*Leucopogon humifusum*		x									

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	RM Lot 12	RM Yellow Box 1	RM Yellow Box 2	RM Yellow Box 3 - Arthursleigh
ERIACEAE	*Melichrysus urceolatus*			x	x					x	x	
FABACEAE	*Bossiaea buxifolia*				x		x					
FABACEAE	*Glycine clandestina*	Love Creeper		x	x							
FABACEAE	*Glycine microphylla*								x			
FABACEAE	*Glycine tabacina*				x						x	
FABACEAE	*Hardenbergia violacea*	Purple Coral Pea							x			
FABACEAE	*Jacksonia scoparia*	Jacksonia							x	x		
FABACEAE	*Trifolium subterraneum**	Subterranean Clover	x									
FABACEAE	*Zornia dyctiocarpa var dyctiocarpa*		x									
GENTIANACEAE	*Centaurium erythraea**	Common Centaury	x	x						x		
GERANIACEAE	*Geranium solanderi*	Native Geranium							x			
GOODENIACEAE	*Goodenia hederacea*	Ivy-leaved Goodenia							x			
HALOGORACEAE	*Gonocarpus teucrioides*	Rasp Wort	x	x	x	x				x	x	
LILIACEAE	*Arthropodium milleflorum*	Vanilla Lily							x			
LILIACEAE	*Bulbine bulbosa*								x		x	
LILIACEAE	*Wahlenbergia gracilis*	Bluebell					x			x	x	
LILIACEAE	*Wahlenbergia stricta*	Bluebell			x							

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	RM Lot 12	RM Yellow Box 1	RM Yellow Box 2	RM Yellow Box 3 - Arthursleigh
LOMANDRACEAE	*Lomandra filiformis*	A Mat-rush		x	x		x	x		x		x
LOMANDRACEAE	*Lomandra multiflora*	Many-flowering Mat-rush							x			
MALACEAE	*Craetagum monogyna**	Hawthorn							x			
MALVACEAE	*Modiola caroliana**	Small-flowering Mallow							x			
MIMOSOIDEAE	*Acacia parramattensis*	Parramatta Green Wattle		x		x				x		
MIMOSOIDEAE	*Acacia terminalis*	Sunshine wattle										
MYRSINACEAE	*Anagallis arvensis**	Scarlet Pimpernel							x			
MYRTACEAE	*Eucalyptus agglomerata*	Blue-leaved Stringybark							x			
MYRTACEAE	*Eucalyptus amplifolia*	Cabbage Gum				d	x	d			x	
MYRTACEAE	*Eucalyptus bridgesiana*	Apple Box			d							
MYRTACEAE	*Eucalyptus eugenoides*	Brown Stringybark				x						
MYRTACEAE	*Eucalyptus melliodora*	Yellow Box					d			d	d	d
MYRTACEAE	*Eucalyptus pauciflora*	Snow Gum		d								
MYRTACEAE	*Eucalyptus rubida ssp rubida*	Candlebark							x			
MYRTACEAE	*Eucalyptus sieberi*	Silvertop Ash				d	x					

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	RM Lot 12	RM Yellow Box 1	RM Yellow Box 2	RM Yellow Box 3 - Arthursleigh
MYRTACEAE	*Kunzea parvifolia*	Violet Kunzea	x			x						
MYRTACEAE	*Leptospermum myrtifolium*	Grey Tea-tree	x									
ORCHIDACEAE	*Eriochilus cucullatus*	Pink Autumn Orchid							x			
ORCHIDACEAE	*Diuris chryseopsis*	Common Golden Moths							Previous recorded			
OXALIACEAE	*Oxalis sp*	Oxalis		x	x			x				
PHORMIACEAE	*Dianella sp*								x			
PHYLLANTHACEAE	*Poranthera microphylla*							x				x
PHYTOLACCEACEAE	*Phytolacca octandra**	Ink Weed						x				
PLANTAGINACEAE	*Plantago lanceolata**	Plantain	x					x			x	
PLANTAGINACEAE	*Plantago sp*								x			x
PLANTAGINACEAE	*Veronica sp*	Speedwell										x
POACEAE	*Aira cupaniana**	Silvery Hairgrass						x				
POACEAE	*Aristida calycina var calycina*	A Wire Grass	x	x	d	d	d	x		x	x	x
POACEAE	*Aristida ramosa var speciosa*	A Wire Grass	x	x	d	d	d	x		x	x	x
POACEAE	*Aristida sp*	A Wire Grass							x			
POACEAE	*Austrodanthonia sp*	A Wallaby Grass				x	d	x			x	
POACEAE	*Austrodanthonia tenuoir*	A Wallaby Grass					x					

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	RM Lot 12	RM Yellow Box 1	RM Yellow Box 2	RM Yellow Box 3 - Arthursleigh
POACEAE	*Bothriochloa macra*	Red-leg Grass							x			
POACEAE	*Briza maxima**	Blow Fly Grass	x									
POACEAE	*Briza minor**	Shivery Grass		x								
POACEAE	*Bromus catharticus**	Prairie Grass						x				
POACEAE	*Cynodon dactylon**	Couch							x			
POACEAE	*Dichelachne micrantha*	Short-haired Plume Grass			x		x					
POACEAE	*Eleusine tristachya**	Crab Grass							x			
POACEAE	*Eragrostis curvula**	African Love Grass						x				
POACEAE	*Eragrostis leptostachya*	Paddock Love Grass	x									
POACEAE	*Imperata cylindrica*	Blady Grass						x				
POACEAE	*Lachnagrostis aemula*	Blown Grass		x	x							
POACEAE	*Microlaena stipoides*	Weeping Meadow Grass		x	d		x	d		x	d	x
POACEAE	*Nassella trichotoma* *	Serrated Tussock	x	x	x	x	x	x		x	x	x
POACEAE	*Panicum sp*	Panic Grass					x					x
POACEAE	*Paspalum dilatatum**	Paspalum							x			
POACEAE	*Phalaris aquatica**	Canary Grass							x			

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	RM Lot 12	RM Yellow Box 1	RM Yellow Box 2	RM Yellow Box 3 - Arthursleigh
POACEAE	*Poa sieberiana*			x	x							
POACEAE	*Setaria gracilis**	Pigeon Grass						x				
POACEAE	*Sporobolus elongatus*	Rat's Tail Grass						x				x
POACEAE	*Themeda australis*	Kangaroo Grass	d	d	x		x			x	d	x
POLYGONACEAE	*Acetosella vulgaris**	Sheep Sorrel		x	x			x				x
POLYGONACEAE	*Persicaria decipiens*	Slender Knot Weed							x			
POLYGONACEAE	*Rumex sp*	A Dock						x				
PROTEACEAE	*Banksia marginata*	Silver Banksia								x		
RANUNCULACEAE	*Clematis aristata*											
ROSACEAE	*Acaena sp probably ovina**			x								
ROSACEAE	*Rosa rubignosa**	Briar Rose						x			x	
ROSACEAE	*Rubus fruticosus aggregate**	Blackberry	x			x	x	d			x	
RUBIACEAE	*Galium sp*								x			
RUBIACEAE	*Richardia stellaris**		x									
SOLANACEAE	*Solanum nigrum**	Blackberry Nightshade						x				
URTICACEAE	*Urtica incisa*	Stinging Nettle							x			
VERBENACEAE	*Verbena bonariensis**	Purpletop							x			

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	RM Lot 12	RM Yellow Box 1	RM Yellow Box 2	RM Yellow Box 3 - Arthursleigh
* = introduced species; d = dominant species												

Appendix B

Fauna Species List

Table 8 Fauna species list

Scientific Name	Common Name	Recorded during previous surveys	Recorded during current survey (9/10 March 2009)
Frogs			
Limnodynastes tasmaniensis	Spotted Grass Frog	Seen	
Crinia parainsignifera	Beeping Toadlet	Heard	
Crinia signifera	Common Eastern Froglet	Heard	Heard
Litoria peroni	Peron's Tree Frog	Heard	
Litoria verreauxii	Whistling Tree Frog	Seen	
Uperoleia fusca	Dusky Toadlet	Seen	
Uperoleia laeviagata	Smooth Toadlet	Heard	
Limnodynastes peroni			Heard
Birds			
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	Seen	Seen
Acanthiza lineata	Striated Thornbill	Seen	Seen
Acanthiza nana	Yellow Thornbill	Seen	
Acanthiza pusilla	Brown Thornbill	Seen	Heard
Acanthiza reguloides	Buff-rumped Thornbill	Seen	Seen
Acanthiza sp.	Unidentified Thornbill	Seen	Seen
Acanthorhynchus tenuirostris	Eastern Spinebill	Heard	
*Acridotheres tristis**	Common Myna	Seen	
Aegotheles cristatus	Australian Owlet-nightjar	Heard	Seen
Anas gracilis	Grey Teal	Seen	
Anas superciliosa	Pacific Black Duck	Seen	Seen
Anthochaera carunculata	Red Wattlebird	Heard	Seen
Anthus australis	Australian Pipit	Seen	
Artamus cyanopterus	Dusky Woodswallow		Seen
Aquila audax	Wedge-tailed Eagle	Seen	
Cacatua galerita	Sulphur-crested Cockatoo	Heard	
Cacatua sanguinea	Little Corella	Heard	
Cacomantis flabelliformis	Fan-tailed Cuckoo	Heard	
Cacomantis variolosus	Brush Cuckoo	Seen	

Scientific Name	Common Name	Recorded during previous surveys	Recorded during current survey (9/10 March 2009)
Callocephalon fimbriatum	**Gang-gang Cockatoo**	**Seen**	
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	Seen	
Calyptorhynchus lathami	**Glossy Black-Cockatoo**	**Seen, chewed cones**	
Chenonetta jubata	Australian Wood Duck	Seen	Seen
Chthonicola sagittata	**Speckled Warbler**	**Seen**	
Chrysococcyx basalis	Horsefields Bronze Cuckoo	Seen	
Colluricincla harmonica	Grey Shrike-thrush	Heard	Seen
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Seen	Seen
Corcorax melanorhamphos	White-winged Chough	Seen	Heard
Cormobates leucophaea	White-throated Treecreeper	Seen	Seen
Corvus coronoides	Australian Raven	Seen	Seen
Corvus mellori	Little Raven	Heard	Seen
Cracticus torquatus	Grey Butcherbird	Seen	Seen
Cuculus pallidus	Pallid Cuckoo	Heard	
Dacelo novaeguineae	Laughing Kookaburra	Seen	Seen
Dicaeum hirundinaceum	Mistletoebird	Seen	
Egretta novaehollandiar	White-faced Heron	Seen	
Eolophus roseicapillus	Galah	Seen	Seen
Eopsaltria australis	Eastern Yellow Robin	Seen	
Falco longipennis	Australian Hobby	Seen	
Gallinula tenebrosa	Dusky Moorhen	Heard	
Gerygone olivacea	White-throated Gerygone	Seen	Heard
Grallina cyanoleuca	Magpie-lark	Seen	Seen
Gymnorhina tibicen	Australian Magpie	Seen	Seen
Hieraaetus morphnoides	Little Eagle	Seen	
Hirundo ariel	Fairy Martin	Seen	
Hirundo neoxena	Welcome Swallow	Seen	Seen
Lichenostomus chrysops	Yellow-faced Honeyeater	Seen	
Lichenostomus leucotis	White-eared Honeyeater	Seen	Seen

Scientific Name	Common Name	Recorded during previous surveys	Recorded during current survey (9/10 March 2009)
Lichenostomus penicillatus	White-plumed Honeyeater	Seen	
Malurus cyaneus	Superb Fairy-wren	Seen	Seen
Manorina melanocephala	Noisy Miner	Seen	Seen
Microeca fascinans	Jacky Winter	Seen	
Neochmia temporalis	Red-browed Finch	Seen	
Ninox strenua	**Powerful Owl**	**Seen**	
Ocyphaps lophotes	Crested Pigeon	Seen	Seen
Pachycephala pectoralis	Golden Whistler	Seen	Heard
Pardalotus punctatus	Spotted Pardalote	Heard	Heard
Pardalotus striatus	Striated Pardalote	Seen	
*Passer domesticus**	House Sparrow	Seen	
Pelecanus conspicillatus	Pelican	Seen	
Petrochelidon sp.	Martin	Nest	
Petroica boodang	Scarlet Robin	Seen	
Phaps chalcoptera	Common Bronzewing	Seen	Seen
Philemon citreogularis	Little Friarbird	Seen	
Philemon corniculatus	Noisy Friarbird	Seen	
Platycercus adscitus eximius	Eastern Rosella	Seen	Seen
Platycercus elegans	Crimson Rosella	Seen	Seen
Podargus strigoides	Tawny Frogmouth	Seen	
Poryphyrio poryphyrio	Purple Swamphen	Seen	
Psephotus haematonotus	Red-rumped Parrot	Seen	Seen
Rhipidura fuliginosa	Grey Fantail	See	Seen
Rhipidura leucophrys	Willie Wagtail	Seen	Seen
Sericornis frontalis	White-browed Scrubwren	Seen	
Strepera graculina	Pied Currawong	Heard	Seen
*Sturnus vulgaris**	Common Starling	Seen	Seen
Tachybaptus novaehollandiae	Australasian Grebe	Seen	
Taeniopygia bichenovii	Double-barred Finch	Seen	
Todiramphus sanctus	Sacred Kingfisher	Seen	Seen

Scientific Name	Common Name	Recorded during previous surveys	Recorded during current survey (9/10 March 2009)
*Turdus merula**	Eurasian Blackbird	Seen	
Vanellus miles	Masked Lapwing	Heard	Seen
Zosterops lateralis	Silvereye	Heard	Seen
Mammals			
*Bos taurus**	European cattle	Seen	Seen
*Canis lupus**	Dingo, domestic dog	Scat	
Chalinolobus gouldii	Gould's Wattled Bat	Anabat	
Chalinolobus morio	Chocolate Wattled Bat	Anabat	
*Equus caballus**	Horse	Seen	
*Lepus capensis**	Brown Hare	Seen	Seen
Macropus giganteus	Eastern Grey Kangaroo	Seen	Seen
Macropus robusta	Wallaroo	Seen	
Macropus rufogriseus	Red-necked Wallaby	Seen	
Miniopterus schreibersii oceanensis	**Eastern Bentwing-bat**	Anabat	
Myotis macropus	**Large-footed Myotis**	Anabat	
Nyctophilus sp.	A Long-eared Bat	Anabat	
*Oryctolagus cuniculus**	Rabbit	Seen	
*Ovis aries**	Sheep	Seen	Seen
Petaurus breviceps	Sugar Glider	Seen, heard	Seen, heard
Pseudocheirus peregrinus	Common Ringtail Possum	Seen	
*Sus scrofa**	Pig	Scat	
Trichosurus vulpecula	Common Brushtail Possum	Seen	Seen
Vespadelus darlingtoni	Large Forest Bat	Anabat	
Vespadelus regulus	Southern Forest Bat	Harp Trap	
Vespadelus vulturnus	Little Forest Bat	Anabat	
Vombatus ursinus	Common Wombat	Scat, burrow	Burrow
*Vulpes vulpes**	Fox	Dead, scat	Seen
Reptiles			
Amphibolurus muricatus	Jacky Lizard	Seen	

Scientific Name	Common Name	Recorded during previous surveys	Recorded during current survey (9/10 March 2009)
Lampropholis sp.	Sunskink	Seen	Seen

* = *introduced species*

bold = *threatened species*

Appendix C

Threatened Species Table

Table 9 Threatened fauna with the potential to occur and likelihood of proposal impacting

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Fish					
Macquaria australasica	Macquarie Perch	FV		This species of freshwater fish inhabits river and lake habitats, especially the upper reaches of rivers and their tributaries. Spawning occurs in spring and summer in shallow upland streams or flowing sections of river systems. This species is found in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas.	Potentially present in Wingecaribbee River. Would not occur in isolated farm dams.
Frogs					
Litoria aurea	Green and Golden Bell Frog	E1		This species inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. It prefers sites containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. They are active by day and breed during the summer months (DEC 2006).	Unlikely. Suitable habitat absent from the study area.
Birds					

