



CDB Environment Pty Ltd

North South Liddell Gas Pipeline

Ecological Assessment

February 2009



Alison Hunt and Associates Pty Ltd

TERRESTRIAL



MARINE



AQUATIC

Executive Summary

Alison Hunt & Associates Pty Ltd was commissioned by CDB Environment Pty Ltd to undertake an ecological assessment under Part 3A of the of the NSW *Environmental Planning and Assessment Act 1979* for the 51 km North South Liddell Gas Pipeline corridor proposed by Macquarie Generation in the Hunter Valley, NSW. The proposed gas pipeline would supply gas as fuel to supplement coal-fired electricity generation at Liddell Power Station, located in the Hunter Valley of NSW. Currently methane gas produced as a by-product of coal mining at neighbouring Upper Hunter coal mines is disposed of by flaring into the atmosphere.

Ecological assessments were undertaken with particular reference to threatened species, populations and / or ecological communities listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The proposed gas pipeline would consist of up to two polyurethane or fibreglass 500 millimetre (mm) pipes buried side by side approximately 1 metre (m) below ground. Construction techniques would include a combination of open trench (dig and lay) and horizontal directional drilling (HDD) under the Hunter River and Wollombi Brook. . The pipeline requires a construction right-of-way (ROW) of approximately 20 metre wide plus temporary work space within the 50m wide assessment corridor. Temporary extra work space will be required in areas such as watercourse and road crossings. Although a 20 m construction ROW is required for the majority of the pipeline length, it is intended wherever possible to confine the high disturbance zone to a 10 m to 12 m width for trenching, brush and spoil storage and vehicle movement

Initial assessment of the pipeline corridor found that corridor traversed Warkworth Sands Woodlands which is listed as an endangered ecological community (EEC) under the TSC Act. The pipeline corridor was subsequently realigned to avoid areas of conservation significance.

Assessment of the revised pipeline corridor was undertaken from 4 to 8 August 2008 and 25 to 27 August 2008. The corridor was traversed by foot or by car along areas of clearly disturbed habitat. Not all areas could be accessed and these were assessed from neighbouring properties. Since assessment a 1.25 km section on the Xstrata mining area has been realigned to avoid sensitive heritage sites. Assessment of this section was undertaken through desktop assessment.

The corridor traverses highly modified environments including coal mines, a power station, road reserves (predominately mown grassy strips) and agricultural lands. Vegetation communities were dominated by Introduced Pastures but small areas of several other vegetation communities were either traversed, or were in close proximity to, the corridor and these included: Planted areas, Bulloak / Narrow-leaved Ironbark Open Woodland, Spotted Gum / Narrow-leaved Ironbark Open Grassy Woodland and Hunter Valley River Oak Forest. The construction of the ROW would result in a total of up to 1.59 ha of woodland being removed. The remainder of vegetation to be cleared are introduced pasture species and agricultural weeds. Listed species recorded include, Slaty Red Gum which is part of an endangered population within the Hunter Valley which was recorded at two creek crossing and the Grey-crowned Babbler on Xstrata mining area at Charlton Road. There is also the potential for a number of other species and populations to occur within the locality.

Assessments under the Part 3A of the NSW EP&A Act including those species, populations and communities listed under the TSC Act, concluded that significant impacts are unlikely due to the highly modified nature of the pipeline corridor. Similarly, it is concluded that matters of NES listed under the Commonwealth EPBC Act would not be significantly impacted.

To ensure the protection of native vegetation communities, a range of measures to manage risks to the neighbouring and aquatic environments during construction and operation, are recommended with the aim of protecting existing biodiversity. It is important that a Sediment and Erosion Management Plan be prepared for the proposed construction works as there is the risk of spread of weeds and erosion during construction. With this measure in place it is unlikely that this proposal would have significant impacts on threatened species, population or ecological communities listed under the TSC Act and EPBC Act.

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1 INTRODUCTION

1.1 Context

Alison Hunt & Associates Pty Ltd was commissioned by CDB Environment Pty Ltd to undertake an ecological assessment of the 51 km North South Liddell Gas Pipeline corridor proposed by Macquarie Generation in the Hunter Valley, NSW (Figure 1). An application under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) resulted in Director-General's requirements for environmental assessment being issued on 5 May 2008 (Appendix A). The potential impacts of the proposed gas pipeline were considered within the framework for assessment under Part 3A of the EP&A Act, NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Key ecological issues that required clarification included:

- The potential for endangered ecological communities, threatened species and / or their habitat listed under the NSW TSC Act to occur within the study area;
- The potential presence of any matters of National Environmental Significance (NES) listed under the Commonwealth EPBC Act;
- Assessment of the likely impacts of the proposal on the ecology of the site with particular reference to threatened species, populations and / or ecological communities; and
- Preliminary recommendations to mitigate and ameliorate potential impacts associated with this proposal.

1.2 Project Setting

The proposed pipeline corridor is approximately 51 km in length and is located within the Hunter Valley on the northern boundary of the Sydney Basin Biogeographic Region, within the Hunter Catchment Management Authority (CMA) and falls within the Muswellbrook and Singleton Local Government Areas (LGA). The proposed pipeline alignment begins at the Bulga Mine Site and terminates at the Liddell Power Station. It traverses Macquarie Generation lands, coal mines, road reserves and private properties, the majority of which are highly disturbed agricultural and / or mining operations and very little native vegetation remains. Wollemi National Park and Yengo National Park are located nearby and these areas form part of The Greater Blue Mountains World Heritage Area.

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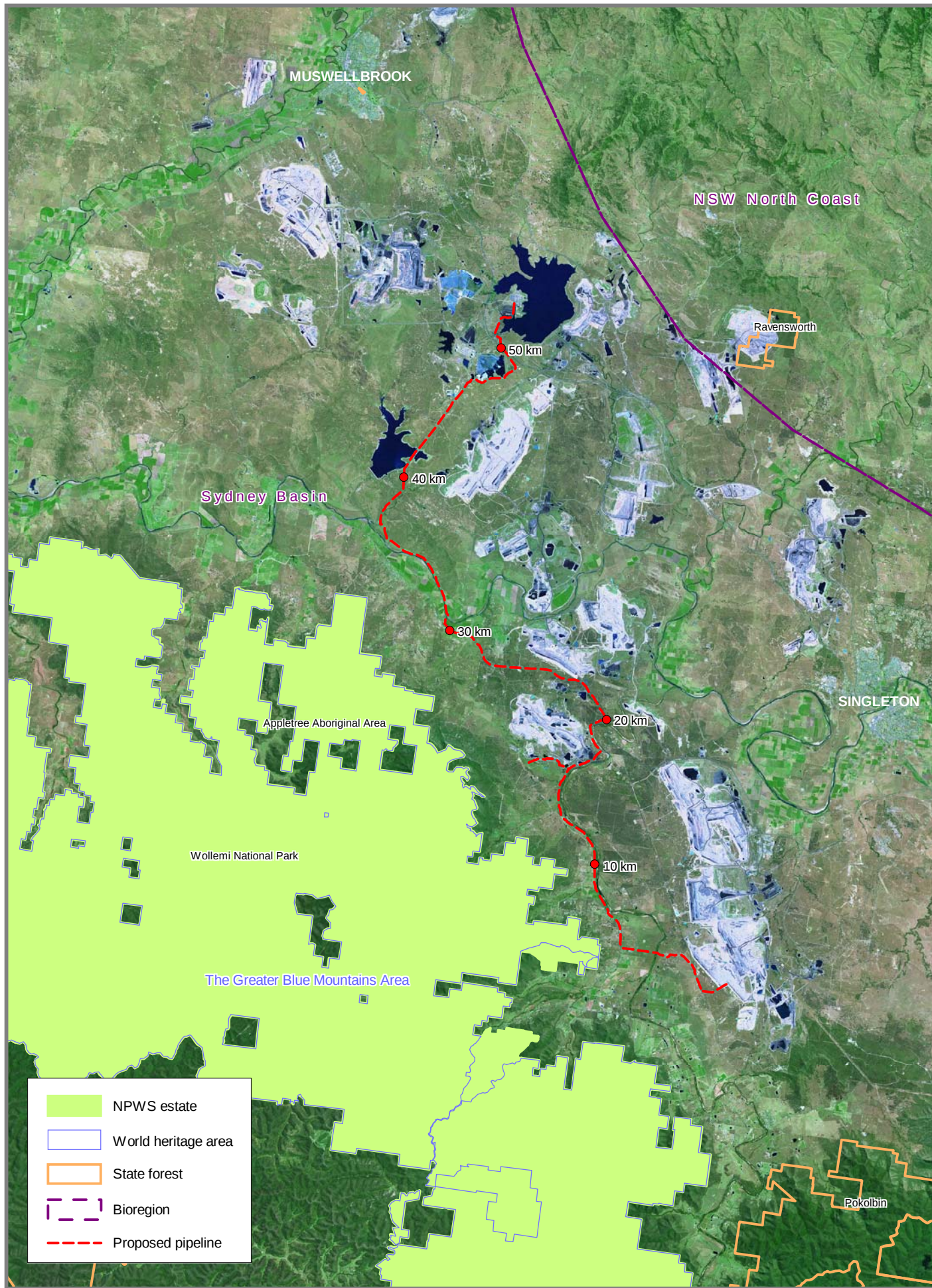


