Appendix F
Flora and Fauna Assessment

MARULAN GAS TURBINE FACILITIES

ENVIRONMENTAL ASSESSMENT

JOINT CONCEPT APPLICATION

VOLUME 2 | APPENDICES | August 2008

R E P O R T

Biodiversity Impact Assessment
Gas Turbine Facilities Project
Marulan, NSW

Prepared for

EnergyAustralia and Delta Electricity

14 July 2008

43177371

Peer Reviewer: Jeremy Pepper
Associate Environmental Scientist

URS Australia Pty Ltd
Level 3, 116 Miller Street
North Sydney, NSW 2060 Australia
Tel: 61 2 8925 5500
Fax: 61 2 8925 5555

Project Manager: Nicole Brewer
Associate Environmental Scientist

Authors: Ben Harrington
Environmental Scientist

Angela Standley
Environmental Scientist

Date: 14 July 2008
Reference: Biodiversity Asst
Status: Final

Contents

Contents

Tables, Figures, Plates, Drawings Appendices

Tables

Figures

Appendices

Executive Summary

URS Australia Pty Ltd was engaged by EnergyAustralia and Delta Electricity to prepare Biodiversity Impact Assessment for the proposed gas turbine electricity generation facilities (the 'Facilities') in Marulan, NSW. The report addresses the relevant requirements for the Environmental Assessment issued by the Director-General of the NSW Department of Planning on 3 March 2008. This report forms an appendix to the joint EnergyAustralia and Delta Electricity Concept Application.

Field surveys were conducted on the Marulan Site from 3 to 5 October 2006, with additional surveys undertaken on 10 May, 5 and 6 June and 22 to 24 October 2007. Flora surveys involved mapping and describing the vegetation communities of the site, compiling a list of flora species and targeted searches for threatened flora species. Fauna survey methods included habitat identification and assessment, diurnal bird counts, harp trapping and Anabat recording for micro-bats, spot-lighting, stag watching, active searches for frogs and reptiles, opportunistic observations of fauna species and searches for signs of fauna activity (e.g. tracks, scratches in bark and scats). Desktop literature reviews involved searches of relevant threatened species databases.

The majority of the Site comprises cleared grazing land dominated by exotic pasture grasses and herbs, with isolated stands of woodland throughout the central parts. A total of 91 flora species have been recorded on the Site. No threatened flora species, as listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act), were recorded. Four vegetation communities were identified and mapped, including Tableland Hills Grassy Woodland, Wollondilly River Riparian Forest, cleared exotic grassland and Tableland Grassy Box-Gum Woodland. None of the vegetation communities recorded satisfy the definition of an endangered ecological community (EEC) under the TSC Act.

A total of 86 fauna species have been recorded on the Site, including six species of amphibian, 57 species of bird, one reptile and 22 native mammals. Three threatened bird species, (Diamond Firetail, Gang-gang Cockatoo, Hooded Robin), and two threatened bat species (Eastern Falsistrelle, Eastern Bent-wing Bat) were recorded during the October 2007 surveys. An additional three threatened fauna species, the Greater Broad-nosed Bat, Little Bent-wing Bat and Powerful Owl, were recorded on adjacent land during a previous study. The woodland present on the Site provides nesting, roosting and foraging habitat for these species.

Measures to avoid, mitigate and offset impacts on native biodiversity have been employed in the current assessment. Direct impacts on biodiversity have been partly avoided by locating the proposed Facilities as far as possible within cleared pasture land, whilst allowing for a suitable set-back from the Wollondilly River. A range of mitigation measures is recommended, including salvage of hollow stems and branches during tree-felling, pre-clearing surveys (and rescue) for tree-dwelling and ground-dwelling fauna, erosion control, removal of stock (grazing), weed management and rehabilitation of disturbed land.

Given that construction of the proposed Facilities will require the removal of around 22ha of Tableland Hills Grassy Woodland, a biodiversity offset strategy has been developed to compensate for direct permanent impacts on vegetation and habitat that cannot be avoided. The key element to the strategy is the creation of a 38.9ha offset area within the Site, which would contain 32.3ha of woodland and involve improvements to a 9ha riparian area. Net improvements to biodiversity values will be made through removal of grazing stock (fencing), weed control, retention of fallen timber and tree-hollows, erosion control and rehabilitation of degraded land. The combination of avoidance, mitigation and offset measures, proposed in this assessment is deemed to maintain the biodiversity values of the Site.

No EPBC Act matters of national environmental significance were recorded at the Site or are likely to be affected by the Project. Therefore a 'referral' of the proposal to the Australian Government Environment Minister for determination under the Act is not considered necessary.

Section 1 Introduction

1.1 Scope of Report

Delta Electricity ('Delta') and EnergyAustralia are proposing to construct two separate gas turbine facilities on the Marulan Site (the 'Project'). The Project includes construction of a gas supply pipeline between the Site and the Moomba to Sydney gas pipeline, as well as electricity connection to the existing transmission network grid, as shown on **Figure 1**. The Project is a Major Project according to *State Environmental Planning Policy (Major Projects) 2005*, by virtue of the proposed capital investment value of the facility and its proposed electricity generation. Accordingly, it is to be assessed under the provisions of Part 3A of the *NSW Environmental Planning & Assessment Act 1979* (EP&A Act), with the Minster for Planning as the Consent Authority for the Concept Application and associated Project Applications.

URS Australia Pty Ltd (URS) was engaged by EnergyAustralia and Delta to prepare this Biodiversity Impact Assessment as part of the background studies for the Environmental Assessment (EA). The assessment addresses the relevant requirements for the EA issued by the Director-General of the NSW Department of Planning (dated 3 March 2008). The report also considers applicable Commonwealth and State environmental legislation, as well as draft guidelines for Part 3A biodiversity assessments currently applied by the NSW Department of Environment & Climate Change (DEC 2005).

- The assessment is based on research and field surveys conducted by URS in May, June and October 2007 and October 2006.

1.2 Study Area

The Marulan Site is part of the Arthursleigh property, which is located on Canyonleigh Road, Brayton, approximately 12km northeast of the village of Marulan within the Upper Lachlan local government area (LGA). Delta Electricity and EnergyAustralia own the land, which is known as Lot 2 DP 1120270.

The study area is located within the South Eastern Highlands bioregion as defined in the *Interim Biogeographic Regionalisation for Australia* (Thackway & Creswell 1995). The location of the site is illustrated in **Figure 1**.

For the purpose of the report the following definitions apply:

The Marulan Site or Site: The location proposed for the Gas Turbine Facilities, which is a portion of land surrounding the existing TransGrid Marulan Switchyard area as shown in **Figure 2a.**

Delta Facility: The portion of the Site that the Delta Facility would be located. The proposed facility pad area (or footprint) is 7.8ha. It is noted that some of the common infrastructure would be located within Delta land outside the facility footprint.

EnergyAustralia Facility: The portion of the Site that the EnergyAustralia Facility would be located. The proposed facility pad area (or footprint) is 7.8ha. It is noted that some of the common infrastructure would be located within EnergyAustralia land outside the facility footprint.

Proposed Laydown Area: The portion of the Site where the laydown area would be located. For the purposes of this report, this area is considered as a single area for the two proponents. It is noted that this entire may not be required as laydown area.

Common infrastructure: The portion of the Site where the following common infrastructure would be located:

- Access Road from Canyonleigh Road noting that the portion along the current access into the Arthursleigh property will be under an existing easement and a formed road.
- Transmission Line connection to the TransGrid Switchyard.

Section 1 Introduction

Gas Pipeline Corridor: The area between the Marulan Site and the Moomba to Sydney gas pipeline identified as a corridor as identified n **Figure 2b**. The final route of the pipeline would be defined further in a subsequent application seeking approval for that route.

Development footprint: The construction footprint for the Project comprising the Delta Facility footprint, the Energy Australia facility footprint, the Proposed Laydown Area and indicative alignments for the common infrastructure.

Study area: Includes the Site and additional areas that could potentially be affected by the proposal either directly or indirectly. Specifically the study area includes the entire Site and the Arthursleigh property including the TransGrid Site, as well as land between the Site and the Moomba-Sydney Gas Pipeline within which the proponent would construct a gas pipeline connecting to the proposed facility, as shown in **Figure 2b**.

Locality: All land within a 10 kilometre (km) radius of the Site.

Region: A bioregion, as defined in the *Interim Bioregionalisation of Australia* (Thackway & Creswell 1995). The study area is located in the South Eastern Highlands bioregion.

1.3 Site Description

The Marulan Site occupies 117.6ha of dry eucalypt woodland and grazing land adjacent to the Wollondilly River (refer to **Figure 2a**).

The topography, geology and soils of the Site are described in **Section 9** of the EA, and are summarised for completeness below.

Topography

The Site contains a number of mostly dry channel-confined drainage lines which drain directly to the Wollondilly River. Drainage lines feature moderate gully erosion through woodland and serious gully erosion through cleared pasture. The Site contains a cleared area approximately 300m wide, bordering a tree covered area which continues on high ground to the east of the Wollondilly River. The Site slopes gently west from 626m AHD to the Wollondilly River corridor at around 590m AHD.

The Gas Pipeline Corridor ranges in height from 590 m AHD to 670 m AHD and is bordered on the east by Paddy's River. Uringalla Creek also runs through the south-eastern part of the proposed Gas Pipeline Corridor. Tributaries for both of these waterways traverse the proposed Gas Pipeline Corridor.

Geology

The 1:250,000 Wollongong geological map indicates that the locality of the Site and surrounding land is underlain by granite, granodionite or porphyry of Devonian age. Observations on Site during preliminary investigations supported this general geological setting with granite rock outcrops and granite-derived soils observed along watercourses and large granite boulders on the surface in some locations.

The depth to the top of the granite bedrock was found in preliminary investigations to vary across the Site, but was generally in the range of 1.5 to 5.5 m, being shallower to the east of the Site (typically 1.5 to 2.5 m). The granite is typically medium to coarse grained, and was found to be of extremely low strength within the upper weathered profile, progressively grading to high strength with depth.

Soils

The Site and the proposed Gas Pipeline Corridor fall within the Marulan Soil Landscape (Hazelton and Tille, 1990). The soils within this landscape are dominated by colluvial processes. Mass movement is the principal agent of parent material accumulation. Cliffs, scarps, and steep slopes are dominant features in upper parts of the landscapes with undulating hills and broad benches in lower catchment areas. Alluvial processes are likely to dominate in downslope areas adjacent to the Wollondilly River.

Section 1 Introduction

Red Podzolic Soils occur on hillcrests and upper slopes, grading into Yellow Podzolic soils on the lower slopes. Gleyed Podzolic soils are found in drainage depressions (Hazelton and Tille, 1990).

The preliminary investigations encountered granite derived colluvium / slopewash and residual soils overlying granite bedrock across the investigation areas.

Climate

The study area is located within the Goulburn meteorological region and has a dry, continental climate. It experiences mean annual rainfall of 665mm, and a mean daily temperature range of 7.3 to 20.1 degrees (BOM, 2007. The region was experiencing a prolonged, severe drought at the time of the October 2006 survey, though experienced average conditions through 2007 and received rainfall in the weeks preceding the November 2007 survey.

1.4 Proposal Description

Proposed Delta Facility

The proposed plant will occupy a construction pad of approximately 7.8ha on land currently containing pasture and dry eucalypt woodland. The proposed facility footprint is in the central portion of the Site on higher ground east of the Wollondilly River (refer to **Figure 2a**). The proposed plant would be situated at an elevation of approximately 605 m AHD.

Proposed EnergyAustralia Facility

The proposed plant will occupy a construction pad of approximately 7.8ha on land currently containing pasture, remnant woodland and dry eucalypt woodland. The proposed facility footprint is in the north western corner of the Site immediately adjacent to the proposed Delta Facility (refer to **Figure 2a**). The proposed plant would be situated at an elevation of approximately 605 m AHD.

Proposed Laydown Area

A common laydown area is proposed for the construction of both facilities. It would be located in woodland immediately to the east of the facilities and would occupy an area of approximately 2.4ha.

Common infrastructure

Construction at the Marulan Site will involve the following common infrastructure:

- an Access Road connecting the facilities to Canyonleigh Road ; and
- Transmission Line connection to the TransGrid Switchyard.

The common infrastructure passes through dry eucalypt woodland, cleared pasture land, existing easements and a formed road. Construction of common infrastructure will require the clearing of approximately 13.8ha of vegetation. This estimate accounts for overlap with clearing required for the construction of other infrastructure.

Gas pipeline

The pipeline would be located to the south of the Site. A proposed corridor is shown on **Figure 2b.** The Gas Pipeline will run south from the Marulan Site to connect to the Moomba to Sydney Gas Pipeline within the corridor as shown**.** The pipeline location would be optimised as part of a separate Project Approval process. Two Gas Pipeline route options are presented on **Figure 2a** are to allow for flexibility to reach to the south of the Marulan Site.

Section 2 Legislative Framework

2.1 Environmental Planning and Assessment Act 1979

The EP&A Act forms the legal and policy platform for development assessment and approval in NSW and aims to, *inter alia*, 'encourage the proper management, development and conservation of natural and artificial resources'. The proposal is a Major Project according to *State Environmental Planning Policy (Major Projects) 2005* and as such, is to be assessed under the provisions of Part 3A of the EP&A Act, with the Minster for Planning as the Consent Authority for the Project Application.

Section 5A (s.5A) of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of a proposed development on 'threatened species, populations or ecological communities (or their habitats)' listed under the TSC Act. The so-called '7-part test' is used to determine whether a proposed development is 'likely' to impose 'a significant effect' on threatened biota and thus whether a Species Impact Statement (SIS) is required to accompany the DA. For development applications under Part 4 and 5 of the EP&A Act, if the 7-part test concludes that there is 'likely' to be 'a significant effect' on a listed species, population or EEC, a Species Impact Statement (SIS) must be prepared.

Under Part 3A of the EP&A Act, there is no requirement for s.5A of the EP&A Act to be addressed; hence there is no requirement for an SIS. However, s.5A has been addressed in the current assessment as a guide to assessing impacts on threatened biota that could be affected by the proposal. A 7- part test was carried out for those TSC Act listed species and communities recorded and/or predicted to occur at times on the Site or within adjoining areas.

2.2 Threatened Species Conservation Act 1995

The TSC Act provides legal status for biota of conservation significance in NSW. The TSC Act aims to, *inter alia,* 'conserve biological diversity and promote ecologically sustainable development'. It provides for:

- The listing of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, vulnerable species and communities listed under Schedule 2;
- The listing of 'Key Threatening Processes' (under Schedule 3);
- The preparation and implementation of Recovery Plans and Threat Abatement Plans; and
- Guidelines for the preparation of SISs.
- As discussed in Section 4, species listed under the TSC Act were recorded on the Site during the current and previous surveys. Potential impacts on these species are addressed in Section 5.

2.3 Native Vegetation Act 2003

The NSW *Native Vegetation Act 2003* (NV Act) was established to prevent broad scale clearing, protect native vegetation of high conservation significance, improve the condition of existing native vegetation and encourage the regeneration of native vegetation in NSW. Catchment Management Authorities (in this case Hawkesbury Nepean CMA), administer property vegetation plans under the NV Act.

According to s.75U(e) of the EP&A Act, an authorisation under section 12 of the NV Act to clear native vegetation or State protected land is not required for a project approved under Part 3A. Hence, the NV Act does not apply to the current proposal.

Section 2 Legislative Framework

2.4 Noxious Weeds Act 1993

Under the NSW *Noxious Weeds Act 1993* (NW Act), Council is responsible for the control of noxious weeds in its local government area (LGA). The NW Act provides for the declaration of noxious weeds by the Minister of Agriculture. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act.

2.5 State Environmental Planning Policy 44 – Koala Habitat Protection

State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44) aims to 'encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas'. SEPP 44 applies to local government areas (LGAs) listed under Schedule 1 of the Policy. The study area lies within the Upper Lachlan LGA, which is listed under Schedule 1 of SEPP 44.

SEPP 44 requires that a Koala Plan of Management be prepared for developments or LGAs where 'potential koala habitat' and 'core koala habitat' are likely to be affected by development. Under the SEPP, where potential habitat is identified, the area must be investigated for core koala habitat, defined as 'an area of land with a resident breeding population of koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population'. Where core koala habitat is present, SEPP 44 requires that a site-specific Koala Plan of Management be prepared.

2.6 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause 'a significant impact' on a 'matter of national environmental significance' undergo an assessment and approval process.

Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' may not be undertaken without prior approval from the Commonwealth Minister for the Environment.

The EPBC Act defines matters of national environmental significance (NES) as:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

The Administrative Guidelines for the EPBC Act (DEH 2006) set out criteria intended to assist in determining whether an action requires approval. In particular, the Guidelines contain criteria for determining whether a proposed action is likely to have a 'significant impact' on matters of national environmental significance (NES). In the context of this report, the matters of NES of relevance are (i) threatened species and ecological communities and (ii) migratory (bird) species.

If the proposal is likely to have a significant impact on a matter of NES, referral of the proposal to the Australian Government Environment Minister is required to confirm whether the proposal is a 'controlled action', which requires the Minister's approval under the Act

Section 3 Methodology

3.1 Literature Review

A desktop literature review was undertaken by URS to identify the representative spectrum of threatened species, populations and ecological communities listed under the TSC Act and the Commonwealth EPBC Act that could be expected to occur within the study area, based on habitats present. To this end, the following documentation was reviewed prior to the conduct of the field investigations:

- NSW NPWS Wildlife Atlas database;
- EPBC online Protected Matters Database Search tool;
- A flora and fauna study on nearby land and part of the Marulan Site by Parsons Brinkerhoff (PB 2005); and
- Additional threatened species identified by DECC as part of the Director-General's requirements for the EA.

A summary of literature review results including species status, habitat requirements, likelihood of occurrence and a comparison of flowering seasons for flora and breeding seasons for fauna with field surveys conducted is contained in **Table 1** and **Table 2**, and the database search results are attached in **Appendix A.**

3.2 Field Survey

3.2.1 Summary of Survey Effort

A summary of survey work conducted on the Site by URS staff and others is as provided in Table 3-1.

Table 3-1 Summary of Field Survey Effort

Surveyor	Survey Type	Survey Length	Dates	Season
PB	Flora and fauna	5 days	10 - 14 October 2005	Spring
URS	Initial flora and fauna	3 days	3 - 5 October 2006	Spring
URS	Additional flora and fauna	1 day	10 May 2007	Autumn
URS	Additional flora and fauna	3 days	4 - 6 June 2007	Winter
URS	Targeted fauna and opportunistic flora	3 days	22 - 24 October 2007	Spring

3.2.2 Flora

Initial flora surveys were conducted by URS field ecologists from 3 to 5 October 2006, with additional survey undertaken on 10 May 2007 and 5 and 6 June 2007, and opportunistic observations made during an additional targeted fauna survey undertaken 22 to 24 October 2007. The primary objectives of the survey were to:

- map and describe the vegetation communities occurring within the Site;
- compile a flora list of those species occurring within the vegetation communities, identifying any threatened, nationally, regionally or locally significant species and communities; and
- assess the likely impacts of the Project and provide recommendations to assist in minimising impacts to flora in the study area.

Section 3 Methodology

Survey locations were positioned to represent the variety of vegetation communities and to detect any threatened species that may be present on Site.

The botanical surveys were consistent with the *Threatened Biodiversity and Assessment; Guidelines for Developments and Activities Working Draft* (DEC 2004). All vascular taxa observed were recorded on appropriate proforma field data sheets.

Field vegetation surveys utilised air photos and design drawings loaded onto a handheld GPS unit. Survey locations were positioned such that the extent of vegetation which may be disturbed as a result of the proposal was appropriately assessed. Quadrat surveys were carried out to sample the floristics and structure of the vegetation within the site. A total of seven 20m x 20m quadrats were established and surveyed during the October 2006 field investigation. The locations of plots were captured with a hand-held GPS unit and are provided in **Figure 3.** The quadrat based survey was augmented with a random meander search (Cropper, 1993) during October 2006 and additional searches during May and June 2007 and October 2007.

Vegetation community structure was described according to the classifications of Specht & Specht (1999). Vegetation communities were defined according to the mapping units of Tindall *et al*. (2004), which maps the vegetation of the Goulburn Mulwaree local government area at a scale of 1:100,000.

Vascular plants recorded during the surveys were compiled into a floristic list provided as **Table 3**. Plant identifications were made according to nomenclature used in the National Herbarium of New South Wales. Some plant specimens which were difficult to classify (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.

Areas of weed infestation were surveyed using a Random Meander technique. The locations of any significant infestations were captured using a hand held GPS unit. Details of patch size, dominant species and severity of infestation were recorded in data tables on the GPS. Species listed under the *Noxious Weeds Act* were noted.

Conservation values of species communities mapped across the study area were determined with reference to relevant legislation including the TSC Act and the EPBC Act applicable at the time of the surveys.

3.2.3 Fauna

Preliminary fauna surveys were carried out between 3 and 5 October 2006, with additional targeted fauna surveys on 10 May 2007 and on 4 and 5 June 2007. Survey techniques were generally consistent with the DEC (2004) working draft survey guidelines and included habitat identification and assessment, diurnal bird counts, spot-lighting and stag watching, opportunistic observations of fauna species and searches for signs of fauna. Weather experienced during the surveys comprised mild to warm days (15-25 ^{o}C) and cool nights (5-10^{o}C). No rain was experienced during the October 2006, or May and June 2007 survey work.

Targeted fauna surveys were carried out from 22 to 24 October 2007, involving the above metnioend techniques, as well as ultrasonic call recording (Anabat) for microchiropteran bats, active searches for reptiles and nocturnal call playback for forest owls. The survey design was based on the likelihood of threatened species identified in the literature review occurring on Site and the initial habitat assessment. Threatened woodland birds, including the Diamond Firetail *Stagonopleura guttata*, Hooded Robin *Melanodryas cucullata cucullata* and Gang-Gang Cockatoo *Callocephalon fimbriatum* were particularly targeted at this time as it correlates with their breeding and/or peak activity periods.

The locations of trees containing hollows (stem and/or branch hollows, or hollow stags) were recorded using a hand-held GPS and subsequently mapped. GIS software was later used to calculate a mean density of hollow-bearing trees within the stands of woodland within the Site. Stag watching was conducted on hollows assessed as having the potential to shelter arboreal fauna, including mammals, bats and hollow-nesting birds. Nominated hollows were observed during dusk between 6 and 7pm by two field staff over two nights, noting any fauna emerging from hollows or nests.

Section 3 Methodology

Weather during the October 2007 surveys comprised dry, clear, warm days (16-29^{o}C) and cool nights (5-7^{o}C). Conditions during the dawn and dusk bird surveys were calm, with mild to medium easterly and north-westerly breezes (BOM, 2007). The moon was in the first quarter during the October surveys and there was no light spill from human sources. There was no traffic near to the site. Some background noise was emitted from the transmission station. Conditions through the October survey were suitable for the detection of small nocturnal fauna.