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Botaurus poiciloptilus	Australasian Bittern	V		This species favours permanent freshwater wetlands with tall dense reedbeds particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.) with adjacent shallow, open water for foraging. It hides during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Unlikely. Potentially present along Wingecaribbee River. Would not occur in isolated farm dams which lack aquatic vegetation.
Callocephalon fimbriatum	Gang-gang Cockatoo	V		This species is nomadic, spending summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests and winter at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests (DEC 2007).	Recorded during previous surveys. Suitable habitat in woodland and forest throughout study area.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		This species is highly specialised, feeding almost exclusively on the seeds extracted from the wooden cones of Allocasuarina species including Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*Allocasuarina torulosa*) or Drooping She-oak (*Allocasuarina verticilliata*).This species needs suitable hollows in living and dead trees for nesting and breeds between March and August (DEC 2007).	Recorded during previous surveys, however, the north eastern route option is devoid of Allocasruaina and this area is unlikely to be important habitat for this species.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V		This species inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey within coastal areas. They nest in hollows in standing dead or live trees and tree stumps. Fallen timber is an important habitat component for this species (DEC 2007).	Possible. May occur in forest and woodland areas.
Melanodryas cucullata	Hooded Robin	V		The Hooded Robin is a large Australian robin reaching 17 cm in length. The Hooded Robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. (DECC 2007).	Present. Previously recorded within the Facilities' site (URS, 2008).. Potential habitat present on Lot 12.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V		This species is the largest of its genus, and is widespread, from the Tablelands of the Great Dividing Range to the northwest and central west plains of the Riverina. It is rarely recorded eat of the Great Dividing Range, although regularly observed from the Richmond River district. It occupies mostly upper levels of drier open forest or woodlands dominated by Box and Ironbark eucalypts, as well as open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. This species usually occurs in pairs or is nomadic. It forages along twigs, branches, and trunks probing for insects. Nectar is taken from flowers and honeydew is gleaned from foliage. The Black-chinned Honeyeater nests high in the crown of a tree in the uppermost lateral branches (DEC 2007).	Possible. May forest and woodland areas.
Neophema pulchella	Turquoise Parrot	V		This species of parrot occurs in open eucalypt woodlands and forests, typically with a grassy understorey. It favours the edges of woodlands adjoining grasslands or timbered creek lines and ridges. A granivorous species, the Turquoise Parrot feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat for this species. This species nests in tree hollows, logs or posts from August to December.	Possible. May occur in forest and woodland areas.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Ninox connivens	Barking Owl	V		Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or in dense clumps of canopy leaves in large eucalypts. The Barking owl feeds on a variety of prey, with invertebrates predominant for most pf the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits important during breeding. This species lives alone or in a pair with territories ranging from 30 to 200 hectares. Nests are built in hollows of large, old eucalypts including River Red Gum (*Eucalyptus camandulensis*), White Box (*Eucalyptus albens*), Red Box (*Eucalyptus polyanthemos*), and Blakely's Red Gum (*Eucalyptus blakelyi*). Breeding occurs during late winter and early spring (DEC 2007).	Possible. May occur in forest and woodland areas.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Ninox strenua	Powerful Owl	V		This species is a nocturnal, solitary and sedentary species. They occur in a number of vegetation types ranging from woodland and open sclerophyll forest to tall open wet forest and rainforest. However, this species does prefer large tracts of vegetation. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old with breeding taking place from late summer to late autumn. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400 - 1,450 ha. It forages within open and closed woodlands as well as open areas (DEC 2006). This Owl has a variety of vocal calls and is known to 'dawn call' when returning from its night hunting activities to mark the position of its daytime roost (Parks Victoria 2003).	Recorded during previous surveys. Suitable foraging habitat in woodland and forest throughout study area.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Oxyura australis	Blue-billed Duck	V		It is a partly migratory bird that travels short-distances between breeding swamps and over-wintering lakes, with some long-distance dispersal to breed during spring and early summer. It prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Nesting occurs in Cumbungi over deep water between September and February, as well as in trampled vegetation of Lignum, sedges or Spike-rushes, where a bowl-shaped nest is constructed. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes. The species is completely aquatic, swimming low in the water along the edge of dense cover. They feed on seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies found on the bottom of swamps they inhabit.	Unlikely. Farm dams in study area too small and lacking in aquatic vegetation.
Pachycephala olivacea	Olive Whistler	V		The Olive Whistler inhabits the wet forests on the ranges of the east coast mostly above 500 m. During the winter months they may move to lower altitudes. Favours beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range. It forages in trees and shrubs and on the ground, feeding on berries and insects, making a nest of twigs and grass in low forks of shrubs (DECC 2007).	Unlikely. May occur in forest and woodland areas but typically favours moister, higher altitude forests.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Pyrrholaemus sagittatus	Speckled Warbler	V		This species of small wren occurs in a range of Eucalyptus dominated communities that have a grassy understorey with a sparse shrub layer and open canopy, often in gullies or on rocky ridges. The species requires large, relatively undisturbed remnants in order to persist in an area. Its diet consists mainly of seeds and insects. Threats include habitat loss and fragmentation through clearing for firewood and development, grazing, removal of fallen timber and logs, and nest predation by feral animals due to urbanisation and fragmented habitat (DECC 2007).	Recorded during previous surveys. Suitable habitat in woodland and forest throughout study area.
Rostratula benghalensis	Painted Snipe (was Australian Painted Snipe)	E	V, M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. This cryptic species nests on the ground amongst tall reed-like vegetation near water. It emerges from the dense growth at dusk to feed on mudflats and the water's edge taking insects, worm and seeds (DEC 2007). This species prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Unlikely. Potentially present along Wingecaribbee River. Would not occur in isolated farm dams which lack aquatic vegetation.
Stagonopleura guttata	Diamond Firetail	V		This species is known to occur in grassy eucalypt woodlands, including Box-Gum Woodlands, and Snow Gum (Eucalyptus pauciflora) Woodlands, riparian areas (rivers and creeks), and sometimes in lightly wooded farmland (DEC 2007).	Recorded on Facilities' site during previous surveys (URS, 2008). Suitable habitat in woodland and forest throughout Lot 12.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Tyto novaehollandiae	Masked Owl	V		This species occurs in dry eucalypt woodlands at altitudes from sea level to 1100 m and roosts and breeds in hollows and sometime caves in moist eucalypt forested gullies. It hunts along the edges of forests and roadsides and has a home range covering between 500 ha and 1000 ha. Prey for this species are principally terrestrial mammals but arboreal species may also be taken. It has also been recorded on the Nullarbor plain. The southern subspecies occupies a home range of 5 to 10 square km (DEC 2007).	Possible. May occur in forest and woodland areas.
Xanthomyza phrygia	Regent Honeyeater	E1		This species is a semi-nomadic species that inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak where there are significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast (DEC 2007).	Possible. May occur in forest and woodland areas.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Lathamus discolor	Swift Parrot	E	E	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 mostly occurs on the coast and south west slopes. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta)*, Spotted Gum (*Corymbia maculate)*, Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box *(E. albens*). Commonly used lerp infested trees include Grey Box (*E. macrocarpa*), Grey Box *(E. moluccana*) and Blackbutt (*E. pilularis*). Swift Parrots will return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum *(E. globulus*). (DECC 2005).	Possible. May occur in forest and woodland areas.
Mammals					
Chalinolobus dwyeri	Large-eared Pied Bat	V		This species is distributed between south-eastern QLD to NSW from the coast to the western slopes of the divide. This species roosts in caves and mines and has been most commonly recorded from dry sclerophyll forests and woodlands. C. dwyeri is an insectivorous species that flies relatively slowly over the canopy or along creek beds (Churchill 1998). Threats include clearing and isolation of habitat, damage to roosting and maternal sites from mining operations, and recreational caving activities, and the use of pesticides (DEC 2007).	Possible. Suitable foraging habitat in woodland and forest throughout study area. Suitable roosts in rock outcrops present in adjacent woodland areas.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Dasyurus maculatus	Spotted-tailed Quoll	V		This species of carnivorous marsupial is largely nocturnal but opportunistically hunts prey during the day. It inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are found in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines. Threats include habitat loss and fragmentation, poisoning through dog-baiting programs, and competition for food with feral animals (DEC 2007).	Possible. May occur in forest and woodland areas.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		This species of bat inhabits moist forest generally with trees larger than 20 m and roosts in eucalypt hollows, underneath bark or in buildings. Diet consists of moths, beetles and other insects, which it collects within or just below the tree canopy. This species hibernates during winter and breeding takes place in late spring (DEC 2007).	Present. Recent (URS, 2008) record in locality. Suitable foraging and roosting habitat in woodland and forest throughout study area.
Miniopterus australis	Little Bentwing-bat	V		This species of bat inhabits moist eucalypt forest, rainforest or dense coastal Banksia scrub. This species primarily roosts in caves, tunnels and sometimes tree hollows. Breeding for this species occurs during winter at maternal roost sites (DEC 2007).	Present. Recent (PB, 2005) record in locality. Suitable habitat in woodland and forest throughout study area.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		This species has dark reddish-brown to dark brown fur and is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998, DEC 2006). In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within 6 m of the ground. Moths form the major component of their diet and breeding takes place from October to April (Churchill 1998).	Likely. Tentatively recorded via anabat by GHD. Recent (PB, 2005) record in locality. Suitable foraging habitat in woodland and forest throughout study area. Suitable roosts in rocky cliffs. Maternity colony within 300km of study area (Bungonia)
Mormopterus norfolkensis	Eastern Freetail-bat	V		This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range and roosts primarily in tree hollows but also in man-made structures or under bark. This species is solitary and probably insectivorous (DEC 2007).	Present. Recent (URS, 2008) record in locality. Suitable foraging and roosting habitat in woodland and forest throughout study area.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Myotis adversus	Large-footed Myotis	V		Primarily a coastal species that forages over streams and watercourses feeding on fish and insects which it catches by raking its feet across the water surface, it will occur inland along large river systems. Breeding takes place during November or December, roosting in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. Threats include loss and degradation of roosting and feeding sites, increased use of pesticides, and the reduction in water qulaity occuring within waterbodies (DECC 2007).	Highly likely. This species was tentatively identified via anabat over a farm dam (not to be impacted by the proposal). Suitable forging habitat in Wingecaribee River and farm dams. Roosting habitat in woodland and forest.
Petaurus australis	Yellow-bellied Glider	V		This species of large arboreal mammal occurs in a variety of forest types though prefers tall mature eucalypt forest with high rainfall and rich soils, along the east coast to the western slopes of the Great Divide. This species relies on hollow-bearing trees for shelter and nesting. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Plant and insect exudates provide the bulk of this gliders diet including nectar, sap, honeydew and manna, whilst protein is obtained from arthropods and some pollen. The Yellow-bellied Gilder incises tree trunks and branches to obtain phloem sap, often leaving a distinctive 'V'-shaped scar. Tree selection and usage is complex and a large number of tree species are used as sap trees throughout the range of this glider. Threats include loss and fragmentation of habitat, and loss of hollow-bearing and feed trees (DEC 2007).	Unlikely. May occur in forest and woodland areas however not identified despite targeted surveys. Habitat within the north eastern route is unlikely to support yellow-bellied gliders.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Petaurus norfolcensis	Squirrel Glider	V		This species of glider is widely though sparsely distributed throughout eastern Australia. In NSW it inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. This species prefers a diversity of food supplies including acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein, and requires an abundant supply of tree-hollows for nesting and shelter. Threats include loss and fragmentation of habitat, flowering trees and shrubs, and hollow-bearing trees, and barbed wire fences snagging individuals whilst gliding (DEC 2007).	Possible. May occur in forest and woodland areas, however targeted surveys did not identify this species.
Petrogale penicillata	Brush-tailed Rock-wallaby	E1		This species of small wallaby occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. (DECC 2008).	Possible but unlikely. Suitable habitat in ridgeline to west of study area however unlikely due to presence of foxes and dogs.
Phascolarctos cinereus	Koala	V		The Koala is limited to areas of preferred feed trees in eucalypt woodlands and forests. The size of their home range varies depending on the quality of habitat, ranging from less than 2 ha to several hundred hectares in size.	Possible but unlikely. Suitable foraging habitat in woodland and forest throughout study area however his species has not

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
					been previously recorded in the locality.
Scoteanax rueppellii	Greater Broad-nosed Bat	V		It hunts from above rows of trees lining creeks and the edges of woodland in otherwise cleared paddocks, roosting in hollow tree trunks and branches as well as the roofs of old buildings (Churchill 1998). It inhabits a variety of habitats ranging from moist and dry eucalypt forest and rainforest to tall wet forest, however tends to prefers moist gullies in mature coastal forest or rainforest from the Atherton Tablelands in north QLD, along the coastal regions to southern NSW.	Likely. Recent (PB, 2005) records in locality. Suitable foraging and roosting habitat in study area.
Reptiles					
Delma impar	Striped Legless Lizard	V		Found in natural and secondary temperate grasslands and open Box-Gum Woodland containing tussock forming perennial grasses, and occasionally in areas containing surface rock or high amount of exotic grasses. It feeds on spiders, moth larvae, crickets and cockroaches. This species shelters under logs and rocks, and lays its eggs in early summer.	Possible. Suitable habitat in native grasslands in north of study area, less suitable in heavily grazed improved pasture in south.

Table 10 Threatened flora and EECs with the potential to occur and likelihood of impacting

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Endangered Ecological Communities	Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT	EEC	E	Fertile lower parts of the landscape where water and nutrients are abundant but tree growth is limited by other factors. Altitude between 560 and 1200 metres above sea level.	Unlikely to occur within the study area. This community is typified by being historically treeless and this is unlikely to be the case with grassland within the study area. These areas are treeless due to clearing for agriculture.
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland	E	CE	Tablelands and western slopes of NSW, typically on fertile substrates in lower parts of the landscape.	Patches identified within the study area, the proposal may remove native pasture associated with these patches, however is unlikely to impact.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
FLORA					
Baloskion longipipes		V		Dense Cord-rush is a perennial, grass-like herb. It has been recorded from the Kanangra-Boyd area to the Southern Tablelands but all populations are small. Populations have been recorded in Blue Mountains National Park, Kanangra-Boyd National Park, Penrose State Forest (in Hanging Rock Swamp), Morton National Park (The Vines), the Clyde Mountain area and Ballalaba (south of Braidwood). This species is commonly found in swamps or depressions in sandy alluvium, sometimes growing with sphagnum moss. It also occurs in swales within tall forest, and in Black Gum (*Eucalyptus aggregata*) Woodland. Threats include damage to plants from roadworks and weed spraying. Pigs rooting for food cause direct damage to the species and to the surrounding habitat.	Unlikely. The study area did not include appropriate habitat such as swamps
Bossiaea oligosperma	Few-seeded Bossiaea	V		Erect shrub to 2 m tall. The Few-seeded Bossiaea is known from two disjunct areas - the lower Blue Mountains in the Warragamba area and the Windellama area in Greater Argylle Shire, where it is locally abundant. It occurs on stony slopes or ridges on sandstone in the Yerranderie area, and low woodland on loamy soil in the Windellama area. Nothing is known about its ecology but it probably has hard-coated seeds that respond well to fire and soil disturbance. Frequent fire, clearing and habitat loss are the primary threats t this species (DECC 2008).	Unlikely. May occur forest but not previously recorded within the locality. Easily identifiable in the field.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Caladenia tesselata	Thick-lipped Spider Orchid	E	V	This species of orchid inhabits grassy sclerophyll woodland on clay loam or sandy soils, and low woodland with stony soil. Flowering generally occurs between September and November, however late flowering in September or early October has been recorded in southern populations. This species is known from Sydney (historic records), Wyong, Ulladulla and Braidwood regions in NSW. Kiama and Queanbeyan populations are presumed extinct. Records from the 1930's occur within the Huskisson area. *C. tessellata* occurs on the coast of Victoria from east of Melbourne to almost the NSW border. Threats to this species include clearing associated with urban development, pedestrian activity associated with recreational use along coastal areas, long-term absence of fire, and events leading to local population extinctions (DEC 2007).	Possible. May occur in forest and woodland at the site, surveys during this species flowering time are required to verify its presence at the site.
Dillwynia glaucula	Michelago Parrot-pea		E1	This erect shrub grows to 2.5m and is recorded from three areas on the NSW Southern Tablelands - near Windellama, where the species is locally abundant, north-east of Michelago and at Numeralla. There is potential habitat between the known sites. Threats include weed invasion, stock grazing, damage during road maintenance/widening and overspray from chemical weed control (DECC 2008).	Unlikely. Appropriate habitat not present within the study area.
Diuris aequalis	Buttercup Doubletail		E1	This species is a terrestrial "donkey" orchid, and has been recorded in forest, low open woodland with grassy understorey and secondary grasslands on the higher parts of the central and southern tablelands. Threats include habitat loss, roadwork's, rubbish dumping and rural-residential subdivision (DEC 2007)	Possible. May occur in forest and woodland at the site, surveys during this species flowering time are required to verify its presence at the site.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Diuris tricolor	Pine Donkey Orchid	V		This species is a tuberous terrestrial species, with a flower stalk 20 to 40 cm high, flowering in September and November with bright yellow to orange flowers speckled with red, purple, or white flecks. It is sporadically distributed along the western slopes of NSW, growing in sclerophyll forests among grass, often with native Cypress Pine (*Callitris* sp.). It is found on sandy soils, and may appear to favour disturbed soils (DEC 2007).	Unlikely. Known associated overstorey species not present within the study area.
Dodonaea procumbens	Creeping Hop-bush		V	This species of low-spreading shrub occurs in bare patches on sandy-clay soils on or near shale outcrops in Natural Temperate Grassland or Snow Gum (*Eucalyptus pauciflora)* Woodland in the dry areas of the Monaro. Flowering occurs in early spring with fruits forming late spring and early summer. Threats include habitat loss and degradation from clearing for urban and agricultural development, road construction and upgrading, stock grazing, and weed invasion (DEC 2007).	Unlikely. Potential habitat present within the study area, however this species not identified despite targeted searches.
Eucalyptus aqautica	Broad-leaved Sally			This species of small tree grows to 7 m and occurs on open, swampy flats as scattered individuals in the Penrose area near Goulburn in NSW. Threats include too frequent and hot fire, and localised events leading to population extinctions (DEC 2007).	Unlikely. Known habitat absent from the study area.
Eucalyptus macarthurii	Camden Woollybutt		V	This species of tree grows to 40 m and occurs in grassy woodlands on relatively fertile soils on broad cold flats from the Moss Vale District to Kanangra Boyd National Park, and in the southern highlands in the north west part of the Boyd Plateau (DEC 2007: Royal Botanic Gardens & Domain Trust - PlantNET 2007). Threats include habitat loss and degradation through clearing for agricultural and urban development, stock grazing, weed infestation, and localised extinctions due to random natural and human-induced events.	Unlikely. May occur in forest and woodland at the site however not identified despite targeted surveys..