Figure 1

Location

North South Lidell Gas Pipeline
CDB Environment Pty Ltd

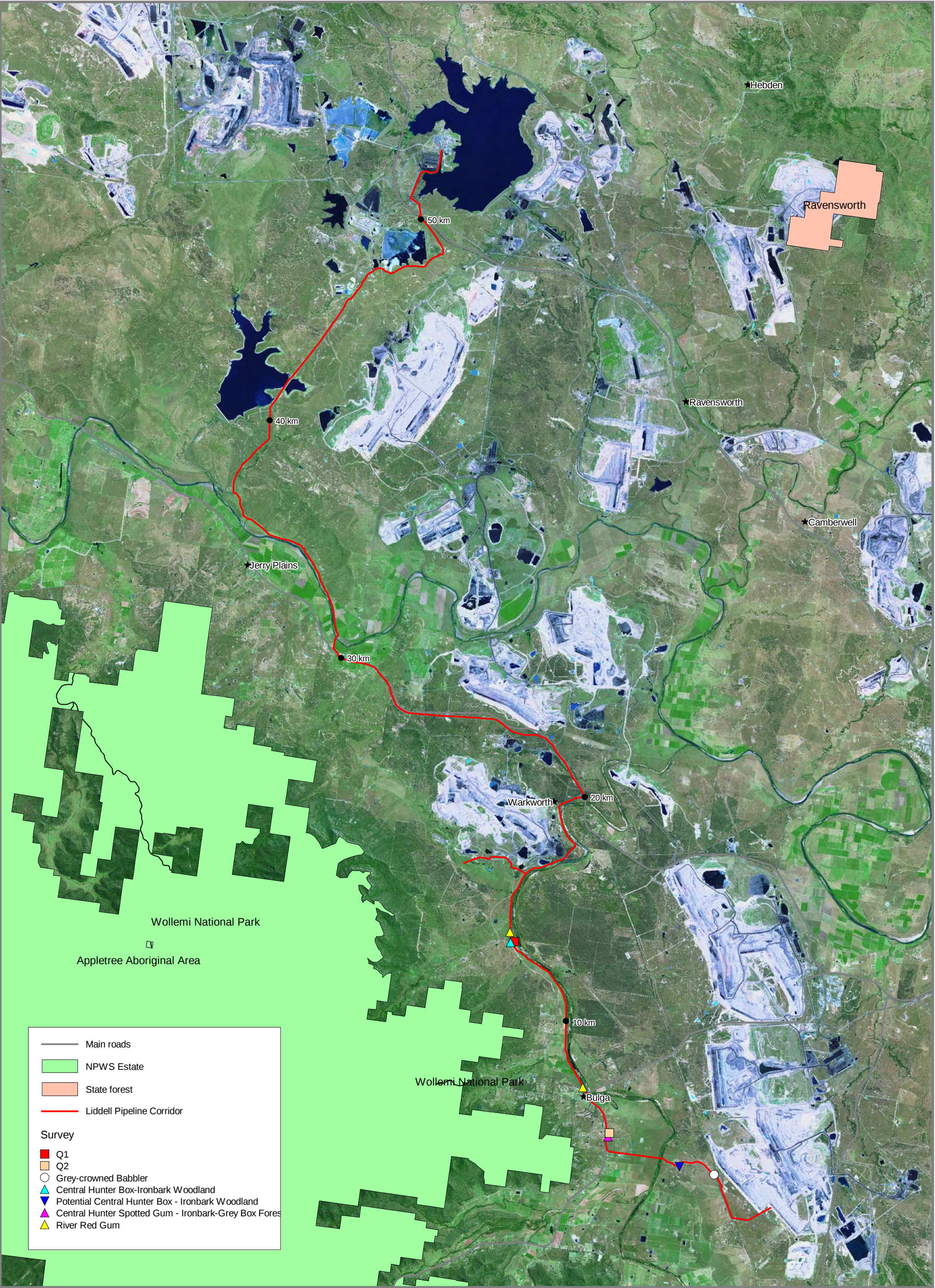


Figure 2

Location of quadrats, vegetation communities and threatened species

2 PROPOSAL

2.1 Background

Macquarie Generation proposes to construct a gas pipeline to supply gas as fuel to supplement coal-fired electricity generation at Liddell Power Station, located in the Hunter Valley of NSW. Currently methane gas produced as a by-product of coal mining at neighbouring Upper Hunter coal mines is disposed of by flaring into the atmosphere. Macquarie Generation proposes to use this gas by injecting it into the coal combustion fire-ball within the power station boilers. This may displace up to 5% of the coal (by mass) and have the following benefits through:

- Supply of gas fuel to supplement coal-fired electricity generation at Liddell Power Station;
- Providing nearby Hunter Valley mines with the means of disposing of up to 270,000 tonnes per year of methane gas;
- Reduce the greenhouse impacts of both the coal mining proves and electricity generation; and
- Offset greenhouse gas production in response to Greenhouse Gas Reduction Scheme (GGAS) obligations under Macquarie Generation's electricity contract with Tomago Aluminium.

2.2 Pipeline Corridor

2.2.1 Initial Proposed Pipeline Corridor

Macquarie Generation carried out the initial pipeline corridor selection and environmental assessment for the North South Liddell Gas Pipeline. Following the submission of the project application and preliminary environmental assessment report, subsequent field reconnaissance and consultation with the Department of Planning (DoP), Macquarie Generation realigned the North South Liddell Gas Pipeline corridor so as to avoid the Warkworth Sands Woodlands which is listed as an endangered ecological community (EEC) under the TSC Act. This realignment forms the final corridor assessed in this ecological assessment report.

2.2.2 Final Pipeline Corridor Alignment

Existing and potential future land uses were considered in the final selection of the pipeline corridor. In particular the north-south corridor has been selected to avoid areas of high ecological significance (in particular the Warkworth Sands Woodlands) or known Cultural Heritage sites and existing or potential mining activities. Where possible, the North South Liddell Gas Pipeline corridor has been selected to utilise existing roads and property access roads, as well as cleared property boundaries or fence lines.

The proposed pipeline corridor traverses land with a range of land uses (Table 1) including mining, road reserves, agriculture, power station and several watercourses.

Table 1 Land ownership details

Corridor Sequence	Deposited Plan #/ Location	Lot	Owner	Existing Land Use	LGA	LEP Zone
1	DP657988	1	Xstrata	Mining	Singleton	1(a) – Rural
2	Charlton Road		Singleton Shire Council	Road	Singleton	1(a) – Rural
3	DP811613	20	Xstrata	Mining	Singleton	1(a) – Rural
4	Wollombi Brook		Crown Land	Watercourse	Singleton	1(a) – Rural
5	DP10022	7	Xstrata	Agriculture	Singleton	1(a) – Rural
6	DP10022	6	Xstrata	Agriculture	Singleton	1(a) – Rural
7	Putty Road		RTA	Road	Singleton	1(a) – Rural
8	DP753821	64	Crown Land	Agriculture	Singleton	1(a) – Rural
9	DP93633	7001	Crown Land	Agriculture	Singleton	1(a) – Rural
10	DP731921	5	Private	Agriculture	Singleton	1(a) – Rural
11	DP1030910	100	Private	Agriculture	Singleton	1(a) – Rural
12	Putty Road		RTA	Road	Singleton	1(a) – Rural
13	DP252777	5	Private	Agriculture	Singleton	1(a) – Rural
14	DP753821	5	Private	Agriculture	Singleton	1(a) – Rural
15	DP857834	104	Private	Agriculture	Singleton	1(a) – Rural
16	DP790963	1	Private	Agriculture	Singleton	1(a) – Rural
17	DP571290	282	Private	Agriculture	Singleton	1(a) – Rural
18	DP571290	281	Private	Agriculture	Singleton	1(a) – Rural
19	DP586792	91	Private	Agriculture	Singleton	1(a) – Rural
20	DP579424	312	Private	Agriculture	Singleton	1(a) – Rural

Corridor Sequence	Deposited Plan #/ Location	Lot	Owner	Existing Land Use	LGA	LEP Zone
21	DP735566	3	Private	Agriculture	Singleton	1(a) – Rural
22	DP735566	1	Private	Agriculture	Singleton	1(a) – Rural
23	DP732501	2	Wambo Coal	Mining	Singleton	1(a) – Rural
24	DP732501	3	Wambo Coal		Singleton	1(a) – Rural
25	DP732501	4	Wambo Coal		Singleton	1(a) – Rural
26	DP732501	5	Wambo Coal		Singleton	1(a) – Rural
27	DP732501	6	Wambo Coal		Singleton	1(a) – Rural
28	DP732501	1	Wambo Coal		Singleton	1(a) – Rural
29	DP110084	1	Wambo Coal		Singleton	1(a) – Rural
30	DP110084	2	Wambo Coal		Singleton	1(a) – Rural
31	Wambo Creek		Crown Land	Watercourse	Singleton	1(a) – Rural
32	DP548749	83	Wambo Coal	Mining	Singleton	1(a) – Rural
33	DP753817	113	Wambo Coal		Singleton	1(a) – Rural
34	DP33149	C	Wambo Coal		Singleton	1(a) – Rural
35	DP33149	B	Wambo Coal		Singleton	1(a) – Rural
36	DP33149	A	Wambo Coal		Singleton	1(a) – Rural
37	North Wambo Creek		Crown Land	Watercourse	Singleton	1(a) – Rural
38	DP753817	4	Wambo Coal	Mining	Singleton	1(a) – Rural
39	DP753817	3	Wambo Coal		Singleton	1(a) – Rural
40	DP753817	10	Wambo Coal		Singleton	1(a) – Rural
41	DP753817	11	Wambo Coal		Singleton	1(a) – Rural

Corridor Sequence	Deposited Plan #/ Location	Lot	Owner	Existing Land Use	LGA	LEP Zone
42	DP753817	71	Wambo Coal		Singleton	1(a) – Rural
43	DP753817	18	Wambo Coal		Singleton	1(a) – Rural
44	DP753817	58	Wambo Coal		Singleton	1(a) – Rural
45	DP753817	57	Wambo Coal		Singleton	1(a) – Rural
46	DP753817	58	Wambo Coal		Singleton	1(a) – Rural
47	Golden Highway		RTA	Road	Singleton	1(a) – Rural
48	DP579587	92	Private	Agriculture	Singleton	1(a) – Rural
49	Hunter River		Crown Land	Watercourse	Singleton	1(a) – Rural
50	DP1017998	101	Private	Agriculture	Singleton	1(a) – Rural
51	DP752468	4	Private		Singleton	1(a) – Rural
52	DP752468	3	Private		Singleton	1(a) – Rural
53	DP1112847	1	Private		Singleton	1(a) – Rural
54	DP547864	107	Macquarie Generation	Power Station	Singleton	1(a) – Rural
55	DP234545	1	Macquarie Generation		Singleton	1(a) – Rural
56	DP1059007	112	Macquarie Generation		Singleton	1(a) – Rural
58	DP752468	86	Macquarie Generation		Singleton	1(a) – Rural
59	DP752468	151	Macquarie Generation		Singleton	1(a) – Rural
60	DP700554	10	Macquarie Generation		Singleton	1(a) – Rural
61	DP574168	1	Macquarie Generation		Singleton	1(a) – Rural
62	DP247943	6	Macquarie Generation		Muswellbrook	5(a) – Special Uses

Corridor Sequence	Deposited Plan #/ Location	Lot	Owner	Existing Land Use	LGA	LEP Zone
63	DP966589	5	Macquarie Generation		Muswellbrook	5(a) – Special Uses
64	DP247943	6	Macquarie Generation		Muswellbrook	5(a) – Special Uses
65	New England Highway		RTA	Road	Muswellbrook	5(a) – Special Uses
66	DP1019325	601	Macquarie Generation	Power Station	Muswellbrook	5(a) – Special Uses
67	DP1022827	2	Macquarie Generation		Muswellbrook	5(a) – Special Uses

The proposed pipeline alignment begins at the Bulga Mine Site and terminates at the Liddell Power Station (as shown in Figure 1). From the Bulga Mine area, the proposed alignment travels in a north-westerly direction, crossing Charlton Road heading down to Wollombi Brook. After crossing to the west side of the brook it then travels westerly to intersect with Putty Road. Travelling north, passing by the township of Bulga then continuing parallel with rural property boundaries and Wollombi Brook, it enters the Wambo Mining Area. It continues in a northerly direction crossing the Wambo and Wambo North Creeks before intersecting the Golden Highway. The proposed alignment then runs within the Golden Highway road reserve for approximately 10 km, before turning north to cross the Hunter River. From the north side of the Hunter River the proposed pipeline corridor runs within cleared agricultural land parallel with the Hunter River before entering Macquarie Generation owned land. It then crosses Parnellels Creek and continues running parallel to existing road access and infrastructure corridors for approximately 8 km before intersecting the New England Highway. The alignment then crosses under the New England Highway and joins the existing infrastructure corridor terminating at the Liddell Power Station (or at the proposed east - west pipeline). The total length of the proposed pipeline alignment is approximately 51 km, the majority of which is within previously cleared land or road reserves.