Survey effort and timing was consistent with the DEC (2004) guidelines. All observations were recorded on appropriate proforma field data sheets. The locations of fauna surveys sites are shown on **Figure 3**.

Fauna species identified in the field surveys are presented in **Table 4.** Survey techniques and effort are outlined below.

Fauna Habitat Assessment

An assessment of the quality of habitats present for both TSC/EPBC listed species was made during the field surveys. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. This technique is important in assisting in the compilation of a comprehensive list of fauna that are predicted within the vicinity of the Site, rather than relying solely on one off surveys that are subject to seasonal limitations and only represent a snapshot of assemblages present. **Table 5** presents habitat features which were assessed during field surveys and indicative threatened species that are known to utilise these features. A complete list of habitat requirements of threatened species potentially present in the study area is presented in **Table 2**.

Floristic composition and structure and the presence/absence of habitat movement corridors were also recorded.

Diurnal Bird Counts

Diurnal bird counts were undertaken on 4 and 5 October 2006, 5 and 6 June 2007 and 23 and 24 October 2007. In the October 2006 survey two 45-minute counts were undertaken at dawn in the southern portion of the Site, relevant to initial footprint locations and the southern portion of the common infrastructure routes. In the June 2007 survey two 40-minute counts were undertaken at both dusk and dawn through the proposed footprint envelope. An additional one hour diurnal count was performed through an area of grassland which represents potential foraging habitat for the threatened Diamond Firetail (*Stagonopleura guttata*). In the October 2007 survey two 40-minute counts were undertaken at both dusk and dawn through the proposed footprint envelope. Species and bird numbers were recorded by visual observation and call as well as scat and sign identification (nests, whitewash, chewed fruits, pellets etc). All data was recorded on proforma data sheets.

Active Searches

Active searches for reptiles were performed within and adjacent to the site focussing on suitable substrate. Shelter sites were carefully lifted and replaced, trunks and decorticating bark were scanned, crevices were searched, leaf litter was raked and visual scanning of vegetation for active and foraging specimens was undertaken.

Anabat Survey

Fixed Anabat recordings were undertaken on the nights of 22 and 23 October 2007, with two Anabat SD1 devices recording from one hour before dusk and until the following morning. Due to the high number of passes recorded on the Anabats a representative subset of calls was selected through the stream.

Harp Trap Survey

Four Harp Traps were left out in suitable habitat for two nights (22 and 23 October). Harp Traps were placed in fly-ways for micro-bats including drainage lines, adjacent to water bodies and at the margins of forest patches and cleared land.

Section 3 Methodology

Stag Watching

Suitable stag watching sites were identified during daytime habitat assessments and included hollow-bearing trees and roosts with white wash. Selected sites were observed on the evening of 6 June and 22 and 23 October 2007 for 30 minutes before dark and for one hour after dark.

Call Playback

Call playback was performed over two nights (22 and 23 October 2007) targeting Powerful Owl, Sooty Owl, Masked Owl and Squirrel Glider. Call playback was undertaken in accordance with DECC guidelines (DEC 2004) which included at least five minutes broadcasting and 10 minutes listening for each species per night.

Spotlighting

Spotlighting surveys were performed on the evenings of 22 and 23 October and involved walking 1km transects for one hour. Approximately two hours of additional, opportunistic spotlighting was performed each evening through the entire October 2007 survey period.

Fauna Habitat Assessment

An assessment of the quality of habitats present for native fauna was made across the entire Site. 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 URS field ecologists. This technique is important in assisting in the compilation of a comprehensive list of fauna that are predicted within the vicinity of the Site, rather than relying solely on one off 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 and photographed where appropriate.

Ground debris searches

Ground debris searches, including active searches for scats, were undertaken during the entire survey period while incidentally traversing the Site. Scats, regurgitated pellets, burrows and other traces were identified with reference to field guides (e.g. Triggs, 2004). Samples were also sent to a specialist for identification if required (B Triggs). Feeding signs, such as chewed capsules and seeds, of targeted species were also established by direct observation as appropriate.

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.

3.3 Conservation Significance

Conservation status of species and communities recorded across the study area were determined with reference to the following:

- the TSC Act for State significance; and
- the EPBC Act for national significance.

Section 3 Methodology

3.4 Gas Pipeline

The biodiversity assessment for the proposed Gas Pipeline was limited to a desktop literature review and air photo interpretation.

The literature review was undertaken by URS to identify the representative spectrum of threatened species, populations and ecological communities that could be expected to occur within the study area, based on habitats present. The following documentation was reviewed:

- NSW NPWS Wildlife Atlas database;
- EPBC online Protected Matters Database Search tool.

A summary of literature results is contained in **Table 1** and **Table 2**, and the database search results are attached in **Appendix A.** Air photo interpretation was used to identify areas of native vegetation and potentially significant habitat along the proposed route.

A detailed field assessment will be undertaken in support of the Project Application for the gas pipeline.

3.5 Survey Limitations

Flora and fauna field surveys have been conducted by URS on four occasions between 2006 and 2007. However, it is possible that some species that occur on, or utilise, the Site periodically were not detected during these surveys. These species are likely to include threatened flora species that flower after rainfall as well as annual, ephemeral or cryptic species. Some fauna species are also mobile and transient in their use of resources and it is likely that not all species (resident or transitory) that utilise were recorded during the survey period. The habitat assessment conducted for the current assessment allows for identification of habitat resources for such species. As such the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values of the Site in order to predict the potential impacts of the proposal.

However, it should be noted that two separate surveys have been conducted during spring, including October 2006 and October 2007. These surveys were conducted during the optimal time to detect most flowering threatened plants (particularly orchids). Additionally, most fauna species are active during this time.

Section 4 Results

4.1 Literature Review

4.1.1 Flora

The results of the desktop literature review indicate the potential for 24 threatened plant species listed under the EPBC Act and/or the TSC Act, which have been previously recorded within the locality. Of these species, fourteen are classified as being Vulnerable and nine as Endangered under these Acts.

A review of the specific habitat requirements of these species, and the habitat offered by the Site and its surrounds allowed a number of these species to be immediately eliminated as having no (or low) likelihood of occurrence at the Site. Those that remain as having a potential medium to high likelihood of occurrence at the Site and immediate surrounds are indicated in **Table 1**. A total of 22 of the listed species could potentially occur on the Site based on their habitat requirements and on the habitats present at the site.

Included in this list is *Diuris lanceolata* (Snake Orchid), which was recorded in the Site during the PB (2005) survey. This species was described by PB (2005) as listed as endangered under the EPBC Act at the time of the survey. However the EPBC Act Threatened Species profiles database states that the threatened population of *D. lanceolata* is restricted to Tasmania. Mainland populations formerly known as *D. lanceolata* are now considered to be a separate species *D. chryseopsis* (Bishop, 2000) and are not listed under the TSC Act or EPBC Act.

The local area surrounding the Site consists of agricultural lands that have been previously cleared and used for agricultural purposes since the times of European settlement in the area. Consequently, clearing has resulted in the removal of most of the naturally occurring vegetation, which was generally representative of dry open woodlands and grasslands.

4.1.2 Fauna

Results from fauna desktop reviews indicate the potential presence of 29 threatened species listed under the TSC Act and/or the EPBC Act that have been previously recorded within the locality. This list of threatened fauna species is presented in **Table 2**. Review of the habitat requirements of these species allows the assessment of the likelihood of occurrence at the Site. A total of 20 threatened fauna species are considered likely to occur at the Site, all of which are listed as Vulnerable.

Common species previously recorded within the vicinity of the Site (PB 2005), including the Common Brushtail Possum (*Trichosurus vulpecular*), Eastern Grey Kangaroo (*Macropus rufus*), Common Wallaroo (*Macropus robustus*) and a variety of generalist and woodland species of bird.

The TSC Act listed Powerful Owl (*Ninox strenua*) was recorded by call identification within 3km of the Marulan Site. Three microchiropteran bat species ('micro-bats') listed as Vulnerable under the TSC Act were recorded by ultrasonic call location during the PB (2005) survey. The Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Little Bent-wing Bat (*Miniopterus australis*) were recorded within 5km of the Marulan Site, whereas the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) was recorded on the Marulan Site (**Figure 5**). A *7*-Part Test for these threatened micro-bats is included in **Appendix B**.

4.2 Field Survey

4.2.1 Flora Species

A total of 91 flora species have been recorded on the Site (**Table 3**). None of these species is listed as threatened under either the TSC Act or EPBC Act. *Diuris chryseopsis* (Syn *D. lanceolata*) was observed but is not listed under the TSC Act or EPBC Act as discussed above.

Section 4 Results

Plate 4-1. *Diuris chryseopsis syn. D. lanceolata.*

4.2.2 Vegetation Communities

The following vegetation communities were identified on the Site and are presented on **Figure 4**.

Tableland Hills Grassy Woodland

Woodland vegetation occurs on the elevated slopes above the Wollondilly River and occupies approximately 62.9ha of the Site. There is a well developed canopy layer and a dense groundcover layer consisting of native and exotic grasses and herbs. The shrub layer is sparse to absent. Canopy tree species include *Eucalyptus cinerea, E. rossii* and *E. eugenioides.* This structure and suite of species is characteristic of the Tableland Hills Grassy Woodland community of Tindall *et al.* (2004). In most areas the eucalypt species were co-dominant however *E. cinerea* dominated the woodland in the northern portion of the Site.

The groundcover features exotic pasture species and herbs mixed with a reasonable diversity of native grasses, including *Themeda australis, Aristida vagans*, and *Austrostipa scabra* subsp. *scabra*, and herbs including *Ajuga australis*, *Geranium* spp. and *Crassula sieberiana*. The noxious pasture weed *Nasella trichotoma* (Serrated Tussock) is present, but in lower concentrations than in other communities on Site.

Section 4 Results

Plate 4-2. Tableland Hills Grassy Woodland.

There are also isolated stands of *E. rossii* and *E. cinerea* within areas of cleared open grassland. Given their position in the landscape and the eucalypt canopy species present, the vegetation is most likely a modified form of Tableland Hills Grassy Woodland (**Figure 4)**). Shrubs were absent and the understorey was dominated by exotic pasture species and weeds, especially Serrated Tussock.

Tableland Hills Grassy Woodland does not form part of the Box-Gum Woodland EEC. The key reasons supporting this position are as follows:

- The key characteristic canopy species of Box-Gum Woodland are white box *Eucalyptus albens*, yellow box *E. melliodora* and Blakely's gum *E. blakelyi*. These species are not present within the Tableland Hills Grassy Woodland community. One exception is the presence of a small number of scattered individuals of Blakely's gum in one part of the site. However, this species also occurs in several other vegetation communities and its presence alone does not indicate a Box-Gum vegetation type.
- The canopy species recorded within the Tableland Hills Grassy Woodland community (*Eucalyptus cinerea, E. rossii* and *E. eugenioides*) are not listed as 'characteristic' species under the definition of Box-Gum Woodland in the *Final Determination* of the NSW Scientific Committee (2004).
- The Box-Gum Woodland *Identification Guidelines* (NPWS, undated) states that 'Whether the characteristic trees of the site are (or are likely to have been) White Box, Yellow Box or Blakely's Red Gum'. As noted above, these species are not the characteristic species of the site, and further, even if the woodland vegetation on the site was argued to be a degraded form of the EEC, the site would not be likely to regenerate over time (with or without management actions) to include these species.
- Reference to the most recent publicly available regional vegetation mapping and report (Tindall *et al.* 2004) indicates that Tableland Hills Grassy Woodland is not part of the Box-Gum Woodland association.

Section 4 Results

Cleared grassland

Cleared grassland occupies approximately 51.4ha of the Site. These areas have been extensively modified by clearing, the introduction of pasture species and subsequent grazing. Patches of native grasses occur, including *Themeda australis* and *Aristida vagans* however these are dominated by exotic pasture species, including Kikuyu *Pennisetum clandestinum*, and the noxious weed *Nasella trichotoma*. This community contains some native groundcover species, including the herbs *Poranthera microphylla, Cheilanthes distans* and *Oxalis perennans*, although these are less abundant than herbaceous weeds such as *Plantago lanceolata* and *Hypochaeris radicata.*

Natural Temperate Grasslands of the Southern Highlands is an endangered ecological community (EEC) listed under both the TSC Act and the EPBC Act. This community has previously been recorded within the locality of the study area (DEH, 2005) and may occur as small pockets amongst Non-native/Non-vegetated areas (Tindall *et al*, 2004). No areas of this EEC were identified on the site during field surveys.

An area of open grassland to the south of the proposed Marulan Site contains a greater diversity and abundance of native species than other areas. Species recorded include the orchid *Diuris chryseopsis*, as well as the native herbs *Drosera peltata, Haloragis heterophylla* and *Hydocotile laxifloa*, grasses *Aristida vagans* and *Themeda australis* and sedges *Juncus australis* and *Luzula flaccida.* Many of these species are shared with Natural Temperate Grasslands EEC; however the position of this area in the landscape and presence of scattered trees suggests that this vegetation is instead a modified form of Tableland Hills Grassy Woodland.

Plate 4-3. Cleared grassland with pasture grasses and Serrated Tussock infestation.

Section 4 Results

Riverbank Forest

There is a narrow strip of vegetation along both sides of the Wollondilly River for several kilometres of its length in the vicinity of the Site. In the northern portion of the study area the River features broad (50-100m wide) banks within steep levee banks rising to the surrounding cleared farmland. There is a monotypic canopy of River Oak *Casuarina cunninghamiana*, with an understorey of herbs and grasses. No shrub layer is present apart from clumps of Blackberry (*Rubus fruticosa* sp. agg.). The understorey contains the exotic grasses Serrated Tussock and Kikuyu, the native grass Couch (*Cynodon dactylon)*, native herbs including *Dichondra repens* and *Poranthera microphylla* and exotic pasture weeds including *Sonchus* spp*.* (see **Figure 3**). The floristics of the community, along with its geomorphic position and understorey species, most closely align with the Riverbank Forest of Tindall *et al.* (2004).

Within the river channel the exotic weed Willow *Salix* spp*.* occurred as clumps of trees. *Triglochin procerum* was the most common emergent aquatic plant. Other aquatic species included *Ranunculus inundatus, Baumea* sp. and water lilies (Family Menyanthaceae).

Through the central and southern portion of the study area steep levee banks adjoin the river and support a narrower strip of vegetation. This consists of isolated River Oak and a dense small tree-shrub layer dominated by the exotics Blackberry, Hawthorn (*Crateagus monogyna*) and Willows (*Salix* spp.). The dense understorey featured native and exotic grasses and herbs and dense cover of *Pteridium esculentum* (Bracken). This community is too small in area and too modified to be defined as a specific vegetation community (Tindall, 2004).

Plate 4-4. Riverbank Forest, adjacent to Wollondilly River.

Snow Gum Woodland

There is a small area of Snow Gum *E. pauciflora* woodland located outside the site boundary, near the eastern end of the proposed transmission line. It features a moderately dense canopy and a dense grassy understorey dominated by serrated Tussock.

Section 4 Results

The floristics and structure of the vegetation align most closely with the Tableland Grassy Box-Gum Woodland community of Tindall *et al* (2004). This community does not qualify as the Box-gum Woodland EEC, as the Final Determination for this EEC specifically excludes Snow Gum woodland, stating that 'the *Eucalyptus pauciflora* grassy woodlands of the cooler parts of the southern tablelands are not covered by this Determination' (NSW Scientific Committee, 2002).

4.2.3 Fauna Species

A total of 86 fauna species have been recorded on the Site, including six species of frog, 57 species of bird, one reptile and 22 native mammals (including 11 micro-bats) have been recorded on the Site. These species are listed in **Table 4,** the majority of which are common and widespread. Of the total suite of species recorded, five are listed as threatened species under Schedule 2 of the TSC Act, including the Diamond Firetail (*Stagonopleura guttata*), Gang-gang Cockatoo (*Callocephalon fimbriatum*), Hooded Robin (*Melanodryas cucullata*), Eastern Falsistrelle (*Falsistrellus tasmaniensis*) and Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*). These species were all recorded in woodland habitats within the central to northern parts of the Site.

The bird species recorded include diurnal woodland, open country and wetland bird species. One nocturnal species, the Southern Boobook Owl was observed by call recognition. One exotic species, the Indian Mynah, was recorded.

Over 70% of temperate woodland in NSW has been cleared and many woodland bird species are considered to be declining (Ried, 1999). Accordingly the suite of woodland bird species are of conservation significance even though individual species recorded are not listed under the TSC Act or EPBC Act. The Reid (1999) report into *Threatened and Declining Birds in the NSW Sheep Wheat Belt* identified 20 bird species as declining and at risk. The present study area is outside of the study area range; however the conservation status of the bird species is considered to be similar. Declining woodland bird species observed include the Rufous Whistler, Jacky Winter, Varied Sitella, Chestnut-rumped Thornbill and Dusky Woodswallow.

Wetland bird species were observed in the Wollondilly River, Riparian Vegetation and on farm dams in the Site including the common species Little Pied Cormorant, Wood Duck, Eurasian Coot and Chestnut Teal.

A total of 22 native mammals have been recorded on the Site. These include Water Rat (*Hydromys chrysogaster*), Sugar Glider *(Petaurus breviceps)*, Common Wombat *(Vombatus ursinus)*, Eastern Grey Kangaroo *(Macropus giganteus)*, Red-necked Wallaby *(Macropus rufogriseus)* and 11 species of micro bats including Lesser Long-eared Bat (*Nyctophilus geoffroyi*), Gould's Wattled Bat (*Chalinolobus gouldii*) and Little Forest Bat (*Vespadelus vulturnus*). Eastern Grey Kangaroos and Common Wombat were observed directly throughout the Site, during all surveys. Red-necked Wallaby was recorded by scat identification. A Water Rat was observed opportunistically in the Wollondilly River, east of the proposed Plant Site. A Sugar Glider was recorded by call identification in woodland during the June 2006 survey. The Site is currently used for grazing cattle. A number of European Rabbits were physically observed across the site. Scats of the Dog and Red Fox were also observed across the property.

No fauna were observed utilising tree hollows targeted during the stag watching surveys.

One unidentified reptile species was observed.

Six species of amphibian were observed by sight or call identification. *Crinea signifera* (Common Eastern Froglet), *Litoria peronii* (Peron's Tree Frog) and *Limnodynastes dumerilli* (Eastern Banjo Frog) were heard in the vicinity of the Wollondilly River. The Common Eastern Froglet, Peron's Tree Frog, *Limnodynastes tasmaniensis* (Spotted Marsh Frog), *Litoria ewingii* (Brown Tree Frog) and *Uperoloeia laevigata* (Smooth Toadlet) were seen and heard in the vicinity of Dam 1, shown on **Figure 6**. No threatened frog species were recorded during the surveys.

Section 4 Results

4.2.4 Fauna Habitats

- Habitat features considered in assigning the quality of habitat at the Site were:
- native diversity in ground flora;
- presence and quantity of litter layer and fallen dead timber;
- level of shelter, breeding, roosting and nesting resources available;
- presence of trunk hollows and quantity of mature hollow bearing trees;
- fauna movement corridors;
- position in the landform, connectivity or value as a habitat corridor;
- presence of rocky outcrops or scattered partially buried rocks;
- presence, size and ecological integrity of remnant communities; and
- structural and floristic diversity of vegetation layers, particularly presence or absence of midcanopy vegetation in areas of remnant vegetation (shrubs and regenerating eucalypts).
- This last habitat characteristic is of particular significance for woodland birds, including threatened species known to occur in the local area.

Figure 5 maps the significant habitat features on Site based on the above criteria. The habitat value of vegetation communities and other landscape features are assessed below:

Woodland and Habitat Trees

Tableland Hills Grassy Woodland in the area consisted of a well developed canopy layer and a patchy to dense groundcover layer consisting of native and exotic grasses and herbs. The shrub layer was sparse to absent. Dominant eucalypt species included *Eucalyptus cinerea, E. rossii* and *E. eugenioides.* This structure and suite of species is characteristic of Tableland Hills Grassy Woodland (Tindall *et al*. 2004). In some areas (Q1, Q2, Q4, Q7) the eucalyptus species were co-dominant however *E. cinerea* dominated the woodland in the northern portion of the Site (Q3, Q5).

The absence of a shrub layer is likely to limit the habitat value of this community for some woodland bird species. The common shrub layer foragers Superb Blue Wren and Red Browed Firetail were observed opportunistically in Wollondilly River Riparian Vegetation (see below) but were not recorded in the woodland targeted bird surveys. This may suggest that woodland on the Site does not provide suitable habitat for this guild of species (Keast *et al*, 1985).

The groundcover featured exotic pasture species and herbs mixed with a reasonable diversity of native grasses and herbs. Native grasses and herbs are an important food source for many native species, but are reduced in many woodlands and grasslands in NSW by grazing. The woodland on the Site is likely to provide good quality foraging habitat for ground layer foragers including the threatened species such as the Diamond Firetail.

Mature eucalyptus throughout the woodland provide foraging habitat for native birds and arboreal mammals. The TSC Act listed Gang-gang Cockatoo was observed feeding on *Eucalyptus eugenioides* fruits in the May and June 2007 surveys. Up to four adult birds were observed repeatedly through the northern portion of the Site. Evidence of feeding (chewed fruits) was observed throughout Tableland Hills Grassy Woodland on Site. This suggests that the species was targeting this food resource and that woodland in the study area is significant habitat for the species.

Section 4 Results

The Tableland Hills Grassy Woodland contained fibrous barked trees (*E. cinerea, E. eugenioides*) which provide habitat for the TSC Act listed Brown Treecreeper. Other bark-foraging species, including the White Throated Treecreeper and Varied Sitella, were observed during the October 2006 and June 2007 surveys.

The woodland provides suitable breeding habitat for bird species. Four nests were observed during the October 2006 surveys, belonging to the Spotted Pardalote, Yellow Faced Honeyeater, Jacky Winter and Dusky Woodswallow. The absence of a shrub-small tree layer in this community may limit the number of species for which suitable breeding habitat is present. Suitable resources are present for canopy nesters (including the Jacky Winter observed), trunk nesters (including the Dusky Woodswallow observed) or earth bank nesters (including the Spotted Pardalote observed) (Simpson and Day, 1993; Keast *et al*, 1985). However there are very limited opportunities for species which require dense undergrowth for nesting, including the TSC Act listed Diamond Firetail.

A number of standing and fallen hollow bearing trees were recorded throughout the Tableland Hills Grassy Woodland (**Figure 5, Plate 4-4**). The mean density of hollows within the woodland habitat is approximately 3.6 hollows per hectare. These may provide roosting or nesting habitat for the Gang-gang Cockatoo, native parrot species including the Superb Parrot, arboreal mammals and micro-bat species. Four threatened micro-bats have been recorded in the vicinity of the study area, and may utilise these hollows as diurnal roosts. A number of stags (large, dead trees with hollow trunks and/or limbs) are also present on the Site, as shown in **Figure 5 and Plates 4-6, 4-7**. A Wedge-tailed Eagle was observed roosting in a stag adjacent to the Wollondilly River. No white wash or regurgitated pellets were detected beneath stags through the remainder of the Site.