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Eucalyptus recurva	Mongarlowe Mallee	E1		This species of Mallee grows to 4 m and occurs on shallow soils on gentle slopes in low heathland dominated by Stunted She-oak (*Allocasuarina nana*) and Finger Hakea (*Hakea dactyloides*), and at the margins of adjacent low woodland dominated by Brittle Gum (*Eucalyptus mannifera*) and Snow Gum (*E. pauciflora*). This species is confined to the NSW Southern Tablelands where it is known from only four locations between Mongarlowe and Windellama. Only 5 indivduals of this tree are known to exist. They are likely to be relics from a more widespread ancestor and it is unlikely that further extensive populations of the species remain undiscovered (DEC 2005).	Unlikely. Although associated canopy species are present within the study area other undiscovered population are considered unlikely to exist.
Genoplesium plumosum	Tallong Midge Orchid		E1	The Tallong Midge Orchid has flower spikes to 20 cm tall, with one to eight flowers on each spike. It was originally collected at Kurnell in 1947; presumably it also occurred south of there, but it is now only known from two areas - the village of Tallong and its immediate environs, and a site in Morton National Park 8.5 km south-east of the town of Wingello. It occurs exclusively in heathland, generally dominated by Violet Kunzea (*Kunzea parvifolia*), Common Fringe-myrtle (*Calytrix tetragona*) and parrot-peas (*Dillwynia* spp.) and grows on very shallow soils or within mosses on sandstone conglomerate shelves. This species of orchid reproduces by seed and has no mechanism for vegetative reproduction. Individuals exist as a dormant tuber for much of the year, dying back after flowering and fruiting in late summer or early autumn. The Tallong Midge Orchid can be difficult to survey as flowering is highly dependant on seasonal conditions. Threats include loss, degradation and fragmentation of habitat and/or populations for residential developments and road works (DECC 2008).	Possible. May occur in forest and woodland at the site, surveys during this species flowering time are required to verify its presence at the site.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Gentiana wingecarribensis	Wingecarribee Gentian	E	E	Wingecarribee Gentian is an erect annual herb, to 9 cm tall, and is known only from Hanging Rock Swamp and Wingecarribee Swamp on the Southern Highlands. Wingecarribee Gentian grows in bogs, in Sphagnum Moss humps and in sedge communities.	Unlikely. Preferred habitat absent from the study area.
Grevillea molyneuxii	Wingello Grevillea	V	V	The Wingello Grevillea is a low spreading shrub to 60 cm tall that is restricted to a small area south of Penrose, above Tallowa Gully and Bundanoon Creek, in Morton National Park and on Crown Land. This species has only been recorded in low heathland on sandstone, where it grows in skeletal soil on flat, wet sandstone shelves above dissected valleys. It seems to prefer open areas within heathland patches and is colonising the few tracks that bisect its habitat. Plants are killed by fire but seem to regenerate readily from seed in open spaces. Very young plants have been observed to flower so the species is probably well adapted to fire. Threats include damage by vehicles, digging by animals and frequent fire (DECC 2008).	Unlikely. Preferred habitat absent from the study area.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Kunzea camgagei	Cambage Kunzea	V	V	Wingecarribee Gentian is an erect annual herb, to 9 cm tall, and is known only from Hanging Rock Swamp and Wingecarribee Swamp on the Southern Highlands. Wingecarribee Gentian grows in bogs, in Sphagnum Moss humps and in sedge communities. Cambage Kunzea is a ground cover. Like other species of Kunzea, it appears to be a relatively long-lived species with older plants having tangled mats of thick, woody stems that grow up to a metre tall. Cambage Kunzea occurs mainly in the Yerranderie / Mt Werong area in the Blue Mountains but has also been collected on the Wanganderry Plateau, and at Medway and along the Wingecarribee River (near Berrima). Cambage Kunzea is restricted to damp, sandy soils in wet heath or mallee open scrub at higher altitudes on sandstone outcrops or Silurian group sediments. Some populations have been recorded on roadsides where road maintenance (e.g. road widening, weed spraying) may be a threat.	Unlikely. Preferred habitat absent from the study area.
Leuchochrysum albicans var tricolor	Hoary Sunray		E	A perennial herb with a stout, erect, woody rootstock. This species will have originally occupied *Eucalyptus pauciflora* woodland and tussock grassland, however most of this habitat is now converted to improved pasture or cropland. Little information is known of this species ecology in NSW.	Possible. May occur in forest and woodland at the site, surveys during this species flowering time are required to verify its presence at the site.
Phyllota humifusa	Dwarf Phyllota	V		Dwarf Phyllota is a prostrate shrub with hairy leaves, at least when they are young that is is known from the southern Blue Mountains (Bimlow Tableland), the Joadja area west of Mittagong and Penrose area near Paddys River. The species occurs in dry sclerophyll forest, sometimes near swamps, in deep sandy soils or gravely loams over a sandstone substrate. Accompanying trees are often Brittle Gum Eucalyptus	Unlikely. Preferred overstorey species absent.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
				mannifera, Narrow-leafed Peppermint (*E. radiata*) or Sydney Peppermint (*E. piperita*). Plants apparently resprout following fire and threats include sand and sandstone mining, both directly and through changes to hydrology. The species may also be threatened by forestry activities (DECC 2008).	
Pomaderris cotoneaster	Cotoneaster Pomaderris		E1	Cotoneaster Pomaderris is a shrub growing to 4 m tall. It has a very disjunct distribution, being known from the Nungatta area, northern Kosciuszko National Park (near Tumut), the Tantawangalo area in South-East Forests National Park and adjoining freehold land, Badgery's Lookout near Tallong, the Yerranderie area, the Canyonleigh area and Ettrema Gorge in Morton National Park. Cotoneaster Pomaderris has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs. Little is known about the ecology of the species. It is probably killed by fire but plants have been observed to re-sprout from the stem following death of the crown from apparent drought. Populations tend to be isolated and range in size from a few individuals to many hundreds. The distribution of this species suggests that catastrophic events have led to its fragmentation, of which fire is the most likely. Fires at too short an interval may cause local extinction. Some populations are located in areas of high public use and some plants have been damaged along walking tracks (DECC 2008).	Unlikely. May occur in forested areas on slopes but is distinct and easily identified in the field. Not identified despite targeted surveys.
Pomaderris delicata	Delicate Pomaderris	E1		This species of shrub is known from only two sites between Goulbourn and Bungonia and south of Windellana, where it occurs in dry open forest dominated by *Eucalyptus sieberi* with a dense she-oak understorey. Soils are shallow and derived from sandstone and siltstone. Threats include habitat disturbance and under-scrubbing (DEC 2007).	Unlikely. Although potential habitat for this species exists in Stringybark forest where both *E sieberi* and *Allocasuarina littoralis* were present, this species was not identified despite targeted surveys.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
Pomaderris pallida	Pale Pomoderris	V		Pale Pomaderris is a compact rounded shrub to 1.5 m tall. Pale Pomaderris has been recorded from near Kydra Trig, north-west of Nimmitabel, Tinderry Nature Reserve, and the Queanbeyan River. A record from Byadbo in Kosciuszko National Park has not been relocated. The main distribution is along the Murrumbidgee in the ACT. This species usually grows in shrub communities surrounded by Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhynca*) or *Callitris* spp. woodland. It is threatened by rural residential development, weed competition, goat browsing (Kydra) and too-frequent fire patterns (DECC 2008).	Unlikely. Preferred overstorey species absent.
Pultenaea pedunculata	Matted Bush-pea	E1		This species of prostrate shrub grows to 20 cm high. It is found on clay or sandy clay soils on Wianamatta Shale, close to localised patches of tertiary alluvium, or on the shale / sandstone interface. In NSW it is represented by three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn (where it is locally abundant). The species occurs in a range of habitats including woodland vegetation, road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area. Threats include habitat loss and fragmentation due to clearing for urban, rural, and pastural development, powerline, trail, and road maintenance, and poor understanding and management of species populations. Low intensity fires or an absence of fire may also be a threat (DEC 2007).	Unlikely. May occur in forest and woodland at the site however not identified despite targeted surveys over a number of months.
Rulingia prostrata	Dwarf Kerrawang	E	E1	This species is a prostrate shrub that forms mats to more than 1 m across, occurring on sandy, sometimes peaty soils in a wide variety of habitats. Occurs on sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum (*Eucalyptus pauciflora*) Woodland at Rose Lagoon; Blue leaved Stringybark *(E. agglomerata*) Open Forest at Tallong; and in Brittle Gum (*E. mannifera*) Low Open Woodland at Penrose; Scribbly Gum (*Eucalyptus haemostoma*)/ Swamp Mahogany (*E. robusta*) Ecotonal Forest at Tomago. Associated native species may include *Imperata cylindrica, Empodisma*	Unlikely. May occur in forest and woodland at the site however not identified despite targeted surveys.

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Association	Likelihood of Occurrence
				minus and *Leptospermum continentale*. This species is threatened by a poor understanding of responses to environmental conditions and management practices which could result in inappropriate management actions or inactions (DEC 2007).	
Rutidosis leptorhynchoides	Button Wrinklewort	E	E	The Button Wrinklewort is a perennial, multi-stemmed herb. Flower-heads are bright yellow, slightly domed and button-like, to 2 cm wide. Occurs in Box-Gum Woodland, secondary grassland derived from Box-Gum Woodland or in Natural Temperate Grassland; and often in the ecotone between the two communities. Threats include competition with other grassland species, changes in fire regime, road/rail maintenance, grazing and weed invasion.	Possible. Box-Gum Woodland present within the study area. Surveys during this species flowering time are required to verify its presence at the site.
Solanum celatum		E1		This species of shrub grows to 2.5 m and occurs in rainforest clearings, or in wet sclerophyll forests from Wollongong to just south of Nowra, and west to Bungonia in NSW. Flowering occurs from August to October with fruiting following in December/January. Threats include habitat loss and degradation from weed infestation, in particular *Lantana camara*, local extinction due to small population size, and too frequent fire (DECc 2008).	Unlikely. Preferred habitat absent from the study area.
Zieria murphyi	Velvet Zieria	V		Zierias are shrubs or small trees closely related to the boronias; the Velvet Zieria species is found in the Blue Mountains at Mt Tomah and on the southern tablelands where it has been recorded in Morton National Park in the Bundanoon area. It is found in gullies in dry sclerophyll forest with sandy soil. Frequent fire is a potential threat (DECC 2008).	Unlikely. Although Gullies with intact remnant vegetation present within the study area this species was not identified despite targeted surveys.

Appendix D

Part 3A Threatened Species Assessment

Forest Dependent Small Bird Species

Speckled Warbler

This species of small wren occurs in a range of eucalyptus dominated communities that have a grassy under storey with a sparse shrub layer and open canopy, often in gullies or on rocky ridges. The species requires large, relatively undisturbed remnants in order to persist in an area. Its diet consists mainly of seeds and insects. Threats include habitat loss and fragmentation through clearing for firewood and development, grazing, removal of fallen timber and logs, and nest predation by feral animals due to urbanisation and fragmented habitat (DECC 2005). This species was identified (visually) at a number of locations throughout the study area. This species is listed as vulnerable under the TSC Act.

Hooded Robin

The hooded robin is a large Australian robin reaching 17 cm in length. The hooded robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania (DECC 2005). The hooded robin prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. The hooded robin requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses (DECC 2005). This species is listed as vulnerable under the TSC Act.

This species has been recorded near the study area north of Canyonleigh Rd, at the proposed gas Facilities' site.

Brown treecreeper

The eastern subspecies of the brown treecreeper, is Australia's largest treecreeper. It is found in eucalypt woodlands Box-Gum Woodland and dry open forest of the inland slopes and plains of the Great Dividing Range. It mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species (DECC 2006). This species is not usually found in woodlands with a dense shrub layer and fallen timber is an important habitat component for foraging. Hollows in standing dead or live trees and tree stumps are essential for nesting. The brown treecreeper is terrestrial and arboreal and forages on trunks and branches of trees and fallen timber in groups of 8-12 birds. Ants constitute up to 80% of the diet, though other invertebrates (including spiders, insect larvae, moths and beetles) are also taken. The brown treecreeper frequents drier forests and woodlands, including Box-Gum Woodland, preferring more woodland with an open understorey and plentiful fallen timber. This species breeds between May and December, utilizing nests of grass, usually in tree hollows. Breeding occurs in pairs or in co-operative groups of 2-5 birds in territories ranging in size from 1.1 to 10.7 ha. This species is territorial year-round at many sites, although some birds may disperse locally following breeding.

The major potential impact to the lifecycle of a local population of this species would be further loss or degradation of habitat, particularly loss of potential breeding sites and foraging areas. The clearing of dead and fallen timber removes nesting and roosting hollows and major foraging substrates.

This species was not recorded during surveys but the study area contains potential habitat for this species. It has been previously recorded in the locality. This species is listed as vulnerable under the TSC Act.

Black-chinned honeyeater

The black-chinned honeyeater occupies mostly upper levels of drier open forest or woodlands dominated by Box and Ironbark eucalypts, as well as open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. This species usually occurs in pairs or is nomadic. It forages along twigs, branches, and trunks probing for insects. Nectar is taken from flowers and honeydew is gleaned from foliage. The black-chinned honeyeater nests high in the crown of a tree in the uppermost lateral branches (DECC 2005).

This species was not recorded during surveys but the study area contains potential habitat for this species. It has been previously recorded in the locality. This species is listed as vulnerable under the TSC Act.

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

(i) **displaces or disturbs threatened species and/or populations;**

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation however, vegetation clearance of canopy trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide foraging and breeding habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Temporary fragmentation of this vegetation may result in an increase in predators such as the red fox, however, vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and woodland would also be retained and improved. Construction during the peak breeding season for these species (spring) would be avoided. Given the above considerations, the proposal is unlikely to affect the life cycle of any forest dependent bird species.

(ii) **disrupts breeding cycle;**

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation, however, vegetation clearance of canopy trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide breeding habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Temporary fragmentation of this vegetation may result in an increase in predators such as the red fox, however, vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native vegetation would also be retained. Impacts to foraging and potential breeding habitat for these species would be temporary and alterative breeding habitat exists within the vicinity of the site and in the locality. These species are mobile and transient in their use of resources. It is not expected that the proposal would disrupt the breeding cycle of these species.

(iii) **disturbs the dormancy period;**

NA for any of the listed forest dependent bird species.

(iv) **disrupts roosting behaviour;**

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation, however, vegetation clearance of canopy trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide roosting habitat for these species. This vegetation would be re-instated either as existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Temporary fragmentation of this vegetation may result in an increase in predators such as the red fox, however, vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest would also be retained. Pre-clearance surveys would aim to identify roosting birds prior to construction and construction would wait until these birds have moved on. These species are mobile and roosting behaviour is unlikely to be affected.

(v) **changes foraging behaviour;**

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees. These species are mobile. The proposal is unlikely to change foraging behaviour of any of the listed bird species.

(vi) **affects migration and dispersal ability;**

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by any of the listed bird species. Connectivity would be restored via site remediation with native species. Substantial alternative habitat exists within the vicinity of the site and the locality. Construction works would aim to avoid the spring breeding period of these species in forested areas. The proposal is considered unlikely to affect migration and dispersal ability.

(vii) **disrupts pollination cycle;**

NA for listed fauna species.

(viii) **disturbs seedbanks;**

The proposal would impact on approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

(ix) **affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).**

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of habitat for each of these bird species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to lands the gas pipeline would traverse. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. Works are not expected to reduce these species' food sources. Temporary fragmentation of this vegetation may result in an increase in predators such as the red fox, however, vegetation surrounding the proposed gas

pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. Thus the proposal is unlikely to affect interactions with other species in the community. Local land owners currently control foxes on lands associated with the proposal.

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

a) disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

b) degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

c) clears or modifies native vegetation;

The proposal would initially remove up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of forested vegetation and another 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area however this modification is unlikely to impact any of the listed forest-dependent bird species.

d) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated. Local land owners currently control foxes on lands associated with the proposal.

e) removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. No substantial caves would be impacted as a result of the proposal, however some rock outcrops are likely to be disturbed. The proposal would also result in an initial removal of 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for the listed bird species, however, this loss would be temporary, and substantial alternative habitat exists immediately adjacent to the site, including a high quality offset within the locality. Leaf litter and top soil would be retained and reused. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

f) **affects natural revegetation and re-colonisation of existing species following disturbance.**

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

a) **generates or disposes of solids, liquid or gaseous waste; or**

NA

b) **uses pesticide, herbicides, other chemicals.**

Low grade herbicides such as Roundup® may be used during weed control, however, these are unlikely to impact on the listed species.

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

None of the listed species is at the limit of its known distribution.

a) **modifies the intensity and frequency of fires;**

Fire regimes are unlikely to change as a result of the proposal.

b) **modifies flooding flows;**

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

a) **creates a barrier to fauna movement;**

b) **removes remnant vegetation or wildlife corridors; and**

c) **modifies remnant vegetation or wildlife corridors.**

The proposal would not create any barrier to any of the listed bird species however vegetation would be fragmented until remediation of the gas pipeline route is undertaken. This fragmentation is unlikely to be of a width that is unpassable for these species. However, no vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of canopy trees where possible;
- Remediation of the site with local native vegetation; and

- Run-off and sedimentation protocols.

Given the above considerations, it is considered unlikely that the Hooded Robin, Speckled Warbler, Brown Treecreeper and Black-chinned Honeyeater would be significantly impacted by the proposal.

Large Forest Owls

Powerful Owl

The powerful owl is a nocturnal, solitary and sedentary species. They occur in a number of vegetation types ranging from woodland and open sclerophyll forest to tall open wet forest and rainforest. However, this species does prefer large tracts of vegetation. Powerful owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old with breeding taking place from late summer to late autumn. Pairs of powerful owls are believed to have high fidelity to a small number of hollow-bearing nest trees and would defend a large home range of 400 - 1,450 ha. The powerful owl forages within open and closed woodlands as well as open areas (DECC 2005). This species responded to call playback and was spotlighted along Wollombi Rd during recent surveys.