2.3 Construction Description

The proposed gas pipeline would consist of up to two polyurethane or fibreglass 500 millimetre (mm) pipes buried side by side approximately 1 metre (m) below ground. Construction techniques would include a combination of open trench (dig and lay) and boring.

Construction activity will be confined to the pipeline corridor and adjoining land to which access is available for construction purposes. The pipeline requires a construction right-of-way (ROW) of approximately 20 metre wide plus temporary work space within the 50m wide assessment corridor. Temporary extra work space will be required in areas such as watercourse and road crossings. The

temporary work space will be leased for the duration of the construction phases of the Project. Although a 20m construction ROW is required for the majority of the pipeline length, it is intended wherever possible to confine the high disturbance zone to a 10m to 12m width for trenching, brush and spoil storage and vehicle movement.

2.4 Watercourse Crossings

The pipeline will cross two substantial watercourses; Wollombi Brook and the Hunter River (Figure 2). The location of the crossing and techniques to be used is based on a range of criteria including safety, environmental and social sensitivities, watercourse substrate type, bank scour potential, approach slope and bank access, costs, pipeline security requirements, adjacent infrastructure and construction workspace availability.

Watercourse crossings would be undertaken by one of two methods:

- **Open Trenching**

This involves surface excavation across the watercourse. Where practicable, construction is scheduled for periods of nil to low flow. The selection of the crossing location is based on minimising potential impacts and achieving long-term site stability. Sediment and water quality control measures, such as silt curtains, or isolation construction using dam and pump or flume pipe techniques, may be applied as necessary dependent upon site specific sensitivities. .

- **Horizontal Directional Drilling (HDD)**

Involves boring beneath the invert of the river from bank to bank, then pulling the pipe through the bore hole. This method avoids river bank and in-stream construction activities, but it can pose high technical and environmental risks. Geotechnical (e.g. hard bedrock, fissures and cracks, unconsolidated substrata and subsurface scour or cavern potential) constraints can preclude the use of this method in some situations. Where HDD is proposed, the open trenched method would remain as a contingency in the event that problems developed with HDD.

The Wollombi Brook and Hunter River watercourse crossings will be completed using HDD construction techniques where as all other creeks and drainage lines will be open cut.

2.5 Legislative Framework

A number of legislative requirements in relation to the biodiversity of the site would be relevant to the proposed gas pipeline. These include but are not necessarily limited to those listed below.

- The proposed development falls under the *State Environmental Planning Policy (Major Projects) 2005* (SEPP Major Projects) and consequently will be assessed under Part 3A of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act);
- Flora and fauna issues listed under the TSC Act would be considered using the Draft *Guidelines for Threatened Species Assessment* (DEC & DPI 2005) as required under Part 3A of the EP&A Act; and

- The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also requires assessment of proposed actions that are likely to cause significant impacts on matters of National Environmental Significance (NES) listed under the Act. The EPBC Act identifies seven matters of NES and those matters of NES relevant to this proposal may include: threatened species and ecological communities and migratory species.

- *State Environmental Planning Policy No. 44 Koala Habitat* (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline by:
 - Requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat;
 - Encouraging the identification of areas of core koala habitat; and
 - Encouraging the inclusion of areas of core koala habitat in environment protection zones.

The policy applies to 107 local government areas including the Muswellbrook and Singleton LGA and therefore this policy is considered in assessing this proposal.

3 METHODS

The assessment was undertaken to describe the biodiversity of the proposed 51 km pipeline corridor and locality (i.e. within 10 km of the pipeline corridor) to determine the likely potential impacts associated with redevelopment of the site within the framework provided by Part 3A under the EP&A Act, TSC Act and Commonwealth EPBC Act and with reference to Muswellbrook Shire Council (undated) *Development Application and Guidance Notes - Annexure A*.

Several tasks were addressed including:

- A review of available literature and databases to assist with the identification of the pipeline corridor values especially in relation to threatened species, populations and endangered ecological communities;
- Field investigations to ascertain the current site condition and the presence or likely presence of threatened or protected species;
- An impact assessment to determine the likely effects of the proposal on the terrestrial and aquatic ecology of the site with particular reference to threatened species, populations and / or ecological communities; and
- Preparation of preliminary recommendations to ameliorate and mitigate impacts.

3.1 Literature Review

Studies have been undertaken previously within the area and those available and applicable to this site were reviewed including an Ecological Assessment of North South Liddell Gas Pipeline corridor previously proposed by Macquarie Generation. The reports of particular applicability are listed below. A complete list is provided in Section 8.

- Biosis Research 2007 Terrestrial Flora and Fauna Impact Assessment: Gas Supply Pipeline, Liddell Power Station. Prepared for Parsons Brinckerhoff, Sydney.
- Peake 2006 The Vegetation of the Central Hunter Valley, NSW. A Report on the Findings of the Hunter Remnant Vegetation Project. Volume 2: Profiles of Vegetation Communities. Version 2.2. Hunter-Central Rivers Catchment Management Authority.
- Umwelt (Australia) Pty Limited 2007 Bulga Complex Ecological Monitoring Report 2006. Prepared for Bulga Coal Management Pty Ltd.

Database records pertaining to the site and locality (i.e. within a 10 km radius) were also searched and included:

- Department of Environment and Climate Change (DECC) – Threatened species database records (July 2008); and
- Department of Environment, Water, Heritage and Arts (DEWHA) – Online protected matters search tool for Matters of National Environmental Significance (NES) under the EPBC Act (July 2008).

3.2 Field Investigations

Assessments of the study area were undertaken to determine the current values of the ecology of the pipeline corridor with particular focus on the presence, or likely presence of threatened flora or fauna, and the likely potential impacts of construction and operation.

Assessments of the pipeline corridor were undertaken from 4 to 8 August 2008 and 25 to 27 August 2008.

- Where possible the proposed pipeline corridor was traversed by:
 - foot in areas of intact vegetation or where no vehicular access was available; or
 - vehicle along areas of clearly disturbed habitat.
- In some instances access to private landholdings could not be sought. These areas were assessed from the fence line of adjoining properties.

Since the assessment, there have been several adjustments to the corridor alignment. In most cases this has resulted in the corridor being realigned to avoid vegetation (in particular trees) and drainage lines and to follow tracks and or cleared paddocks. In one instance this has resulted in the realignment of approximately 1.25 km along the edge of a woodland between Wollombi Brook and Charlton Road. A desktop assessment of this section of the pipeline was undertaken but ground verification was not carried out.

3.2.1 General Habitat Description

Habitat descriptions were recorded along the corridor. Details recorded included:

- Vegetation type (including dominant canopy, shrub and ground cover species);
- Soil type;
- Topography;
- GPS coordinates;
- Potential habitat for threatened species (e.g. presence of hollow-bearing trees, waterbodies, nests, fallen logs, rocks); and
- Indirect evidence of species (e.g. diggings, scratches, feed scars, burrows, nests).

3.2.2 Vegetation Mapping

General

Previous vegetation mapping for the site was reviewed and included the mapping prepared by Peake (2006). These maps were ground-verified during the surveys and further details on the dominant species within each community recorded. Areas traversed by the proposed pipeline corridor which included native vegetation communities were mapped.

Endangered Ecological Communities

Of particular focus was the potential presence of any endangered ecological communities listed under the TSC Act and EPBC Act. The data from quadrat surveys was used to obtain a list of species and these were compared to characteristic species listed in the Scientific Committee Final Determinations for each of the EECs with the potential to occur within the locality. Other key characteristics such as elevation, soil type and hydrological requirements listed in the determination for the EEC were also used in determining the presence or absence of an EEC.

3.2.3 General Flora Surveys

The pipeline corridor was traversed and the dominant flora species were recorded. The vast majority of the corridor traversed areas of heavily disturbed mining, agricultural lands or road reserves devoid of any substantial vegetation. The assessment of flora in these areas consisted of noting the dominant flora species and the degree of disturbance. Where the pipeline corridor traverses intact vegetation communities vegetation quadrats (20 m x 20 m) were placed arbitrarily within each of the vegetation communities in accordance with the DEC *Draft Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004). All species within the quadrat were identified. Any specimens unidentifiable in the field were retained for later identification.

3.2.4 Threatened or Significant Flora Surveys

The likelihood of threatened species listed under the TSC Act and / or EPBC Act occurring across the proposed pipeline corridor was determined through consideration of vegetation type and condition, and the occurrence of habitat across the locality and review of literature and database records. Targeted flora surveys were undertaken for a number of threatened species known to occur within the locality, or with the potential to occur using random meanders surveys.

Habitat surveys were undertaken for those species which are cryptic or difficult to identify when not in flower during recognised flowering periods. These data were used as a predictor of the likelihood of occurrence of these species given the habitat, vegetation community, terrain, soil type and level of disturbance.

During general flora surveys and targeted surveys for threatened species, consideration was also given to detecting the presence of regionally significant species and those species listed as Rare or Threatened Australian Plants (ROTAP). Regionally significant flora are those which are uncommon, have narrow habitat requirements, are restricted to the Hunter CMA or are close to the limit of their distribution in the Hunter.

3.2.5 Fauna

The highly disturbed and degraded nature of the vast majority of the pipeline corridor meant that general fauna habitat assessments were conducted instead of detailed fauna surveys. Habitat assessments comprised an assessment of the nature and condition of habitats, specific resources and features of relevance for native fauna. In addition, indirect evidence of fauna (e.g. scats, feathers, fur, tracks, dens, nests, scratches, chew marks and owl wash) was recorded. Incidental records of fauna were also made during the course of the pipeline assessment.

3.2.6 Threatened or Significant Fauna

The likelihood of threatened species listed under the TSC Act and / or EPBC Act occurring across the proposed pipeline corridor was determined through consideration of vegetation type and condition, and the occurrence of habitat across the locality and its condition, and review of literature and database records. In line with the central tenet of the precautionary principle it was assumed that if habitat was present for a threatened species then it was considered that the threatened species could potentially use this resource and assessments were made accordingly.

3.2.7 Aquatic Habitat Assessment

An assessment of aquatic habitats was undertaken for creeks and drainage lines traversed by the proposed pipeline corridor. A number of features were noted at each crossing and these included:

- Topography;
- Water level;
- Riparian vegetation;
- Stream width;
- Instream features;
- Apparent water quality; and
- Riparian zone condition.

3.3 Impact Assessment

As required for Part 3A of the EP&A Act the Project impact assessment was undertaken in accordance with the *Draft Guidelines for Threatened Species Assessment* (DEC & DPI 2005) .

An assessment was also undertaken of the impacts of the Project on ecological communities, populations and species listed under the EPBC Act using the Significant Impact Criteria detailed in the *EPBC Act Administrative Guidelines for Significance* (DEH 2006).

3.4 Limitations

All ecological assessments have limitations to the efficacy of the study. Those of particular relevance to this study include.