There were large amounts of intact fallen timber and intact leaf litter throughout the woodland (**Plates 4-8, 4-9**). These are likely to support a healthy and diverse invertebrate assemblage, which in turn provides good quality foraging habit for birds, reptiles and mammals. The position of large, hollow bearing fallen timber was recorded and is presented on **Figure 5.** These are likely to provide shelter for native reptiles and mammals. No rock outcrop was observed in the woodland.

Plate 4-5. Hollow-bearing tree in Tableland Hills Grassy Woodland.

Section 4 Results

Plate 4-6. Hollow-bearing trees and stags.

Plate 4-7. Stag with large, deep branch hollows.

Section 4 Results

Plate 4-8. Tableland Hills Grassy Woodland with good quality habitat in fallen timber and leaf litter.

Plate 4-9. Tableland Hills Grassy Woodland with hollow-bearing fallen timber.

Section 4 Results

The stands of modified grassy woodland feature a highly disturbed understorey with little intact leaf litter and small amounts of fallen timber. The habitat value of these areas for small woodland birds, reptiles and native mammals is likely to be much lower than intact areas of grassy woodland. However these areas contain large isolated paddock trees, including trees with hollows. These may provide significant habitat for native parrots, woodland birds, arboreal mammals and micro bats. Hollow-bearing trees may provide highly significant roosting habitat when located in extensively cleared landscapes. In this context it is unlikely that they play this role considering the availability hollow-bearing trees in intact woodland and forest habitat in close proximity.

Cleared grassland

Areas of cleared grassland on Site are likely to provide moderate foraging habit for native mammals particularly given the shelter provided by adjacent woodland and riparian vegetation. However the moderate to severe Serrated Tussock infestation across the Site limits its value as Serrated Tussock is poor quality feed. The habitat value of this area for native species is likely to increase if cattle are excluded from the Site as this may favour the regeneration of native herbs and grasses.

Cleared areas contained isolated hollow-bearing paddock trees and stags (**Figure 5**, **Plate 4-5**). These are likely to contain habitat for birds, and potentially for micro bats but may have less value than equivalent habitat located within vegetated areas on Site. Cleared grassland areas are most likely to favour generalist open country bird species, which are typically common.

Serrated Tussock forms thick tussocks and resists grazing by cattle, so may provide shelter for native invertebrates, reptiles and small mammals. Granitic rock outcrops occur in the south and western portions of the Site (**Figure 5**). These have weathered to form a diverse substrate of boulders and platey fragments which would provide quality shelter greatly increasing the habitat value of grassland in this area.

Clumps of the exotic weeds Blackberry and Hawthorn provide limited areas of shelter, foraging and breeding habitat for woodland bird species, including the Chestnut-rumped Thornbill which was observed nesting (**Figure 5**).

Woodland margins in the southern portion of the Site feature a greater diversity of native grasses and herbs than found elsewhere in this community (**Plate 4.10)**. This may increase the value of these areas as habitat for native fauna assemblages, including the TSC Act listed Diamond Firetail, which selectivelyforages on native grass species.

Plate 4-10. Cleared grassland with a moderate diversity of native plant species.

Section 4 Results

Riverbank Forest

The Riverbank Forest in the northern portion of the riparian zone occupies a broad area on the river banks. This area may provide significant grazing habitat for large native mammals due to the presence of shelter, water and comparatively succulent grass species including Cooch and Kikuyu. The shrub layer was absent apart from clumps of Blackberry (*Rubus fruticosa)*. This community may provide foraging habitat for the threatened species the Gang-gang Cockatoo (*Callocephalon fimbriatum*) and Glossy Black Cockatoo (*Calyptorhynchus lathami*). The Glossy Black Cockatoo is less likely as it typically favours larger-fruited, forest and woodland Casuarinaceae species including *Allocasuarina torulosa* and *A. littoralis*.

Through the central and southern portion of the riparian zone steep levee banks adjoin the river and support a narrower strip of vegetation. The dense small tree-shrub layer in this area provides provide shelter for species which utilise adjacent areas of grassland and woodland for foraging. The presence of shelter makes this area better foraging habitat than the Tableland Hills Grassy Woodland. Opportunistic sampling during random meanders through this area recorded large numbers and diversity of bird species. These included the guild 'shrub layer foragers' (Keast *et al*, 1985), such as the Superb Blue Wren and Red Browed Firetail, which were largely absent from the woodland. Dense vegetation within this community provides quality foraging and breeding habitat for declining woodland birds and may support threatened bird species.

The strip of Riparian vegetation is significant in a regional context due to the connectivity that it provides between other patches of native vegetation along the Wollondilly River.

Snow Gum Woodland

Snow Gum *Eucalyptus pauciflora* woodland outside the southern edge of the Site features a moderate to dense canopy cover which would provide shelter and foraging habitat for native birds and possibly micro bats. The small size of the patch and absence of a shrubby understorey probably limit its habitat value for declining woodland birds and other threatened species. It is likely to favour common generalist species.

The ground layer was sparse and lacking in leaf litter, rock outcrop and dead wood which may limit its value as habitat for native invertebrates, reptiles and small mammals.

Aquatic

There are three dams located on the Site: two small dams within the woodland close to the proposed access road (**Plate 4-11**) and a larger dam downslope from the substation. There are drainage lines downslope of both dams which were dry at the time of the surveys (**Plate 4-12**). Both watercourses appear to only carry water immediately after rainfall events and are unlikely to provide significant aquatic habitat. The dams provide significant habitat for wetland birds but are unlikely to support the threatened Blue-billed Duck or Australian painted Snipe due to their limited size and absence of fringing vegetation. The dams may provide habitat for many frog species due to the presence of macrophytes and natural vegetation in the surrounding area. However they may not contain specific habitat requirements for the Giant Burrowing Frog, Littlejohns Tree Frog or other threatened frog species (refer **Table 2**).

The locations of significant areas of habitat were recorded with a handheld GPS unit and are presented in **Figure 5**.

Section 4 Results

Plate 4-12. Dam in woodland adjacent to the Site footprint and access road.

Plate 4-11. Drainage line through woodland within the Site.

Section 4 Results

4.3 Gas Pipeline

From aerial photo interpretation (API), the Study Area surrounding the proposed easement consists of agricultural lands that have been previously cleared and used for agricultural purposes since the times of European settlement in the area. Consequently, clearing has resulted in the removal of most of the naturally occurring vegetation. **Figure 2b** illustrates identified area of vegetation along the proposed gas pipeline. A detailed field assessment will be undertaken in support of the Project Application for the gas pipeline002E.

Section 5 Impact Assessment

5.1 Construction impacts

The proposed works involves the construction and operation of two separate facilities and associated common infrastructure at the Site. Construction within the Project footprint will require the clearing of native vegetation and fauna habitats. The proposed **Construction Footprint** would comprise:

- **Delta Facility:** The construction footprint for the proposed Delta Facility including the facility pad area. Vegetation that would be cleared for the proposed Energy Australia Facility and Laydown Area was excluded from calculations.
- **Energy Australia Facility:** The construction footprint for the proposed Energy Australia Facility including the facility pad area. Vegetation that would be cleared for the proposed Delta Facility and Laydown Area was excluded from calculations.
- **Proposed Laydown Area:** The laydown area required for the construction of both facilities.
- **Common infrastructure:** The proposed access road from Canyonleigh Road and the Transmission Line connection to the high voltage Switchyard. It is assumed that the entire 70m easement for these connections will be cleared (although this is unlikely to be required). Vegetation that would be cleared for the proposed facilities and Laydown Area was excluded from calculations.
- Upgrade works to the existing road network will be determined at the detailed design stage. Accordingly, the amount of vegetation clearing, if any, will be determined at this point. The works will be designed to to minimise the removal of trees and potential habitat.

The areas calculated for vegetation clearance are based on the assumption that no additional clearing outside of the Facility boundary will be required to achieve an Asset Protection Zone (APZ). As discussed in the Bush Fire Hazard Assessment (refer **Chapter 16** of the EA), it is likely that the minimum required APZ can be achieved within the Facility boundary.

The estimated areas of vegetation clearing associated with each component of the Project are presented in **Table 5-1**. The extent of vegetation clearing quoted for the 'Construction Footprint' in **Table 5-1** has been calculated using the combined construction footprint for all components of the Project at the Marulan Site. Clearing for the construction footprint is used to assess impacts in this Section and in the 7-part tests (**Appendix B**).

Section 5 Impact Assessment

Table 5-1 Vegetation Clearing, Offset and Retention Areas

Area	Tableland Hills Grassy Woodland (ha)	Riverbank Forest (ha)	Cleared Grassland (ha)	Subtotal
Delta Facility	5.6	0	2.2	7.8
EnergyAustralia Facility	2.2	0	5.6	7.8
Laydown Area	4.3	0	0.0	4.3
Common Infrastructure	9.6	0	4.7	14.3
Construction Footprint (Sum)[1]	***21.7[1]***	***0***	***12.5***	***34.2***
Biodiversity Offset Area	***32.3[2]***	***0***	***6.8[3]***	***39.1***
Other Retained Vegetation	8.9	6.2	32.1	47.2
Total Area within Site[1]	**62.9[1]**	**6.2**	**51.4**	**120.4[1]**

Notes:

1 Includes approximately 2.6ha of Cleared Grassland within the proposed transmission line easement within the TransGrid site.

2 Comprises 29.9ha within the Woodland Offset Area and 2.4ha within the Riparian Rehabilitation Area.

3 Comprises 0.2ha within the Woodland Offset Area and 6.6ha within the Riparian Rehabilitation Area.

5.1.1 Flora

Development at the Marulan Site will require the clearing of approximately 34.2ha of vegetation, comprising 21.7ha of Tableland Hills Grassy Woodland and 12.5ha of Cleared Grassland (Table 5-1). There is approximately 62.9ha of this community present within the Site. Approximately 32.3ha (51%) of the woodland will be permanently conserved within the proposed biodiversity offset area (refer Section 6), with scattered patches of woodland totalling 8.9ha (14%) to be retained elsewhere on the Site (Table 5-1). Tindall *et al.* (2004) estimate that approximately 18,800ha of Tableland Hills Grassy Woodland remains in south-eastern NSW. This community is not currently listed as threatened and no threatened flora species were recorded within the community.

Approximately 12.5ha of cleared grassland will be removed during construction (**Table 5-1**), with 6.8ha to be conserved in the offset area and 32.1ha to remain elsewhere on the Site. No stands of Riverbank Forest will be affected by construction, with around 6.2ha to remain along the Wollondilly River.

The area traversed by the proposed gas pipeline and transmission lines is dominated by exotic pasture and weed species, with limited diversity and abundance of native species. The proposal is unlikely to have a significant impact on native flora through these areas.

5.1.2 Fauna

Clearing of woodland habitat will result in the loss of nesting, roosting and foraging resources for native fauna. The Project footprint contains a number of habitat features including feed trees, hollow bearing trees, standing and fallen dead timber, and a good coverage of leaf litter and woody debris. Approximately 65% of the mapped area of this habitat, and associated habitat values, will be retained within the Site. The habitat values of the vegetation surrounding the site are likely to be equivalent to those within the site and as such the loss of habitat associated with construction is unlikely to have a significant impact upon local populations of native fauna.

[1] Includes approximately 2.6ha of Cleared Grassland within the proposed transmission line easement within the TransGrid site.

Section 5 Impact Assessment

Clearing of woodland at the Site is unlikely to result in significant isolation or fragmentation of habitat. The position of the proposed Facilities is such that contiguity of woodland is maintained in areas adjoining the proposed facility. There will be some fragmentation of remaining woodland to the south caused by the proposed access road, gas pipeline and transmission line (**Figure 5**). The gaps created by this common infrastructure are likely to have a minor impact upon the movement of native fauna due to the relatively small nature of the disturbance (<20m). In addition woodland on the Site is already highly fragmented by existing infrastructure including the TransGrid switchyard, access tracks and transmission line easements.

Approximately 12.5ha of cleared grassland will be removed during construction of the Project (**Table 5-1**). Habitat values in cleared areas are low and so the construction of the proposed transmission line and gas pipeline within the Site is likely to have negligible impact on ecological values. If possible the route of these easements should avoid areas of higher habitat value such as remnant woodland, water bodies, paddock trees and rock outcrop identified in **Figure 5**. The indicative alignment of the access road and Gas Pipeline Route 2 intersects with Dam 1. The final alignment of this infrastructure should avoid Dam 1, as it contains important habitat for native frogs and other fauna. There is ample room within the proposed infrastructure easements to avoid the dam and appropriate erosion controls should ensure no secondary impacts on aquatic habitat in the vicinity.

5.1.3 Threatened Species

Eight threatened species listed as Vulnerable under the TSC Act have either been recorded or are considered likely to occur at the Site. The Diamond Firetail (*Stagonopleura guttata*) was recorded within Tableland Hills Grassy Woodland during the URS October 2006 and June 2007 surveys and the Gang-gang Cockatoo (*Callocephalon fimbriatum*) was recorded in the URS May and June 2007 surveys. The Hooded Robin (*Melanodryas cucullata cucullata*) and two threatened species of micro-bat, Eastern Falsistrelle (*Falsistrellus tasmaniensis*) and Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*), were recorded during the October 2007 survey. The Greater Broad-nosed Bat (*Scoteanax rueppellii*), Eastern Bent-wing Bat and Little Bent-wing Bat (*Miniopterus australis*) have previously been recorded in the immediate vicinity of the Site. The Powerful Owl (*Ninox strenua*) was recorded approximately 5 km from the Site and may also occur at the Site (PB, 2005). Clearing of Tableland Hills Grassy Woodland within the Proposed Footprint Envelope will remove foraging habitat for these species. Accordingly, assessments pursuant to Section 5A of the EP&A Act (the so-called '7-Part Test') for these species were undertaken and are included as **Appendix B**. The results of these tests are summarised below:

- It is possible that the Site supports a 'viable local population' of the Gang-gang Cockatoo which may occur on a temporary or seasonal basis as part of annual migrations and depending on the seasonal availability of food resources. Impacts associated with the proposal are likely to be limited to the loss of potential foraging, roosting and breeding resources. Accordingly the proposed works are not likely to have 'an adverse effect on the life cycle' of these species such that local populations of these species would be placed 'at risk of extinction'. Substantial areas of equivalent grade habitat are available in the local area, including woodland within the Site that will not be impacted by the proposal. Therefore the habitat to be impacted is probably of minor importance to the long-term survival of the species in the locality.
- The Diamond Firetail is likely to use foraging resources present on Site, but the absence of a dense, shrubby understorey on the Site means that it is unlikely to comprise breeding habitat. Impacts on the species are likely to be limited to the removal of foraging habitat. Accordingly the proposed works are not likely to have 'an adverse effect on the life cycle' of these species such that local populations of these species would be placed 'at risk of extinction'. The proposal will probably constitute a minor impact on the foraging resources available to the Diamond Firetail in this locality as bird species are mobile and will travel to utilise suitable habitats. Significant areas of equivalent grade habitat are available in the local area, including extant woodland within the Site that will not be impacted by the proposal. Therefore the habitat to be impacted is probably of minor importance to the long-term survival of the species in the locality.

- the Site could theoretically support a 'viable local population' of the Hooded Robin, although there is insufficient evidence to support this theory at present. This population may occur on a temporary or seasonal basis during season expansion of a breeding pair's home range or may support breeding pairs during some seasons. The proposed works will not disturb known nesting or roosting sites for individuals, breeding pairs, or local populations of these species. Impacts associated with the proposal are likely to be limited to the loss of potential foraging, roosting and breeding resources. Substantial areas of equivalent grade habitat are available in the local area, including woodland within the Site that will not be affected by the proposal. Therefore the habitat to be impacted is probably of minor importance to the long-term survival of the species in the locality. Accordingly the proposed works are not likely to have 'an adverse effect on the life cycle' of these species such that local populations of these species would be placed 'at risk of extinction'.

- The Powerful Owl may utilise foraging habitat in woodland and forest communities across the Site and suitable roosting habitat is present in the tall, dense *Casuarina cunninghamiana* Riverbank Forest where the proposed transmission line crosses the Wollondilly River. No suitable Powerful Owl nesting trees were observed and so there is probably not suitable breeding habitat in the locality The Powerful Owl occupies large (of 400-1450 ha) home ranges and so the loss of foraging habitat and other impacts associated with the Project are likely to be minor. Accordingly the proposed works are not likely to have 'an adverse effect on the life cycle' of these species such that local populations of these species would be placed 'at risk of extinction'.

- four threatened micro-bat species, the Eastern Falsistrelle, Greater Broad-nosed Bat, Eastern Bent-wing Bat and Little Bent-wing Bat were recorded on or within the vicinity of the Site and are likely to utilise foraging habitat in the study area. Potentially suitable diurnal roost sites are present within hollow-bearing trees present throughout the woodland habitats within the Site. The removal or fragmentation of habitat will have a minor impact on the foraging resources available to these species as they are mobile and can travel to utilise suitable habitats. Significant areas of equivalent grade habitat are available in the local area, including extant woodland within the Site that will not be impacted by the proposal. These areas are likely to contain equivalent quantities of suitable hollow-bearing trees and other resources. Therefore the habitat to be impacted is probably of minor importance to the long-term survival of the species in the locality.

Mitigating factors considered in determining the significance of potential impacts on the threatened biota listed above included: the limited area of habitat to be affected, the retention of adjacent habitat within the Site, degradation of the site by weed species and grazing and availability of suitable habitat in the surrounding area. Tree-hollow salvage and fauna monitoring and rescue (see **Section 6**) are also recommended to minimise impacts on hollow-dwelling fauna within the development footprint.

Based on the factors summarised above (and described in detail in **Appendix B**), the proposed works are not 'likely' to impose a 'significant effect' on any 'threatened species, populations or ecological communities' listed under the TSC Act.

5.2 Operational Impacts

The Project involves the construction and operation of two Facilities at the Marulan Site. For the purpose of this assessment the two Facilities have been assumed to be constructed on similar sized pads and have similar operational impacts.

5.2.1 Sediments and runoff

The Wollondilly River and associated riparian vegetation lie in close proximity and downslope of the development footprint. The CEMP should include safeguards and mitigation measures to minimise potential impacts from additional runoff, erosion and transported sediments (**Section 6.7**). Provided erosion and sediment controls and other mitigation measures outlined in the CEMP are followed then the proposal is unlikely to result in significant impacts on these areas.

It is recommended that during its operational phase the proposed facilities operate as zero-discharge Sites.

Section 5 Impact Assessment

5.2.2 Artificial lighting

Night-time security or operational lighting can potentially discourage habitat use where diffuse light penetrates into adjoining areas of vegetation. Nocturnal foraging regimes could be disrupted and may advantage predators such as cats, dogs and foxes as they are not strictly nocturnal foragers. Nocturnal species' (such as owls, gliders and possums) eyesight is hindered by bright lights, and where they are affected by this, they become more susceptible to predation.

Construction would only occur during daylight hours and so it unlikely that large floodlights would be required during the construction phase. It is likely that some lighting may be required for emergencies, maintenance or security. It is recommended that this lighting should be designed as 'down lights' and not spill outside the area directly disturbed by the development footprint.

5.2.3 Roads and access

Site access to the Marulan site would be via Canyonleigh Road. Internal roads would be constructed on the site to facilitate the movement of construction and operation traffic to the proposed facility. Predicted traffic volumes during the construction phase are presented in the **EA Chapter 10**.

This may increase the risk of vehicle collisions with fauna utilising habitats along the entrance road and Canyonleigh Road. Collisions within this area are unlikely as ongoing disturbance from construction activities are likely to discourage fauna from using this area. Construction would only occur during daylight hours and so vehicle collisions with macro- fauna are unlikely to correspond to travel periods for species present in the area. Large native animals at risk of collision are predominantly nocturnal or crepuscular (most active at dawn and dusk).

During the operational phase, staff levels will be low and will result in a minor increase in the risk of collisions. It is recommended that a maximum vehicle speed be set in the OEMP to minimise the risk of fauna collisions.

5.3 Gas Pipeline

A detailed flora and fauna assessment will be undertaken in support of a separate Project Application for the gas pipeline. The design of the alignment will aim to avoid areas of high conservation value.

5.4 EPBC Act Matters

No threatened species, ecological communities, migratory birds or other matters of national environmental significance listed under the EPBC Act were recorded during the field surveys on the Site.

One particular consideration is the potential presence of 'White box – yellow box – Blakely's gum woodland and derived native grassland' (referred to informally as 'Box-gum woodland and derived native grassland'), which is listed under the EPBC Act as an endangered community and thus is a 'matter of national environmental significance'. Review of the relevant Commonwealth guidelines and policy statements (DEH 2006) indicates that the vegetation on the Site does not meet the definition for this nationally listed EEC. Importantly, the guideline states that 'Sites dominated by other tree species that do not have White Box, Yellow Box or Blakely's Red Gum as co-dominants are not considered to be part of the ecological community…'. Even if, as is common for agricultural properties of the region, the vegetation on the site was previously or historically disturbed by grazing, clearing, shrub removal, slashing or selective logging, the three characteristic canopy species of the EEC would have regenerated in some form.

Consideration of the Significant Impact Guidelines (DEH 2006) indicates that, given the absence of records for threatened species, ecological communities or migratory species listed under the EPBC Act, the proposal is not likely to impose 'a significant impact' on any matters of NES. Hence, referral of the proposal to the Commonwealth Department of the Environment, Water, Heritage and the Arts for determination under the EPBC Act is not considered necessary.

Section 6 Biodiversity Maintenance and Improvement

The following section identifies measures that have been employed to in order to avoid, mitigate and offset impacts on biodiversity values associated with the construction and operation of the Project. This section has been structured according to the principles stated in the DEC (2005) guidelines for Part 3A biodiversity assessments.

6.1 Impact Avoidance

Impacts on biodiversity have been avoided where possible, through the following means:

- Locating the proposed Facilities as far as possible in cleared areas, aiming to avoid woodland areas. The location of the Facilities was constrained by the need to remain at some distance from the Wollondilly River (for environmental and aesthetic reasons), so the Site is located partly within cleared pasture and partly within woodland. Hence some direct impacts on woodland vegetation are unavoidable; and
- siting new infrastructure developments, such as electricity transmission lines and access roads, in existing easements. The proposed access road will utilise the existing unsealed road from Canyonleigh Road, but will then traverse through existing woodland nearer to the proposed Facilities. The proposed gas pipeline will be largely located within cleared land, although it too will pass through woodland (within the same easement as the access road in this area) near the Site. The electricity easement will require clearing of a corridor of woodland vegetation, due to the location of existing services and due to the need for clearances around overhead transmission lines for safety and bush fire mitigation purposes.

6.2 Impact Mitigation

6.2.1 Environmental Management Plan

An Environmental Management Plan (EMP) will be developed for the construction and operational phases of the proposal and will include measures for the minimisation or avoidance of impacts on native flora and fauna. An overview of the impact mitigation and environmental management measures recommended for flora and fauna is provided below. The EMP will contain further details regarding these measures, including performance indicators, timing and responsibilities.