Barking Owl

The barking owl inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or in dense clumps of canopy leaves in large eucalypts. The barking owl feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits important during breeding. This species lives alone or in a pair with territories ranging from 30 to 200 hectares. Nests are built in hollows of large, old eucalypts including river red gum (*Eucalyptus camandulensis*), white box (*Eucalyptus albens*), red box (*Eucalyptus polyanthemos*), and Blakely's red gum (*Eucalyptus blakelyi*) (DECC 2005). Habitat for this species exists within the study area however none were identified despite targeted surveys (call playback and spotlighting).

Masked Owl

This species occurs in dry eucalypt woodlands at altitudes from sea level to 1100 m and roosts and breeds in hollows and sometime caves in moist eucalypt forested gullies. It hunts along the edges of forests and roadsides and has a home range covering between 500 ha and 1000 ha. Prey for this species are principally terrestrial mammals but arboreal species may also be taken. Masked Owls are sparsely distributed from southern QLD to SA and WA. It has also been recorded on the Nullarbor plain. The southern subspecies occupies a home range of 5 to 10 square km. Threats include clearing for agriculture (DECC 2005). Habitat for this species exists within the study area, however, none were identified despite targeted surveys (call playback and spotlighting).

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

a. displaces or disturbs threatened species and/or populations;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees of a size to support breeding owls, however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation within the study area would provide foraging habitat for each of the listed owl species. This vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would also be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees

would also be retained. Powerful Owls are known to return to preferred breeding trees each year. Pre-clearance surveys would aim to identify roosting or breeding trees for forest owls prior to construction and, should any be identified, these trees would be avoided where to the highest degree practicable. Given the above considerations, the proposal is unlikely to affect the life cycle of any large forest owls.

b. disrupts breeding cycle;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees of a size to support breeding owls however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Nest boxes may also be installed within the north eastern route to mitigate the loss of any hollow-bearing trees from this area. Vegetation within the study area would provide foraging habitat for each of the listed owl species. This vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees would also be retained. Powerful Owls are known to return to preferred breeding trees each year. Pre-clearance surveys would aim to identify roosting or breeding trees for forest owls prior to construction and these trees would be avoided wherever practicable. It is not expected that the proposal would disrupt the breeding cycle of these species.

c. disturbs the dormancy period;

NA for the listed owl species.

d. disrupts roosting behaviour;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes hollow-bearing trees and roosting habitat would also be retained. Pre-clearance surveys would aim to identify roosting trees prior to construction and these trees would be avoided where possible. Therefore the proposal is unlikely to disrupt the roosting behaviour of these owl species.

e. changes foraging behaviour;

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. The proposal is unlikely to change foraging behaviour of any of the listed owl species.

f. affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by any of the listed owl species. Fragmentation would be temporary and connectivity would

be restored. These species are highly mobile and have large home ranges. Substantial alternative habitat exists within the vicinity of the site and the locality. Construction works would aim to avoid the autumn/winter breeding period of these species in forested areas. The proposal is considered unlikely to affect migration and dispersal ability of these owls.

g. disrupts pollination cycle;

NA for listed fauna species.

h. disturbs seedbanks;

The proposal would impact on approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

i. disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

j. affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. Works are not expected to disrupt these species' preferred prey (e.g. small mammals, insects etc.). Thus the proposal is unlikely to affect interactions with other species in the community.

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

***(i)* disturbs any permanent, semi permanent or ephemeral water bodies;**

The proposal would not disturb any water bodies.

***(ii)* degrades soil quality;**

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

***(iii)* clears or modifies native vegetation;**

The proposal would initially remove 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of forested vegetation and other 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area, however, this modification is unlikely to impact any of the owl species.

***(iv)* introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;**

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes, cats and dogs into this area, however, this impact would be temporary as native vegetation would be re-established, and unlikely to impact upon owl species. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated. Landowners currently control foxes at the site.

(v) **removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;**

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. The proposal would also result in an initial removal of 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for the listed owls, however, this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site and in the locality, including a high quality offset and within the locality. Woody debris would be stockpiled in adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

(vi) **affects natural revegetation and re-colonisation of existing species following disturbance.**

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

(vii) **generates or disposes of solids, liquid or gaseous waste; or**

NA

(viii) **uses pesticide, herbicides, other chemicals.**

Low grade herbicides such as Roundup® may be used during weed control however these are unlikely to impact on the listed species.

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

None of the listed species is at the limit of its known distribution.

(i) **modifies the intensity and frequency of fires;**

Fire regimes are unlikely to change as a result of the proposal.

(ii) **modifies flooding flows;**

Not applicable to the site.

d) How is the proposal likely to effect habitat connectivity?

(iii) **creates a barrier to fauna movement;**

(iv) **removes remnant vegetation or wildlife corridors; and**

(v) **modifies remnant vegetation or wildlife corridors.**

The proposal would not create any barrier to any of the listed owl species; however, vegetation would be fragmented until remediation of the gas pipeline route is undertaken. This fragmentation is unlikely to affect these species. No vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

e) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees and potential breeding trees where possible;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for any of these species. Given the above considerations, it is considered unlikely that the powerful owl, masked owl and barking owl would be significantly impacted by the proposal.

Gang-gang Cockatoo

This species is nomadic, spending summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests and winter at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests (DECC 2005). This species was recorded within the study area during recent surveys and is likely to feed on flowering stringybarks in the study area.

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

(i) **Displaces or disturbs threatened species and/or populations;**

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees of a size to support breeding gang-gang cockatoos, however, this species shows a preference for breeding near water which is not present within the vicinity of the study area. Also, hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Nest boxes may also be installed within the north eastern route to mitigate the loss of any hollow-bearing trees from this area. Vegetation within the study area would provide foraging habitat for the gang-gang. This vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees would also be retained. Gang-gangs migrate seasonally and were observed at the site in winter. This species is unlikely to be present at the site during its known breeding season. Given the above considerations, the proposal is unlikely to affect the life cycle of the gang-gang cockatoo as a result of the proposal.

(ii) **Disrupts breeding cycle;**

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees of a size to support breeding gang-gangs, however, this species shows a preference for breeding near water which is not present within the vicinity of the study area. Also, hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Nest boxes may also be installed within the north eastern route to mitigate the loss of any hollow-bearing trees from this area. Vegetation within the study area would provide foraging habitat for the gang-gang. This vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees would also be retained. Gang-gangs migrate seasonally and were observed at the site in winter, however this species breeds in spring/summer and as such is unlikely to breed within the study area. Construction would aim to avoid this period when gang-gangs are likely to be active at the site which would further mitigate impacts on this species. Given the above considerations it is not expected that the proposal would disrupt the breeding cycle of this species.

(iii) **Disturbs the dormancy period;**

NA for the gang-gang cockatoo.

(iv) **Disrupts roosting behaviour;**

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation which may be utilised by the gang-gang cockatoo for roosting, however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation removed would be re-instated either as existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east and includes relevant feed trees for this species. A high quality offset which includes potential roost sites for this species would also be retained. These species are mobile and transient in their use of resources. Therefore the proposal is unlikely to disrupt the roosting behaviour of gang-gang cockatoo.

(v) **Changes foraging behaviour;**

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove canopy trees such as stringybarks which the gang-gang is likely to feed on (blossom), however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Vegetation removed would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east and includes relevant feed trees for this species. A high quality offset which includes hollow-bearing trees and a large area of potential feed trees would also be retained. These species are mobile and transient in their use of resources. Therefore the proposal is unlikely to change foraging behaviour of the gang-gang cockatoo.

(vi) **Affects migration and dispersal ability;**

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by the gang-gang cockatoo. Fragmentation would be temporary and connectivity would be restored. These species are highly mobile. Substantial alternative habitat exists within the vicinity of the site and the locality. The proposal is considered unlikely to affect migration and dispersal ability of the gang-gang cockatoo.

(vii) **Disrupts pollination cycle;**

NA for listed fauna species.

(viii) **disturbs seedbanks;**

The proposal would impact on approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

(ix) **disrupts recruitment (i.e. germination and establishment of plants);**

NA for listed fauna species.

(x) **affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).**

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of habitat for each of these species until vegetation is restored via remediation and possible replanting. However,

substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. Works are not expected to substantially deprive this species of feeding resources in the locality. Thus the proposal is unlikely to affect interactions with other species in the community.

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

(i) **disturbs any permanent, semi permanent or ephemeral water bodies;**

The proposal would not disturb any water bodies.

(ii) **degrades soil quality;**

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

(iii) **clears or modifies native vegetation;**

The proposal would initially remove 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of forested vegetation and other 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas will be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area. This modification is unlikely to impact on the gang-gang cockatoo as substantial alternative habitat is present in the immediate vicinity of the site and in the locality.

(iv) **introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;**

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

(v) **removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;**

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. The proposal would also result in an initial removal of 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of potential foraging habitat for the gang-gang cockatoo however this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site and in the locality, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the

above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

(vi) **affects natural revegetation and re-colonisation of existing species following disturbance.**

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

(vii) **generates or disposes of solids, liquid or gaseous waste; or**

NA

(viii) **uses pesticide, herbicides, other chemicals.**

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

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

None of the listed species is at the limit of its known distribution.

(i) **modifies the intensity and frequency of fires;**

Fire regimes are unlikely to change as a result of the proposal.

(ii) **modifies flooding flows;**

Not applicable to the site.

d) How is the proposal likely to effect habitat connectivity?

(i) **creates a barrier to fauna movement;**

(ii) **removes remnant vegetation or wildlife corridors; and**

(iii) **modifies remnant vegetation or wildlife corridors.**

The proposal would not create any barrier to the gang-gang cockatoo. Vegetation would be fragmented until remediation of the gas pipeline route is undertaken however this fragmentation would not be of a width that is unpassable for this species. No vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

e) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;

- Avoidance of hollow-bearing trees and other canopy trees where possible;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, it is considered unlikely that the gang-gang cockatoo would be significantly impacted by the proposal.

Migratory or Nomadic Birds

Swift parrot

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 mostly occurs on the coast and south west slopes. Favoured feed trees include winter flowering species such as swamp mahogany (*Eucalyptus robusta*), spotted gum (*Corymbia maculata*), red bloodwood (*C. gummifera*), mugga ironbark (*E. sideroxylon*), and white box (*E. albens*).

Commonly used lerp infested trees include grey box (E. *macrocarpa*), grey box (*E. moluccana*) and blackbutt (*E. pilularis*) and swift parrots would return to some foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian blue gum (*E. globulus*). (DECC 2005).

Regent honeyeater

This species is a semi-nomadic species that inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of river she-oak where there are significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. 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. There are only three known key breeding regions remaining: 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. In some years non-breeding flocks converge on flowering coastal woodlands and forests. (DECC 2005).

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

i) displaces or disturbs threatened species and/or populations;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation which may provide occasional foraging habitat for the regent honeyeater and swift parrot, however, these species generally follow known migration paths that does not include the Marulan site. However, the swift parrot particularly may occur on a transient basis in some years. Vegetation at the site would be avoided wherever possible using controlled, sensitive construction techniques. Where vegetation must be removed, this vegetation would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest would also be retained. These species are only likely to occur on a transient occasional basis and the site is unlikely to constitute important habitat for this species and there is substantial alternative habitat in the locality. Given the above considerations, the proposal is unlikely to affect the life cycle of either the regent honeyeater or swift parrot as a result of the proposal.

ii) disrupts breeding cycle;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation which may provide occasional foraging habitat for the regent honeyeater or swift parrot,

however these species generally follow known migration paths that does not include the Marulan site. Both the swift parrot and regent honeyeater have known breeding grounds that do not occur within the vicinity of the site. It is not expected that the proposal would disrupt the breeding cycle of this species.

iii) disturbs the dormancy period;

NA for the listed migratory species.

iv) disrupts roosting behaviour;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation which may provide temporary roosting habitat for the regent honeyeater or swift parrot, however these species generally follow known migration paths that does not include the Marulan site. Substantial vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest would also be retained. These species are only likely to occur on a transient occasional basis, and the site is unlikely to constitute important habitat for these species and there is substantial alternative habitat in the locality. Therefore the proposal is unlikely to disrupt the roosting behaviour of these species.

v) **changes foraging behaviour;**

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of potential foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. These species are only likely to occur on a transient occasional basis, and the site is unlikely to constitute important habitat for these species and there is substantial alternative habitat in the locality. The proposal is unlikely to change foraging behaviour of either the regent honeyeater or swift parrot.

vi) **affects migration and dispersal ability;**

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by of either the regent honeyeater or swift parrot. These species are highly mobile. Fragmentation would be temporary and connectivity would be restored. Substantial alternative habitat exists within the vicinity of the site and the locality. The proposal is considered unlikely to affect migration and dispersal ability of either the regent honeyeater or swift parrot.

vii) disrupts pollination cycle;

NA for listed fauna species.

viii) **disturbs seedbanks;**

The proposal would impact on approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

ix) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

x) affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of potential foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. These species are only likely to occur on a transient occasional basis, and the site is unlikely to constitute important habitat for these species and there is substantial alternative habitat in the locality. Thus the proposal is unlikely to affect interactions with other species in the community.

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

i) disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

ii) **degrades soil quality;**

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

iii) **clears or modifies native vegetation;**

The proposal would initially remove 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of forested vegetation and other 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area, however, this modification is unlikely to impact either the regent honeyeater or swift parrot.

iv) introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

v) **removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;**

Sensitive construction techniques would be used in areas of native vegetation to avoid canopy trees wherever possible. The proposal would also result in an initial removal of 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat however this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site and in the locality, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would

be returned to within the 20 metre corridor. These species are only likely to occur on a transient occasional basis, and the site is unlikely to constitute important habitat for these species and there is substantial alternative habitat in the locality. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

vi) **affects natural revegetation and re-colonisation of existing species following disturbance.**

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works will also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

vii) **generates or disposes of solids, liquid or gaseous waste; or**

NA

viii) **uses pesticide, herbicides, other chemicals.**

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

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

None of the listed species is at the limit of its known distribution.

i) modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

ii) **modifies flooding flows;**

Not applicable to the site.

d) How is the proposal likely to effect habitat connectivity?

i) creates a barrier to fauna movement;

(iv) **removes remnant vegetation or wildlife corridors; and**

(v) **modifies remnant vegetation or wildlife corridors.**

The proposal would not create any barrier for either the regent honeyeater or swift parrot, however, vegetation would be fragmented until remediation of the gas pipeline route is undertaken. This fragmentation would not be of a width that is unpassable for these species. These species are only likely to occur on a transient occasional basis, and the site is unlikely to constitute important habitat for these species and there is substantial alternative habitat in the locality. No vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

e) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

Given the above considerations, it is considered unlikely that either the regent honeyeater or swift parrot would be significantly impacted by the proposal.

Granivorous Birds

Diamond Firetail

This species is known to occur in grassy eucalypt woodlands, including Box-Gum Woodlands, and Snow Gum (*Eucalyptus pauciflora)* Woodlands, riparian areas (rivers and creeks), and sometimes in lightly wooded farmland (DECC 2005).

Turquoise Parrot

This species of parrot occurs in open eucalypt woodlands and forests, typically with a grassy understorey. It favours the edges of woodlands adjoining grasslands or timbered creek lines and ridges. A granivorous species, the turquoise parrot feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat. This species nests in tree hollows, logs or posts from August to December (DECC 2005).

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

(i) **Displaces or disturbs threatened species and/or populations;**

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and temporarily remove up to 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Vegetation within the study area would provide habitat for the diamond firetail and turquoise parrot. Hollow-bearing trees (used by the turquoise parrot for breeding) would be avoided wherever possible during construction. Vegetation to be impacted would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Substantial areas of alternative habitat are present within the locality and edge habitats preferred by the turquoise parrot would be retained. This vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest, woodland and grassland areas would also be retained. Pre-clearance surveys would aim to identify roosting areas or nests trees prior to construction and these trees would be avoided. Given the above considerations, the proposal is unlikely to affect the life cycle of either the turquoise parrot or diamond firetail as a result of the proposal.

(ii) **Disrupts breeding cycle;**

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and temporarily remove up to 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Vegetation within the study area would provide habitat for the diamond firetail and turquoise parrot. Hollow-bearing trees (used by the turquoise parrot for breeding) would be avoided wherever possible during construction. Vegetation to be impacted would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Substantial areas of alternative habitat are present within the locality and edge habitats preferred by the turquoise parrot would be retained. This vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest, woodland and grassland areas would also be retained. Pre-clearance surveys would aim to identify roosting areas or nests trees prior to construction and these trees would be avoided. It is not expected that the proposal would disrupt the breeding cycle of these species.

(iii) **disturbs the dormancy period;**

NA for the listed bird species.

(iv) **disrupts roosting behaviour;**

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and temporarily remove up to 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Vegetation within the study area would provide habitat for the diamond firetail and turquoise parrot. Vegetation to be impacted would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Substantial areas of alternative habitat are present within the locality and edge habitats preferred by the turquoise parrot would be retained. This vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest, woodland and grassland areas would also be retained. Pre-clearance surveys would aim to identify roosting areas or nests trees prior to construction and these trees would be avoided. These species are mobile and are unlikely to be directly impacted by the proposal. Therefore the proposal is unlikely to disrupt the roosting behaviour of these two bird species.

(v) **changes foraging behaviour;**

The proposal would modify up to 7 ha of potential foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest, woodland and grassland adjacent to the subject lands. Both these species are mobile and unlikely to be directly impacted by the proposal.

(vi) **affects migration and dispersal ability;**

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by either the diamond firetail or turquoise parrot. Fragmentation would be temporary and connectivity would be restored. These species are mobile. Substantial alternative habitat exists within the vicinity of the site and the locality. The proposal is considered unlikely to affect migration and dispersal ability of these species.

(vii) **disrupts pollination cycle;**

NA for listed fauna species.