- Not all properties could be accessed and hence assessment was undertaken from neighbouring fence lines. In all instances those properties which could not be accessed were highly modified agricultural lands;
- At the time of assessment a number of unresolved issues with the preferred pipeline corridor still existed and on occasion the corridor assessed was not necessarily the exact corridor currently proposed for the pipeline. In most cases this has resulted in the corridor being realigned to avoid vegetation (in particular trees) and drainage lines and to follow tracks and or cleared paddocks. On one occasion 1.25 km of the proposed corridor was shifted south along the boundary of a

woodland. This 1.25km section of the proposed corridor has not been ground verified but was assessed through review of desktop studies; and

- This assessment was undertaken over a short time period and during a single season so not all species would have been recorded as species may either be resident or transitory, whilst some species may have been inactive, dormant or with cryptic habits, and some may be nomadic or migratory in nature. Additionally, some fauna species are mobile or transient in their use of resources. Therefore, not all species, either resident or transitory, would have been recorded during the single event assessment. This assessment was aimed at providing an overall assessment of the ecological values of the proposed corridor with particular emphasis on threatened species.

4 RESULTS

4.1 The Hunter Valley

The proposed pipeline corridor is located in the Hunter Valley on the northern boundary of the Sydney Basin Biogeographic Region, within the Hunter CMA and stretches over Muswellbrook and Singleton Local Government Areas. The Hunter River sub-catchment is the centre of the Hunter catchment and the Hunter River drains the largest coastal catchment in NSW covering approximately 22,000 km². It is located within the Hunter Estuary Wetlands catchment which is listed as a Ramsar site. The area is also covered by the Lower North East NSW Regional Forest Agreement.

The geology of the catchment includes late Permian sediments, early Permian marine sediments and quaternary alluvium. The Permian rocks consist of conglomerate, sandstone, shale and coal. This softer rock sequence has been eroded to form the main corridor of the broad Hunter River Valley. The Permian rocks are derived from ancient marine sediments and therefore contain salt and as a consequence, many of the streams flowing through the central valley floor are naturally high in salinity. The accumulation of riverine sediments has formed alluvial flats along the Hunter River and its tributaries. Adjacent to the Hunter River the soils are rich alluvial. The smaller tributaries and foothills consist of highly erodible and dispersible sodic and saline soils whilst sandy soils are predominant in the southern area of the catchment. Consequently, a range of soil landscapes occur across the Hunter Valley and those of particular relevance to this proposal are shown in Table 2.

Table 2 Soil landscapes in the Hunter Valley and of relevance to this proposal

Soil Landscape	Type	Parent Rock
Red clays	Brays Hill on low undulating hills west of Muswellbrook.	Calcareous shale, some basalt and sandstone
Yellow podzolic	Branxton on undulating hills and rises with many small creeks and drainage lines.	Sandstone, shale, mudstone, siltstone, tuff, limestone and coal.
Soloths	Bulga on colluvial slopes.	Sandstone, conglomerate, claystone, shale, mudstone and coal.
	Jerry Plains on low undulating hills south and west of Jerry Plains.	Lithic sandstone, mudstone, siltstone and conglomerate.
	Liddell on low undulating hills around Liddell Power Station.	Lithic sandstone, shale, mudstone, conglomerate, siltstone and coal.
Siliceous sands	Warkworth on linear sand dunes on old terraces of the Hunter River.	Quaternary aeolian.
Alluvial	Hunter on the floodplains of the Hunter River and tributaries.	Alluvium.
	Wollombi on undulating rises and valley flats of Wollombi Brook.	Sandstone and conglomerate.
Source: Kovac & Lawrie 1991		

The Hunter region experiences warm wet summers and dry cool winters. South-easterly and north-easterly sea breezes are common in the summer months, whilst in winter the winds are mainly from the west and southwest. In the area, mean temperatures peak in January at 31.7 °C when rainfall is highest (mean rainfall 77.4 mm) with mean summer minimum temperatures of 17.1 °C. The lowest mean temperatures occur in July with a maximum of 17.4 °C and a minimum temperature of 3.8 °C and rainfall drops to a monthly mean of 36.5 mm in August (BoM 2008; Jerrys Plains Post Office). The mean yearly rainfall is around 800 mm.

The Hunter River catchment covers a diverse area with dominant non-agricultural land use including urban and rural residential development, coal mining, power generation, heavy industry, shipping, tourism, manufacturing and fisheries. The major agricultural industries include table and wine grapes, cereal cropping, grazing, dairying, and beef, pork and poultry production.

The Hunter Valley has a long history of agriculture and coal mining and supports other associated infrastructure such as power generation plants, heavy industry and manufacturing. The Hunter catchment also supports substantial urbanisation and the Hunter River catchment is home to around 80,000 people.

Predictably much of the pre-settlement biodiversity has been lost from the catchment. Nonetheless, the Hunter CMA still supports 116 threatened species and 13 endangered ecological communities (EEC) and some of these species and communities are known to have very restricted distributions, (e.g. Kurri Sand Swamp Woodland and Warkworth Sands Woodland). Vegetation of the Hunter River valley is restricted to fragmented and isolated patches, riparian vegetation and areas unsuitable for farming and / or coal mining.

4.2 Conservation Areas within the Locality

Wollemi National Park and Yengo National Park are located to the west and south-west of the proposed pipeline corridor. Wollemi National Park comes to within 1 km of the pipeline corridor near Bulga, and Yengo National Park is located around 6 km south and south-west from Bulga. Both areas form a part of the Greater Blue Mountains World Heritage Area.

4.3 Past Vegetation Mapping

Peake (2006) mapped the vegetation of the Hunter Valley and those communities occurring along the proposed pipeline corridor are shown in Figure 3 and discussed below.

- Central Hunter Ironbark – Spotted Gum – Grey Box Forest;

Peake (2006) mapped small patches of this community as occurring near the northern end of the proposed pipeline corridor. This community occurs as an open forest or woodland dominated by Ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*) and Grey Box (*Eucalyptus moluccana*) with a sparse mid-layer consisting of species such as Bullock (*Allocasuarina leuhammii*) or Silver-stemmed Wattle (*Acacia parvipinnula*). Ground cover is often sparse and can consist of numerous herbs, some grasses and a limited number of ferns, sedges or other herbs. This community is not listed as endangered but it is estimated that over 60% of this vegetation community has been cleared with remnants occurring as fragmented and isolated patches.

- Central Hunter Box - Ironbark Woodland;

This community is the most commonly occurring vegetation association mapped by Peake (2006) within the vicinity of the proposed pipeline corridor. A low to mid-high woodland dominated by Narrow-leaved Ironbark, Kurrajong (*Brachychiton populneus* subsp. *populneus*) and Grey Box. Bulloak can be dominant in the sub-layer and Cooba (*Acacia salicina*) occurs frequently. The understorey is often present and may be dense to sparse and can include such species as Native Blackthorn (*Bursaria spinosa*). The ground layer may be dense and is typically composed of a variety of forbs, many grasses with a small number of sedges, ferns and twiners occurring. This community is poorly conserved. It is estimated that around 68% of this community has been cleared.

- Bulga Wattle Woodland;

This community was mapped by Peake (2006) as occurring north of Bulga on the eastern side of Wollombi Brook. Low to mid-high woodland to open forest dominated by Bulga Wattle (*Acacia bulgaensis*) with emergent trees such as Smooth-barked Apple (*Angophora costata*), Narrow-leaved Ironbark and Grey Gum (*Eucalyptus punctata*). Sub-canopy species may include Native Cherry (*Exocarpus cupressiformis*) and Gosford Wattle (*Acacia prominens*). Although this community is not listed as an EEC, Bulga Wattle is listed as a RoTAP species.

- Hunter Floodplain Red Gum Woodland Complex;

Peake (2006) has mapped this community as occurring around Wambo Creek and North Wambo Creek. This community can be a very tall or open woodland which occurs on floodplains and floodplain rises along the Hunter River and several major tributaries. This community is typically dominated by River Red Gum (*Eucalyptus camaldulensis*) with Forest Red Gum (*Eucalyptus tereticornis*), Yellow Box (*Eucalyptus melliodora*) and Rough-barked Apple (*Angophora floribunda*) being co-dominant in places. Much of the remaining occurrences of this community exist as single trees of River Red Gum which co-occur with *Casuarina cunninghamiana* ssp. *cunninghamiana*. It is likely that more than 95% of this vegetation community has been cleared. Although this community is not listed as an EEC, River Red Gum is a part of an endangered population.

- Central Hunter Bulloak Forest Regeneration; and

Peake (2006) has mapped this community as occurring sporadically along the proposed pipeline corridor. It occurs as a mid to mid-high open to closed forest dominated by Bulloak with other species occurring depending on location and these may include Narrow-leaved Ironbark, Swamp Oak (*Casuarina glauca*) and Grey Box. The sub-stratum is normally lacking but the ground layer can be varied but is typically sparse. Approximately 822 ha of this community has been mapped in the Hunter Valley.

- Planted areas.

A number of planted areas occur along or adjacent to the proposed pipeline route. They are comprised of native species which have often been planted to provide screening.

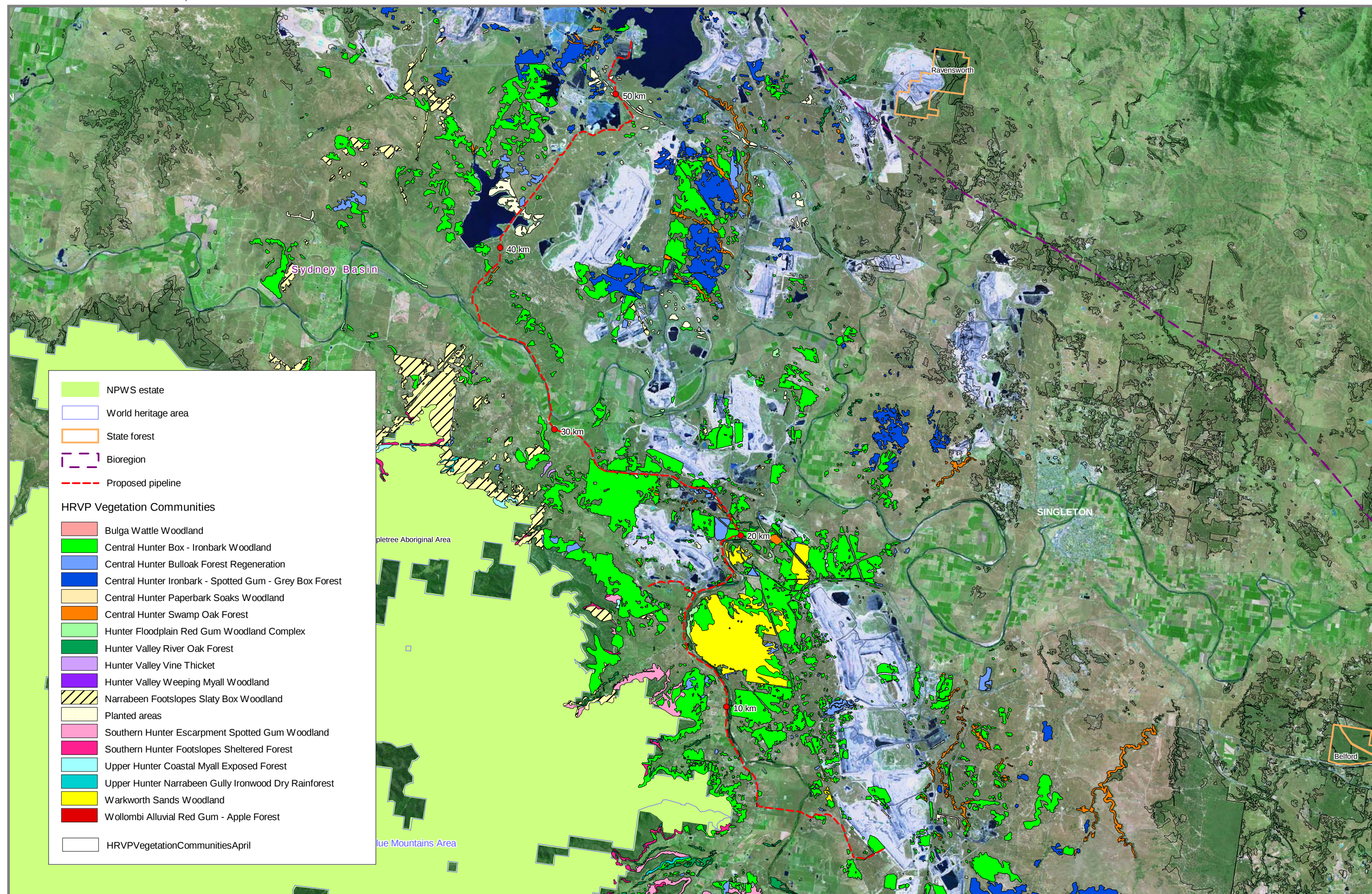


Figure 3

Vegetation communities along the pipeline route (Peake 2006)