6.2.2 Tree Fauna Management

Construction of the Facilities will require the removal of potential habitat trees (>40cms diameter or any trees with hollows). Further, nesting birds were observed in the development footprint during field surveys and would potentially occupy the Site during construction. Due care during clearing is recommended to reduce direct impacts to any tree dwelling fauna species which may be utilising the area. The CEMP should detail procedures for a pre-clearance survey and fauna management including the following points:

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

Section 6 Biodiversity Maintenance and Improvement

A detailed pre-clearance survey by qualified ecologists will be required prior to development of the Site. This would involve:

- diurnal searches for birds, nests and roosts;
- active searches for reptiles, including checking of woody debris within the development 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 development footprint then construction should be postponed until the nestlings have hatched and fully-fledged. If construction constraints mean that this delay is not practicable then DECC should be consulted to determine if relocating the species is acceptable.

6.2.3 Groundcover Clearance Protocol

Groundcover substrate and especially large woody debris provides important habitat for native fauna, including threatened species. It is recommended that a groundcover clearance protocol be incorporated into the CEMP. It is recommended that the protocol involve the following steps:

- remove large woody debris using excavator grabs or manual handling if practicable (raking);
- place intact large woody debris 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 rehabilitation works.

6.2.4 Site Management

The following mitigation measures are recommended in order to minimise potential impacts on native fauna associated with the operation of the proposed Facilities:

- set maximum speed limits during construction and operation traffic on site to reduce fauna road fatalities;
- limit vehicular and personnel entry into retained vegetation (including offset areas) during construction and operation through temporary exclusion fencing during construction, locating access roads and paths to avoid biodiversity areas and use of signage where necessary; and
- employing down-lights and motion sensor lighting in order to reduce light spill and the associated secondary impact on nocturnal fauna species potentially utilising the adjoining vegetation.

6.2.5 Exclusion of Grazing

Fencing to exclude grazing by cattle is recommended at the Marulan Site as a means of improving the habitat value and floral diversity of retained vegetation. This is likely to aid the regeneration of cleared areas and degraded remnants. Exclusion of grazing improves the growth of many native herbs and grass species which are important feed species for declining woodland birds and other native animals (Garnett and Crowley, 2000).

Section 6 Biodiversity Maintenance and Improvement

6.2.6 Weed and Pest Management

A weed and pest management plan should be completed as part of the EMP for the site. Active control of feral animals, such as the Red Fox and European Rabbit, and noxious weeds, such as Blackberry and Serrated Tussock, will be required during and after construction.

To limit the spread of weeds into remnant vegetation during construction it is recommend that intact areas be fenced. This should be done prior to construction, restricting access by construction crew and machinery to remnant vegetation. Materials stockpiles (soil, fill, etc) should be placed in areas of cleared pasture grassland.

6.2.7 Bushfire Management

The Bush Fire Assessment (refer Chapter 16 in the Environmental Assessment) identifies a minimum recommended Asset Protection Zone of 10-15 m, depending on the applicable site boundary. The Assessment recommends the preparation of a Bushfire Management Plan, which will include specific measures to avoid undue or adverse effects on native flora and fauna. However, it is not anticipated that clearing or hazard reduction burns will be required to manage the APZ once established.

6.2.8 Soil Erosion / Runoff

The CEMP should formulate safeguard measures to reduce soil erosion and pollutant run-off during both construction and operation phases. Particular areas of concern are: Dam 1 and the drainage line downslope of the proposed access road; the dam and drainage line east of the TransGrid Switchyard; and the west-facing slope adjacent to the proposed plant footprint, which drains to the Wollondilly River.

6.3 Biodiversity Offsets

6.3.1 Overview

DECC is currently trialling the Biobanking Scheme, which will formalise the process for offsetting the biodiversity impacts of development within NSW (DECC 2007). Prior to the establishment of this scheme, biodiversity offsets must be identified and communicated to DECC on a case-by-case basis, as required. The DECC (2007) *Guidelines for Biodiversity Certification of Environmental Planning Instruments Working Draft* outlines offsetting principles. The key principles include the '*like-for-like or better*', meaning the same vegetation or habitat type being cleared should be conserved in the offset, and the 'maintain or improve' test, which is that the proposal must demonstrate that it maintains or improves biodiversity.

The DECC (2007) principles were used as the basis of the offset package outlined below. Review of provisional guidelines and case studies suggests that the proposed package outlined below constitutes an acceptable offset. Further to the above broad principles a set of specific principles were applied to the current offset package, as follows:

- preferably located on the site or at least within the locality;
- contains the same or equivalent vegetation communities as the impacted area (as per the 'like-for-like' principle stated above);
- is in equivalent or better condition than the impacted area and thus has equivalent or higher biodiversity value;
- has the potential for improvement in biodiversity values as a result of conservation and management;
- is located on land owned by the proponent (or can be purchased by the proponent);
- has a low perimeter-to-area ratio and therefore avoids high edge effects and maintenance requirements; and

- is suitably located for ongoing administration, maintenance and evaluation by either the proponent or DECC and has relatively easy access.

6.3.2 Proposed Biodiversity Offset

The proposed offset strategy recognises the scale and importance of the impact on the woodland and adopts the DECC principles for offsets. The key features of the strategy include the creation of a 39.1ha biodiversity offset area comprising:

- a woodland offset area, involving permanent conservation of a 30.1ha portion of land that contains Tableland Hills Grassy Woodland; and
- a riparian rehabilitation area of 9ha, located along a degraded drainage line in the northern parts of the Site.

The woodland and riparian components of the proposed offset area are presented on **Figure 7** and shown below in **Table 6-1**.

Table 6-1 Vegetation within Offset

Area	Tableland Hills Grassy Woodland (ha)	Riverbank Forest (ha)	Cleared Grassland (ha)	Subtotal (ha)
Woodland Offset	29.9	0	0.2	30.1
Riparian Rehabilitation Area	2.4	0	6.6	9.0
Total	**32.3**	**0**	**6.8**	**39.1**

Woodland Offset Area

The proposed Woodland Offset Area contains 29.9ha of Tableland Hills Grassy Woodland (**Table 5-1; Figure 7**). The woodland within the proposed offset adjoins and is contiguous with woodland within the development footprint. Hence, the structure, species composition, density of trees with hollows and condition of the offset area are equivalent to woodland within the proposed construction footprint. The offset area also contains equivalent quantities of habitat resources such as feed trees, hollow bearing trees, standing and fallen dead timber, leaf litter and woody debris. It is likely to provide habitat for the threatened fauna species recorded on the Site and surrounding areas.

The understorey vegetation within the proposed offset area is patchy and of low density, probably due to historic grazing of the Site. It is likely that the condition of the vegetation would improve with the exclusion of grazing. Accordingly fencing and conservation of this area as a biodiversity offset is likely to improve the biodiversity value of the area over time. Additional management actions may achieve further conservation gains (see below).

Riparian Rehabilitation Area

The biodiversity offset area also includes a 9ha portion of degraded riparian habitat along the drainage line in the northern portion of the Site (shown as the Riparian Rehabilitation Area on **Figure 7**). The riparian area contains approximately 6.6ha of cleared grassland and 2.4ha of highly modified woodland. The drainage line currently features severe gully erosion and adjacent cleared land is also seriously eroded. This is probably causing ongoing sedimentation and degradation of aquatic habitat in the Wollondilly River downstream. It is recommended that a rehabilitation program be undertaken within this area.

The rehabilitation of the area would have an emphasis on controlling the gully erosion that is currently evident. Measures proposed include erosion control, complementary plantings, weed control, habitat enhancement and stock fencing. Plantings should be extended to bridge cleared areas between the proposed woodland offset area and stands of woodland along the drainage line. This would provide an

important linkage between the offset area, woodland to the north of the Site, and the riparian vegetation along the drainage line. Details of the rehabilitation program would be included in the EMP for the proposed works.

6.3.3 Management of Offset Area

Ongoing management of the offset area will be required to comply with the DECC (2006a) guidelines and to maintain or improve biodiversity values. Management actions would include, as a minimum:

- exclusion of grazing through fencing;
- weed removal and control;
- erosion control;
- retention of fallen timber, hollow logs, leaf litter, rocks and other habitat resources;
- maintenance and monitoring of natural surface water quality and flows;
- control of feral animals, where appropriate and practical; and
- annual monitoring and reporting on biodiversity, results of management actions undertaken and general condition of the Site.

Full details of the proposed management regime would be included in a Vegetation Management Plan that would be included in the Environmental Management Plan for the proposed facility.

6.3.4 The Maintain or Improve Test

The DEC (2005) guidelines identify matters that are relevant to the assessment of impacts to threatened species, populations or ecological communities, or their habitats, arising from a development proposal assessed under Part 3A. A key principle presented in these guidelines is that proposals should maintain or improve biodiversity values (i.e. there is no net impact on threatened species or native vegetation). Where impacts cannot be avoided or mitigated then it is necessary to identify a suitable biodiversity 'offset' in order to maintain or improve biodiversity values. The application of the 'maintain or improve' test to the proposal is summarised in **Table 6-2**.

The biodiversity offset package is proposed as a means to ensuring that construction and operation of the proposed Facilities maintains or improves biodiversity values at the Site. The offset will protect and conserve, in perpetuity, threatened species habitats, vegetation types, habitat types and landscape features similar or equivalent to those found within the development footprint. Moreover, the proposed offset package will improve biodiversity values at the Site due to the following:

- the woodland offset area is larger than the area of woodland impacted by the Project;
- ongoing management of the offset area will improve its condition and biodiversity values;
- rehabilitation of the degraded drainage line in the northern portion of the Site will provide substantial improvements in the biodiversity values of riparian and aquatic habitats; and
- rehabilitation of the riparian corridor will also enhance corridor links between the woodland offset and similar woodland stands adjoining the Site to the north.

On the basis of the above assessment, the proposed offset is consistent with the DECC guidelines for offsets and meets the key criterion for like-for-like trade-offs of biodiversity values. Adoption of the offset would adequately compensate for the loss of threatened species habitat associated with the Project and maintain biodiversity values. The proposed biodiversity offset package will be included in the Draft Statement of Commitments provided in the EA. With regard to the specific administrative arrangement for titling the offset area, the proponent would negotiate and finalise a suitable arrangement with DECC prior to construction works commencing, in accordance with the options discussed above.

Section 6 Biodiversity Maintenance and Improvement

Table 6-2 Comparison of Biodiversity Impacts and Offsets

Impacts	Mitigation	Offsets
• Permanent removal of 21.7ha of Tableland Hills Grassy Woodland during construction • Permanent loss of fauna habitat features (hollow-bearing trees, logs, leaf litter, ground debris, rocks and other resources) • Loss of 21.7ha of threatened fauna species habitat	• Retention of fallen timber (salvage of selected felled trees in development footprint) • Temporary exclusion fencing during construction • Timing of construction to avoid breeding seasons of resident fauna (where practical) • Retention of woodland on other parts of the Site • presence of similar woodland in the locality • Pre-clearing surveys for (and salvage of) resident native fauna • Installation of nest boxes for displaced arboreal fauna located in the development footprint	• Maintenance of woodland biodiversity values through permanent conservation of 32.3ha of Tableland Hills Grassy Woodland. Land portion to be re-titled (with VCA or equivalent) for this purpose in perpetuity • Permanent conservation of fauna habitat features (hollow-bearing trees, logs, leaf litter, ground debris, rocks and other resources) equivalent ot those in impact area • Improvement in biodiversity values through ongoing management of woodland offset area. Stock-proof fencing, retention of fallen timber, weed control, erosion control, feral animal control • Rehabilitation of 9 ha of riparian vegetation and adjoining cleared land in Riparian Rehabilitation Area. Creation of vegetated corridor connecting offset area to nearby woodland stands and adjacent riparian zone

Section 7 References

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

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

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

DEC (2005) *Draft Guidelines for Threatened Species Assessments.* Department of Environment and Conservation, Department of Primary Industries, Sydney.

DECC (2006a) *Draft Lower Hunter Regional Conservation Plan.* Department of Environment and Climate Change NSW, Sydney.

DECC (2006b) *Avoiding and offsetting biodiversity loss - Case studies*, Department of Environment and Climate Change NSW, Sydney.

DECC (2007) *Biodiversity Banking Scheme home page* (http://www.environment.nsw.gov.au/threatspec/biobankscheme.htm). NSW Department of Environment & Climate Change, Sydney.

DECC (2007) *Guidelines for Biodiversity Certification of Environmental Planning Instruments Working draft,* NSW Department of Environment and Climate Change, Sydney.

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

DEH (2006) *EPBC Act Policy Statements. White box – yellow box – Blakely's gum woodland and derived native grassland.* Department of the Environment and Heritage, Canberra.

DECC Threatened Species website http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx. NSW Department of Environment and Climate Change, Sydney

Ehmann H (1997) *Threatened Frogs of New South Wales: Habitat, Status and Conservation*. Frog and Tadpole Study Group of NSW.

Garnett TS and Crowley GM (2000), *The Action plan for Australian Birds,* Environment Australia, 2000

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

Keast A, Recher, HF, 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.

NPWS (undated) *Identification Guidelines for Endangered Ecological Communities: White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland)*. NSW National Parks & Wildlife Service, Sydney.

NSW National Parks and Wildlife Service (2003) *Draft Recovery Plan for the Koala (Phascolarctos cinereus)*. NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee (2004) *White box yellow box Blakely's red gum woodland - endangered ecological community listing NSW Scientific Committee - final determination.* NSW Department of Environment & Climate Change, Sydney.

PB (2005) *Big Hill Gas Turbine Baseline Ecological Surveys*. Parsons Brinkerhoff, Sydney.

Section 7 References

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

Reid, J. W. (1999). *Threatened and declining birds in the New South Wales sheep-wheat belt: diagnosis,*

Robinson, M (1993) *A Field Guide to Frogs of Australia*, Aust. Museum /Reed Publication.

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

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

Taxon Summary: Diamond Firetail, The Action plan for Australian Birds http://www.deh.gov.au/biodiversity/threatened/publications/action/birds2000.

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,* DIPNR (NSW, DEC).

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

Section 8 Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Delta and EnergyAustralia and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in our Proposal.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Tables

Tables

Table 1: Habitat requirements of threatened flora previously recorded or predicted to occur in the locality

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Flowering time	Corresponding URS Survey	Potential Occurrence on Site	Notes
Bossiaea oligosperma[1]	Few seed Bossiaea	V		Stony slopes or ridges in dry eucalypt forest or woodland. Low woodland on loamy soil.[a]	Late spring; flowers not required for identification	3-5 Oct 2006 22-24 Oct 2007	Medium	Suitable habitat present in study area.
Caladenia tessellata[2]	Thick-lipped Spider-orchid		V	Low open forest with a heathy or sometimes grassy understorey[b]	Late September - November	3-5 Oct 2006 22-24 Oct 2007	Low	Suitable habitat present in study area. Sporadic distribution, mostly in coastal areas.
Diuris aequalis[1]	Buttercup Doubletail	E1		Montane eucalypt forest with a grassy-heathy understorey on gravely clay-loams[a]	Mid-October to mid-November	3-5 Oct 2006 22-24 Oct 2007	Low	Suitable habitat present in study area. Generally known from higher altitudes and rare outside of Boyd plateau.
Diuris lanceolata[3]	Large Golden Moth Orchid		E	Moist grassy areas, among shrubs in sclerophyll forest and heath[b]	Not predicted to occur		None	Mainland populations now known as *D. chryseopsis* (not listed on TSC Act). No likelihood of occurrence
Diuris tricolor[1]	Pine Donkey Orchid	V		Grassy *Callitris* woodland on sandy soils[b]	September - November	3-5 Oct 2006 22-24 Oct 2007	Medium	Marginal habitat in study area. Other *Diuris* spp. Recorded.
Dillwynia glaucula[1]	Michelago Parrot-pea	E1		Exposed patches of clay or on rocky outcrops in eucalypt woodland. [a]	Late spring; flowers not required for identification	3-5 Oct 2006 22-24 Oct 2007	Medium	Suitable habitat present in study area.
Eucalyptus aquatica[2]	Broad-leaved Sally		V	Open, swampy flats[c]	Flowers not required for identification	All	Low	No suitable habitat in study area.

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Flowering time	Corresponding URS Survey	Potential Occurrence on Site	Notes
Eucalyptus macarthurii[2]	Camden Woolybutt		V	Beyond known distribution specific requirements not known[c]	Flowers not required for identification	All	Medium	Study area is within known range of species.
Eucalyptus recurva[1]	Mongarlowe Mallee	E1		Shallow soils on gentle slopes in low heathland	Flowers not required for identification	All	Low	Population limited to five individuals in four locations outside study area.
Genoplesium plumosum[2]	Plumed Midge-orchid		E	Heathland, dry sclerophyll forest and moss gardens over sandstone sheets[b]	Late summer – autumn	3-5 Oct 2006 10 May 2007	Low	Suitable habitat in study area but known only from six recognised locations outside study area.
Gentiana wingecarribiensis[2]	Wingecarribee Gentian		E	Sphagnum swamps, sedgelands and grasslands in upland peatlands, swamp margins[c]	Not predicted to occur		Low	No suitable habitat in study area.
Grevillea molyneuxii[1]	Wingello Grevillea	V		Open patches in low heathland. Skeletal soils on flat, wet sandstone shelves above dissected valleys. [a]	Not predicted to occur		None	No suitable habitat in study area. Known only from small area near Wingello.
Kunzea cambagei[2]	Cambage Kunzea		V	Heathland near Mt Werong and Berrima[c]	Not predicted to occur		None	No suitable vegetation associations in study area. Outside known range.
Leuchochrysum albicans var. *tricolor*[2]	Hoary Sunray		E	Well drained soils. Open areas. No other habitat preferences listed[c]	Spring - Summer	3-5 Oct 2006 22-24 Oct 2007	Medium	Required habitat may be present in study area.
Baloskion longipes[2]	Dense Cord-rush		V	In swamps or depressions on alluvium[c]	Summer	22-24 Oct 2007	Medium	No swamps but some poorly drained depressions on alluvium present in study area.

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Flowering time	Corresponding URS Survey	Potential Occurrence on Site	Notes
Phyllota humifusa[1]	Dwarf Phyllota	V		Dry sclerophyll forest in deep sands or gravely loams on sandstone substrate[a]	Flowers not required for identification		Medium	Suitable habitat in study area.
Pomaderris cotoneaster[1]	Cotoneaster Pomaderris	E1	E	A range of forested habitats including deep friable soils and amongst rocks[a]	October - November	3-5 Oct 2006 22-24 Oct 2007	Medium	Known from disjunct populations with no clear preferences. Suitable habitat may be present.
Pomaderris delicata[1]		E1		Dry open *E. sieberi* forest with *Casuarina* understorey. Shall soils derived from siltstone or sandstone[a]	Not predicted to occur		None	Known from two sites outside study area.
Pomaderris pallida[1]	Pale Pomaderris	V		Shrub communities surrounded by eucalyptus or Callitris woodland[a]	September - December	3-5 Oct 2006 22-24 Oct 2007	Medium	Suitable habitat may be present.
Solanum celatum[1]		E1		Rainforest clearings or wet sclerophyll forest. [a]	Not predicted to occur		None	No suitable habitat present in study area.
Pultenaea pedunculata[1]	Matted Bush-Pea	E1		Open patches in transitional areas between clay and shale-sandstone woodland communities[a]	Spring	3-5 Oct 2006 22-24 Oct 2007	Medium	Suitable habitat present in study area.

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Flowering time	Corresponding URS Survey	Potential Occurrence on Site	Notes
Rutidosis leptorrhynchoides	Button Wrinklewort	E1	E	Occurs in Box-Gum Woodland, and Natural Temperate Grassland. Soils usually shallow, stony red-brown clay loams. Occupies areas where less competition from herbaceous species. Small number of populations on roadsides, rail reserves and other un-grazed or very lightly grazed sites.[a]	Summer	3-5 Oct 2006 22-24 Oct 2007	Low-medium	Suitable habitat (grassy woodland and grassland) in study area but site has been intensively grazed.
Thesium australe [1]	Austral Toadflax, Toadflax	V		Damp sites in grassland or grassy woodland, often with *Themeda australis*	Spring	3-5 Oct 2006 22-24 Oct 2007	Low	Suitable habitat (moist grasslands) in study area but known only from scattered populations in eastern Australia.
Zieria murphyi[1]	Velvet Zieria	V		Gullies in dry sclerophyll forest with sandy soil. [a]	Year round	All	Medium	Suitable habitat present in study area.
Endangered Ecological Communities								
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory [1,2]		EEC	E	Fertile lower parts of the landscape where resources such as water and nutrients are abundant, but tree growth is restricted by other factors. Within an altitude range of between 560 and 1200 metres. [a]	Year round	All	Low-Medium	Suitable geomorphology in study area. Extensive history of grazing at the Site.

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat Requirements	Flowering time	Corresponding URS Survey	Potential Occurrence on Site	Notes
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland [2]			Critically Endangered	Tablelands and western slopes of NSW, typically on fertile substrates in lower parts of the landscape [a]	Year round	All	Medium	Suitable geomorphology in study area.

1 =Threatened species listed under TSC Act 1995 previously recorded within Goulburn-Mulwaree LGA
2 = Threatened species or species habitat listed under EPBC Act 1999 in local area

3 = recorded on the Marulan Site in the PB (2005) survey

a = DECC threatened species profile (http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/browse_allspecies.aspx?kingdom=community)

b = Bishop, T (1996), *Field Guide to the Orchids of NSW*, UNSW press.

c = National Herbarium Flora Online (http://plantnet.rbgsyd.nsw.gov.au/search/simple.htm)

Tables

Table 2: Habitat requirements of threatened fauna previously recorded or predicted to occur within the locality

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat requirements	Breeding or activity season	Time of year Surveyed	Potential Occurrence on Site	Notes
Amphibians								
Heleioporus australiacus	Giant Burrowing Frog[1,2]	V	V	Sclerophyll communities with sand-sandy loam soils. Breeds in slow flowing streams or hanging swamps in broad upland valleys or ridgetops. [a, b]	March - August	10 May 4-5 June	Low	Suitable foraging habitat but marginal or degraded watercourses in study area.
Litoria littlejohni	Littlejohn's Tree Frog[1, 2]	V	V	Permanent rocky streams with thick fringing vegetation associated with wet sclerophyll forest, woodlands and heaths. Relatively undisturbed sites with slow flowing, unpolluted water[a, b]	Not predicted to occur		Low	No suitable habitat present in study area.
Reptiles								
Aprasia parapulchella	Pink-tailed worm-lizard	V		Sloping, open woodland with predominantly native grassy ground layers, particularly Kangaroo Grass. Sites well-drained, with rocky outcrops or scattered, partially-buried rocks. Commonly found beneath small, partially-embedded rocks in; burrows constructed by small black ants and termites. Feeds on ant larvae and eggs[a]	Warmer months	3-5 Oct 2006 22-24 Oct 2007	Medium	Suitable habitat at the site.
Hoplocephalus bungaroides	Broad-headed Snake[1, 2]	E	V	Sandstone escarpments and ridges with abundant platey rock fragments. [a]	Not predicted to occur		Low	No suitable habitat in study area.
Varanus rosenbergi	Rosenberg's Goanna	V		Found in heath, open forest and woodland. Nests in termite mounds (a critical habitat component). Requires large areas of habitat. Shelters in hollow logs, rock crevices and in burrows (inc. rabbit warrens)[a]	Spring - Summer	3-5 Oct 2006 22-24 Oct 2007	Medium	Suitable habitat in study area including critical features (hollow bearing logs, termite mounds).