(viii) **disturbs seedbanks;**

The proposal would impact on approximately 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

(ix) **s) disrupts recruitment (i.e. germination and establishment of plants);**

NA for listed fauna species.

(x) **affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).**

The proposal would modify up to 7 ha of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. Thus the proposal is unlikely to affect interactions with other species in the community.

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

(i) **disturbs any permanent, semi permanent or ephemeral water bodies;**

The proposal would not disturb any water bodies.

(ii) **degrades soil quality;**

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

(iii) **clears or modifies native vegetation;**

The proposal would initially remove 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of forested vegetation and other 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area, however, this modification is unlikely to impact the diamond firetail or turquoise parrot as substantial alternative habitat exists in the vicinity of the site and in the locality.

(iv) **introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;**

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

(v) **removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;**

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. The proposal would also result in an initial removal of 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of forest and 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture, however, this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site and in the locality, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

(vi) **affects natural revegetation and re-colonisation of existing species following disturbance.**

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

(vii) **generates or disposes of solids, liquid or gaseous waste; or**

NA

(viii) **uses pesticide, herbicides, other chemicals.**

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

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

None of the listed species is at the limit of its known distribution.

(i) **modifies the intensity and frequency of fires;**

Fire regimes are unlikely to change as a result of the proposal.

(ii) **modifies flooding flows;**

Not applicable to the site.

d) How is the proposal likely to effect habitat connectivity?

(i) **creates a barrier to fauna movement;**

(ii) **removes remnant vegetation or wildlife corridors; and**

(iii) **modifies remnant vegetation or wildlife corridors.**

The proposal would not create any barrier to either the diamond firetail or turquoise parrot, however, vegetation would be fragmented until remediation of the gas pipeline route is undertaken. This fragmentation would not be of a width that is unpassable for these species. However, no vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

e) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for either of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees where possible;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

Given the above considerations, it is considered unlikely that the diamond firetail and turquoise parrot would be significantly impacted by the proposal.

Cave-roosting Microchiropteran Bat Species

Large-eared Pied bat

This species is distributed between south-eastern QLD to NSW from the coast to the western slopes of the divide. This species roosts in caves and mines and has been most commonly recorded from dry sclerophyll forests and woodlands. The large-eared pied bat is an insectivorous species that flies relatively slowly over the canopy or along creek beds (Churchill 1998). Threats include clearing and isolation of habitat, damage to roosting and maternal sites from mining operations, and recreational caving activities, and the use of pesticides (DECC 2005).

Little Bentwing Bat

This species of bat inhabits moist eucalypt forest, rainforest or dense coastal Banksia scrub. This species primarily roosts in caves, tunnels and sometimes tree hollows. Breeding for this species occurs during winter at maternal roost sites (DECC 2005).

Eastern Bentwing Bat

This species has dark reddish-brown to dark brown fur and is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures. It is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998, DECC 2005). In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within six m of the ground. Moths form the major component of their diet and breeding takes place from October to April (Churchill 1998).

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

displaces or disturbs threatened species and/or populations;

No substantial caves that are likely to house roosting bats would be directly impacted by the proposal, however, a number of rocky outcrops are likely to be disturbed which may include temporary roost sites. The proposal would also modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation which would provide foraging habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Furthermore, vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact forest would also be retained. Given the above considerations, the proposal is unlikely to affect the life cycle of any cave-roosting bat species as a result of the proposal.

disrupts breeding cycle;

All three species require caves of medium to substantial size for breeding. No breeding habitat in the form of caves would be directly impacted by the proposal. Alternative habitat in the form of small caves which may be utilised by the large-eared pied bat occur within the broader study area including on the proposed offset site. Consequently, as no maternal breeding habitat would be impacted by the proposal it is considered unlikely that the proposal would disrupt the breeding cycle of any of these bat species.

disturbs the dormancy period;

Many species of microchiropteran bat species would become dormant during cold weather. As the above listed species all rely of caves for roosting, and no caves would be directly impacted by the proposal, it is considered unlikely that the proposal would disturb the dormancy period of any of these bat species.

disrupts roosting behaviour;

As the above listed species all rely of caves for roosting, and no caves would be directly impacted by the proposal, and works would not be conducted at night, the proposal is unlikely to disturb roosting behaviour.

changes foraging behaviour;

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. The proposal is unlikely to change foraging behaviour of any of the listed bat species.

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by any of the listed bat species nor would it create any barriers to fauna movement. No breeding habitat for any of these species would be affected. The proposal is considered unlikely to affect migration and dispersal ability.

disrupts pollination cycle;

NA for listed fauna species.

disturbs seedbanks;

The proposal would impact on approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. Works are not expected to disrupt these species' preferred prey (e.g. insects) nor substantially increase predators of these species in the locality. Thus the proposal is unlikely to affect interactions with other species in the community.

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

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

clears or modifies native vegetation;

The proposal would initially remove 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of forested vegetation and other 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area, however, this modification is unlikely to impact any of the listed cave-roosting bat species. The initial removal of native vegetation is also not expected to impact on these species as substantial alternative habitat exists and no important features for these species such as roost caves would be impacted by the proposal.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. No substantial caves would be impacted as a result of the proposal, however, some rock outcrops are likely to be disturbed. The proposal would also result in an initial removal of 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for the listed bat species however this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube

stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

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

None of the listed species is at the limit of its known distribution.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and

modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to any of the listed bat species however vegetation would be fragmented until remediation of the gas pipeline route is undertaken. However, no vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees where possible;
- No direct impacts on any caves;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for

any of these species not would any important habitat features such as roosting or maternity caves be impacted by the proposal. Given the above considerations, it is considered unlikely that the large-eared pied bat, little bentwing bat or eastern bentwing bat would be significantly impacted by the proposal.

Hollow-dependent Microchiropteran Bat Species

- eastern false pipistrelle *(Falsistrellus tasmaniensis*);
- eastern freetail bat (*Mormopterus norfolkensis*);
- greater broadnosed bat *(Scoteanax ruepellii).*

Eastern False Pipestrelle

This species of bat inhabits moist forest generally with trees larger than 20 m and roosts in eucalypt hollows, underneath bark or in buildings. This species generally roosts in hollow trunks of eucalypts in colonies of 3 to 36 (Churchill, 1998). Diet consists of moths, beetles and other insects, which it collects within or just below the tree canopy. This species hibernates during winter and breeding takes place in late spring (DECC 2005).

Eastern Freetail Bat

This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range and roosts primarily in tree hollows but also in man-made structures or under bark. This species is solitary and probably insectivorous (DECC 2005).

Greater Broadnosed bat

This species is a large and robust bat that feed on slow-flying prey such as large moths and beetles. It hunts from above rows of trees lining creeks and the edges of woodland in otherwise cleared paddocks, roosting in hollow tree trunks and branches as well as the roofs of old buildings (Churchill 1998). It inhabits a variety of habitats ranging from moist and dry eucalypt forest and rainforest to tall wet forest, however tends to prefers moist gullies in mature coastal forest or rainforest from the Atherton Tablelands in north QLD, along the coastal regions to southern NSW. The species is only found at low altitudes (below 500 m) (Churchill 1998; DECC 2005). Reproduction takes place in January at maternal roosting sites (DECC 2005). Suspected threats include clearing and fragmentation of forests in coastal and lowland areas, and the effects of logging activities including direct mortality and reduction of suitable hollows.

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

displaces or disturbs threatened species and/or populations;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Nest boxes may also be installed within the north eastern route to mitigate the loss of any hollow-bearing trees from this area. Vegetation within the study area would provide foraging habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of 6 metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes hollow-bearing trees would also be retained. Pre-clearance surveys would

aim to identify roosting trees prior to construction and these trees would be avoided. Given the above considerations, the proposal is unlikely to affect the life cycle of any hollow-dependent bat species as a result of the proposal.

disrupts breeding cycle;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Nest boxes may also be installed within the north eastern route to mitigate the loss of any hollow-bearing trees from this area. Vegetation within the study area would provide foraging habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes hollow-bearing trees would also be retained. Pre-clearance surveys would aim to identify roosting trees prior to construction and these trees would be avoided. Impacts to foraging and potential breeding habitat for these species would be temporary and alterative breeding habitat exists within the vicinity of the site and in the locality. It is not expected that the proposal would disrupt the breeding cycle of this species.

disturbs the dormancy period;

Many species of microchiropteran bat species become dormant during cold weather. Pre-clearance surveys would aim to identify roosting trees prior to construction and these trees would be avoided. Where possible, construction would aim to avoid the breeding period of microchiropteran bat species. Consequently, it is considered unlikely that the proposal would disturb the dormancy period of any of these species.

disrupts roosting behaviour;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees however, these trees would be avoided wherever possible using controlled, sensitive construction techniques. Nest boxes may also be installed within the north eastern route to mitigate the loss of any hollow-bearing trees from this area. Vegetation within the study area would provide foraging habitat for these species. This vegetation would be re-instated either as with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes hollow-bearing trees would also be retained. Pre-clearance surveys would aim to identify roosting trees prior to construction and these trees would be avoided. Therefore the proposal is unlikely to disrupt the roosting behaviour of these bat species.

changes foraging behaviour;

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest adjacent to the subject lands. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. The proposal is unlikely to change foraging behaviour of any of the listed bat species.

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by any of the listed bat species. Substantial alternative habitat exists within the vicinity of the site and the locality. The proposal is considered unlikely to affect migration and dispersal ability.

disrupts pollination cycle;

NA for listed fauna species.

disturbs seedbanks;

The proposal would impact on approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for each of these species until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. Works are not expected to disrupt these species' preferred prey (e.g. insects) nor substantially increase predators of these species in the locality. Thus the proposal is unlikely to affect interactions with other species in the community.

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

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

clears or modifies native vegetation;

The proposal would initially remove 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of forested vegetation and other 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area however this modification is unlikely to impact any of the listed hollow-dependent bat species.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. Feral cats and dogs are also likely to occur within the study area. The six metre corridor of shrubs and ground layer species is likely to deter these once established as these species are known to avoid dense intact native vegetation. The six metre corridor of shrubs and ground layer species is likely to deter foxes once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation will be remediated.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

Sensitive construction techniques would be used in areas of native vegetation to avoid hollow-bearing trees wherever possible. No substantial caves would be impacted as a result of the proposal, however, some rock outcrops are likely to be disturbed. The proposal would also result in an initial removal of 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of foraging habitat for the listed bat species, however, this loss would be temporary and substantial alternative habitat exists immediately adjacent to the site, including a high quality offset and within the locality. Woody debris would be dragged into adjacent areas and where practicable would be returned to within the 20 metre corridor. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect these species.

affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

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

None of the listed species is at the limit of its known distribution.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and

modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to any of the listed bat species, however, vegetation would be fragmented until remediation of the gas pipeline route is undertaken. This fragmentation is unlikely to be of a width that is unpassable for these species. However, no vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees where possible;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for any of these species not would any important habitat features such as roosting or maternity caves be impacted by the proposal. Given the above considerations, it is considered unlikely that the eastern false pipistrelle *(Falsistrellus tasmaniensis*), eastern freetail bat (*Mormopterus norfolkensis*); and greater broadnosed bat *(Scoteanax ruepellii)* would be adversely impacted by the proposed development.

Spotted-tail Quoll

This species inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are found in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines. (DECC 2005).

The study area offers potential habitat for this species. It has been previously recorded in the locality, however no latrine sites or scats of this species were identified during surveys.

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

displaces or disturbs threatened species and/or populations;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees, fallen logs and rocky areas that may be utilised by this species, however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Nest boxes may also be installed within the north eastern route to mitigate the loss of any hollow-bearing trees from this area. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 m corridor. Vegetation removed during construction would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees, caves, rocky outcrops and woody debris would also be retained. Pre-clearance surveys would aim to identify roosting or breeding sites for the spotted-tail quoll prior to construction and these trees would be avoided. These species are highly mobile and have large home ranges. Given the above considerations, the proposal is unlikely to affect the life cycle of the spotted-tail quoll as a result of the proposal.

disrupts breeding cycle;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees fallen logs and rocky areas that may be utilised by this species, however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Nest boxes may also be installed within the north eastern route to mitigate the loss of any hollow-bearing trees from this area. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 metre corridor. Vegetation removed during construction would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees, caves, rocky outcrops and woody debris would also be retained. Pre-clearance surveys would aim to identify roosting or breeding sites for the spotted-tail quoll prior to construction and these trees would be avoided. Construction would be avoided during the peak breeding time for this species. This species are highly mobile and have large home ranges. It is not expected that the proposal would disrupt the breeding cycle of the spotted-tail quoll.

disturbs the dormancy period;

NA for the spotted-tail quoll.

disrupts roosting behaviour;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees fallen logs and rocky areas that may be utilised by this species however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Nest boxes may also be installed within the north eastern route to mitigate the loss of any hollow-bearing trees from this area. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 m corridor. Vegetation removed during construction would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees, caves, rocky outcrops and woody debris would also be retained. Pre-clearance surveys would aim to identify roosting or breeding sites for the spotted-tail quoll prior to construction and these areas would be avoided or quolls carefully relocated.

changes foraging behaviour;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees fallen logs and rocky areas that may be utilised by this species however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Nest boxes may also be installed within the north eastern route to mitigate the loss of any hollow-bearing trees from this area. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 m corridor. Vegetation removed during construction would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees, caves, rocky outcrops and woody debris would also be retained. This species are highly mobile and have large home ranges. The proposal is unlikely to change foraging behaviour of the spotted-tail quoll.

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat to the extent that it would become unpassable by the spotted-tail quoll. Fragmentation would be temporary and connectivity would be restored. This species are highly mobile and have large home ranges. Substantial alternative habitat exists within the vicinity of the site and the locality. Construction works would aim to avoid the breeding period of this species in forested areas. The proposal is considered unlikely to affect migration and dispersal ability of the spotted-tail quoll.

disrupts pollination cycle;

NA for listed fauna species.

disturbs seedbanks;

The proposal would impact on approximately 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation, however works would aim to stockpile topsoil (which would include existing seed bank) and this topsoil would be used in remediation works.

s) disrupts recruitment (i.e. germination and establishment of plants);

NA for listed fauna species.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify up to 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of habitat for the spotted-tail quoll until vegetation is restored via remediation and possible replanting. However, substantial alternative habitat exists in the locality including a high quality offset of intact native forest. No works would be conducted at night and works in forested areas would aim to minimise impacts on canopy trees where possible. The proposal is unlikely to affect interactions with other species in the community.

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

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Existing top soil would be stockpiled for a short time and then reused in remediation works. Weeds would be managed at the site. Measures to contain impacts from construction including sediment control and soil management would also be implemented. Based on the above, soil quality is unlikely to be affected.

clears or modifies native vegetation;

The proposal would initially remove 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of forested vegetation and other 4.81 hectares (Alternative A) to 5.32 hectares (Alternative B) of native pasture. Native pasture would be restored once works are complete and vegetation in forested areas would be allowed to re-establish to width of six metres where shrubs and ground layer species would be maintained. Thus the proposal would result in the modification of native vegetation within the study area however this modification is unlikely to impact on the spotted-tail quoll in the long-term.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil and allowed to re-establish with local native species. Run-off controls and a weed management plan would be implemented to manage weeds at the site. As such an increase in weeds is not expected. The initial fragmentation of vegetation at the site may encourage foxes into this area, however, this impact would be temporary as native vegetation would be re-established. This species is particularly sensitive to competition with introduced predators such as cats and dogs. The six metre corridor of shrubs and ground layer species is likely to deter feral species once established as these species are known to avoid dense intact native vegetation. No vegetation would be isolated as a result of the proposal and initial fragmentation would be remediated.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees fallen logs and rocky areas that may be utilised by this species however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 m corridor. Rocky areas disturbed by the proposal would also be placed into adjacent bushland areas. Based on the above, the disturbance to the above listed habitat features is unlikely to substantially affect the spotted-tail quoll.

affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

Low-grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

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

None of the listed species is at the limit of its known distribution.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and

modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to any the spotted-tail quoll however vegetation would be fragmented until remediation of the gas pipeline route is undertaken. This fragmentation would not be of a width that is unpassable for the spotted-tail quoll. However, no vegetation would become isolated as a result of the proposal and no substantial impacts would occur to existing corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. Mitigation measures of relevance include:

- Retention and re-use of existing topsoil;
- Avoidance of hollow-bearing trees and potential breeding trees where possible;
- Avoidance of construction during the known breeding period of these species;
- Retention and relocation of woody debris, rocky areas etc;
- Remediation of the site with local native vegetation; and
- A run-off and sedimentation protocols.

Given the above considerations, it is considered unlikely that the spotted-tail quoll would be significantly impacted by the proposal.

Reptiles

Striped Legless Lizard

This species of lizard is found in natural and secondary temperate grasslands and open Box-Gum Woodland containing tussock forming perennial grasses, and occasionally in areas containing surface rock or high amount of exotic grasses. It feeds on spiders, moth larvae, crickets and cockroaches. This species shelters under logs and rocks, and lays its eggs in early summer. Threats include clearing and fragmentation of habitat, agricultural practices, weed invasion, vehicle movement, changed fire regimes, and any other change to vegetation structure (DECC 2005).