4.4 Vegetation

Of the 94 flora species recorded, 44% were weed species (Appendix B). Such a high proportion was expected given that the vast majority of the proposed pipeline corridor traverses exotic pastures. Native flora species recorded were typical of dry sclerophyllous communities. In all, five vegetation communities were recorded along the proposed pipeline corridor:

- Pasturelands;
- Planted areas;
- Bulloak (*Allocasuarina luehmannii*) / Narrow-leaved Ironbark (*Eucalyptus crebra*) Open Woodland;
- Spotted Gum (*Corymbia maculata*) / Narrow-leaved Ironbark (*Eucalyptus crebra*) Open Grassy Woodland; and
- Hunter Valley River Oak Forest.

Pasturelands dominated along the length of the pipeline corridor with minor occurrences of the four other vegetation communities (Figure 2). The flora and the distribution of vegetation communities recorded along each section of the proposed pipeline corridor are discussed below.

1 Xstrata Mine site – approximately 2 km

This area runs parallel to Charlton Road between screening vegetation through highly modified areas on the edge of the open cut mine site. Large bund walls have been constructed throughout this area to provide protection from flooding. Two drainage lines would be crossed, one of which is a large dry grassy area dominated by Couch and Sharp Rush. The other is further south and it passes between two bund walls. This area is narrower but is also dominated by Sharp Rush with groves of Bull Oak nearby.

2 Charlton Road crossing

The road verge on both sides of Charlton Road is mowed grassy areas dominated by introduced grasses and weed species.

3 Xstrata Mining – approximately 2 km

The proposed pipeline corridor continues on through pastures and passes through a wide drainage line that appears to be man-made. The pipeline veers slightly to the south before meeting the access road to this property. A desktop assessment of this 1.25 km section of the corridor indicates that this isolated grassy woodland area is comprised of clusters of trees as well as scattered trees and it is likely that this grassy woodland would have been grazed until recently. Peake (2006) has mapped this area of vegetation as *Central Hunter Box – Ironbark Woodland*. From the access road to Charlton Road the proposed corridor traverses open paddocks dominated by pasture grasses and agricultural weeds.

4 Wollombi Brook crossing

Pastures lead down to the terrace of Wollombi Brook which is heavily weed infested and densely lined with River Oak along its banks.

5 – 6 Xstrata Land – approximately 2.5 km

The majority of this section of the pipeline corridor passes through highly modified agricultural land dominated by introduced pasture grasses and agricultural weeds although some native species were present. In one section the proposed pipeline corridor passes through a small area of Kangaroo Grass (*Themeda australis*) which grades into a relatively intact area of regenerating open woodland just south of Noses Peak Road. This woodland is Spotted Gum / Narrow-leaved Ironbark Open Woodland. A detailed assessment of this site was undertaken and it is marked as Quadrat 1 on Figure 2. This area was gravelly with around 30% of bare ground. The canopy comprised small Narrow-leaved Ironbark and Spotted Gum trees up to 12 m in height. Larger trees of both species are present further to the east of this open grassy woodland. The ground layer is relatively intact with a range of *Lomandra* species dominating but Mulga Fern, Wallaby Grass (*Austrodanthonia tenuior*) and Purple Wiregrass are also present. This area grades into saplings of Narrow-leaved Ironbark and the groundlayer once again becomes weedy and agricultural in nature.

This community is likely to represent *MU27 Central Hunter Ironbark* (*Eucalyptus crebra*) – *Spotted Gum* (*Corymbia maculata*) – *Grey Box* (*Eucalyptus moluccana*) *Forest* (Peake 2006) rather than *M10 Central Hunter Box – Ironbark Woodland* mapped by Peake (2006) as Spotted Gum was co-dominant with Narrow-leaved Ironbark. This community is not considered to be *Lower Hunter Spotted Gum / Ironbark Forest* (Peake 2006) which is an Endangered Ecological Community under the TSC Act as the community was dominated by Narrow-leaved Ironbark rather than Broad-leaved Ironbark (*Eucalyptus fibrosa*) characteristic of this community.

7 Putty Road – approximately 0.5 km

The corridor follows along the mown grassy verge on the eastern side of the Putty Road. This area adjoins agricultural land.

8 – 11 Agricultural Land – approximately 0.3 km

The proposed pipeline corridor follows the grassy mown verge and crosses two small dry weed infested drainage lines that have culverts which pass under the road.

12 Putty Road crossing

The point where the corridor crosses Putty Road is devoid of vegetation as there is a wide cleared area either side to facilitate traffic turning onto the bridge over Wollombi Brook.

13 - 22 Private Agricultural Lands – approximately 4 km

Heading north from Bulga the proposed corridor continues to follow Wollombi Brook through agricultural lands. The majority of these private landholdings were or have been used extensively for agriculture with very little natural and / or native vegetation remaining. Instead this sandy area

supports primarily introduced grasses and an extensive range of agricultural weeds. The occasional tree (primarily River Oak and Black Wattle) occur especially towards the northern end of this section.

The corridor traverses two drainage lines along this section. Both are highly eroded dry creek beds heavily weed infested. The native shrub and ground layers were absent although in both drainage lines some native tree species occurred, including River Oak and Forest Red Gum. The introduced Pepper Tree was also prevalent. Notably, old and large River Red Gums (*Eucalyptus camaldulensis*) was recorded at the most southerly just north of Bulga. This species is a part of the *River Red Gum Population in the Hunter Catchment* which are protected under the TSC Act as an endangered population.

23 – 46 Wambo Coal – approximately 8.5 km

The corridor through Wambo mining area runs parallel to Wollombi Brook and traverses land which is largely comprised of agricultural properties, powerline easements and scattered remnant vegetation, and regenerating or rehabilitated areas. Pastures were typical of the area and these were dominated by introduced grass species and other agricultural weeds although Barbed Wire Grass (*Cymbopogon refractus*) was also prevalent. The corridor followed tracks where available otherwise it closely followed fence lines.

The corridor passes through a small patch of Bulloak / Narrow-leaved Ironbark Open Woodland adjacent to a powerline easement. A detailed flora assessment of this area was undertaken (marked as Quadrat 2 on Figure 2). The canopy of Bulloak / Narrow-leaved Ironbark Open Woodland reached approximately 16 m in height although the open grassy woodland lacked a shrub layer. although, Broom Bitter Pea (*Daviesia genistifolia*) was incidentally recorded outside the quadrat area. The ground layer included such species as *Glycine tabacina*, Purple Burr-daisy (*Calotis cuneifolia*), *Brachyscome* sp., Wattle Mat-rush (*Lomandra filiformis* ssp. *filiformis*) and Purple Wiregrass (*Aristida ramosa*). The only weed species recorded were Serrated Tussock (*Nassella trichotoma*) and Fireweed (*Senecio madagascariensis*) and these were scattered along the track which bisected this area. The vegetation community is likely to correspond to *M10 Central Hunter Box – Ironbark Woodland* mapped by Peake 2006 but with strong Narrow-leaved Ironbark and Bulloak influences. This community is highly capable of establishing in degraded areas and occurs frequently where areas have been cleared, grazed and then removed from agricultural use.

The proposed pipeline corridor crosses a number of drainage lines which include broad open grassy areas and highly eroded gullies dominated by weed species. Some of these had substantial indigenous trees present including Cabbage Gum (*Eucalyptus amplifolia*), Rough-barked Apple (*Angophora floribunda*) and River Oak. River Red Gum (*Eucalyptus camaldulensis*) were also recorded at the Wambo Creek crossing.

47 Golden Highway – approximately 10 km

The proposed pipeline corridor passes along the southern road reserve of the Golden Highway. This road reserve varies from areas of bare ground, mown verges to areas of regenerating vegetation dominated by small Acacia species with an occasional sapling of Narrow-leaved Ironbark. There were some native herbs amongst the ground cover including Mulga Fern (*Cheilanthes sieberi* ssp. *sieberi*), Sprawling Bluebell (*Wahlenbergia gracilis*) and Common Woodruff (*Asperula conferta*). Vegetation further south from the road verge included Grey Box / Bulloak / Narrow-leaved Ironbark woodland with the occasional Spotted Gum further south.

48 K & C Smith – approximately 0.5 km

The proposed pipeline corridor follows the fence line bordering the road which links up with the Golden Highway. At the time of assessment this area had been ploughed and the majority of the ground was bare.

49 Hunter River Crossing

The site of the crossing of the Hunter River is situated close to the existing road bridge crossing. The banks are largely weed infested. The most visually dominant species is River Oak (*Casuarina cunninghamiana*) which are scattered along the river banks. Ground cover consists of exotic pasture weeds common in the area.

50 – 53 Wonderoi Farm – approximately 6 km

The proposed pipeline corridor largely follows the eastern bank of the Hunter River through 'Wonderoi' a property used for cropping. This property was substantially impacted by the 2007 floods and weed invasion along many of the banks and near-bank areas of the Hunter River is intense. The proposed corridor traverses paddocks used for grazing. Dominant species in these paddocks includes Couch, Summer Grass (*Digitaria* sp.), Fireweed, Rhodes Grass (*Chloris gayana*) and Galenia (*Galenia pubescens*). The corridor then crosses a steep sided highly eroded gully which is choked with Weeping Willows (*Salix babylonica*). The banks are either bare or covered in weed species such as Noogoora Burr (*Xanthium occidentale*), Veined Verbena (*Verbena rigida*), Pigweed (*Portulaca oleracea*), Galenia, Summer Grass and Hedge Mustard (*Sisymbrium officinale*). The proposed corridor follows the upper terrace of the Hunter River along a dirt vehicular track and weed infested areas dominated by Pepper Trees (*Schinus areira*), Fennel (*Foeniculum vulgare*), Veined Verbena, Cobbler's Pegs (*Bidens pilosa*) and Fierce Thornapple (*Datura ferox*).