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat requirements	Breeding or activity season	Time of year Surveyed	Potential Occurrence on Site	Notes
Birds								
Callocephalon fimbriatum	Gang-gang Cockatoo[1]	V		Sclerophyll forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests.	Foraging on site in Winter; breeding off site in Oct-Jan	3-5 Oct 2006 22-24 Oct 2007	Present	Observed in Tableland Hills Grassy Woodland at the site.
Calyptorhynchus lathami	Glossy Black-Cockatoo[1]	V		Eucalypt woodland and forest with feed tree species (*Allocasuarina littoralis* and *Allocasuarina torulosa*). Hollow-bearing eucalypts. [a]	March and August	10th May 4-5 June	Medium	Foraging and breeding habitat present in study area (woodland with hollow-bearing eucalypts). Sub-optimal feed trees present (*Allocasuarina cunninghamiana*).
Climacteris picuminus	Brown Treecreeper[1]	V		Eucalypt woodland with rough-barked tree species and an open, grassy understorey. Structurally diverse vegetation and intact fallen timber. [a]	June - January	All	High	Optimum habitat (structurally diverse woodland with stringybarks, intact understorey and fallen timber) in study area.
Lathamus discolor	Swift Parrot	E	E	Migratory between Tasmania and mainland. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations.	Passes through in Autumn and Winter	4-5 June	Low-medium	Winter flowering gum (*Eucalyptus eugenioides*) present in study area but no optimal feed tree species.

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat requirements	Breeding or activity season	Time of year Surveyed	Potential Occurrence on Site	Notes
				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. albensa				
Melanodryas cucullate cucullate	Hooded Robin	V		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. Home ranges of 10-30 ha. [a]	August - November	3-5 Oct 2006 22-24 Oct 2007	Present	Observed in cleared grassland to the south of the site.
Neophema pulchella	Turquoise Parrot			Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Feeds on seeds or grasses and herbaceous plants, or browsing on vegetable matter. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.[a]	August - December	3-5 Oct 2006 22-24 Oct 2007	Medium	Suitable foraging and roosting present in study area.
Ninnox connivens	Barking Owl[1]	V		Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting[a]	Late winter – early spring	3-5 Oct 2006	Medium	Suitable habitat present in study area.

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat requirements	Breeding or activity season	Time of year Surveyed	Potential Occurrence on Site	Notes
Ninox strenua	Powerful Owl[1,4]	V		Tall, moist eucalypt forest. Home range centred on large, hollow-bearing trees[a]	Autumn - Winter	4-5 June	Medium-High	PB (2005) record from adjacent site. Foraging habitat in study area. No roosting habitat (tall moist forest with stem hollows).
Oxyura australis	Blue-billed Duck[1]	V		Deep water in large permanent wetlands and swamps with dense aquatic vegetation[a]	Not likely to breed on site		Low	No suitable habitat in study area.
Pyrrholaemus sagittatus	Speckled Warbler	V		A wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area .[a]	August - January	3-5 Oct 2006 22-24 Oct 2007	Medium	Suitable habitat present in study area.
Rostratula benghalensis	Australian Painted Snipe [2]	E	V	Fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber[a]	September - December	3-5 Oct 2006 22-24 Oct 2007	Medium	Potential foraging habitat along Wollondilly River. Dams in study area lack dense fringing vegetation.
Stagonopleura guttata	Diamond Firetail[1]	V		Open woodland with understorey of native grasses and intact fallen timber and leaf litter[a]	August – January	3-5 Oct 2006 22-24 Oct 2007	Present	Optimal habitat (structurally diverse woodland with grassy understorey and intact fallen timber and leaf litter) in study area.

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat requirements	Breeding or activity season	Time of year Surveyed	Potential Occurrence on Site	Notes
Tyto novaehollandiae	Masked Owl	V		Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.[a]	All year	All	Medium	Suitable foraging and roosting present in study area.
Xanthomyza phrigia	Regent Honeyeater [2]	E	E	Dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Large numbers of mature trees, high canopy cover and abundance of mistletoes[a]	July - December	3-5 Oct 2006 22-24 Oct 2007	Low-Medium	Suitable habitat in study area (River Sheoak riparian forest). Species basically restricted to known core breeding range outside study area.
Mammals								
Chalinolobus dwyeri	Large-eared Pied Bat [1,2]	V	V	Roosts in caves cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Well-timbered areas containing gullies[a]	November - January	22-24 Oct 2007	Medium	Foraging habitat within study area and sandstone escarpments, potentially containg suitable roost-caves, within local area.
Dasyurus maculatus	Spotted-tailed Quoll [2]	V	V	Large home ranges in variety of woodland and forest types. Sub-alpine to coastal.	April - July	10 June	Medium	Foraging habitat in study area. More likely to utilise taller, moister woodland and forest.

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat requirements	Breeding or activity season	Time of year Surveyed	Potential Occurrence on Site	Notes
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.a	Late spring – summer	3-5 Oct 2006 22-24 Oct 2007	Present	Recorded on Anabat.
Miniopterus australis	Little Bent-wing Bat [4]	V		Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Spring – summer	3-5 Oct 2006 22-24 Oct 2007	High	Recent records in local area (PB, 2005). Suitable foraging habitat and diurnal roosts present.
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat [1,3]	V		Primarily roost in caves, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Feed in forested country within 300km of suitable maternity caves[a]	Spring - summer	3-5 Oct 2006 22-24 Oct 2007	High	Recent records in local area (PB, 2005). Suitable foraging habitat present. Site within 300km of suitable maternity cave (Bungonia).
Myotis adversus	Large-footed Myotis	V		River Red Gum forest, semi-arid woodlands and savannahs. Also occurs in box/ironbark/Callitris open forests and Buloke woodland. Requires large, still water bodies for feeding.[a]	November - December	22-24 Oct 2007	Medium	Foraging habitat in study area.

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat requirements	Breeding or activity season	Time of year Surveyed	Potential Occurrence on Site	Notes
Petaurus norfolcensis	Squirrel Glider	V		Inhabits dry sclerophyll forest and woodland. Potential habitat includes Box-Ironbark woodland and River Red Gum forests. Requires abundant hollow bearing trees and a mix of eucalypts, banksias and acacias.[a]	All year	All	Medium	Ample hollows in woodland on site but may be limited foraging resources due to scarcity of acacias and banksias.
Petrogale penicillata	Brush-tailed Rock-wallaby [1 2]	E	E	Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north[a]	Not likely to occur		Low	No rocky escarpments in study area.
Phascolarctos cinereus	Koala	V		Open forest and woodland, favouring stands of Manna Gum, Swamp Gum, Forest Red Gum and Swamp Mahogany on high nutrient soils. a Forests containing SEPP 44, Schedule 2 feed tree species.	Not likely to occur		Medium	No Schedule 2 feed tree species in the site. Secondary feed tree species (*Eucalyptus cinerea* and *E. blakelyi*) in grassy woodland.
Potorous tridactylus tridactylus	Long-nose Potoroo[2]	V	V	Sclerophyll forests and woodlands with dense shrubby understorey. Friable soil[a]	Not likely to occur		Low-Medium	Marginal foraging habitat in study area due to sparse understorey. Generally known from lower altitudes especially the coastal zone.
Pteropus poliocephalus	Grey-headed Flying Fox[2]	V	V	Tall forests with blossom or fruit-bearing trees. Roosting colonies in dense stands of tall, mature trees[a]	Active all year round	All	Medium-High	Suitable foraging habitat in study area.

Tables

Botanical Name	Common Name	TSC Act Status	EPBC Act Status	Habitat requirements	Breeding or activity season	Time of year Surveyed	Potential Occurrence on Site	Notes
Scoteanax rueppellii	Greater Broad-nosed Bat[1,4]	V		Variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Open structure favours feeding habits. Roosts in tree hollows[a]. Little known of biology; young are born in January following maternity period.	December - January	All	High	Recent records in local area (PB, 2005). Suitable roosting and foraging habitat present.

1 =Threatened species listed under TSC Act 1995 previously recorded within 10km of the study area
2 = Threatened species or habitat listed under EPBC Act 1999 known or predicted to occur within 10km of the study area
3 = recorded on the Marulan Site in the PB (2005) survey
4= recorded within 5km of the Site in the PB (2005) survey
a = DECC threatened species profile (http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/browse_allspecies.aspx?kingdom=community)
b = Ehmann H (1997) *Threatened Frogs of New South Wales: Habitat, Status and Conservation*. Frog and Tadpole Study Group of NSW.

Tables

Table 3: Plant species recorded on the Site

Botanical Name	Common Name
Adiantaceae	
Cheilanthes distans	Rock fern
Antheriaceae	
Laxmannia gracilis	Slender Wire Lily
Apiaceae	
Hydrocotyle laxiflora	Stinking Pennywort
Asteraceae	
Calotis lapulacea	Yellow Burr daisy
*Conyza sumatrensis**	Tall Fleabane
Chrysocephalum apiculatum	Yellow Buttons
Cymbonotus lawsonianus	Bears Ears
Euchiton sp.	Cudweed
Gamochaeta sp. *	Cudweed
Hypochaeris radicata	Flatweed
Leptorhynchos squamatus subsp. *squamatus*	
Senecio quadridentatus	Cotton Fireweed
Sonchus asper subs. *glaucescens*	Prickly Cowthistle
Sonchus oleraceus	Common Sowthistle
Campanulaceae	
Wahlenbergia sp.	Bluebell
Caryophyllaceae	
*Cerastium glomeratum**	Chickweed
Petrorhagia nanteuillii	
Casuarinaceae	
Casuarina cunninghamiana	River She-oak
Clusiaceae	
Hypericum gramineum	Small St Johns Wort
Convolvulaceae	
Dichondra repens	Kidney Weed
Crassulaceae	
Crassula sieberiana	Stonecrop
Dilleniaceae	
Hibbertia obtusifolia	Hoary Guinea Flower
Hibbertia diffusa	Wedge Guinea Flower
Droseracea	
Drosera peltata	
Epacridaceae	
Acrotriche serrulata	Honeypots

Tables

Botanical Name	Common Name
Brachyloma daphnoides	Daphne Heath
Melichrus urceolatus	Urn Heath
Euphorbiaceae	
Poranthera microphylla	
Fabaceae (Faboidaeae)	
Bossiaea prostrata	
Glycine sp.	
Hardenbergia violaceae	
Indigofera australis	Austral Indigo
Fabaceae (Mimosoidaeae)	
Acacia longifolia	
Acacia paradoxa	Kangaroo Thorn
Acacia parramattensis	Green Wattle
Geraniaceae	
Geranium homeanum	
Geranium solanderi	Native Geranium
Goodeniacea	
Goodenia hederacea	Forest Goodenia
Haloragaceae	
Gonocarpus tetragynus	
Haloragis heterophyllus	Rough Raspwort
Juncaceae	
Juncus australis	
Luzula flaccida	
Lamiaceae	
Ajuga australis	Austral Bugle
Lomandraceae	
Lomandra sp.	
Malaceae	
*Crateagus monogyna**	Hawthorn
Myrtaceae	
Eucalyptus blakelyi	Blakely's Red Gum
Eucalyptus cinerea	Argyle Apple
Eucalyptus eugenioides	Brown Stringybark
Eucalyptus pauciflora	Snow Gum
Kunzea parviflora	Violet Kunzea
Melaleuca erubescens	Pink Honey Myrtle
Orchidaceaea	
Diuris chyryseopsis syn. *D. lanceolata*	Snake Orchid
Diuris platichila	Broad-lip Doubletail Orchid

Tables

Botanical Name	Common Name
Oxalidaceae	
Oxalis perennans	Grassland Wood Sorrel
Plantaginaceae	
*Plantago lanceolata**	Lamb's Tongues
Polygonaceae	
*Acetosella vulgaris**	Sheep Sorrel
Poaceae	
Aira cupaniana	Silvery Hairgrass
Aristida sp.	Speargrass
Aristida vagans	Three-awn speargrass
Austrostipa scabra subs. scabra	Speargrass
Cynodon dactylon	Couch
Dichelachne sp.	Plumegrass
Echinopogon ovatus	Forest Hedgehog Grass
*Nasella trichotoma***	Serrated Tussock
*Pennisetum clandestinum**	Kikuyu grass
Themeda australis	Kangaroo Grass
Polygonaceae	
*Acetosella vulgaris**	Sheep Sorrel
Rosaceae	
*Rubus fruticosus***	Blackberry
*Rosa rubiginosa***	Briar Rose
*Acaena ovina**	Sheep's Burr
Rubiaceae	
Opercularia sp.	Stinkweed
Richardia sp.*	Mexican Clover
Salicaceae	
*Salix babylonica **	Weeping Willow
*Salix fragilis **	Crack Willow
Verbenaceae	
Verbena sp.*	
Scrophulaceae	
Veronica plebeia	Creeping Speedwell
*Verbascum virgatum**	Twiggy Mullein
Thymeleaceae	
Pimelea curviflora	
Xanthorreaceae	
Lomandra sp.	Mat rush

* Exotic
** Declared noxious weed for the Goulbourn-Mulwaree LGA

Tables

Table 4: Fauna species recorded on the Site

Common Name	Scientific Name	TSC Act status	EPBC Act status	Observation Type
Birds				
Buff-rumped Thornbill	*Acanthiza chrysorrhoa*			Seen
Striated Thornbill	*Acanthiza lineata*			Seen
Yellow Thornbill	*Acanthiza nana*			Seen
Brown Thornbill	*Acanthiza pusilla*			Seen
Yellow-rumped Thornbill	*Acanthiza reguloides*			Seen
Common Myna*	*Acridotheres tristis*			Seen
Pacific Black Duck	*Anas superciliosa*			Seen
Richards Pippit	*Anthus novaeseelandiae*			Seen
Wedge-tailed Eagle	*Aquila audax*			Seen
Dusky Woodswallow	*Artamus cyanopterus*			Seen
Masked Woodswallow	*Artamus personatus*			Seen
Sulphur-crested Cockatoo	*Cacatua galerita*			Seen
Galah	*Cacatua roseicapilla*			Seen
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V		Seen
Wood Duck	*Chenonetta jubata*			Seen
White-throated Treecreeper	*Climacteris leucophaea*			Seen
Grey Strike-thrush	*Colluricincla harmonica*			Seen
Black-faced Cuckoo Shrike	*Coracina novaehollandiae*			Seen
White-winged Chough	*Corcorax melanorhamphos*			Seen
Australian Raven	*Corvus coronoides*			Seen
Grey Butcherbird	*Cracticus torquatus*			Seen
Laughing Kookaburra	*Dacelo novaeguineae*			Seen
Varied Sittella	*Daphoenositta chrysoptera*			Seen
White-faced Heron	*Egretta novaehollandiae*			Seen
Australian Kestrel	*Falco cenchroides*			Seen
Australian Magpie-Lark (Pee Wee)	*Grallina cyanoleuca*			Seen
Australian Magpie	*Gymnorhina tibicen*			Seen
Welcome Swallow	*Hirundo neoxena*			Seen
Yellow-faced Honeyeater	*Lichenostomus chrysops*			Seen
Noisy Miner	*Macorina melanocephala*			Seen
Superb Fairy-wren	*Malurus cyaneus*			Seen
Hooded Robin	*Melanodryas cucullata*	V		Seen
White-naped Honeyeater	*Melithreptus lunatus*			Seen
Jacky Winter	*Microeca fascinans*			Seen
Satin Flycatcher	*Myiagra cyanoleuca*			Seen
Leaden Flycatcher	*Myiagra rubecula*			Seen
Red-browed Finch	*Neochmia tempralis*			Seen

Tables

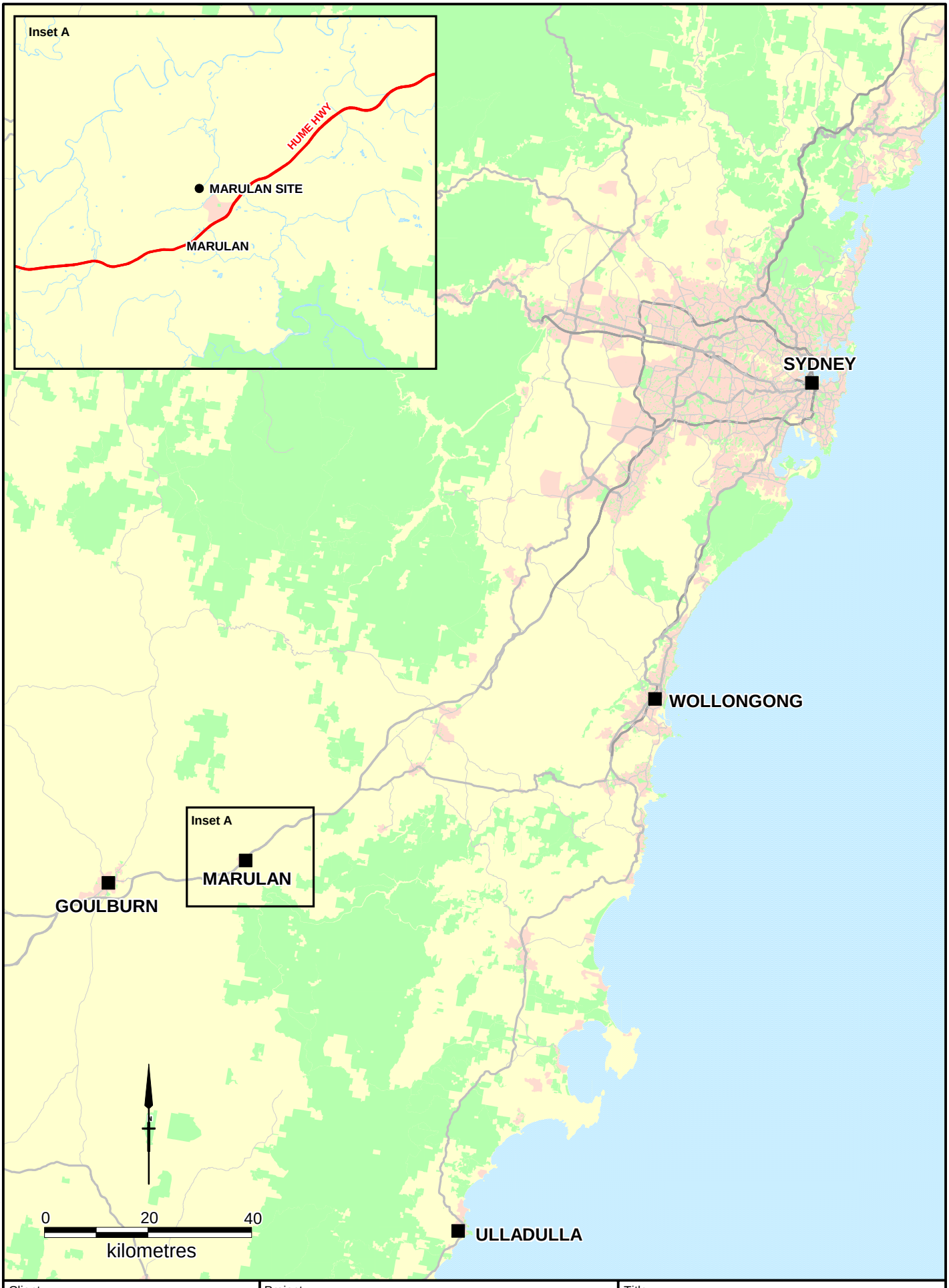
Common Name	Scientific Name	TSC Act status	EPBC Act status	Observation Type
Southern Boobook	*Ninox novaeseelandiae*			Heard
Golden Whistler	*Pachycephala pectoralis*			Seen
Rufous Whistler	*Pachycephala rufiventris*			Seen
Spotted Pardalote	*Pardalotus punctatus*			Seen
Striated Pardalote	*Pardalotus striatus*			Seen
Scarlet Robin	*Petroica multicolor*			Seen
Flame Robin	*Petroica phoenicea*			Seen
Little Pied Cormorant	*Phalacrocorax melanoleucos*			Seen
Brush Bronzewing	*Phaps elegans*			Seen
Noisy Friar Bird	*Philemon corniculatus*			Seen
Crimson Rosella	*Platycercus elegans*			Seen
Eastern Rosella	*Platycercus eximius*			Seen
Tawny Frogmouth	*Podargus strigoides*			Seen
Red-rumped Parrot	*Psephotus haematonotus*			Seen
Grey Fantail	*Rhipidura fuliginosa*			Seen
Willie Wagtail	*Rhipidura leucophrys*			Seen
Diamond Firetail	*Stageonopleura guttata*	V		Seen
Australasian Grebe	*Tachybaptus novaehollandiae*			Seen
Sacred Kingfisher	*Todirhampus sancta*			Seen
Masked Lapwing	*Vanellus miles*			Seen
Frogs				
Common Eastern Froglet	*Crinia signifera*			Seen
Eastern Banjo Frog	*Limnodynastes dumerilii*			Heard
Spotted Marsh Frog	*Limnodynastes tasmaniensis*			Seen
Peron's Tree Frog	*Litoria peronii*			Seen
Brown Tree Frog	*Litoria ewingii*			Seen
Smooth Toadlet	*Uperoleia laevigata*			Seen
Reptiles				
Skink sp.				Seen
Mammals				
Dog	*Canis lupus*			Scat
Gould's Wattled Bat	*Chalinolobus gouldii*			Harp Trap (7)
Chocolate Wattled Bat	*Chalinolobus morio*			Anabat
Eastern Falsistrelle	*Falsistrellus tasmaniensis*	V		Anabat
Water Rat	*Hydromys chrysogaster*			Seen
Eastern Grey Kangaroo	*Macropus giganteus*			Seen
Red-necked Wallaby	*Macropus rufogriseus*			Scat

Tables

Common Name	Scientific Name	TSC Act status	EPBC Act status	Observation Type
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	V		Anabat
Lesser Long-eared Bat	*Nyctophilus geoffroyi*			Harp Trap (15)
Gould's Long-eared Bat	*Nyctophilus gouldi*			Harp Trap (5)
European Rabbit*	*Oryctolagus cuniculus*			Seen
Sugar Glider	*Petaurus breviceps*			Heard
Echidna	*Tachyglossus aculeatus*			Seen
White-striped Mastiff Bat	*Tadarida australis*			Anabat
Brushtail Possum	*Trichosurus vulpecula*			Seen
Large Forest Bat	*Vespadelus darlingtoni*			Harp Trap (2)
Southern Forest Bat	*Vespadelus regulus*			Harp Trap (2)
Forest Bat (Female, identified to genus level only)	*Vespadelus sp.*			Harp Trap (4)
Little Forest Bat	*Vespadelus vulturnus*			Harp Trap (9)
Common Wombat	*Vombatus ursinus*			Seen
Red Fox*	*Vulpes vulpes*			Seen