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

displaces or disturbs threatened species and/or populations;

The proposal would impact on native pasture and areas of rock that may provide habitat for the striped legless lizard. The species has not been previously recorded in the locality and was not identified within the study area despite targeted searches. Where possible, areas of potential habitat would be avoided. Where rock areas must be impacted these would be shifted and then returned once works are complete. Native pasture would be rehabilitated back to their existing state. Alternative habitat exists within the area. The proposal would not isolate or fragment any grassland vegetation from other areas of vegetation. Given the above considerations, the proposal is unlikely to displace or disturb this species as a result of the proposal.

disrupts breeding cycle;

The proposal would impact on native pasture and areas of rock that may provide breeding habitat for the striped legless lizard. The species has not been previously recorded in the locality and was not identified within the study area despite targeted searches. Where possible, areas of potential habitat would be avoided. Where rock areas must be impacted these would be shifted and then returned once works are complete. Native pasture would be rehabilitated back to their existing state. Alternative habitat exists within the area. The proposal would not isolate or fragment any grassland vegetation from other areas of vegetation. Given the above considerations, it is unlikely that the proposal would disrupt the breeding cycle of this species, should it occur.

disturbs the dormancy period;

NA for the striped legless lizard.

disrupts roosting behaviour;

NA for the striped legless lizard.

changes foraging behaviour;

The proposal would remove potential habitat for the striped legless lizard. The species has not been previously recorded in the locality and was not identified within the study area despite targeted searches. If the species is present in the study area it would be relocated during pre-clearance surveys in consultation with DECC, however the species is considered unlikely to occur. Where possible, areas of potential habitat would be avoided. Where rock areas must be impacted these would be shifted and then returned once works are complete. Native pasture would be rehabilitated back to their existing state. Alternative habitat exists within the area. The proposal would not isolate or fragment any grassland vegetation from other areas of vegetation.

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat nor would it create any barriers to fauna movement. Where possible, potential habitat would be avoided. Alternative habitat exists within the area. The proposal is unlikely to disturb these species in the area or locality and is considered unlikely to affect migration and dispersal habitat.

disrupts pollination cycle;

NA for the striped legless lizard.

disturbs seedbanks;

NA for the striped legless lizard.

disrupts recruitment (i.e. germination and establishment of plants);

NA for the striped legless lizard.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

Some potential habitat for the striped legless lizard would be impacted as a result of the proposal. However, habitat to be impacted would be re-instated once works are complete, and no habitat would be isolated or fragmented as a result of the proposal. Alternative habitat exists within the area. Thus the proposal is unlikely to affect interactions with other species in the community.

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

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Areas of impact would be restored after construction and alternative habitat exists else where in the study area and these areas would not be affected. Measures to contain impacts from construction including sediment control and the retention and re-spreading of topsoil would be implemented, and thus soil quality is unlikely to be affected.

clears or modifies native vegetation;

The gas pipeline would impact areas of native pasture that may include habitat for the striped legless lizard, however these would be restored once construction is complete. Alternative habitat also exists within the study area and locality. As such, proposed vegetation clearance is unlikely to impact on this species.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil. Run-off controls and sowing soil stockpiles with a sterile cover crop are to be implemented to manage weeds at the site. As such an increase in weeds is not expected. The proposal is unlikely to increase the presence of feral animals within the study area as no vegetation relevant to this species would be fragmented or isolated. Vermin

or feral species are not expected to increase within areas of potential habitat for this species (grassland) as a result of the proposal.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

The proposal would temporarily remove some areas of rocky debris, boulders or outcrops within areas of native pasture however this would be returned and grassland re-established.

affects natural revegetation and re-colonisation of existing species following disturbance.

Natural revegetation and re-colonisation would be actively encouraged at the site once works are complete. Works would also include weed control, fencing to exclude grazing, revegetation with tube stock if necessary and supplementary watering as required. The project is unlikely to negatively affect natural revegetation and re-colonisation of existing species following disturbance.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

Low grade herbicides such as Roundup® may be used during weed control however these unlikely to impact on the listed species.

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

The striped legless lizard occurs in the Southern Tablelands, the South Western Slopes and possibly in the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. If the species is present at the site it is likely to be at the northern limit of its distribution. However, this species has not been previously recorded in the locality (10 km radius) and was not identified despite targeted searches.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and

modifies remnant vegetation or wildlife corridors.

The proposal would not create any permanent barrier to remnant vegetation and would not modify any remnant vegetation. No habitat would become isolated or fragmented as a result of the proposal. The proposal would not remove any vegetation or wildlife corridors or disconnect any vegetation. The proposal would not isolate any vegetation or wildlife corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for any of these species. The following mitigation measures would manage any impacts on potential habitat for this species:

- Retention and re-use of existing topsoil;
- Avoidance of potential habitat where possible;
- Re-instatement of rocky areas;
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of any areas of potential habitat for the striped legless lizard.

Box-Gum Woodland EEC

White Box Yellow Box Blakely's Red Gum Woodland is an open woodland or forest community, and is characterized by white box (*Eucalyptus albens*), yellow box (*E. melliodora*) and Blakely's red gum (*E. blakelyi*). Intact sites contain a high diversity of plant species, including dominant and additional tree species, shrubs, climbers, grass species and a high diversity of herbs. Intact stands that contain diverse upper and mid-storeys and ground layer s are rare. Modified sites include the following areas where the main tree species are present ranging from an open woodland formation to a forest structure, with the ground layer predominantly being composed of exotic species. On sites where the trees have been removed, only the grassy ground layer and some herbs remain. It occurs in the tablelands and western slopes of NSW (DEC 2007). Three small patches of Box-Gum Woodland exist within Lot 12 a well as one larger degraded patch on Arthursleigh and may be affected by the proposal depending on final route selection.

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

displaces or disturbs threatened species and/or populations;

The proposed gas pipeline route would impact areas approximately 0.082 ha of edge vegetation associated with this community on Lot 12. The proposal would not isolate or fragment any vegetation from other areas of vegetation. Vegetation will be restored however a 6 m modified corridor will be retained which will contain shrubs and groundlayer species only. Weed management will be undertaken throughout the site. Substantial better quality areas of this community exist within the locality. The removal of a small amount of edge habitat is considered unlikely to substantially displace or disturb this community.

disrupts breeding cycle;

NA for Box-Gum Woodland

disturbs the dormancy period;

NA for Box-Gum Woodland

disrupts roosting behaviour;

NA for Box-Gum Woodland

changes foraging behaviour;

NA for Box-Gum Woodland

affects migration and dispersal ability;

The proposal would not fragment or isolate any existing habitat. Grazing regimes at the site are unlikely to change once works are complete. Migration and dispersal ability of flora species associated with this community is unlikely to change at the site.

disrupts pollination cycle;

As above.

disturbs seedbanks;

The proposal would modify edge habitat associated with this community. The construction phase of the project may temporarily disturb seed banks for flora species associated with this community, however, once rehabilitation takes place these disruptions would cease.

disrupts recruitment (i.e. germination and establishment of plants);

The gas pipeline is unlikely to disrupt recruitment the site has been grazed for over 100 years thus reducing recruitment over a long period of time.

affects the interaction between threatened species and other species in the community (eg. Pollinators, host species, microrrhizal associations).

The proposal would modify edge habitat associated with this community (approximately 0.082 ha). The proposal would not isolate or fragment any vegetation from other areas of vegetation. Thus the proposal is unlikely to affect interactions with other species in the community.

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

disturbs any permanent, semi permanent or ephemeral water bodies;

The proposal would not disturb any water bodies.

degrades soil quality;

Measures to contain impacts from construction including sediment control and the retention and re-spreading of topsoil would be implemented, and thus soil quality is unlikely to be affected.

clears or modifies native vegetation;

The proposal would modify edge habitat associated with this community (approximately 0.082 ha), however, the habitat to be impacted occurs on the edge of existing vegetation and substantial alternative habitat exists within the locality, including as part of a proposed high-quality offset.

introduces weeds, vermin or feral species or provides conditions for them to increase and/or spread;

Areas of vegetation clearance would be rehabilitated using existing topsoil. Run-off controls and sowing soil stockpiles with a sterile cover crop are to be implemented to manage weeds at the site. As such an increase in weeds is not expected. The proposal is unlikely to increase the presence of feral animals within the study area as no vegetation would be fragmented or isolated. Vermin or feral species are not expected to increase and/or spread as a result of the proposal.

removes or disturbs key habitat features such as trees with hollows, caves and rock crevices, foraging habitat;

NA for Box-Gum Woodland

affects natural revegetation and re-colonisation of existing species following disturbance.

Some of the subject land is currently subject to grazing and as such is unlikely to be effectively colonised by native vegetation. Areas not subject to grazing are showing signs of regeneration. Existing topsoil would be re-used to restore areas of impact and would result in the re-colonisation of existing species.

generates or disposes of solids, liquid or gaseous waste; or

NA

uses pesticide, herbicides, other chemicals.

NA

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

This community is not at the limit of its known distribution.

modifies the intensity and frequency of fires;

Fire regimes are unlikely to change as a result of the proposal.

modifies flooding flows;

Not applicable to the site.

v) How is the proposal likely to effect habitat connectivity?

creates a barrier to fauna movement;

removes remnant vegetation or wildlife corridors; and modifies remnant vegetation or wildlife corridors.

The proposal would not create any barrier to remnant vegetation and would not modify any remnant vegetation. No habitat would become isolated or fragmented as a result of the proposal. The proposal would not remove any vegetation or wildlife corridors or disconnect any vegetation. The proposal would not isolate any vegetation or wildlife corridors.

vi) How is the proposal likely to affect critical habitat?

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. The small area of marginal potential habitat to be removed or modified is not considered to constitute important habitat for these species' conservation in the locality or region.

Conclusion

The proposal would not impact on important habitat for this community. Relevant mitigation measures include:

- Only the removal of a small area of edge habitat;
- No vegetation associated with this community will be isolated or fragmented;
- Substantial better quality patches of this community within the locality including part of the proposed offset for the project;
- Retention and re-use of existing topsoil;
- A run-off and sedimentation protocols.

If recommended impact mitigation and management measures for the proposed development of the site are implemented, the proposal is unlikely to result in the degradation of this area of Box-Gum Woodland.

Appendix E

Assessment under EPBC Act

Striped legless Lizard

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

Lead to a long-term decrease in the size of an important population of a species

Targeted surveying did not identify any striped legless lizard within the study area and it has not been previously recorded within the locality. The study area offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Therefore the proposal is unlikely to result in a long-term decrease in the size of a population.

Reduce the area of occupancy of an important population

No individuals of this species were identified despite targeted surveys. It has not been previously recorded within the locality. The study area offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. As such, the proposal is unlikely to result in the area of occupancy for this species.

Fragment an existing important population into two or more populations

No identified populations exist within the study area. The area of impact offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing native pasture habitats. The proposal is unlikely to result in any existing population being fragmented into two or more populations.

Adversely affect habitat critical to the survival of a species

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. Significant alternative habitat for this species exists throughout the surrounding area and locality. The habitat to be removed is unlikely to be important or critical habitat for this species.

Disrupt the breeding cycle of an important population

No individuals have been identified within the study area. The area of impact offers marginal habitat for this species. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing native pasture habitats. The proposal is unlikely to disrupt the breeding cycle of this species.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The habitat to be affected by the proposal is marginal. Significant alternative habitat exists in adjacent bushland areas. Areas of impact would be remediated and are likely to be colonized by existing species. Therefore, the proposal is unlikely to impact on habitat for this species to the extent that the species is likely to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposal is unlikely to introduce more weeds into the area. Top soil would be retained and used to rehabilitate areas of disturbance. The proposal is unlikely to result in an invasive species becoming established within the habitat of striped legless lizard.

Introduce disease that may cause the species to decline

No diseases are known that may result in a decline in this species as a result of the proposal.

Interfere substantially with the recovery of the species

This species was not identified despite targeted surveys. It has not been previously recorded in the locality. Habitat to be impacted by the proposal is marginal and unlikely to constitute important habitat for this species. Therefore the proposal is unlikely to interfere with the recovery of this species.

Conclusion

Consideration of the above assessment criteria concludes that the proposal is unlikely to have a significant impact on striped legless lizard.

Spotted-tail Quoll

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

Lead to a long-term decrease in the size of an important population of a species

The study area may provide potential habitat for the spotted-tail quoll. The proposal would modify 1.9 hectares (Alternative A) to 1.73 hectares (Alternative B) of native vegetation and may remove hollow-bearing trees, fallen logs and rocky areas that may be utilised by this species, however, these hollow-bearing trees would be avoided wherever possible using controlled, sensitive construction techniques. Woody debris would be dragged into adjacent areas and if practicable re-instated back into the 20 m corridor. Vegetation removed during construction would be re-instated either with existing stratums or with shrubs and ground layer species for a width of six metres immediately above the pipeline. Vegetation surrounding the proposed gas pipeline route would be retained, and this vegetation is contiguous with large areas of native forest and woodland to the south and east. A high quality offset which includes intact native forest and hollow-bearing trees, caves, rocky outcrops and woody debris would also be retained. Pre-clearance surveys would aim to identify roosting or breeding sites for the spotted-tail quoll prior to construction and these trees would be avoided. These species are highly mobile and have large home ranges. Given the above considerations, the proposal is unlikely to lead to a long-term decrease in the size of an important population of a species.

Reduce the area of occupancy of an important population

The proposal will impact on existing native vegetation but this impact will only be temporary. Substantial alternative habitat exists within the locality and this species is highly mobile with a large home range. The proposal is unlikely to result in the area of occupancy for this species.

Fragment an existing important population into two or more populations

The proposal will impact on existing native vegetation but this impact will only be temporary. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing natural habitats. The proposal is unlikely to result in any existing population being fragmented into two or more populations.

Adversely affect habitat critical to the survival of a species

No critical habitat listed under legislation occurred in the site or within adjacent areas of vegetation. Significant alternative habitat for this species exists throughout the surrounding area and locality. The habitat to be removed is unlikely to be important or critical habitat for this species.

Disrupt the breeding cycle of an important population

Where feasible, construction would be avoided during the breeding period of this species. Pre-clearance surveys would also aim to identify and manage any individuals within the area of impact prior to construction. Significant alternative habitat exists within the study area and locality. Areas of impact would be remediated to resemble existing natural habitats. The proposal is unlikely to disrupt the breeding cycle of this species.

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 will modify an initial 7 ha of habitat for this species but impacts will be temporary. These areas will be rehabilitated back leaving only a small portion of this vegetation modified. Substantial alternative habitat exists in adjacent bushland areas and within the locality. Areas of impact would be remediated and are likely to be colonized by existing species. Therefore, the proposal is unlikely to impact on habitat for this species to the extent that the species is likely to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposal is unlikely to introduce more weeds into the area. Top soil would be retained and used to rehabilitate areas of disturbance. The proposal is unlikely to result in an invasive species becoming established within the habitat of spotted-tail quoll.

Introduce disease that may cause the species to decline

No diseases are known that may result in a decline in this species as a result of the proposal.

Interfere substantially with the recovery of the species

Habitat to be impacted by the proposal is will only be temporarily impacted. Rehabilitation works will re-instate features of relevance for this species. Alternative habitat exists within adjacent areas and the locality. Therefore the proposal is unlikely to interfere with the recovery of this species.

Conclusion

Consideration of the above assessment criteria concludes that the proposal is unlikely to have a significant impact on spotted-tail quoll

HD

10 Bond Street Sydney NSW 2000

-

T: 2 9239 7100 F: 2 9239 7199 E: sydmail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	V Keyzer	N Witting				
1	B Harrington	Brendan Ryan	*Brendan Ryan*	C Cook		28/4/09

Appendix B

Cultural heritage assessment of alternative gas pipeline routes

Addendum report no. 2, Navin Officer

Marulan Gas Turbine Facilities Project

Cultural Heritage Assessment of Alternative Gas Pipeline Routes

Addendum Report No. 2

February 2009

A Report to GHD

Navin Officer

heritage consultants Pty Ltd

acn: 092 901 605

Number 4
Kingston Warehouse
71 Leichhardt St.
Kingston ACT 2604

ph 02 6282 9415
fx 02 6282 9416

EXECUTIVE SUMMARY

EnergyAustralia and Delta Electricity propose to develop two gas turbine power generating facilities on a site located approximately 12 km north of Marulan on the NSW southern tablelands. A six kilometre gas pipeline and other shared infrastructure servicing both facilities would also be constructed along with high voltage transmission lines connecting each facility to the nearby TransGrid 330 kV Marulan Substation.

On 8 October 2007, the Director-General of the NSW Department of Planning declared the Marulan Gas Turbine Facilities Project to be a Major Project which would be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. A cultural heritage assessment is required to support the Part 3A Environmental Assessment.

This report documents the results of a cultural heritage assessment of two alternative routes for part of the proposed gas pipeline for the Marulan Gas Turbine Facilities Project. The total length of those alternative routes is approximately 4.25 km.

Findings

Two Aboriginal sites (an isolated find [MGPS5] and an artefact scatter consisting of two lithic items [MGPS6]) were identified within the alternative routes for the proposed gas pipeline for the Marulan Gas Turbine Facilities Project that were the subject of this investigation.

No historical objects, sites or places were identified within the alternative routes for the proposed gas pipeline for the Marulan Gas Turbine Facilities Project that were the subject of this investigation.

Recommendations

It is recommended that the following strategies be included in the Statement of Commitments for the project:

Aboriginal Heritage

1. Where feasible, disturbance to Aboriginal heritage recordings MGPS5 and MGPS6 will be avoided.

2. If impact to Aboriginal sites MGPS5 and MGPS6 cannot be avoided then any surface Aboriginal artefacts within the construction footprint will be recovered and re-positioned in a nearby position away from the area of impact.

European Heritage

No further cultural management actions are required for the Historical (European) heritage within the alternative routes for the proposed gas pipeline for the Marulan Gas Turbine Facilities Project that were the subject of this investigation.

~ o0o ~

TABLE OF CONTENTS

1. INTRODUCTION

1.1 The Proposal

EnergyAustralia and Delta Electricity propose to develop two gas turbine power generating facilities on a site located approximately 12 km north of Marulan on the NSW southern tablelands. A six kilometre gas pipeline and other shared infrastructure servicing both facilities would also be constructed along with high voltage transmission lines connecting each facility to the nearby TransGrid 330kV Marulan Substation.