54 - 64 Macquarie Generation – approximately 12 km

From Wonderoi Farm the proposed pipeline corridor would pass under a raised concrete canal and then cross Parnellels Creek before heading north. The proposed pipeline corridor joins River Road road reserve before crossing an existing causeway which would support the pipeline. It then continues along the road reserve where Bulloak and Narrow-leaved Ironbark occur. Vegetation along the remainder of the proposed pipeline corridor is dominated by pasturelands which until recently have been used for cattle grazing. These pastures are dominated by Rhodes Grass and Barbed Wire Grass with a wide range of other weeds present throughout, including Veined Verbena, Fireweed, Serrated Tussock and Lamb's Tongue (*Plantago lanceolata*). Some occasional paddock trees occur and these included Grey Box (*Eucalyptus moluccana*), Forest Red Gum (*Eucalyptus tereticornis*) and Narrow-leaved Ironbark. Some adjacent areas have been revegetated to provide screening from the New England Highway. In several locations the pipeline corridor passes through wet / boggy areas where the pipeline drops down from higher paddock areas. These areas often contained species typical of such environments including Sharp Rush (*Juncus acutus*) and Couch (*Cynodon dactylon*).

4.5 Fauna and Fauna Habitat

Fauna habitat value is generally related to complexity of landscape features as these offer a greater number of habitat opportunities for a range of species. The fauna habitat along the proposed pipeline lacks complexity such as trees, tree hollows, stags, shrubs, rocky areas, ponds and fallen timber, along most of its length. Table 3 shows available habitat along the pipeline corridor.

Table 3 Terrestrial fauna habitat along the proposed pipeline corridor

Habitat Type / Resource	Location	Species
Introduced grasslands	The majority of pipeline corridor.	Introduced small mammals, macropods, raptors.
Drainage lines / creeks / rivers	Hunter River, Wollombi Brook, several creeks and small drainage lines.	Amphibians, birds, microchiropteran bats.
Woodland patches	Wambo Coal – Q1 Xstrata – Q2 Xstrata – desktop assessment section (refer Figure 2).	Woodland birds, arboreal mammals, ground-dwelling mammals, reptiles, microchiropteran and megachiropteran bats.
Paddock trees	Scattered along the corridor.	Breeding and foraging resources for birds, hollow-dependent bird species and microchiropteran bats.

Forty fauna species were incidentally recorded during this assessment and these are listed in Appendix B. The majority of species were birds with raptors (e.g. Black-shouldered Kite (*Elanus axillaris*) and Nankeen Kestrel (*Falco cenchroides*)) recorded hunting across pasturelands, woodland birds (e.g. Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), White-winged Cough (*Corcorax melanorhamphos*), Silvereye (*Zosterops lateralis*), Superb Fairy-wren (*Malurus cyaneus*)) recorded in paddock trees, regenerating vegetation as well as weedy areas, and water birds (e.g. Black Swan (*Cygnus atratus*), Black-winged Stilt (*Himantopus himantopus*)), recorded predominantly around dams associated with mining areas.

Commonly recorded ground-dwelling mammals included the Common Wombat (*Vombatus ursinus*) which was evident along the length of the pipeline corridor with burrows and scats particularly prevalent in sandy areas near Wollombi Brook and Hunter River. Mobs of the Eastern Grey Kangaroo (*Macropus giganteus*) were also recorded in most areas but especially in the large pasture areas on Macquarie Generation land. Habitat was limited for arboreal mammals as there were few hollow-bearing trees except as paddock trees and these were generally isolated from neighbouring habitat.

However, the area may provide a habitat for a range of microchiropteran bats as these are highly mobile species and are able to move between habitat patches.

Reptile habitat was also limited as exposed rocks and fallen timber were not common along the corridor. A Jacky Lizard (*Amphibolurus muricatus*) was recorded near a dam on the Wambo Mining Area. Amphibian habitat was patchily distributed along the pipeline corridor. Two species of common frog were incidentally recorded calling during this assessment and these were Peron's Tree Frog (*Litoria peroni*) and the Common Eastern Froglet (*Crinia signifera*). The majority of the drainage line / creek crossings were dry, eroded and weed infested none of which are likely to provide quality habitat for frogs although there are several waterbodies nearby that would provide good habitat for a range of amphibians. The Hunter River and Wollombi Brook would provide good aquatic habitat for a number of aquatic and terrestrial species, however the crossing of both of these would be undertaken through HDD and consequently the waterbody or riparian vegetation would not be disturbed.

Domestic and feral animals would occur along the proposed pipeline corridor due to its location near to agricultural lands and urbanised areas. The many access roads and tracks along the corridor would also encourage movement of the European Red Fox (*Vulpes vulpes*). It is likely that the House Mouse, rats, cats and dogs would also frequent the site. These fauna are likely to prey on a range of species with the potential to occur in adjacent areas, including mammals, birds, amphibians and reptiles, thus limiting the habitat potential of the pipeline corridor and local area.

4.6 Conservation Significance

The site and locality (i.e. 10 km radius) have a number of features considered to be of conservation significance and these are outlined below.

4.6.1 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Communities

One critically endangered community is predicted to occur within the locality: *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. The proposed pipeline corridor does not traverse woodland areas with the characteristic species of White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and / or Blakely's Red Gum (*E. blakelyi*) and consequently this EEC is unlikely to occur along or adjacent to the corridor.

Species

Predictive modelling indicates that 11 fauna, 6 flora and 10 migratory terrestrial species listed under the EPBC Act have the potential to occur within the locality of the pipeline corridor (i.e. 10 km). These are shown in Table 6 and Table 7, along with the likelihood of their occurrence. The pipeline corridor provides limited habitat for threatened species but the adjacent areas could potentially provide habitat for a range of species especially for those species that are highly mobile (e.g. microchiropteran bats).

4.6.2 NSW Threatened Species Conservation Act 1995

Communities

Thirteen endangered ecological communities (EEC) listed under the TSC Act are known, or are predicted, to occur within the Hunter CMA sub-region and these are listed in Table 5. Given the soil, other ecological requirements and characteristic species of the listed EECs, it was concluded that none of these would be likely to occur along the proposed pipeline corridor or in directly adjacent areas.

Although the vegetation community assessed in Quadrat 2 (refer to 4.4 and Figure 2) supported some elements of *Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion* it was concluded that this vegetation community is more likely to be representative of *MU27 Central Hunter Ironbark (Eucalyptus crebra) – Spotted Gum (Corymbia maculata) – Grey Box (Eucalyptus moluccana) Forest* (Peake 2006) as the canopy was dominated by Narrow-leaved Ironbark rather than Broad-leaved Ironbark which is characteristic of this EEC. Peake (2006) mapped this woodland area as Central Hunter Box – Ironbark Woodland.

Populations

There are three endangered flora populations listed under the TSC Act that have been recorded within the locality (Table 6) of the pipeline corridor and one population was recorded along the proposed pipeline corridor. River Red Gum (*Eucalyptus camaldulensis*) was recorded at the Wambo Creek crossing and this species is a part of the *River Red Gum Population in the Hunter Catchment* protected under the TSC Act as an endangered population (Figure 2). Very old and large River Red Gums were also recorded in the most southerly of a much degraded drainage line which would flow into Wollombi Brook just north of Bulga (Figure 2). In both cases these remnant trees occur within highly eroded and weed infested gullies. There was no evidence to suggest that there was any recruitment of this species / population into these areas which is most likely due to grazing, weed invasion and erosion.

Species

There have been 11 flora and 43 fauna species listed under the TSC Act recorded within the locality (i.e. 10 km radius) and these are listed in Table 6 and Table 7, respectively.

The majority of the proposed pipeline corridor traverses highly modified habitats which are unlikely to provide high quality flora and fauna habitat for the majority of species unless the species are highly mobile, such as the Grey-crowned Babbler (*Pomatostomus temporalis temporalis*). This species was recorded in a planted area where Xstrata Mining Area intersects Charlton Road (Figure 2). Several records of this species have previously been made in close proximity to this site and it is likely that the individual recorded would belong to a previously recorded family group (Umwelt 2007). There are also a number of other highly mobile species with the strong potential of occurring within habitat adjacent to and along the pipeline corridor (e.g. Masked Owl (*Tyto novaehollandiae*), Regent Honeyeater (*Xanthomyza phrygia*) and Squirrel Glider (*Petaurus norfolcensis*)).

4.6.3 RoTAP Species

Three *Rare or Threatened Australian Plants* (RoTAP) are listed as occurring within the Muswellbrook and Singleton LGAs (plantNET 2008).

- Slaty Red Gum (*Eucalyptus glaucina*);
- *Gonocarpus longifolia*; and
- *Grevillea montana*.

None of these species were recorded along the pipeline corridor and whilst the pipeline corridor provides limited potential for the occurrence of these species, adjacent areas could provide potential habitat for a number of these plants.

4.6.4 Noxious Weeds

In NSW the identification, classification and control of noxious weeds is governed by the *Noxious Weeds Act 1993* (NW Act). Plants that have been declared as noxious weeds are classified into specific control classes in each Local Control Area. Those plants listed as Noxious Weeds for the Upper Hunter County Council which includes local council areas of Muswellbrook, Singleton and Upper Hunter and that were found along the pipeline corridor are listed in Table 4.

Table 4 Noxious weeds recorded along the proposed pipeline corridor

Botanic Name	Common Name	Noxious Weed Control Class
<i>Xanthium spinosum</i>	Bathurst Burr	4
<i>Echium plantagineum</i>	Paterson's Curse	4
<i>Opuntia stricta</i>	Common Prickly Pear	4
<i>Cuscuta campestris</i>	Golden Dodder	5
<i>Nassella trichotoma</i>	Serrated Tussock	3
<i>Rubus fruticosus</i>	Blackberry	4
<i>Salix babylonica</i>	Weeping Willow	5
<i>Solanum rostratum</i>	Buffalo Burr	4

The control requirements for each of these classes are:

- **Class 3 - Regionally Controlled Weeds:** Plants that pose a serious threat to primary production or the environment of an area to which the order applies, and are likely to spread in the area or to another area. Legal requirements are that the plant must be fully and continuously suppressed and destroyed.

- **Class 4 - Locally Controlled Weeds:** Plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area. Legal requirements are that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local authority.
- **Class 5 - Restricted Plants:** Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State. Legal requirements are that the requirements in the NW Act for a notifiable weed must be complied with.

Blackberry is also listed as a Weed of National Significance and the plans and controls associated with this listing should also be implemented for control of this weed.

4.6.5 Corridors and Connectivity

The proposed pipeline traverses the Hunter River valley floor. Wollemi National Park, Yengo National Park and Pokolbin State Forest are located to the west, southwest and south, respectively. It is unlikely that the proposed pipeline corridor would be a part of a major connecting corridor as patches of vegetation are severely fragmented as a consequence of many years of clearing. It is more likely that most of the movement by fauna and flora would occur through the vegetated areas of the nearby national parks and state forest. However, the proposed pipeline corridor may be important on a small scale for less mobile species as some fauna and flora are disrupted by small gaps in vegetation.