V =Vulnerable species listed under TSC Act 1995
* = Exotic

Figures



Client: DELTA ELECTRICITY AND ENERGY AUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES	Title: **REGIONAL LOCATION MAP**
URS	Drawn: AJW; Approved: BH; Date: 01/09/2008; Job No: **43177371**; File No: 43177371-011b.wor	Figure: **1**

Indicative
EnergyAustralia
Facility

Indicative Delta
Electricity Facility

Wollondilly River

Paddys River

BRAYTON ROAD

CANYONLEIGH ROAD

BRAYTON

PADDYS RIVER

HUME HWY

To Sydney

To Goulburn

To Marulan

0 1 2
kilometres

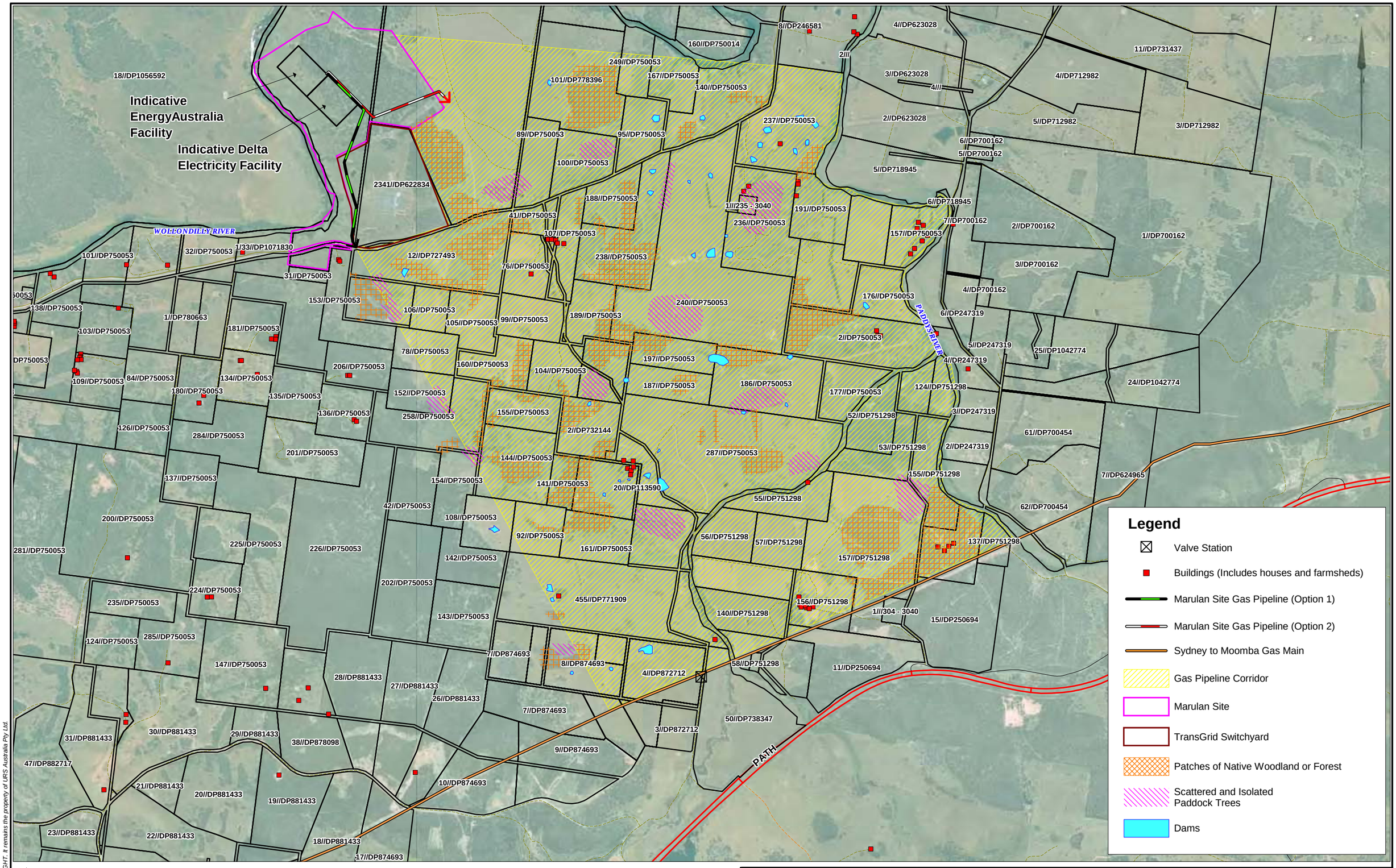
N

Legend

- Valve Station
- Buildings (Includes houses and farmsheds)
- Marulan Proposed Gas Pipeline (Option 1)
- Marulan Proposed Gas Pipeline (Option 2)
- Moomba to Sydney Gas Main
- Existing Transmission Lines
- Marulan Site
- TransGrid Switchyard

Source: Delta Electricity, Energy Australia

Client: DELTA ELECTRICITY AND ENERGY AUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES	Title: **SITE LOCATION**
URS	Drawn: AJW · Approved: BH · Date: 17/12/07	Figure: **2a**
	Job No: **43177371** · File No: 431773711-061.wor	

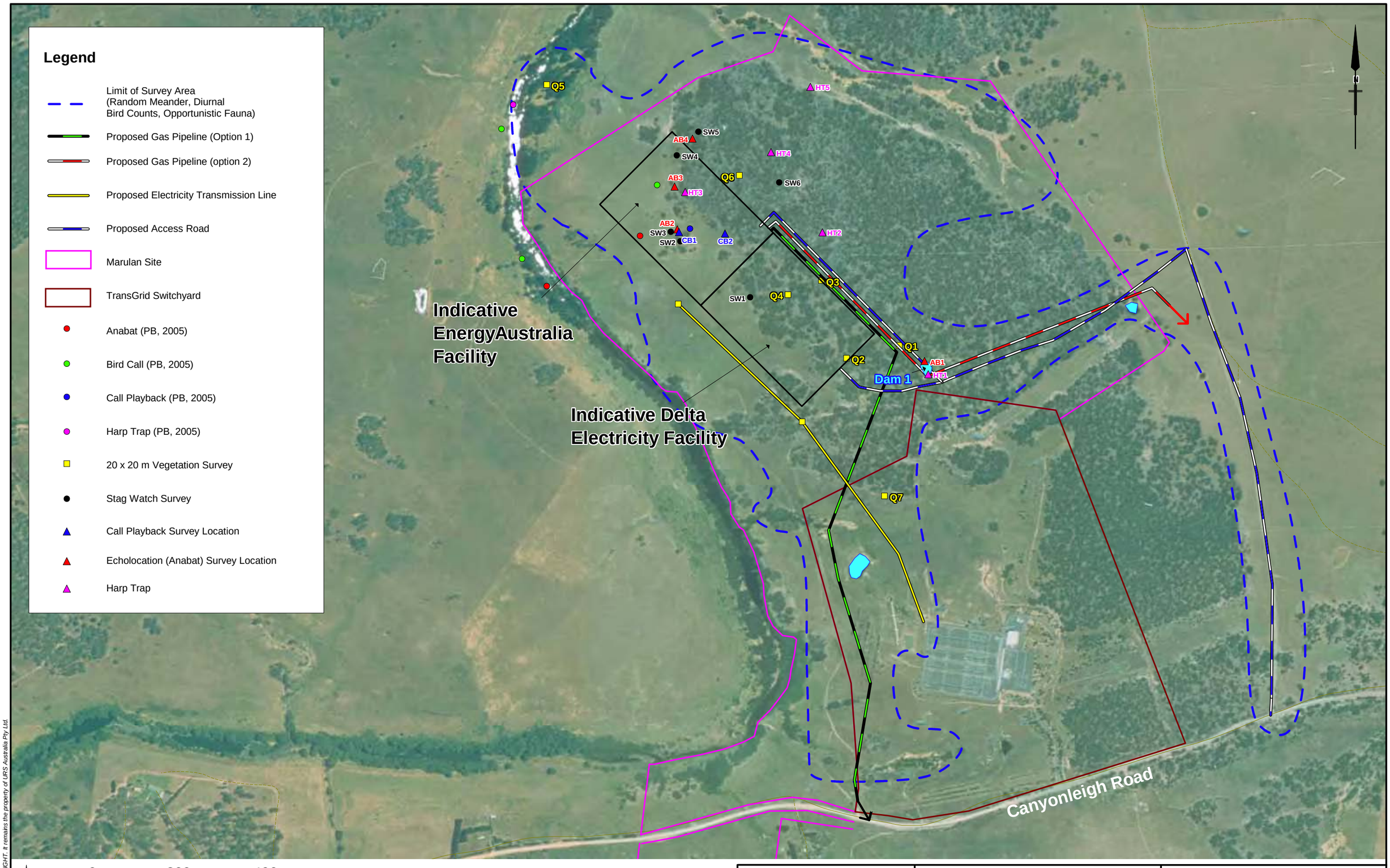


Source: Delta Electricity, EnergyAustralia

Client: DELTA ELECTRICITY AND ENERGYAUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES		Title: **PROPOSED GAS PIPELINE CORRIDOR**
URS	Drawn: AJW	Approved: NB	Date: 03.04.08
	Job No: **43177371**	File No: 431773711-070.wor	Figure: **2b**

Legend

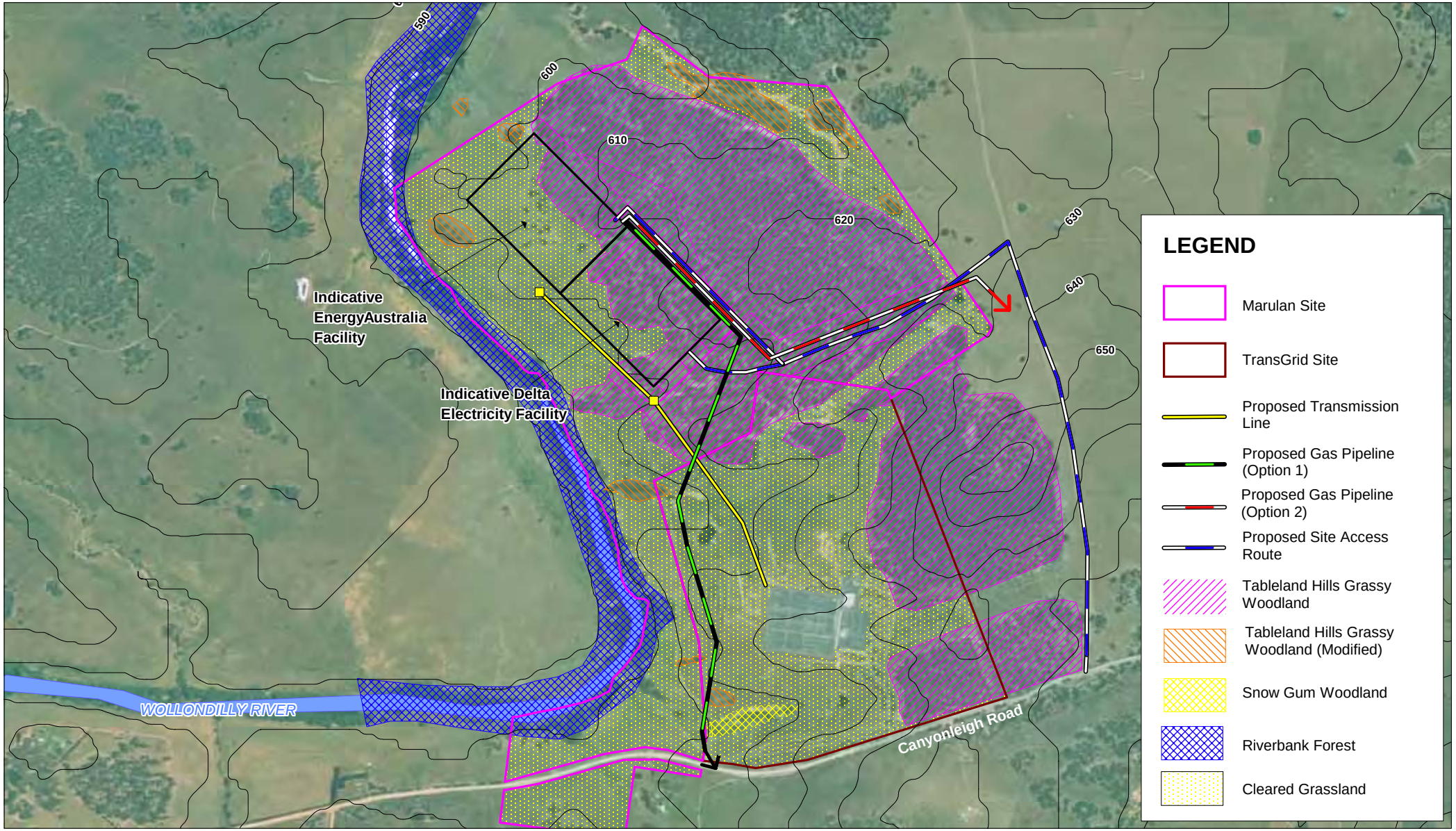
- Limit of Survey Area (Random Meander, Diurnal Bird Counts, Opportunistic Fauna)
- Proposed Gas Pipeline (Option 1)
- Proposed Gas Pipeline (option 2)
- Proposed Electricity Transmission Line
- Proposed Access Road
- Marulan Site
- TransGrid Switchyard
- Anabat (PB, 2005)
- Bird Call (PB, 2005)
- Call Playback (PB, 2005)
- Harp Trap (PB, 2005)
- 20 x 20 m Vegetation Survey
- Stag Watch Survey
- Call Playback Survey Location
- Echolocation (Anabat) Survey Location
- Harp Trap



0 200 400
metres

Source: Delta Electricity, EnergyAustralia

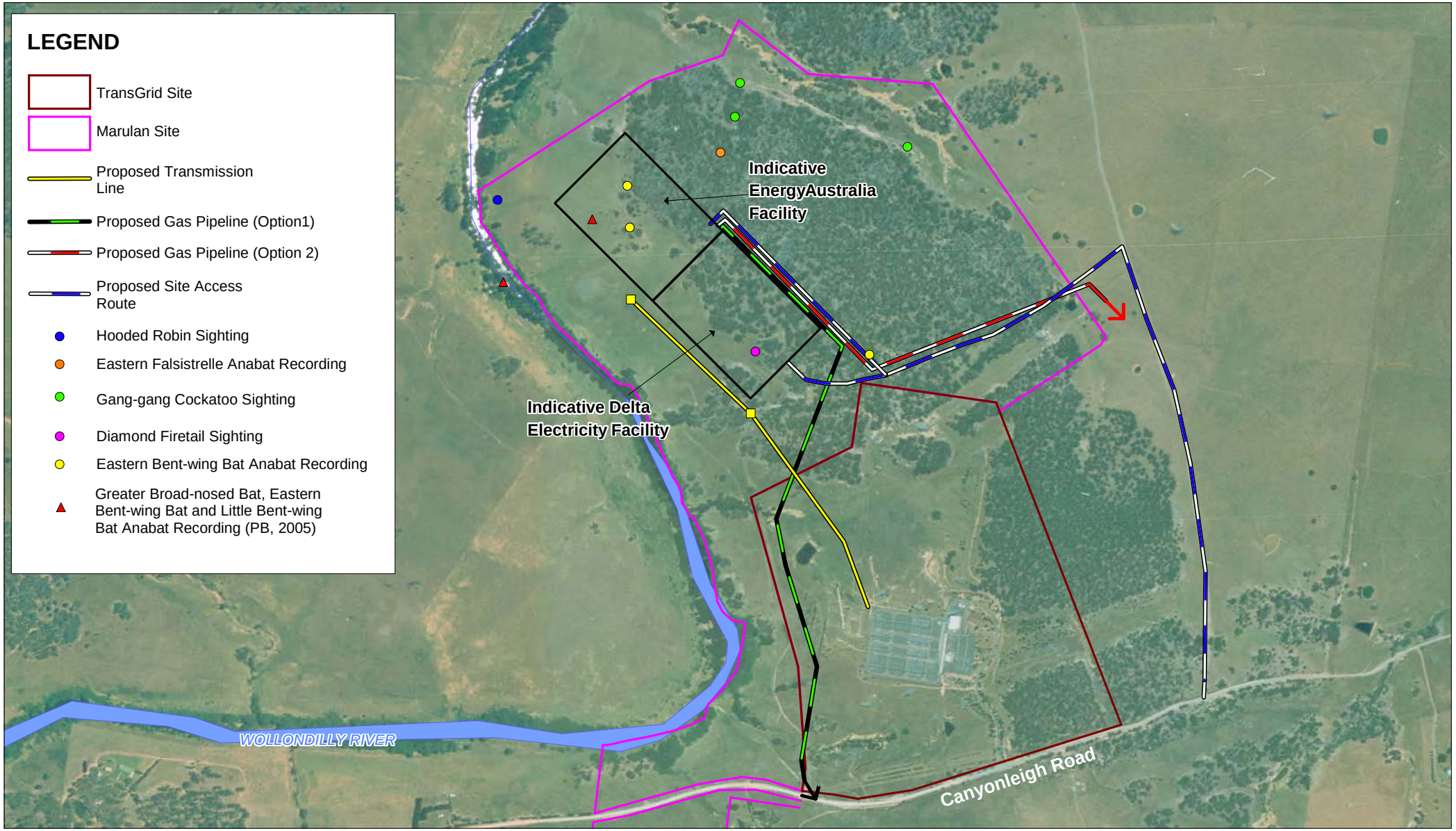
Client	DELTA ELECTRICITY AND ENERGYAUSTRALIA
Project	MARULAN GAS TURBINE FACILITIES
Title	**SURVEY EFFORT**
Drawn: AJW	Approved: BH	Date: 17.12.07
Job No: **43177371**	File No: 431773711-063.wor
Figure: **3**	



0 200 400
metres

Source: Delta Electricity, EnergyAustralia

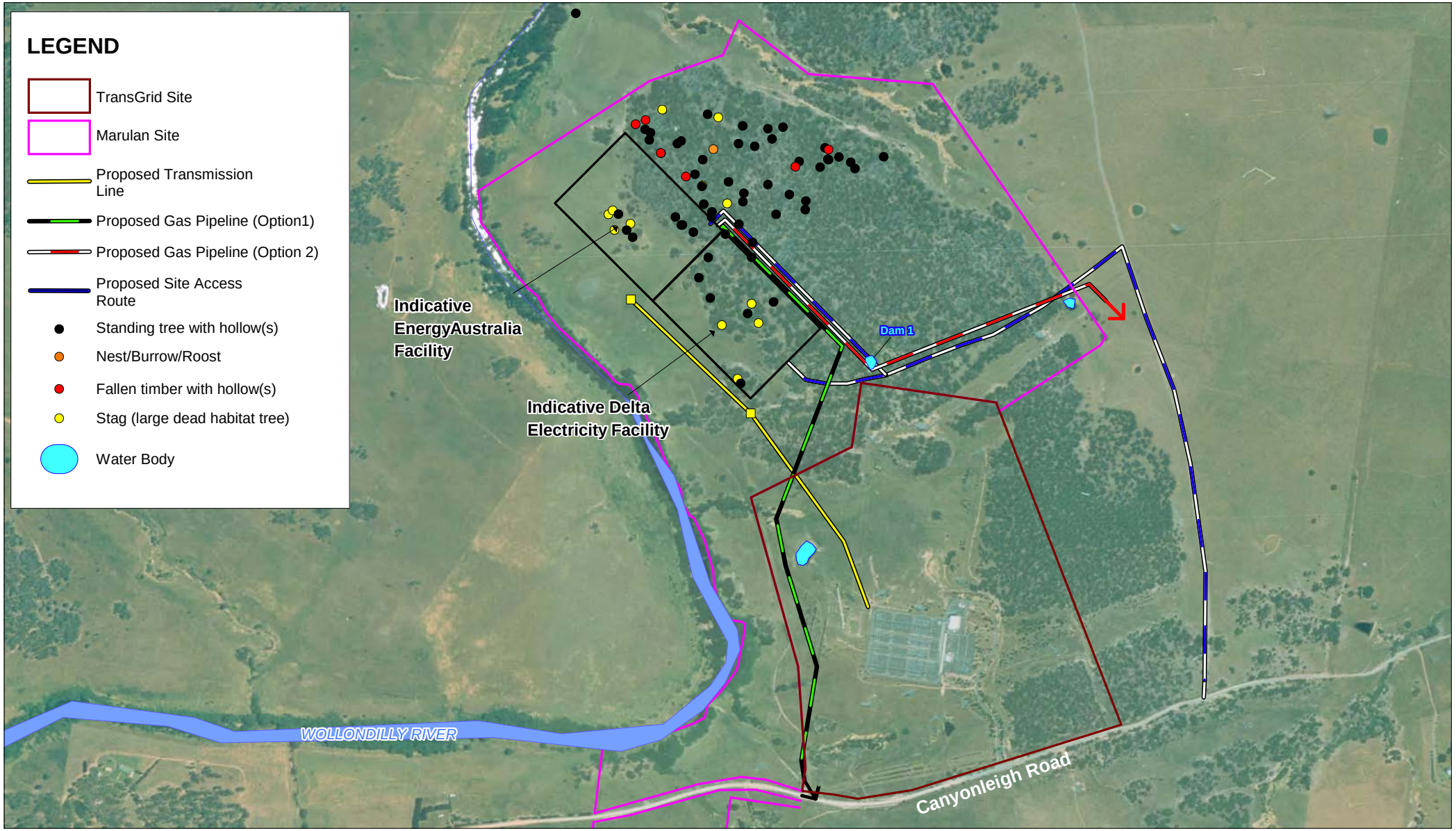
Client: DELTA ELECTRICITY AND ENERGYAUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES	Title: **VEGETATION COMMUNITIES**
URS	Drawn: AJW; Approved: NB; Date: 14.03.08 Job No: **43177371**; File No: 43177371-064.wor	Figure: **4**