The facilities are designed to generate electricity to help meet peaks in demand which occur on hot and cold days. Gas turbine plants are able to fire up and shut down quickly to cater for these demand peaks.

The following infrastructure would be required to serve both facilities:

- A gas pipeline lateral from the main Moomba to Sydney Pipeline, but excluding respective gas receiving delivery stations at the respective facilities;
- A high voltage transmission lines and connection to TransGrid;
- Back-up electrical supply arrangements;
- External telecommunications connections; and
- A common access road to each facility for construction and operational purposes.

Natural gas would be supplied from the existing Moomba to Sydney gas pipeline. The operating pressure of the existing mainline is typically in the range of 4,400 to 5,000 kPA. The pipeline will be located to the south of the site.

On 8 October 2007, the Director-General of the NSW Department of Planning declared the Marulan Gas Turbine Facilities Project to be a Major Project which would be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*. A cultural heritage assessment is required to support the Part 3A Environmental Assessment.

This report documents the results of a cultural heritage assessment of two alternative routes for part of the proposed gas pipeline for the Marulan Gas Turbine Facilities Project, identified as A and B (Figures 1.1 and 1.2). The total length of those parts is approximately 4.25 km. The report was commissioned by GHD Pty Ltd.

1.2 Report Outline

This report:

- Outlines the study methodology;
- Provides a summary of previous cultural heritage studies and heritage listed items within the proposed Marulan Gas Pipeline routes;
- Documents the results of a field survey of the study area;
- Defines statutory requirements relevant to the cultural heritage of the area; and
- Provides recommendations relating to the cultural heritage resource of the study area.

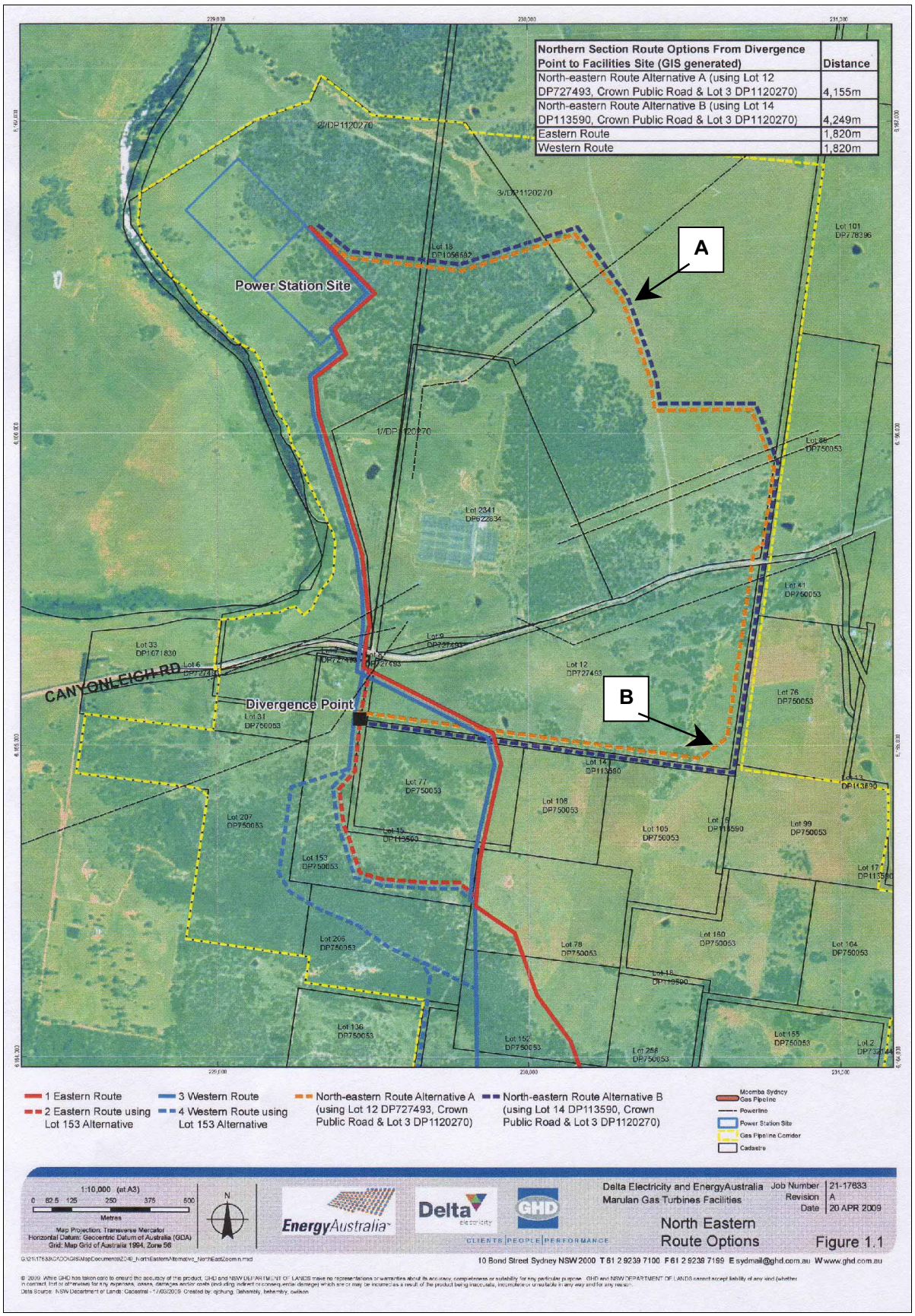


Figure 1.1 Location of proposed alternative gas pipeline routes (dark blue [A] and orange [B] dashed lines) – the study area. (Map supplied by GHD).

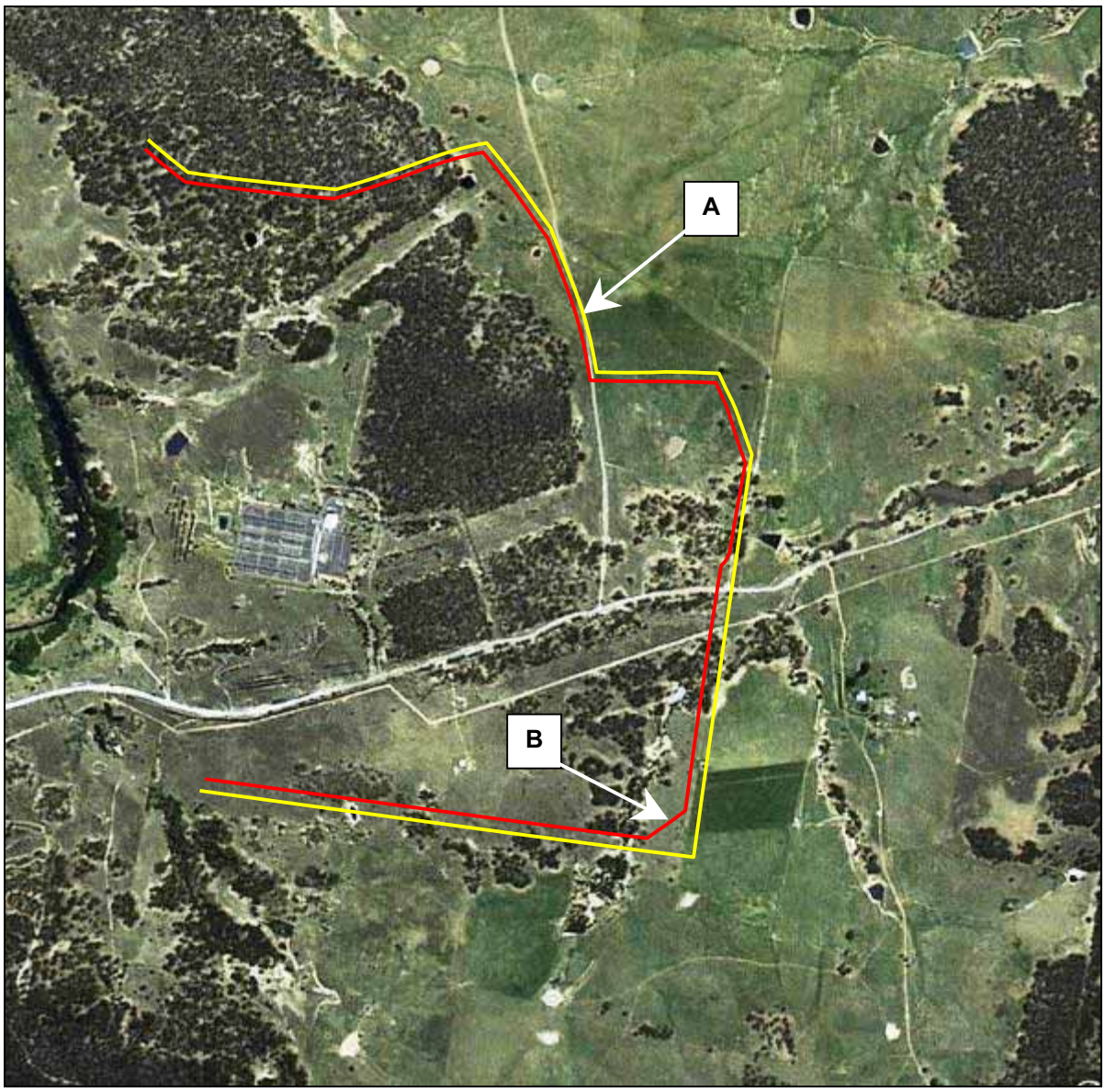


Figure 1.2 Location of proposed alternative gas pipeline routes (yellow [A] and red [B] lines). (Base map Google Earth 2008)

2. STUDY METHODOLOGY

2.1 Literature and Database Review

A range of archaeological and historical documentation was reviewed for the Marulan Gas Pipeline study area and its surrounds. This literature and data review was used to determine if known Aboriginal and historical sites were located within the area under investigation, to facilitate site prediction on the basis of known regional and local site patterns, and to place the area within an archaeological and heritage management context. The review of documentary sources included heritage registers and schedules, local histories, and archaeological reports.

Aboriginal literature sources included the Aboriginal Heritage Information Management System (AHIMS) maintained by the NSW Department of Environment and Climate Change (DECC) and associated files and catalogue of archaeological reports. Sources of historical information included regional and local histories, heritage studies and theses; parish maps; and where available, other maps, such as portion plans.

Searches were undertaken of the following statutory and non-statutory heritage registers and schedules:

- Statutory Listings
    - : Aboriginal Heritage Information Management System (AHIMS) (NSW DECC);
    - : The National Heritage List (Australian Heritage Council);
    - : The Commonwealth Heritage List (Australian Heritage Council);
    - : The Register of the National Estate (Australian Heritage Council);
    - : The State Heritage Register (NSW Heritage Office); and
    - : Heritage Schedule(s) from the Goulburn Mulwaree Local Environmental Plan 2007.
- Non-Statutory Listings
    - : The State Heritage Inventory (NSW Heritage Office); and
    - : Register of the National Trust of Australia (NSW).

2.2 Field Survey and Project Personnel

The field survey was undertaken over one day in February 2009 by archaeologists Lindsay Smith and Deirdre Lewis-Cook. The survey was conducted on foot and involved field personnel walking straight line and opportunistic traverses along and across the assessment area.

The total length of the proposed alternative pipeline routes was approximately 4.25 km. The width of the study corridor that was subject to archaeological survey varied from 30-100 m.

Straight line traverses involved inspecting the ground while walking transects along the length of the proposed pipeline easement. Opportunistic transects were undertaken to inspect old growth trees, rock outcrops and areas of ground surface visibility within the assessment area. A high proportion of all bare ground within the assessment area was inspected and, in areas of limited exposure, an assessment was made of the potential for that area to include Aboriginal sites below the ground. All old growth trees within or near the study area were inspected for potential human origin scarring.

This addendum report was prepared by Lindsay Smith.

3. ABORIGINAL CONTEXT

3.1 Heritage Listed Items

A search of the AHIMS database indicated that one Aboriginal site, No. 52-4-0134, an open campsite, has been previously recorded in the vicinity of the current study area for the proposed Marulan Gas Pipeline. Figure 3.1 shows its location in relation to the study area.

3.2 Previous Research in the Marulan Gas Pipeline Study Area

In April 2008, Biosis Research conducted a cultural heritage assessment of the site proposed for the development of the two gas turbine facilities and associated infrastructure, in the vicinity of the current study area. Ten Aboriginal archaeological sites (isolated finds and stone artefact scatters) were recorded during the field survey of that area. Two landforms within that proposed development area were also identified as having potential to contain further Aboriginal archaeological sites.

The location of the 10 sites and two landforms are shown in Figure 3.1 in relation to the current study area.

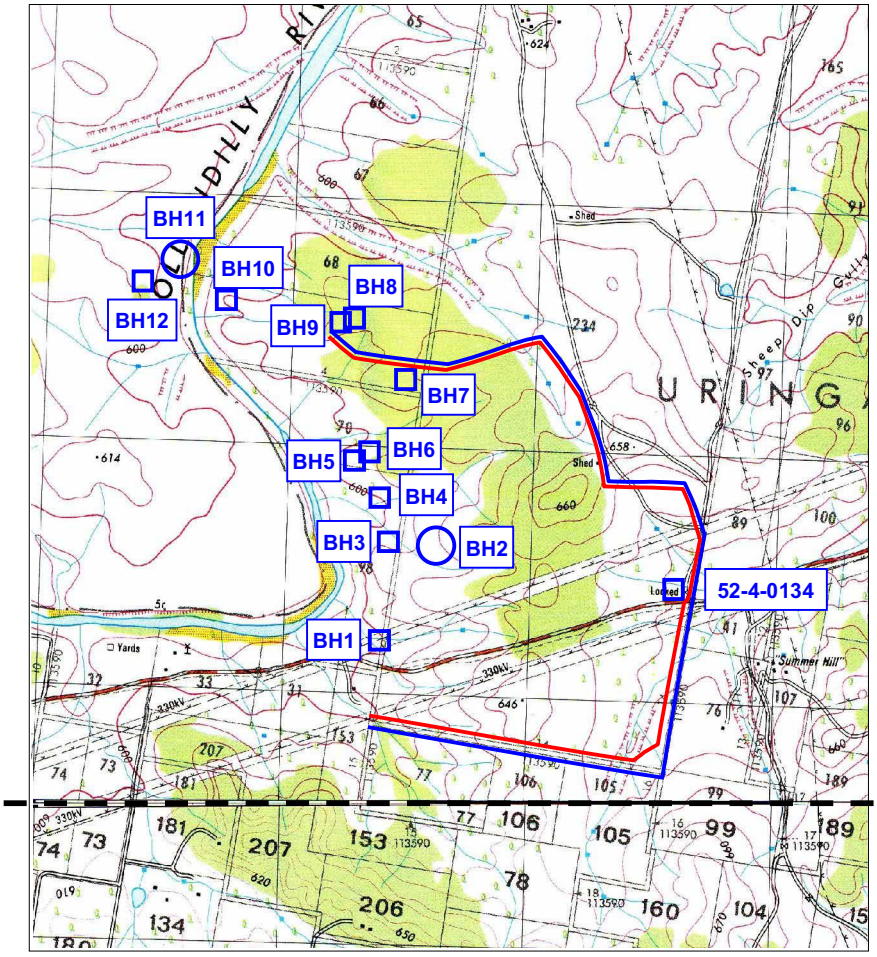


Figure 3.1 Map showing locations of previously recorded sites (blue squares) and landforms (blue circles) in relation to current study area (solid blue [A] and red [B] lines) (extract from 1:25,000 topographic maps Canyonleigh 8928-IV-N [top] & Wingello 8928-4-S [bottom] 2nd Editions, CMA).

4. HISTORICAL CONTEXT

4.1 Heritage Listed Items

There are no heritage listed historic items within the vicinity of the proposed Marulan Gas Pipeline.

4.2 Previous Cultural Heritage Studies

In April 2008, Biosis Research conducted a cultural heritage assessment of the proposed site for the development of two gas turbine facilities and associated infrastructure, in the vicinity of the current study area. No historical sites had been previously recorded within that area and no sites were recorded during the Biosis Research survey.

No historical heritage sites were identified during a survey of part of a proposed Marulan Gas Pipeline route in July 2008 (Navin Officer 2008a).

Three historical (European) heritage recordings were made within part of a proposed Marulan Gas Pipeline route in November 2008, being: a remnant two rail wooden fence line (MGPHS1); a boundary marking stone arrangement (MGPHS2); and a collection of four items of forestry and/or farm machinery (MGPHS3) (Navin Officer 2008b). The latter is the closest of those three recordings to the current study, and is located about one kilometre to the south of the southernmost end of the study area.

5. RESULTS

5.1 Summary

Two Aboriginal sites (an isolated find and an artefact scatter consisting of two lithic items) were identified within the alternative routes for the proposed gas pipeline for the Marulan Gas Turbine Facilities Project that were the subject of this investigation.

No historical objects, sites or places were identified within the alternative routes for the proposed gas pipeline for the Marulan Gas Turbine Facilities Project that were the subject of this investigation.

5.2 Aboriginal Places

Two Aboriginal sites, classified as Marulan Gas Pipeline Sites [MGPS] 5 and 6, were identified during the current survey. Both are described below and their locations are shown in Figure 5.5.

MGPS5: Isolated Find

Map grid reference: 229954.6166557 (GDA)

This recording consists of a single quartz flake, which was exposed on a small (25 x 25 cm) patch of bare ground together with an assortment of small gravels among a number of fallen tree branches. The artefact was located on the crest of a small ridgeline in the northernmost section of the study area. That section consisted of sparse woodland with intermittent grass cover, leaf litter and fallen tree branches. Figure 5.1 gives a photograph of the artefact and Figure 5.2 shows its location.