4.6.6 State Environmental Planning Policy 44 - Koala Habitat Protection

Muswellbrook and Singleton are listed as local government areas subject to the provisions of *State Environmental Planning Policy 44 - Koala Habitat Protection* (SEPP 44). A number of Koala records are known from the locality and close to the proposed pipeline corridor. Two species of Koala feed trees listed on Schedule 2 of SEPP 44, (i.e. Forest Red Gum (*Eucalyptus tereticornis*) and River Red Gum (*Eucalyptus camaldulensis*) were recorded along the pipeline corridor. For an area to be considered as potential Core Koala Habitat, Schedule 2 tree species must occur at densities greater than 15%. Neither of these species occurred at densities greater than 15% but rather as isolated paddock and / or riparian trees. Therefore it is unlikely that the pipeline corridor would be Core Koala Habitat and consequently no further provisions of SEPP 44 need apply.

Table 5 Endangered Ecological Communities recorded, and / or predicated to occur in the Upper Hunter Valley and / or locality

Vegetation Community	Conservation Status	Preferred Habitat	Likely Occurrence Along Pipeline Corridor
Coastal Saltmarsh in the NSW North Coast; Sydney Basin and South East Corner Bioregions	EEC-TSC	Intertidal zone along the NSW coast.	Unlikely. Habitat not present.
Freshwater wetlands on coastal floodplains of the NSW North Coast; Sydney Basin and South East Corner bioregions	EEC-TSC	Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years.	Unlikely. Habitat not present.
Hunter Valley Weeping Myall Woodland of the Sydney Basin Bioregion	EEC-TSC	Dominated by Weeping Myall known from the Singleton and Muswellbrook LGAs.	Unlikely. Weeping Myall not recorded and not previously mapped along the pipeline corridor.
Kurri Sand Swamp Woodland in the Sydney Basin Bioregion	EEC-TSC	Low open-woodland known to occur in the Kurri Kurri – Cessnock area of the lower Hunter Valley.	Unlikely. Outside of range.
Littoral Rainforest in the NSW North Coast; Sydney Basin and South East Corner Bioregions	EEC-TSC	Closed forest on coastal fringes.	Unlikely. Outside of coastal fringe.
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast; Sydney Basin and South East Corner bioregions	EEC-TSC	Tall open forest found on the river flats of the coastal floodplains.	Unlikely. Outside of range.
White Box Yellow Box Blakely's Red Gum Woodland	EEC-TSC CE-EPBC	Characterised by the presence or prior occurrence of White Box, Yellow Box and / or Blakely's Red Gum with a number of co-occurring Eucalypt species. Remnants generally occur on fertile lower parts of the landscape where resources such as water and nutrients are abundant.	Unlikely. Pipeline does not traverse woodland with these characteristics.
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions	EEC-TSC	Open forest on gentle slopes of depressions and drainage flats on the Hunter Valley floor. The most common canopy tree species Forest Red Gum and Grey Gum and subdominants of Smooth-barked Apple, Spotted Gum, Narrow-leaved Ironbark and Grey Box. The mid-storey characterised by sparse shrubs such as	Unlikely. Pipeline corridor predominantly cleared. Characteristic species occur as isolated paddock trees.

Vegetation Community	Conservation Status	Preferred Habitat	Likely Occurrence Along Pipeline Corridor
		<i>Breynia oblongifolia</i> , <i>Leucopogon juniperinus</i> , <i>Daviesia ulicifolia</i> and <i>Jacksonia scoparia</i> with ground cover typically grasses and herbs.	
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	EEC-TSC	Open forest dominated by Spotted Gum and Broad-leaved Ironbark with occasional Grey Gum and Narrow-leaved Ironbark. Understorey comprises tall shrubs and the understorey is diverse.	Unlikely. Pipeline corridor does not traverse areas dominated by Spotted Gum and Broad-leaved Ironbark.
Warkworth Sands Woodland in the Sydney Basin Bioregion	EEC-TSC	Woodland – low woodland on sandy soils with trees of Rough-barked Apple and Coastal Banksia. Shrubs and ground species include <i>Acacia filicifolia</i> , <i>Pteridium esculentum</i> , <i>Imperata cylindrica</i> , <i>Brachyloma daphnoides</i> and <i>Melaleuca thymifolia</i> .	Unlikely. Corridor chosen to avoid mapped occurrences. Pipeline does not traverse woodland with these characteristics.
Swamp oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner bioregions	EEC-TSC	This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which Swamp oak is the dominant species northwards from Bermagui.	Unlikely. Outside of range.
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast; Sydney Basin and South East Corner bioregions	EEC-TSC	This swamp community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing.	Unlikely. Outside of range.
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	EEC-TSC	A complex of vegetation types largely restricted to freshwater swamps in coastal areas.	Unlikely. Outside of range.
Note: TSC Act = <i>Threatened Species Conservation Act 1995</i>; EPBC Act = <i>Environment Protection and Biodiversity Conservation Act 1999</i>, EEC = Endangered Ecological Community, CE = Critically Endangered. Bold indicates those communities with the potential to occur along, or directly adjacent to the pipeline corridor. Source: DECC 2005, PlantNet 2008, Peake 2006.			

Table 6 Threatened flora recorded or with the potential to occur within the locality

Botanic Name / Common Name	Conservation Rating	Habitat Requirements	Likely Occurrence Along Pipeline Corridor
Weeping Myall population in the Hunter catchment	EP-TSC	Disjunct population of < 1000 individuals of <i>Acacia pendula</i> that occurs in the Hunter Valley at the eastern distributional limit of the species' range. Known to occur as far east as Warkworth, and extends northwest to Muswellbrook and to the west of Muswellbrook at Wybong. Only recorded to date at 6 locations. Species typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations.	Closest record 5 km W of pipeline. Unlikely. Pipeline does not traverse any vegetation with the characteristic species typical of this population.
<i>Cymbidium canaliculatum</i> population in the Hunter Catchment	EP-TSC	Large epiphytic orchid commonly occurring within <i>Eucalyptus albens</i> woodland typically in a single clump between 2 and 6 m above ground level. Less commonly found on <i>E. dawsonii</i>, <i>E. crebra</i>, <i>E. moluccana</i>, <i>Angophora floribunda</i>, <i>Acacia salicina</i>.	Closest record 9 km N of pipeline. Potential habitat present.
<i>Darwinia biflora</i>	V-TSC V-EPBC	An erect to spreading shrub to 80cm high. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone.	Closest record 3.5 km S of pipeline. Unlikely. Unsuitable geology and soils.
<i>Dillwynia tenuifolia</i>	V-TSC V-EPBC	A low spreading pea-flower shrub to 1 m. Core distribution is the Cumberland Plain from Windsor to Penrith although a disjunct population known from Bulga Mountains, Yengo. Habitat found within dry areas in Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays.	Closest record 8 km SW of pipeline. Unlikely. Unsuitable geology, soils and vegetation associations.
<i>Diuris tricolor</i> Pine Donkey Orchid	V-TSC EP-TSC	The Pine Donkey Orchid is a terrestrial orchid which grows in sclerophyll forest among grass, often with native Cypress Pine (<i>Callitris</i> spp.). It is found in sandy soils,	Closest record 6 km N of pipeline. Potential habitat present.

Botanic Name / Common Name	Conservation Rating	Habitat Requirements	Likely Occurrence Along Pipeline Corridor
	V-EPBC	either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Muswellbrook population only known population from east of the Great Dividing Range and is found in sclerophyll vegetation on flats or small rises, on a range of substrates including sandy or loamy soils derived from granite, porphyry, laterite or alluvium.	
River Red Gum population in the Hunter Catchment	EP-TSC	The population of River Red Gum in the Hunter is unique in NSW being the only one to occur in a coastal catchment. May occur with <i>Eucalyptus tereticornis</i> , <i>Eucalyptus melliodora</i> , <i>Casuarina cunninghamiana</i> and <i>Angophora floribunda</i> .	Recorded along pipeline corridor.
<i>Eucalyptus glaucina</i> Slaty Red Gum	V-TSC V-EPBC	A medium-sized tree to 30 m tall. Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils.	Closest record 1 km E of pipeline. Potential habitat present.
<i>Melaleuca groveana</i> Grove's Paperbark	V-TSC	Shrub or small tree 2 – 5 m rarely to 10 m high with firm fibrous-papery bark. Grove's Paperbark grows in heath and shrubland, often in exposed sites, at high elevations, on rocky outcrops and cliffs but also occurs in dry woodlands.	Recorded 10 km W of pipeline in Wollemi National Park. Unlikely. Habitat not present.
<i>Olearia cordata</i>	V-TSC V-EPBC	A sweetly aromatic, slender shrub up to 2 m high with a typical daisy-like flowers that can be mauve to deep blue (rarely white), with a yellow centre. Populations are typically small and scattered. Grows in dry open sclerophyll forest and open shrubland, on sandstone ridges.	Recorded 10 km W of pipeline in Wollemi National Park. Unlikely. Habitat not present.

Botanic Name / Common Name	Conservation Rating	Habitat Requirements	Likely Occurrence Along Pipeline Corridor
<i>Pterostylis gibbosa</i> <i>Illawarra Greenhood</i>	E-TSC E-EPBC	A ground dwelling orchid only visible during flowering. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark, Forest Red Gum and Black Cypress Pine.	Recorded 4.5 km SW of pipeline. Unlikely. Corridor does not pass through forest type.
<i>Thesium australe</i> Austral Toadflax	V-TSC V-EPBC	Grassy woodlands with clay soils or coastal headlands. Often found in damp sites in association with Kangaroo Grass.	Unlikely. Corridor does not pass through habitat type.
Note: TSC Act = <i>Threatened Species Conservation Act 1995</i>; EPBC Act = <i>Environment Protection and Biodiversity Conservation Act 1999</i>, V = Vulnerable, E = Endangered, EP = Endangered Population M = Migratory, Mar = Marine. Bold indicates those species with the potential to occur on, or directly adjacent to the site. Source: DECC 2005, PlantNet 2008, Peake 2006.			

Table 7 Threatened or migratory fauna species recorded within the locality or with the potential to occur

Species	Conservation Rating	Habitat Requirements	Likely Occurrence Along Pipeline Corridor
Amphibians			
<i>Heleioporus australiacus</i> Giant Burrowing Frog	V-TSC V-EPBC	Found in heath, woodland and open forest with sandy soils. Burrows into deep litter or loose soil, emerging to feed or breed after rain.	Recorded 8 km SW of pipeline in Yengo National Park. Potential. Habitat present.
<i>Litoria aurea</i> Green & Golden Bell Frog	E- TSC V- EPBC	Marshes, dams & stream-sides particularly those containing Typha or Eleocharis. Need waterbodies unshaded, free of predatory fish and that have grassy areas nearby.	Recorded < 2 km E of pipeline. Potential habitat nearby.
<i>Litoria booroolongensis</i> Booroolong Frog	E-EPBC	Along the western-flowing streams of the Great Dividing Range.	Unlikely. No habitat present.
<i>Pseudophryne australis</i> Red-crowned Toadlet	V-TSC	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	Recorded 9 km SW of pipeline. Unlikely. Habitat not present.
Water-dependent Birds			
<i>Ardea alba</i> White Egret	M-EPBC	Species or species habitat may occur within area. Found in shallows of rivers, estuaries, tidal mudflats, freshwater wetlands, sewage ponds, irrigation areas and larger dams.	Unlikely. No habitat present.
<i>Ardea ibis</i> Cattle Egret	M-EPBC	Species or species habitat may occur within area. Found in stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats and drains.	Potential. May occur in adjacent areas.