0 200 400
metres

Source: Delta Electricity, EnergyAustralia

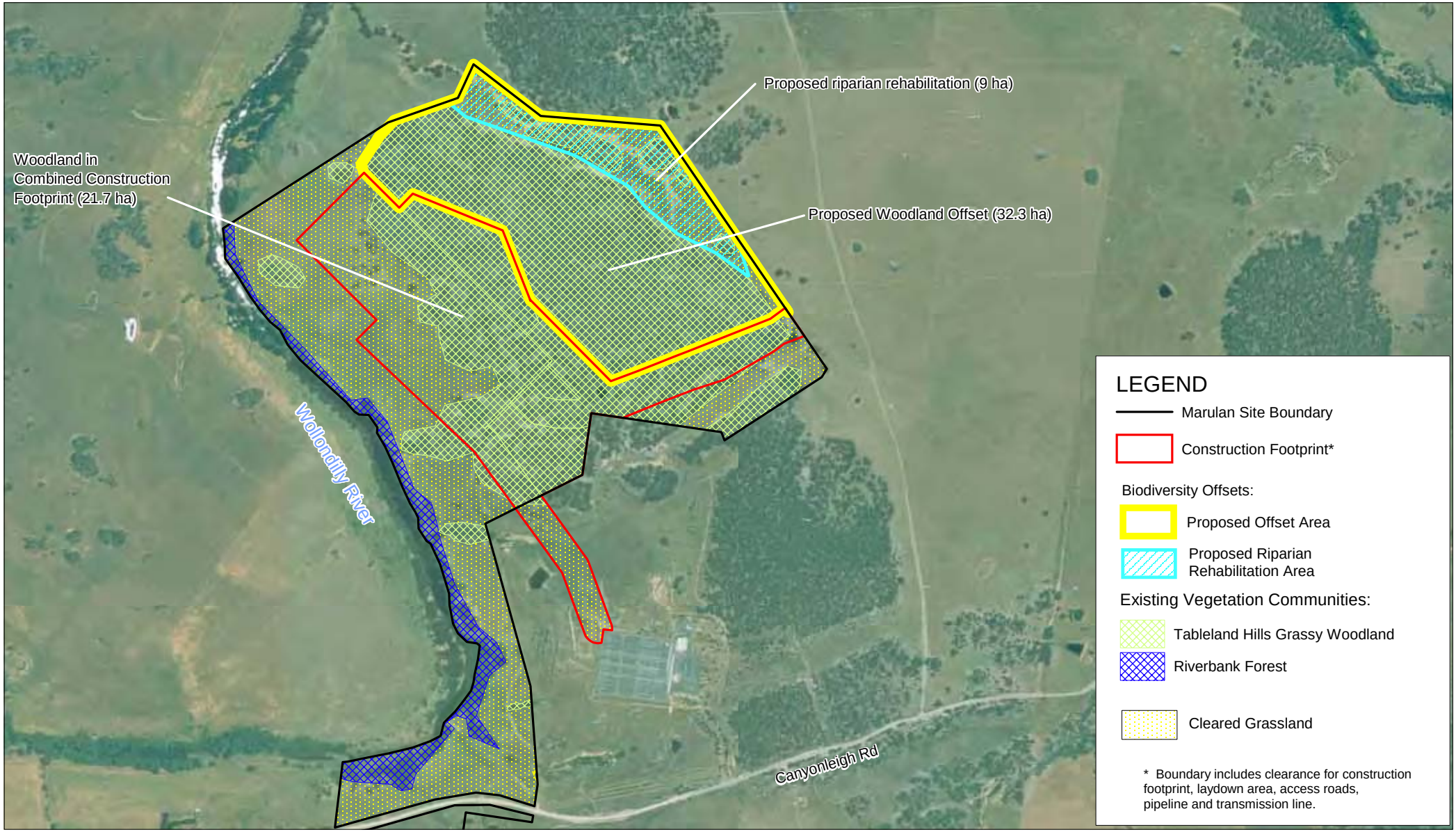
Client	DELTA ELECTRICITY AND ENERGYAUSTRALIA
Project	MARULAN GAS TURBINE FACILITIES
Title	**THREATENED SPECIES**
Drawn: AJW	Approved: BH	Date: 17/12/07
Job No: **43177371**	File No: 43177371-060.wor
Figure: **5**	



0 200 400
metres

Source: Delta Electricity, EnergyAustralia

Client	DELTA ELECTRICITY AND ENERGYAUSTRALIA
Project	MARULAN GAS TURBINE FACILITIES
Title	**IMPORTANT HABITAT FEATURES AND RESOURCES**
Drawn: AJW	Approved: NB Date: 14.03.08
Job No: **43177371**	File No: 43177371-101.wor
Figure: **6**	



0 250 500
metres

Source: Delta Electricity, EnergyAustralia

Client: DELTA ELECTRICITY AND ENERGYAUSTRALIA	Project: MARULAN GAS TURBINE FACILITIES		Title: **PROPOSED OFFSET AREAS**
URS	Drawn: TE	Approved: BH	Date: 07.02.08
	Job No: **43177371**	File No: 43177371-123.wor	Figure: **7**

Appendix A Database Searches

Australian Government
Department of the Environment and Water Resources

Protected Matters Search Tool

You are here: Environment Home > EPBC Act > Search

16 May 2007 16:18

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

---

Search Type: Point
Buffer: 10 km
Coordinates: -34.6121,150.04991

Report Contents:

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties: None

National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	3
Threatened Species:	20
Migratory Species:	14

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Places on the RNE:	None
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Other Commonwealth Reserves:	None
Regional Forest Agreements:	1

Details

Matters of National Environmental Significance

Threatened Ecological Communities [Dataset Information]	Status	Type of Presence

Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	Endangered	Community may occur within area
Temperate Highland Peat Swamps on Sandstone	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area
Threatened Species [Dataset Information]	Status	Type of Presence
Birds		
Lathamus discolor * Swift Parrot	Endangered	Species or species habitat may occur within area
Rostratula australis * Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area
Xanthomyza phrygia * Regent Honeyeater	Endangered	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus * Giant Burrowing Frog	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni * Littlejohn's Tree Frog, Heath Frog	Vulnerable	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri * Large-eared Pied Bat, Large Pied Bat	Vulnerable	Species or species habitat may occur within area
*Dasyurus maculatus maculatus (SE mainland population)** Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	Endangered	Species or species habitat may occur within area
Petrogale penicillata * Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat may occur within area
*Potorous tridactylus tridactylus** Long-nosed Potoroo (SE mainland)	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus * Grey-headed Flying-fox	Vulnerable	Species or species habitat may occur within area
Ray-finned fishes		
Macquaria australasica * Macquarie Perch	Endangered	Species or species habitat may occur within area
Prototroctes maraena * Australian Grayling	Vulnerable	Species or species habitat may occur within area
Reptiles		
Hoplocephalus bungaroides * Broad-headed Snake	Vulnerable	Species or species habitat likely to occur within area
Plants		
Caladenia tessellata * Thick-lipped Spider-orchid, Daddy Long-legs	Vulnerable	Species or species habitat likely to occur within area
Genoplesium plumosum * Plumed Midge-orchid	Endangered	Species or species habitat likely to occur within area
Gentiana wingecarribiensis * Wingecarribee Gentian	Endangered	Species or species habitat likely to occur within area
Kunzea cambagei *	Vulnerable	Species or species habitat likely to occur within area
*Leucochrysum albicans var. tricolor** Hoary Sunray	Endangered	Species or species habitat likely to occur within area
Restio longipes *	Vulnerable	Species or species habitat likely to occur

		within area
Thesium australe * Austral Toadflax, Toadflax	Vulnerable	Species or species habitat likely to occur within area
Migratory Species [Dataset Information]	Status	Type of Presence
Migratory Terrestrial Species		
Birds		
Haliaeetus leucogaster White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Migratory	Species or species habitat may occur within area
Merops ornatus * Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Migratory	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Migratory	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Migratory	Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater	Migratory	Species or species habitat likely to occur within area
Migratory Wetland Species		
Birds		
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area
Gallinago hardwickii * Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Migratory	Species or species habitat may occur within area
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift	Migratory	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Migratory	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine	Species or species habitat may occur within area

	area	
Gallinago hardwickii * Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Lathamus discolor * Swift Parrot	Listed - overfly marine area	Species or species habitat may occur within area
Merops ornatus * Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch	Listed - overfly marine area	Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail	Listed - overfly marine area	Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe	Listed - overfly marine area	Species or species habitat may occur within area

Commonwealth Lands [Dataset Information]

Communications, Information Technology and the Arts - Telstra Corporation Limited

Extra Information

Regional Forest Agreements [Dataset Information]
Note that all RFA areas including those still under consideration have been included.

Southern RFA, New South Wales

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide

only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgments

This database has been compiled from a range of data sources. The Department acknowledges the following custodians who have contributed valuable data and advice:

- New South Wales National Parks and Wildlife Service
- Department of Sustainability and Environment, Victoria
- Department of Primary Industries, Water and Environment, Tasmania
- Department of Environment and Heritage, South Australia Planning SA
- Parks and Wildlife Commission of the Northern Territory
- Environmental Protection Agency, Queensland
- Birds Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- Queensland Herbarium
- National Herbarium of NSW
- Royal Botanic Gardens and National Herbarium of Victoria
- Tasmanian Herbarium
- State Herbarium of South Australia
- Northern Territory Herbarium
- Western Australian Herbarium

- Australian National Herbarium, Atherton and Canberra
- University of New England
- Other groups and individuals

ANUCliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Last updated:

Department of the Environment and Water Resources
GPO Box 787 Canberra ACT 2601 Australia
Telephone: +61 (0)2 6274 1111

NSW National Parks & Wildlife Serv
atlas of nsw wild

NPWS home

Search Results

Your selection: Flora, threatened species, recorded since 1980, Selected Area - 149.93232,-34.70489,150.16775,-34.51023 returned a total of 3 records of 3 species.
Report generated on 17/05/2007 - 17:20 (Data valid to 13/05/2007)

view map | search again | clear selection

Choose up to 3 species to map.

** Exotic (non-native) species*

Plants	Map	Scientific Name	Common Name	Legal Status	Count	Info
Myrtaceae						
	☐	Eucalyptus aquatica	Broad-leaved Sally	V	1	
	☐	Eucalyptus macarthurii	Camden Woollybutt	V	1	
	☐	Kunzea cambagei	Cambage Kunzea	V	1	

** Exotic (non-native) species*

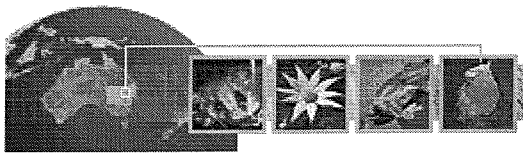
Choose up to 3 species to map.

DISCLAIMER: The Atlas of New South Wales Wildlife contains data from a number of sources including government agencies, non-government organisations and private individuals. These data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Find out more about the Atlas.

BioNet

[Atlas of NSW Wildlife Home]
[NPWS Home | Feedback | Copyright | Disclaimer | Privacy]

OUR ENVIRONMENT it's a living thing



NSW National Parks & Wildlife Ser
atlas of nsw wild

NPWS home

Search Results

Your selection: Fauna, threatened species, recorded since 1980, Selected Area - 149.93232,-34.70489,150.16775,-34.51023 returned a total of 37 records of 14 spec

Report generated on 17/05/2007 - 17:32 (Data valid to 13/05/2007)

view map | search again | clear selection

Choose up to 3 species to map.

** Exotic (non-native) species*

Aves	Map	Scientific Name	Common Name	Legal Status	Count	Info
Anatidae						
	☐	Oxyura australis	Blue-billed Duck	V	1	
Cacatuidae						
	☐	Callocephalon fimbriatum	Gang-gang Cockatoo	V	6	
	☐	Calyptorhynchus lathami	Glossy Black-Cockatoo	V	4	
Climacteridae						
	☐	Climacteris picumnus	Brown Treecreeper	V	2	
Estrildidae						
	☐	Stagonopleura guttata	Diamond Firetail	V	2	
Strigidae						
	☐	Ninox connivens	Barking Owl	V	1	
	☐	Ninox strenua	Powerful Owl	V	2	

Mammalia	Map	Scientific Name	Common Name	Legal Status	Count	Info
Macropodidae						
	☐	Petrogale penicillata	Brush-tailed Rock-wallaby	E1	1	
Petauridae						
	☐	Petaurus australis	Yellow-bellied Glider	V	5	
Phascolarctidae						
	☐	Phascolarctos cinereus	Koala	V	6	
Vespertilionidae						
	☐	Chalinolobus dwyeri	Large-eared Pied Bat	V	2	
	☐	Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	3	
	☐	Myotis adversus	Large-footed Myotis	V	1	
	☐	Scoteanax rueppellii	Greater Broad-nosed Bat	V	1	

Appendix B 7-Part Tests

Appendix B
7-Part Tests

Contents

Appendix B 7-Part Tests

Appendix B
7-Part Tests

B1.1 Introduction

Section 5A of the NSW *Environmental Planning & Assessment Act 1979* (EP&A Act) lists seven factors that must be taken into account[1] in the determination of the significance of potential impacts of a proposed development on 'threatened species, populations or ecological communities (or their habitats)' listed under the *NSW Threatened Species Conservation Act 1995* (TSC Act). The so-called '7-part test' is used to determine whether a proposed development is 'likely' to impose 'a significant effect' on threatened biota and thus whether a Species Impact Statement (SIS) is required to accompany the DA.

Under Part 3A of the EP&A Act, there is no requirement for Section 5A of the EP&A Act to be addressed, hence there is no requirement for an SIS. However, the approach herein has been to address s.5A and complete the 7-part test as a guide to assessing impacts on threatened biota that could be affected by the proposal.

A 7-part test was carried out for those TSC Act listed species and communities recorded and/or predicted to occur at times on the Site or within the adjoining area. Based on habitat availability, survey results and recent records, 7-part tests have been completed for:

- Gang-gang Cockatoo;
- Diamond Firetail;
- Hooded Robin;
- Powerful Owl; and
- Microchiropteran bats.

B1.2 Gang-gang Cockatoo

B1.2.1 Background ecology

Distribution

The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales (NSW). In NSW, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. Isolated records are known from as far north as Coffs Harbour and as far west as Mudgee.

[1] Section 5A must be considered in the administration of sections 78A, 79B, 79C, 111 and 112 of the EP&A Act.

Habitat and ecology

The Gang-gang Cockatoo undertakes nomadic as well as seasonal migrations. In summer, the species occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. The species may also occur in sub-alpine Snow Gum woodlands and occasionally in temperate rainforests. In winter, the Gang-gang Cockatoo occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. These patterns are highly variable within the species in general, and crèches of young birds in particular. Accordingly Gang-gang Cockatoos may occur at apparently random points within the range described above.

The Gang-gang Cockatoo favours old growth attributes for nesting and roosting, requiring hollows in the trunks or large limbs of large trees in which to breed. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests. Nests are most commonly recorded in eucalypt hollows in live trees close to water. Breeding usually occurs between October and January, and individuals are likely to breed from around four years of age.[2]

Local occurrence

There are six previous records of the Gang-gang Cockatoo within 10km radius of the Site (Atlas of NSW Wildlife, DECC, 17/05/2007).

Two adult females were observed during the URS May 2007 field survey feeding on the capsules of a juvenile Thin-leaved Stringybark *Eucalyptus eugenioides* near the western edge of woodland at the Marulan Site (as shown in **Figure 5)**. Four adult individuals, comprising two male/female pairs, were recorded during the URS June 2007 survey. They were observed several times over two days feeding on *E. eugenioides* capsules in the northern portion of woodland at the Marulan Site (**Figure 5)**. Chewed capsules, probably attributable to feeding Gang-gang Cockatoos, were observed throughout the woodland.

No individuals were observed nesting or roosting (in tree-hollows or other nest sites). Tableland Hills Grassy Woodland in the study area contained numerous hollow-bearing trees that may provide suitable nesting sites for the species (**Figure 5**). However the species typically favours taller, moister eucalypt forests for breeding habitat, particularly mature wet sclerophyll forests. This coincides with the species' summer migration to these areas[2].

The Marulan Site contains suitable feeding, roosting and potential breeding habitat for the Gang-gang Cockatoo. General migration patterns for the species suggest that the URS May and June 2007 observations were part of the winter, low-altitude feeding movement. No Gang-gang Cockatoos were recorded at the Site during either the URS October 2006 or October 2007 surveys. Given the absence of Spring observations, marginal breeding habitat at the Site and general migration patterns for the species it

2 WWW.THREATENEDSPECIES.ENVIRONMENT.NSW.GOV.AU/TSPROFILE

may be inferred that the local population of the Gang-gang Cockatoo occurs on the site seasonally, during the winter feeding migration.

B1.2.2 7-Part Test

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

With regard to the Gang-gang Cockatoo the following points are of relevance to Factor a):

- Based on the continuity of observations at the Marulan Site (May and June 2007) and amount of feeding resources available, the Site is likely to support a 'viable local population' of the species. This population may occur on a temporary or seasonal basis as part of annual migrations and depending on the seasonal availability of food resources;
- The proposed works will not disturb known nesting or roosting sites for individuals, breeding pairs, or local populations of these species. The Site contains suitable nesting hollows for the species, however vegetation communities at the Site do not match recognised breeding habitat preferences for the Gang-gang Cockatoo; and
- Clearing and disturbance involved during construction will represent a loss of potential foraging habitat for individuals of this species. Approximately 57% of potential foraging habitat on the Site will be retained as well as substantial areas within the Study Area.

Given the above considerations, the proposed works are not likely to have 'an adverse effect on the life cycle' of these species such that local populations of these species would be placed 'at risk of extinction'.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

There are no listed endangered populations of the Gang-gang Cockatoo within the region or of relevance to the site or the proposal. Hence Factor (b) is not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Factor (c) is not applicable.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

(i) The proposed works will result in the removal of approximately 21.7 ha foraging habitat, in the form of Tableland Hills Grassy Woodland, for the species. This area also contains potential breeding habitat including large numbers of hollow-bearing trees.

(ii) The proposed works will remove potential habitat for this species at an existing edge. The habitat at the Study Area is already fragmented and isolated, being surrounded by cleared grazing land and intersected by cleared transmission line easements. The proposed works will further fragment and isolate potential foraging and breeding habitat for this species.

(iii) The area of potential foraging habitat (21.7ha) to be cleared under the current proposal is small relative to that which is available in the locality and the surrounding region. Approximately 33 ha of equivalent habitat will be retained on the Site. There is approximately 18,800ha of the community in south-eastern NSW[3]. Potential roosting and breeding habitat will also be lost. Surrounding woodland is likely to contain equivalent concentrations of these resources. Given the area of existing habitat available within the locality and region, the removal of habitat associated with the proposal is likely to be of minor importance to the long term survival of this species in the locality.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The study area is not listed as critical habitat under Part 3 Division 1 of the TSC Act.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no Recovery Plan currently published for the Gang-gang Cockatoo. However, DECC lists a number of priority actions for their conservation. The proposal is generally consistent with the recommended actions, where applicable. The mitigation measures proposed in the report, will improve the connectivity of habitats for these species within the study area in the long-term.

[3] Tindall *et al.* (2004).

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A 'key threatening process' 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 Key Threatening Processes listed in Schedule 3 of the TSC Act that are potentially relevant to the current proposal include:

- clearing of native vegetation; and
- invasion by exotic perennial grasses.

The Key Threatening Process, 'Clearing of native vegetation', is relevant to the current proposal (although Gang-gang Cockatoo is not listed as being affected by this process under the Final Determination). The vegetation that would be disturbed during construction is unlikely to be critical to the survival of the local population.

The Key Threatening Process, 'Invasion of exotic grasses', is relevant to the current proposal (although Gang-gang Cockatoo is not listed as being affected by this process under the Final Determination). Mitigation measures for flora and fauna proposed for the current proposal (which are included in the Statement of Commitments for the EA), including weed control, bush regeneration, creek rehabilitation and revegetation of cleared areas, will ensure that the proposal does not exacerbate any existing weed problems and will control any potential weed invasion, including exotic grasses, that could result from construction activities. The proposed plant footprint will not be regenerated using exotic grasses. Consequently, whilst the proposal may temporarily disturb soil which could encourage invasion of exotic grasses, the mitigation measures proposed will ensure that the proposal does not threaten the survival or evolutionary development of the species.

B1.2.3 Conclusion

Based on the consideration of the seven factors of s.5A presented above, it is not 'likely' that the proposed works will result in 'a significant effect' on the Gang-gang Cockatoo.

B1.3 Diamond Firetail

B1.3.1 Background Ecology

Distribution

The Diamond Firetail is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. It is not commonly found in coastal districts, though there are records from near

Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, and also occurs in the Australian Capital Territory, Queensland, Victoria and South Australia[4].

Habitat and ecology

The Diamond Firetail is found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Woodlands. It also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. It is often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.

The species feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). It is usually encountered in flocks of between five to 40 birds, occasionally more.

Groups separate into small colonies to breed between August and January. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting. The species appears to be sedentary, though some populations move locally, especially those in the south.

Much of its habitat has been cleared, and remaining fragments are gradually becoming unsuitable. Factors that may adversely affect Diamond Firetail include loss of key food plants and habitat as a result of invasion by exotic grasses that are more suitable for flock-foraging competitors. These include Red-browed Finches *Neochmia temporalis*, whose expansion in some areas may have disadvantaged Diamond Firetails (Read, 1994).

Diamond Firetails have also been adversely affected by clearing for agriculture or urban development as well as predation of eggs and nestlings by increased populations of native predators such as the Pied Currawong[5].

Local occurrence

Two individuals of the Diamond Firetail were observed opportunistically at the Marulan Site during the October 2006 survey (**Figure 5**). The species was also recorded in the URS June 2007 survey. They were recorded in Box-Gum Woodland dominated by Argyle Apple *Eucalyptus cinerea*, with a grass and herb understorey. There is approximately 57 ha of this habitat type within the Marulan Site. Areas of 200 hectares or greater within woody vegetation are identified as particularly significant in the DECC action plan, though this species also uses treeless grasslands in the Southern Tablelands. Therefore other habitat types recorded in the local area (exotic pasture dominated open grassland, *E. pauciflora* woodland, Wollondilly River riparian vegetation) may also provide suitable habitat for the species.

A search of the NPWS Atlas of NSW Wildlife did not reveal any previous records of the species in the area (**Table 2**).

---

[4] http://www.threatenedspecies.environment.nsw.gov.au/tsprofile

[5] http://www.birdsinbackyards.net/finder

B1.3.2 7-Part Test

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Breeding populations of the Diamond Firetail prefer dense shrubby understoreys for both breeding and roosting[2]. The study area contains a sparse, grassy understorey so the Marulan Site probably provides foraging habitat rather than roosting or nesting habitat for the species.

Bird species are mobile, but they must balance the expenditure of energy travelling to obtain food with the value of food resources. Therefore adequate foraging provisions in the local area are essential for the life cycle of a viable local population of a species. The proposal will result in the removal of approximately 21.7ha of woodland foraging habitat from an estimated total area of 57ha of woodland within the Marulan Site. This loss of foraging habitat will have an adverse effect; however the magnitude of the impact is unlikely to place a local population of the species at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

There are no listed endangered populations of the Diamond Firetail. Hence Factor (b) is not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

There are no listed endangered ecological communities of the Diamond Firetail. Hence Factor (c) is not applicable.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

(i) As discussed above, the woodland within the proposed power station footprint is unlikely to support a local breeding population of the Diamond Firetail since suitable roosting and breeding habitat is not present. The proposed development will result in the removal of foraging habitat for this species. Approximately 21.7ha of woodland habitat will be removed as result of clearing for the proposed facility at the Marulan Site. The significance of this area is likely to be minor in the context of large areas of suitable foraging habitat in the local area, including 33 ha of woodland within the Marulan Site that will not be affected by the proposal.