The area of the find comprised a soil profile of a skeletal, light brown sandy, gravelly loam. There is low potential for the site to be larger and low potential to contain subsurface Aboriginal objects. The potential for *in situ* archaeological material is also considered to be low.

Artefact description:

1. White quartz flake, with serrated edge; 14 x 10 x 2 mm.

Figure 5.1 Isolated find (MGPS5) – quartz flake.

Figure 5.2 General view of location of MGPS5 (red arrow) (facing southeast).

MGPS6: Artefact Scatter

Map grid reference: 229909.6166520 (GDA) (approximate centre)

This recording consists of a low density scatter of two quartz lithic items, which were exposed on a small (20 x 20 cm) patch of bare ground together with an assortment of small gravels. The artefacts were located on the crest of a small ridgeline in the northern-most section of the study area. That section consisted of sparse woodland with intermittent grass cover, leaf litter and fallen tree branches. Figure 5.3 gives a photograph of the artefacts and Figure 5.4 shows their location.

The area of the find comprised a soil profile of a skeletal, light brown sandy, gravelly loam. The site encompasses an area of approximately 10 m diameter but there is low potential for it to contain subsurface Aboriginal objects. The potential for *in situ* archaeological material is also considered to be low.

Artefact descriptions:

1. Milky white quartz scraper: 20 x 21 x 8 mm.

2. White quartz flake with retouch on sides, no negative scars and feather termination: 19 x 17 x 7 mm.

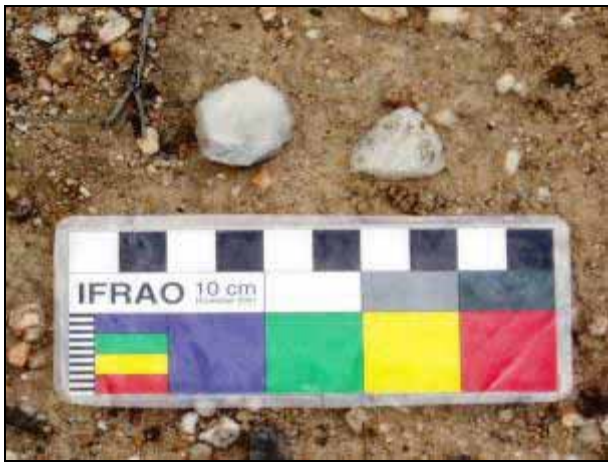


Figure 5.3 Artefact scatter (MGPS6) – quartz scraper (left) and quartz flake (right).

Figure 5.4 General view of location of MGPS6 (red arrow) (facing southeast).

5.3 European Places

No recordings of historic European places were made during the field survey undertaken as part of this project.

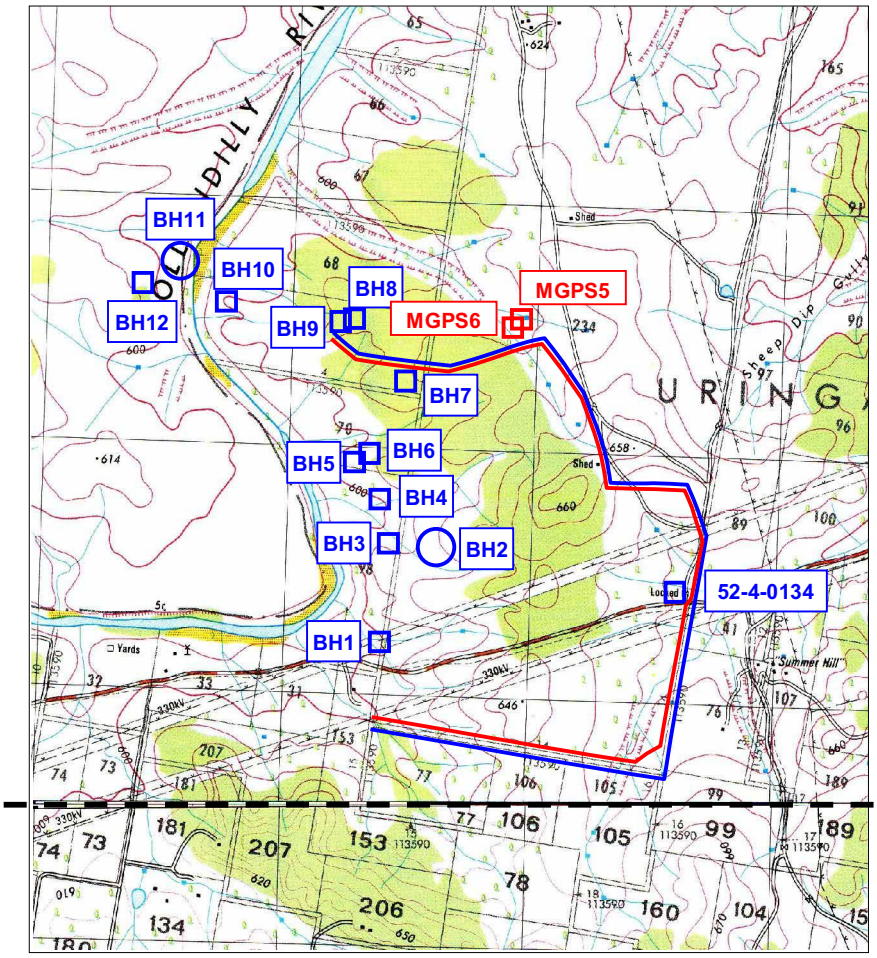


Figure 5.5 Map showing locations of previously recorded sites (blue squares) and landforms (blue circles), and sites recorded during current investigation (red squares) in relation to current study area (solid blue [A] and red [B] lines) (extract from 1:25,000 topographic maps Canyonleigh 8928-IV-N [top] & Wingello 8928-4-S [bottom] 2nd Editions, CMA).

5.4 Survey Coverage and Visibility Variables

Table 5.1 summarises estimates for the degree to which separate landforms within the study area were examined and also indicates the exposure incidence and average ground visibility present in each case. A total of 90% of the ground area in the study area was inspected during the survey.

Taking into account survey coverage, archaeologically useable exposures, and visibility variables, the effective survey coverage (ESC) was 5.5% of the total survey area. The ESC attempts to provide an estimate of the proportion of the total study area that provided a net 100% level of ground surface visibility to archaeological surveyors.

The ESC calculation is defined and required by the DECC and stated to be of use in assessing and cross comparing the adequacy of archaeological surface surveys. The actual utility of the ESC calculation however is challenged by many archaeologists. The limitations of the ESC calculation are emphasised by differences in the subjective assessment of exposure and visibility levels, variations in how survey units are defined and measured, and differences in how and which variables are estimated and combined. In reality, ESC results tend only to be meaningful when compared across surveys conducted by the same surveyors and ESC measurers.

Table 5.1 Survey Coverage Data

Survey division	Survey unit	Landform	Survey mode	Main exposure types	Estimated Survey Unit area (ha)	Proportion of unit surveyed %	Area of unit surveyed (ha)	Exposure incidence %	Average exposure visibility %	Net effective exposure (ha)	Effective survey coverage of survey unit %	Aboriginal Archaeological recordings
A	1	Open valley floor	Foot	Vehicle tracks	2.5	90	2.25	10	60	0.14	5.4	Nil
	2	Ridge and spur slopes	Foot	Vehicle tracks, animal digging and tracks, erosion scalds and gullying	0.5	90	0.45	15	50	0.03	6.8	Nil
	3	Ridge and spur crests	Foot	Animal and insect disturbance.	0.75	90	0.68	5	75	0.03	3.4	2
	4	Drainage lines	Foot	Creek banks and gully scarps	0.5	90	0.45	10	85	0.04	7.7	Nil
Total					*4.25*		*3.83*			*0.23*	*5.5*	*2*

6. STATUTORY AND POLICY CONTEXT[1]

6.1 Environmental Planning and Assessment Act 1979

This Act (the EP&A Act) and its regulations, schedules and associated guidelines require that environmental impacts are considered in land use planning and decision making. Environmental impacts include cultural heritage assessment. The Act was reformed by the *Environmental Planning and Assessment Amendment (Infrastructure and other Planning Reform) Act 2005*.

There are four main areas of protection under the Act:

- Planning instruments allow particular uses for land and specify constraints. Part 3 governs the preparation of planning instruments. Both Aboriginal and Historical (Non-Indigenous) cultural heritage values should be assessed when determining land use;

- A separate streamlined and integrated development assessment and approvals regime for major infrastructure and other projects of significance to the State is defined by Part 3A;

- Section 90 lists impacts which must be considered before development approval is granted. Part 4 relates to the development assessment process for local government authorities. Impact to both Aboriginal and Historical (Non-Indigenous) cultural heritage values are included; and

- State Government agencies which act as the determining authority on the environmental impacts of proposed activities must consider a variety of community and cultural factors in their decisions, including Aboriginal and Historical (Non-Indigenous) cultural heritage values. Part 5 relates to activities which do not require consent but still require an environmental evaluation, such as proposals by government authorities.

Part 3A of the EP&A Act

Part 3A of the Act is an amendment which establishes a separate streamlined and integrated development assessment and approvals regime for 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.

Part 3A removes the stop-the-clock provisions and the need for single-issue approvals under eight other Acts, including the NP&W Act and the Heritage Act 1977. Environmental planning instruments such as the heritage provisions within REP and LEPs, (other than State environmental planning policies) do not apply to projects approved under Part 3A.

Where warranted the Minister may declare any project subject to Part 3A to be a critical infrastructure project. These projects only require a concept approval in contrast to other Part 3A projects which require project approval. In most circumstances, a concept approval will be obtained to establish the environmental performance requirements and consultation requirements for the implementation of the subsequent stages of the project.

Under the provisions of Part 3A, proponents of major and infrastructure projects must make a project application seeking approval of the Minister. The application is to include a preliminary assessment of the project. Application may be for concept plan approval or full approval. Following input from relevant agencies and council(s), DoP will issue the proponent with requirements for the preparation of an Environmental Assessment and a Statement of Commitments. The Statement of Commitments will include how the project will be managed in an environmentally sustainable manner, and consultation requirements.

[1] The following information is provided as a guide only and is accurate to the best knowledge of Navin Officer Heritage Consultants. Readers are advised that this information is subject to confirmation from qualified legal opinion.

Following submission of an Environmental Assessment and draft Statement of Commitments to DoP, these documents are variously evaluated, reviewed, circulated and exhibited. The proponent may modify the proposal to minimise impacts in response to submissions received during this process. The proponent then provides a Statement of Commitments and, following any project changes, a Preferred Project Report. An assessment report is then drafted by the Director-General and following consultation with relevant agencies, a final report with recommendations for approval conditions or application refusal is submitted to the Minister. The Minister may refuse the project, or approve it with any conditions considered appropriate.

Section 75U of the EP&A Act (as amended) establishes exemptions to the requirement for permits and consents under the *National Parks & Wildlife Act 1974*. to disturb, move, impact or destroy Aboriginal objects, and for an excavation permit under s139 of the NSW *Heritage Act 1977* to disturb subsurface relics. This section states that such permits are not required for an approved project subject to the provisions of Part 3A of the EP&A Act. Section 75U also extends this exemption to include 'any investigative or other activities that are required to be carried out for the purpose of complying with any environmental assessment requirements under this Part in connection with an application for approval to carry out the project or of a concept plan for the project' (s75(U)4 EP&A Act 1979 (as amended)).

6.2 Implications for the Marulan Gas Pipeline Development

Aboriginal 'objects' as defined under the *National Parks and Wildlife Act 1974* have been identified within this section of the Marulan Gas Pipeline study area. However, as construction of the project would be conducted subject to an approval under Part 3A of the *Environmental Planning and Assessment Act 1979,* the statutory provisions within that Act that require the receipt of a permit and/or consent prior to impacting Aboriginal objects do not apply.

Not withstanding this, the demonstrated management of cultural heritage values, and the avoidance or mitigation of impact to significant heritage values remains an objective of the Environmental Assessment. To this end it is recommended that the management strategies drafted in this report be adopted by the proponent and included in the Statement of Commitments for the project.

7. SIGNIFICANCE ASSESSMENT

7.1 Aboriginal Heritage

7.1.1 Assessment Criteria

The Burra Charter of Australia defines cultural significance as 'aesthetic, historical, scientific or social value for past, present and future generations' (Aust. ICOMOS 1987). The assessment of the cultural significance of a place is based on this definition but often varies in the precise criteria used according to the analytical discipline and the nature of the site, object or place.

In general, Aboriginal archaeological sites are assessed using five potential categories of significance:

- Significance to contemporary Aboriginal people;
- Scientific or archaeological significance;
- Aesthetic value;
- Representativeness; and
- Value as an educational and/or recreational resource.

Many sites will be significant according to several categories and the exact criteria used will vary according to the nature and purpose of the evaluation. Cultural significance is a relative value based on variable references within social and scientific practice. The cultural significance of a place is therefore not a fixed assessment and may vary with changes in knowledge and social perceptions.

Aboriginal significance can be defined as the cultural values of a place held by and manifest within the local and wider contemporary Aboriginal community.

Scientific significance can be defined as the present and future research potential of the artefactual material occurring within a place or site. This is also known as archaeological significance.

There are two major criteria used in assessing scientific significance:

1. The potential of a place to provide information which is of value in scientific analysis and the resolution of potential research questions. Sites may fall into this category because they: contain undisturbed artefactual material, occur within a context which enables the testing of certain propositions, are very old or contain significant time depth, contain large artefactual assemblages or material diversity, have unusual characteristics, are of good preservation, or are a constituent of a larger significant structure such as a site complex.

2. The representativeness of a place. Representativeness is a measure of the degree to which a place is characteristic of other places of its type, content, context or location. Under this criteria a place may be significant because it is very rare or because it provides a characteristic example or reference.

The value of an Aboriginal place as an educational resource is dependent on: the potential for interpretation to a general visitor audience, compatible Aboriginal values, a resistant site fabric, and feasible site access and management resources.

The principal aim of cultural resource management is the conservation of a representative sample of site types and variation from differing social and environmental contexts. Sites with inherently unique features, or which are poorly represented elsewhere in similar environment types, are considered to have relatively high cultural significance.

The cultural significance of a place can be usefully classified according to a comparative scale which combines a relative value with a geographic context. In this way a site can be of low, moderate or high significance within a local, regional or national context. This system provides a means of

comparison, between and across places. However it does not necessarily imply that a place with a limited sphere of significance is of lesser value than one of greater reference.

The following assessments are made with full reference to the scientific, aesthetic, representative and educational criteria outlined above. Reference to Aboriginal cultural values has also been made where these values have been communicated to the consultants. It should be noted that Aboriginal cultural significance can only be determined by the Aboriginal community, and that confirmation of this significance component is dependent on written submissions by the appropriate representative organisations.

7.1.2 The Marulan Gas Pipeline Study Area

Marulan Gas Pipeline Sites 5 (MGPS5) and 6 (MGPS6)

Both recordings, MGPS5 – an isolated find, and MGPS6 – a low density artefact scatter consisting of two lithic items, have low archaeological significance. The visible artefacts are of locally common types and in typical raw materials. There is a low assessed potential for archaeological material to be present subsurface and *in situ,* and the areal incidence of this material is also likely to low.

Based on the surface evidence and the assessed archaeological potential of the sites, both are assessed as having low archaeological significance within a local context.

7.2 European Heritage

No recordings of historic European places were made during the field survey undertaken as part of this project.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Potential Impact of the Development

Construction of the alternative gas pipeline routes for the Marulan gas turbine facilities project will necessitate disturbance to the ground surface and deposits within the footprint of the proposed easements. This disturbance will result from excavation and backfilling of the pipeline trench, and from vehicle track construction.

The two Aboriginal heritage recordings, MGPS5 and MGPS6, identified during the current investigation may potentially be impacted by such works.

8.2 Recommended Management Strategies

It is recommended that the following strategies be included in the Statement of Commitments for the project:

Aboriginal Heritage

1. Where feasible, disturbance to Aboriginal heritage recordings MGPS5 and MGPS6 will be avoided.

2. If impact to Aboriginal sites MGPS5 and MGPS6 cannot be avoided then any surface Aboriginal artefacts within the construction footprint will be recovered and re-positioned in a nearby position away from the area of impact.

European Heritage

No further cultural management actions are required for the Historical (European) heritage within the alternative routes for the proposed gas pipeline for the Marulan Gas Turbine Facilities Project that were the subject of this investigation.

Report Distribution

Three copies of this report should be forwarded to the NSW DECC for their information at the following address:

Cultural Heritage Officer
Conservation Planning Unit
Southern Branch
PO Box 2115
QUEANBEYAN NSW 2620.

~ o0o ~

9. REFERENCES

Australia ICOMOS 1987 *The Australia Icomos Charter for the Conservation of Places of Cultural Significance (The Burra Charter), Guidelines to the Burra Charter: Cultural Significance and Conservation Policy.* Pamphlet, Australia Icomos (Inc).

Biosis Research 2008 Cultural Heritage Assessment of the Proposed Marulan Gas Turbine Facilities, NSW. Report for URS Australia Pty Ltd.

Navin Officer Heritage Consultants 2008a Marulan Gas Turbine Facilities Project: Cultural Heritage Assessment of Gas Pipeline. Report to GHD Pty Limited (July 2008).

Navin Officer Heritage Consultants 2008b Marulan Gas Turbine Facilities Project: Cultural Heritage Assessment of Alternative Gas Pipeline Routes. Report to GHD Pty Limited (November 2008).

~ o0o ~

GHD

10 Bond Street Sydney NSW 2000

-

T: 2 9239 7100 F: 2 9239 7199 E: sydmail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	M Evans	A Raleigh	A Raleigh	D Chapple	D A Chapple	29-04-09