(ii) Clearing of woodland for the proposed development is unlikely to result in isolation or significant fragmentation of habitat. The position of the proposed facilities is such that continuity of woodland is maintained. There will be some fragmentation of remaining woodland to the south of the footprint caused by the proposed access road, gas pipeline and transmission line. The gaps created by this infrastructure are unlikely to prevent the species from utilising remaining habitat because:

- the gaps in suitable habitat are small (<20m);
- the Diamond Firetail is a mobile species; and
- woodland present on site is already fragmented by existing infrastructure, including the TransGrid switchyard and transmission line easements.

Foraging habitat in woodland in the Marulan Site is already isolated in the regional landscape by surrounding cleared farmland. The proposal will not increase the degree of this isolation.

(iii) The habitat that will be removed under the current proposal is likely to be of minor importance to the long term survival of the Diamond Firetail in the locality. The following factors limit its significance:

- the relatively small area to be removed balanced with the area remaining; and
- the moderate quality of the habitat due to the absence of a shrubby understorey.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The study area is not listed as critical habitat under Part 3 Division 1 of the TSC Act.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A total of six recovery strategies have been identified to help recover the threatened population of the Diamond Firetail in NSW. The proposal is broadly consistent with these strategies:

- Community and land-holder liaison/ awareness and/or education: Increase understanding of woodland birds through promotion of the DECC website and other educational material.
- Habitat management: Other: Develop habitat identification, management and enhancement guidelines for woodland birds; Implement habitat management guidelines in conservation reserves, council reserves and crown reserves containing suitable habitat.

- Habitat Rehabilitation/Restoration and/or Regeneration Identify key habitats or areas on a regional basis for protection and enhanced management through incentives.
- Research: general biological and ecological studies Conduct ecological research to determine habitat and resource requirements, threats and conservation issues.
- Survey and/or Mapping Undertake surveys for threatened woodland birds in new and existing conservation reserves containing suitable habitat to assess the species' conservation status and identify key breeding and foraging habitat.

It is recommended that stock be excluded from the Marulan Site which may improve the value of remaining habitat for the species. This is consistent with the action:

- Reduce heavy grazing by domestic stock in areas of known or potential habitat, to enable flowering and subsequent seeding of grasses and forbs that this species requires.

However the proposal is not consistent with the following actions:

- Retain and protect woodland, open forest, grassland and mallee habitat from clearing, fragmentation and disturbance;
- Ensure remnant populations remain connected or linked to each other; in cases where remnants have lost connective links, re-establish links by revegetating corridors at the Marulan Site to act as stepping stones for dispersal.

Nationally the Diamond firetail is classed as Near-threatened under the *EPBC Act* and is included in the *Action Plan for Australian Birds 2000* (Garnett and Crowley, 2000). The proposed development is inconsistent with the following Recommended Actions:

- Protect all woodland in which Diamond Firetails are known to be resident from clearing, monitoring compliance biennially (s. 11.2).
- Within the firetail's range, manage at least 15% of the pre-European area of all woodland communities on public or private land for nature conservation, using incentives where necessary (s.11.4).

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

In Part 1 of the TSC 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 proposal will result in the operation of the following Key Threatening Processes listed in Schedule 3 of the TSC Act: Clearing of native vegetation.

B1.3.3 Conclusion

The removal of approximately 21.7ha of habitat will have a minor impact on the foraging resources available to the Diamond Firetail in this locality. Bird species are mobile and will travel to utilise foraging

habitats. Significant areas of equivalent grade habitat are available in the local area, including 57ha of woodland within the Marulan Site that will be retained around the proposed facility.

Adjacent and surrounding resources containing high quality habitat will not be impacted by the proposal. It is concluded that that there is not 'likely' to be a 'significant effect' on the Diamond Firetail as a result of the proposed development.

B1.4 Hooded Robin

B1.4.1 Background Ecology

Distribution

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, 2007b).

Habitat and ecology

The Hooded Robin prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. It requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. As is typical for Australian robin species it perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey (DECC, 2007b). Hooded Robins breed in monogamous pairs and are sedentary within home ranges. Territories range from 5-10 ha during the breeding season, to 30 ha in the non-breeding season (BIBY, 2007).

Hooded Robins typically breed between August and November, often rearing several broods. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground. The nest is defended by both sexes. A clutch of two to three is laid and incubated for 14 or 15 days by the female. Young remain in the nest for 13 days (BIBY, 2007). Young from previous clutches often cooperate with adult pairs in brooding and defending breeding territories (Bell, 1983).

Established pairs keep to their territory year round, banding into family groups only briefly after breeding (ACT Govt, 1999). Bell (1983) observed breeding and dispersal behaviour of Hooded Robins over three years. A single adult pair occupied a home range of ca. 6 ha during the breeding season, which expanded to ca. 30 ha during the non-breeding period. The pair relocated their nest site each season with varying breeding success depending on the location of the nest. Nests on open horizontal branches failed whereas a nest on a hollow stump amongst shelter was successful. The pair's single, male offspring remained within the home range the following season.

Local occurrence

A single Hooded Robin was observed during the October 2007 field survey in areas of Cleared Grassland and Riparian Forest to the west of the Site (**Figure 5**). This area contains highly suitable foraging habitat for the species with a mosaic of treed and cleared vegetation, patches of thick shrub cover and dense understorey of native shrubs and grasses. Cleared Grassland and Grassy Woodland in the proposed development footprint also provide suitable foraging habitat for the species.

The Hooded Robin typically occupies a home range of 5ha during the breeding season, centred on a nest Site (BIBY, 2007). The species was seen only once during field surveys, outside the development footprint and so it is unlikely that the species' 2007 breeding territory coincides with the Site. The species forages within a 25-30ha home range outside the breeding season and may occupy alternative nest sites in subsequent seasons. Accordingly the Site provides foraging habitat and potential breeding habitat for the species.

There are no previous NPWS Atlas records within 10km of the Site (DECC, 2007a). The Birds Australia (2007) Birdata Atlas shows two recent records within 20km of the site.

B1.4.2 7-Part Test

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

With regard to the Hooded Robin the following points are of relevance to Factor a):

- the Site is likely to support a 'viable local population' of the species. This population may occur on a temporary or seasonal basis during season expansion of a breeding pair's home range or may support breeding pairs during some seasons;
- the proposed works will not disturb known nesting or roosting sites for individuals, breeding pairs, or local populations of these species. The Site does contain suitable nesting habitat for the species; and
- clearing and disturbance involved during construction will represent a loss of potential habitat for individuals of this species. Approximately 57% of habitat on the Site will be retained as well as substantial areas within the Study Area.

The proposed development is unlikely to have an adverse effect on the life cycle of the species provided that the mitigation measures outlined in **Section 6** are adopted. Specifically: a detailed pre-clearing survey and avoidance of breeding individuals.

Given the above considerations, the proposed works are not likely to have 'an adverse effect on the life cycle' of these species such that local populations of these species would be placed 'at risk of extinction'.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

(i) The proposed works will result in the removal of approximately 21.7ha of foraging habitat in Tableland Hills Grassy Woodland and a further 12.5 ha in Cleared Grassland. This area also contains potential breeding habitat.

(ii) Habitat within the Study Area is partially fragmented and isolated by the existing TransGrid Switchyard and larger expanses of cleared country. The majority of disturbance within the study area, such as grazing land and cleared transmission line easements, probably does not constitute fragmentation of habitat for the species as it will readily occupy treeless habitats. The proposed works will constitute a minor increase in fragmentation by reducing the overall patch size of the remnant Tableland Hills Grassy Woodland. The operating Plant may also pose a minor barrier to the movement of individuals.

(iii) The area of potential foraging habitat (34.2ha) to be cleared under the current proposal is small relative to that which is available in the locality and the surrounding region. This includes approximately 21.7ha of Tableland Hills Grassy Woodland. Approximately 33 ha of equivalent habitat will be retained on the Site and there is approximately 18,800ha of the community in south-eastern NSW[6]. The remainder of the development footprint is Cleared Grassland which is extensively distributed in the locality and the surrounding region. Potential roosting and breeding habitat will also be lost. Surrounding woodland is likely to contain equivalent concentrations of these resources. Given the area of existing habitat available

[6] Tindall *et al.* (2004).

within the locality and region, the removal of habitat associated with the proposal is likely to be of minor importance to the long term survival of this species in the locality.

The importance of the habitat to be removed cannot be definitively assessed without knowledge of breeding individual's movements over successive seasons. A pre-clearing survey will be required to determine if the local population of Hooded Robins has a breeding home range within the proposed development footprint during the construction period. This will help determine the importance of the habitat to be removed.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The study area is not listed as critical habitat under Part 3 Division 1 of the Threatened Species Conservation Act 1995.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The action proposed is not consistent with the objective: protect all woodland in which Hooded Robins are known to be resident from clearing as stated within The Action Plan for Australian Birds 2000 (Environment Australia, 2000).

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Construction at the Site will result in the operation of the following Key Threatening Processes listed in Schedule 3 of the TSC Act:

- Clearing of native vegetation;
- Removal of dead wood and dead trees; and
- Loss of hollow-bearing trees.

These processes have been addressed in 'Part a' and 'Part d' of this assessment.

B1.4.3 Conclusion

Given the consideration of the above seven factors, it is not 'likely' that the proposed works will result in 'a significant effect' on the Hooded Robin.

Appendix B
7-Part Tests

B1.5 Powerful Owl

B1.5.1 Background Ecology

Distribution

The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. Now uncommon throughout its range where it occurs at low densities.

Habitat and ecology

The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species.

The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls. For example in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. Birds comprise about 10% of the diet, with flying foxes important in some areas. As most prey species require hollows and a shrub layer, these are important habitat components for the owl.

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 400-1450 ha. Powerful Owls nest in large tree hollows (at least 0.5m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. During the breeding season, the male Powerful Owl roosts in a "grove" of up to 20-30 trees, situated within 100-200 metres of the nest tree where the female shelters.

Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter, but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days.

Local occurrence

A Powerful Owl was recorded during a targeted call playback survey during the PB October 2005 field survey. The record was from Tableland Grassy Box Woodland approximately 5 kilometres from the location of the proposed works. Powerful Owls have large home ranges and utilise a variety of treed vegetation communities and so this 7-Part test was performed for forest and woodland areas at the

Marulan Site. All woodland and forest communities in the local area provide potential foraging habitat. Suitable prey (e.g. Common Brushtail Possum, Sugar Glider) were observed across the local area by PB (2005) and URS (2007). The study area also contains good quantities of suitable tree hollows for prey species.

No suitable Powerful Owl nesting trees (trunk diameter (DBH) >80cm, hollows at least 50cm deep) were observed and so there is probably not suitable breeding habitat present. Dominant eucalypts observed had diameters of less than 60cm.

Suitable roosting habitat is present in the tall, dense *Allocasuarina cunninghamiana* Riverbank Forest where the transmission line crosses the Wollondilly River. Roosting habitat may also be present in denser stands of the Tablelands Dry Forest in the locality; however Tableland Hills Grassy Woodland on the Marulan Site is probably too lightly vegetated.

B1.5.2 7-Part Test

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

No suitable breeding hollows for the Powerful Owl will be lost as a result of the proposal.

Breeding birds require sufficient areas of suitable foraging habitat and prey densities within their home range to support a pair of adults and their offspring. For Powerful Owls this necessitates a large home range that is adequately provisioned with suitable prey species. The proposed plant footprint at the Marulan Site is unlikely to have a significant impact on the amount of food resources available since 21.7 ha of suitable foraging habitat will be cleared, whilst Powerful Owls utilise a home range of 400-1450ha.

Approximately 33 ha of equivalent habitat will be retained within the site and so it is also unlikely to significantly increase the effort expended in foraging to compensate for the loss. The loss of 21.7ha of woodland is also likely to cause a relatively minor loss in the amount of prey animals available, and may cause a short term increase in prey densities due to the displacement of individuals.

The loss of foraging habitat at the Marulan Site is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species may be placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

There are no listed endangered populations of the Powerful Owl. Hence Factor (b) is not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

There are no listed endangered ecological communities of the Powerful Owl. Hence Factor (c) is not applicable.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

(i) As discussed above, the woodland within the proposed development footprint is unlikely to support a local breeding population of Powerful Owls since suitable breeding hollows are not present. The proposed development will result in the removal of foraging habitat for these species. Approximately 21.7 ha of woodland habitat will be lost as result of clearing for the proposed power station, with around 33 ha of woodland to be retained within the Marulan Site, which will not be affected by the proposal.

(ii) Clearing of woodland for the proposed power station at the Marulan Site is unlikely to result in isolation or significant fragmentation of habitat. The position of the proposed power station footprint is such that continuity of woodland is maintained around it. There will be some fragmentation of remaining woodland to the south of the power station footprint caused by the proposed access road, gas pipeline and transmission line (**Figure 5**). The gaps created by this infrastructure are unlikely to prevent the species from utilising remaining habitat because:

- the gaps in suitable habitat are small (<20m);
- the Powerful Owl is a large, mobile species; and
- woodland present on the site is already fragmented by existing infrastructure including the TransGrid switchyard and transmission line easements.

(iii) The habitat that will be removed is probably of minor importance to the long term survival of the Powerful Owl in the locality. The area to be removed is likely to be of minor significance to the long term survival of the species in the locality when balanced with: the area of woodland to be retained; the high mobility of the species and its large home range (400-1450ha).

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The study area is not listed as critical habitat under Part 3 Division 1 of the TSC Act.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The Powerful Owl is covered by the Recovery Plan for the Large Forest Owls[7]. The proposal is generally consistent with the aims and recovery actions of the Plan. However, the clearing associated with construction of the proposal is inconsistent with the following Actions listed under the Plan:

Objective 1: To minimise further loss and fragmentation of habitat outside conservation reserves and State forests by protection and management of significant owl habitat (including protection of individual nest sites).

Objective 2: To minimise the impacts of development activities on large forest owls and their habitats outside conservation reserves and State forests.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

In Part 1 of the TSC 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".

Development at the Marulan Site will result in the operation of the following Key Threatening Processes listed in Schedule 3 of the TSC Act: Clearing of native vegetation.

B1.5.3 Conclusion

The removal of woodland habitat at the Marulan Site as part of construction of the proposed facilities will have a minor impact on the foraging resources available to the Powerful Owl in this locality. The Powerful Owl is a large, mobile species that occupies home ranges of greater than 400ha. Significant areas of equivalent grade foraging habitat are available in the local area, including 33 ha of woodland within the TransGrid Switchyard that will not be impacted by the proposal.

Adjacent and surrounding resources containing high quality habitat will not be impacted by the proposal. It is concluded that that the proposal is not 'likely' to impose 'a significant effect' on the Powerful Owl.

B1.6 Microchiropteran Bats

This assessment has been prepared for the following tree dependant microchiropteran bat species ('micro-bats') that are listed as threatened under the TSC Act:

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);

[7] http://www.nationalparks.nsw.gov.au/PDFs/recoveryplan_large_forest_owls_draft.pdf

- Greater Broad-nosed Bat (*Scoteanax rueppellii*); and
- Little Bent-wing Bat (*Miniopterus australis*).

B1.6.1 Background Ecology - Eastern False Pipistrelle

Distribution

The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania.

Habitat and ecology

The Eastern False Pipistrelle prefers moist habitats, with trees taller than 20 m. It generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. The species hunts beetles, moths, weevils and other flying insects above or just below the tree canopy.

It hibernates in winter and females are pregnant in late spring to early summer.

Local occurrence

The Eastern False Pipistrelle was recorded by ultrasonic bat detector (Anabat) survey during the URS (October 2007) field survey. Anabat survey locations that resulted in positive identification of threatened micro-bat species are shown in **Figure 5.**

Woodland and forest throughout the Marulan Site provide suitable foraging habitat for the species. There are also large numbers of hollow-bearing trees at the Site that may provide diurnal roosts and possibly also maternity roost sites.

B1.6.2 Background Ecology - Eastern Bent-wing Bat

Distribution

The Eastern Bent-wing Bat has a broad distribution along the east and north-west coasts of Australia.

Habitat and ecology

Caves are the primary roosting habitat, but Eastern Bent-wing Bats also use derelict mines, storm-water tunnels, buildings and other man-made structures. The species forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes.

At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals.

They hunt in forested areas, catching moths and other flying insects above the tree tops.

Local occurrence

The Eastern Bent-wing Bat was recorded by Anabat survey during the URS (October 2007) and PB (October 2005) field surveys. Anabat survey locations that resulted in positive identification of threatened micro-bat species are shown in **Figure 5.** The Site provides suitable foraging habitat for the species and potential diurnal roost Sites. There are no caves or rock outcrops at the Site and so it would not support maternity colonies or winter hibernation colonies.

B1.6.3 Background Ecology - Greater Broad-nosed Bat

Distribution

The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands but does not occur at altitudes above 500 m.

The species distribution is widespread but sparse and patchy in coastal and near coastal east Australia, ranging from the extreme south-east of NSW (Parnaby 1992), as far north as the Atherton and Mt. Carbine Tablelands in north Queensland (Schulz 1995, Clague 1998). In southern NSW it appears to be restricted to lower altitude forests (McKean 1966, Woodside and Long 1984) while in the central part of its range it occurs from near sea level to upland areas (Calaby 1966). In the northern part of its range appears restricted to high altitude areas (Schulz 1995, Clague 1998). In some localities within its range, populations appear to be numerous: in south-east Queensland e.g. Ravensbourne State Forest, Main Range, and in north-east NSW e.g. Richmond Range National Park (Schulz unpub.). However, elsewhere in the same region, the species appears to be absent or present in low densities, despite similar vegetation type and topography.

Habitat and ecology

The Greater Broad-nosed Bat utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.

It forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects. This species has also been known to eat other bat species.

Its roosting requirements are poorly known. Individuals have been recorded roosting in tree hollows, cracks and fissures in the trunk and boughs of stags, and under exfoliating bark. Little is known of its reproductive cycle, however a single young is born in January. Prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.

Local occurrence

The Greater Broad-nosed Bat was recorded Anabat survey during the URS (October 2007) and PB (October 2005) field survey. Anabat survey locations that resulted in positive identification of threatened micro-bat species are shown in **Figure 5.**

Woodland at the Marulan Site provides suitable foraging habitat for the species. The Wollondilly River could represent high quality habitat for this species. There are also large numbers of hollow-bearing trees at the Site that may provide diurnal roosts and possibly also maternity roost sites.

B1.6.4 Background Ecology - Little Bent-wing Bat

Distribution

The Little Bent-wing Bat typically occurs through coastal north-eastern NSW and eastern Queensland.

Habitat and ecology

The Little Bent-wing Bat is found in moist eucalypt forest, rainforest or dense coastal banksia scrub.

Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.

In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (*M. schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear its young.

Local occurrence

The Little Bent-wing Bat was recorded during ultrasonic bat (Anabat) surveys conducted during the PB (October 2005) field survey. Anabat survey locations that resulted in positive identification of threatened micro-bat species are shown in **Figure 5.** This occurrence is considerably farther south than the known distribution of the species.

Woodland and forest throughout the Marulan Site provide suitable foraging habitat for the species. There are no caves or rock outcrops at the Site and so it would not support maternity colonies or winter hibernation colonies.

B1.6.5 7-Part Test

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

No potential habitat for maternity colonies (caves, large rock outcrops, cliff lines) for the Little or Eastern Bent Wing Bat was recorded at the Marulan Site. The local topography is unlikely to provide any such areas. The nearest maternity roost is most likely the Wombeyan Caves or Bungonia Gorge to the east to the north of Marulan.

Hollow-bearing trees at the Site may provide maternity roost sites for the Eastern False Pipistrelle and the Greater Broad-nosed Bat. Woodland outside of the development footprint contains equivalent quantities of these resources. The loss of small numbers of potential roost sites due to vegetation clearing is unlikely to place local populations of these species at risk of extinction.

Reductions in the area or quality of foraging habitat may also impact upon the life cycles of micro-bats. This is addressed in Part *(d)* below.

The loss of foraging habitat at the Marulan Site is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species may be placed at risk of extinction. In line with the mitigation measures outlined in this report, the detailed tree clearing protocol will ensure that any bats that may be temporarily roosting in the area of vegetation to be cleared will not be significantly impacted.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

There are no listed endangered populations of the Eastern False Pipistrelle, Greater Broad-nosed Bat, Eastern Bent-wing Bat or Little Bent-wing Bat. Hence Factor (b) is not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

(i) The proposed development will result in the removal of foraging habitat for these species. Approximately 21.7ha of woodland habitat will be lost as result of clearing for the proposed power station. It will also result in the removal of potential roost sites for the Greater Broad-nosed Bat and Little Bent Wing Bat in the form of tree hollows.

(ii) Clearing of woodland for the proposed power station is unlikely to result in isolation or significant fragmentation of habitat. The position of the proposed facilities is such that continuity of woodland is maintained. There will be some fragmentation of remaining woodland to the south of the facilities caused by the proposed access road, gas pipeline and transmission line (**Figure 5**). The gaps created by this infrastructure are unlikely to prevent the species from utilising remaining habitat because:

- the gaps in suitable habitat are small (<20m);
- the Greater Broad-nosed Bat favours open foraging habitat due to its direct flight
- the other three species of micro-bats are highly mobile aerial mammals; and
- woodland present on site is already fragmented by existing infrastructure, including the TransGrid switchyard and transmission line easements.

(iii) The foraging habitat that will be removed is likely to be of minor importance to the long term survival of micro-bat species in the locality. The significance of this area is low in the context of large areas of suitable foraging habitat in the local area, including the remaining 33 ha of woodland within the Marulan Site that will not be affected by the proposal.

It will also result in the removal of roosting habitat for the Greater Broad-nosed Bat and Little Bent Wing Bat in the form of tree hollows, although these species usually roost in caves or similar structures. However, the surrounding woodland is likely to contain an equivalent density of hollow-bearing trees and hence the habitat to be removed is not highly significant for the ecology of these species.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat for these species has been listed.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery or threat abatement plan for these bat species. However listings for these species identify the following management recommendations:

- Retain hollow-bearing trees and provide for hollow tree recruitment.
- Retain foraging habitat.
- Minimise the use of pesticides in foraging areas.

Although the proposed development is inconsistent with these actions in that it involves loss of hollow bearing trees and foraging habitat, the proposed mitigation measures will ensure similar habitats are created and retained around the development site.

Minimising the use of pesticides on site can be incorporated in the OEMP for the Site.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

In Part 1 of the TSC 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". Clearing of native vegetation is listed as a Key Threatening Process in Schedule 3 of the TSC Act.

Other threats to bats include:

- Deforestation/land clearing;
- Roost disturbance; and
- Change in fire regimes.

B1.6.6 Conclusion

Clearing of potential foraging and roosting habitat for threatened micro-bats as part of the proposed facility will not remove a significant area of known habitat for these species in this locality. Abundant roosting and foraging habitat are available within the woodland vegetation that will be retained on the Site. Adjacent and surrounding resources containing high quality habitat will not be impacted by the proposal.

Given the above considerations, it is not 'likely' that the proposal will impose 'a significant effect' on threatened microbat species.