Species	Conservation Rating	Habitat Requirements	Likely Occurrence Along Pipeline Corridor
<i>Ephippiorhynchus asiaticus</i> Black-necked Stork	E-TSC	Permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.	Recorded 8 km E of pipeline. Unlikely. Habitat not present.
<i>Gallinago hardwickii</i> Latham's Snipe	M-EPBC Mar-EPBC	Summer migrant to coastal Australia where it feeds on soft wet ground or shallow water with tussocks and woodland, saltmarshes and mangrove fringes.	Potential. Habitat present nearby.
<i>Oxyura australis</i> Blue-billed Duck	V-TSC	Aquatic, preferring deep water in large, permanent wetlands with an abundant aquatic flora.	Recorded 6 km E of pipeline. Unlikely. Habitat not present.
<i>Rostratula benghalensis</i> Painted Snipe	V-TSC M-EPBC	Prefers fringes of swamps, dams and nearby marshy areas with a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation. Forages nocturnally.	Potential. Habitat present nearby.
<i>Stictonetta naevosa</i> Freckled Duck	V-TSC	Permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree.	Recorded in Lake Liddell. Unlikely. Habitat not present.
Woodland Birds			
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo	V-TSC	In summer, found in tall mountain forests and woodlands, particularly in heavily timbered wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas.	Recorded 4 km W of pipeline in Wollemi National Park. Unlikely. Habitat not present.
<i>Calyptorhynchus lathamii</i> Glossy Black-cockatoo	V-TSC	Inhabits open forest and woodlands. Feeds on Black She-oak (<i>Allocasuarina littoralis</i>), Forest She-oak (<i>A. torulosa</i>) or Drooping She-oak (<i>A. verticillata</i>).	Recorded < 1 km of pipeline. Potential. May forage in adjacent areas.

Species	Conservation Rating	Habitat Requirements	Likely Occurrence Along Pipeline Corridor
<i>Grantiella picta</i> Painted Honeyeater	V-TSC	Strongly associated with woodland found in open woodlands and dry forests. Found on plains with scattered eucalypts and remnant trees on farmlands.	Recorded 6 km S of pipeline. Potential. Habitat present.
<i>Hirundapus caudacutus</i> White-throated Needletail	M-EPBC Mar-EPBC	Feeds on flying insects, such as termites, ants, beetles and flies. Feed on insects in flight in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts.	Potential. Habitat present.
<i>Lathamus discolor</i> Swift Parrot	E-TSC E-EPBC Mar-EPBC	Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark, and White Box. Commonly used lerp infested trees include Grey Box and Blackbutt.	Recorded < 1 km of pipeline. Potential. May forage in adjacent areas.
<i>Melanodryas cucullata</i> Hooded Robin	V-TSC	Structurally diverse drier eucalypt woodlands, forests, scrubs with fallen timber.	Recorded < 3 km E of pipeline. Potential. May forage across adjacent areas.
<i>Melithreptus gularis gularis</i> Black-chinned Honeyeater	V-TSC	Occurs in open forests and woodlands dominated by box and ironbark eucalypts generally west of the Great Dividing Range.	Recorded 7 km SW of pipeline. Potential. May forage across adjacent areas.
<i>Merops ornatus</i> Rainbow Bee-eater	M-EPBC Mar-EPBC	Summer breeding migrant to south-east Australia. Found in open woodlands with sandy, loamy soil, sandridges, sandpits, riverbanks, cliffs, mangroves, rainforest and woodland.	Potential habitat nearby.
<i>Monarcha melanopsis</i> Black-faced Monarch	M-EPBC Mar-EPBC	Breeding may occur within area. Summer breeding migrant to coastal south-eastern Australia. Found in rainforests, nearby eucalypt woodlands and mangroves.	Unlikely. No habitat present.
<i>Myiagra cyanoleuca</i> Satin Flycatcher	M-EPBC Mar-EPBC	Breeds in Australia from October to January. Heavily vegetated gullies in forests, tall woodlands and during migration coastal forests, woodlands mangroves, trees in open country.	Unlikely. No habitat present.

Species	Conservation Rating	Habitat Requirements	Likely Occurrence Along Pipeline Corridor
<i>Neophema pulchella</i> Turquoise Parrot	V-TSC	Lives on edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends majority of day on ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter.	Recorded < 1 km of pipeline. Potential. May forage across adjacent areas.
<i>Pomatostomus temporalis temporalis</i> Grey-crowned Babbler	V-TSC	Found in drier open forest, scrubby woodlands, road reserves, farmland and sometimes urbanised areas.	Recorded along pipeline corridor.
<i>Pyrrholaemus sagittatus</i> Speckled Warbler	V-TSC	Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies.	Recorded < 1 km of pipeline. Potential. May forage across adjacent areas.
<i>Rhipidura rufifrons</i> Rufous Fantail	M-EPBC Mar-EPBC	Breeding migrant to south-eastern Australia during July to December. Prefers wetter eucalypt forests, gullies, coastal scrub, watercourses and rainforests where it feeds on insects.	Unlikely. Habitat not present.
<i>Stagonopleura guttata</i> Diamond Firetail	V-TSC	Occurs in open eucalypt forest, mallee and acacia scrubs.	Recorded < 1 km of pipeline. Potential. May forage across adjacent areas.
<i>Xanthomyza phrygia</i> Regent Honeyeater	E-TSC E-EPBC M-EPBC	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak (<i>Casuarina cunninghamiana</i>). Inhabit woodlands with a significantly high abundance of bird species. Should have large numbers of mature trees, high canopy cover and abundance of mistletoes.	Recorded 3 km W of pipeline. Potential. May forage across adjacent areas.
Owls			
<i>Ninox connivens</i> Barking Owl	V-TSC	Breeding HBT >20 cm diam. Forage woodlands, grassy woodlands, forests and into grasslands 250 m.	Recorded < 1 km of pipeline. Potential. May forage across adjacent areas.

Species	Conservation Rating	Habitat Requirements	Likely Occurrence Along Pipeline Corridor
<i>Ninox strenua</i> Powerful Owl	V-TSC	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	Recorded 8 km W in Wollemi National Park. Unlikely habitat not present.
<i>Tyto novaehollandiae</i> Masked Owl	V-TSC	Lives in dry eucalypt forests and woodlands. Pair's home-range of 500 to 1000 ha. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	Recorded 6 km E of pipeline. Unlikely. Habitat not present.
<i>Tyto tenebricosa</i> Sooty Owl	V-TSC	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation.	Unlikely. Habitat not present.
Mammals (other than bats)			
<i>Cercartetus nanus</i> Eastern Pygmy-possum	V-TSC	Rainforest, sclerophylla forest and woodland to heath – but heath and woodland preferred. Forages on banksias, eucalypts & bottlebrushes.	Recorded 9 km SW of pipeline in Yengo National Park. Unlikely. Foraging habitat not present.
<i>Dasyurus maculatus maculatus</i> Spotted-tailed Quoll	V – TSC E – EPBC	Occurs in rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	Recorded < 1 km of pipeline. Potential. May forage in adjacent areas.
<i>Petaurus australis</i> Yellow-bellied Glider	V-TSC	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soil.	Recorded 4 km W in Wollemi National Park. Unlikely. Habitat not present.
<i>Petaurus norfolcensis</i> Squirrel Glider	V-TSC	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require	Recorded < 1 km of pipeline. Potential. May forage across adjacent areas.

Species	Conservation Rating	Habitat Requirements	Likely Occurrence Along Pipeline Corridor
		abundant tree hollows for refuge and nest sites	
<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby	E-TSC V-EPBC	Rocky escarpments, outcrops, steep slopes or cliffs – especially those with caves, ledges or overhangs & shrub cover.	Recorded 3.5 km W in Wollemi National Park. Unlikely. Habitat not present.
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	V-TSC	Dry sclerophylla open forest with sparse groundcover. Also heath, swamps, rainforest and wet sclerophylla forest.	Recorded < 1 km of pipeline. Potential. May forage across adjacent areas.
<i>Phascolarctos cinereus</i> Koala	V-TSC	Eucalypt woodlands and forests. Presence of preferred feed species is a determinant of forest suitability.	Recorded 6 km SE of pipeline. Unlikely. Not Core Koala Habitat (see SEPP 44 assessment).
Microchiropteran Bats			
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	V-TSC V-EPBC	Roosts in caves, crevices in cliffs, derelict mines and in the disused, bottle-shaped mud nests of the Fairy Martin frequenting low to midelevation dry open forest and woodland close to these features.	Recorded < 1 km of pipeline. Potential. May forage in adjacent areas.
<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle	V-TSC	Prefers moist habitats with trees >20 m. Roosts in HBT or under bark or in buildings.	Recorded 4 km W of pipeline in Wollemi National Park. Unlikely. Habitat not present.
<i>Miniopterus australis</i> Little Bent-wing Bat	V-TSC	Found in well timbered areas including rainforest, wet and dry sclerophyll forests, melaleuca swamps and coastal forests. Roost in caves.	Recorded < 1 km of pipeline. Potential. May forage across adjacent areas.
<i>Miniopterus schreibersii oceanensis</i> Eastern Bent-wing Bat	V-TSC	Roosting – caves, derelict mines, stormwater tunnels, buildings. Foraging - forested areas.	Recorded < 1 km of pipeline. Potential. May forage across adjacent areas.

Species	Conservation Rating	Habitat Requirements	Likely Occurrence Along Pipeline Corridor
<i>Mormopterus norfolkensis</i> Eastern Freetail-bat	V-TSC	Forages - dry sclerophylla forest and woodland. Roosts - hollows and under bark or man-made structures.	Recorded < 1 km of pipeline. Potential. May forage across adjacent areas.
<i>Myotis adversus</i> Large-footed Myotis	V-TSC	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, HBTs, stormwater channels, buildings, under bridges. Forages over streams and pools catching insects and small fish by raking their feet across the water surface.	Recorded < 1 km of pipeline. Potential. May forage across adjacent areas.
<i>Nyctophilus bifax</i> Eastern Long-eared Bat	V-TSC V-EPBC	Prefers wetter habitats such as rainforest and monsoon forest to riverine forests but sometimes found in tall open forest and dry sclerophyll woodland.	Unlikely. Habitat not present.
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	V-TSC	Woodland, moist and dry eucalypt forest and rainforest but prefers tall wet forest. Roosts - tree hollows but also buildings.	Recorded 6 km NW of pipeline. Potential. May forage across adjacent areas.
<i>Vespadelus troungtoni</i> Eastern Cave Bat	V-TSC	Cave-roosting species found in dry open forest and woodland, near cliffs or rocky overhangs.	Recorded 5 km W of pipeline. Potential. May forage across adjacent areas.
Megachiropteran Bats			
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	V-TSC V-EPBC	Subtropical & temperate rainforests, tall sclerophylla forests & woodlands, heaths & swamps.	Recorded 9 km SW of pipeline. Potential. May forage across adjacent areas..
Note: TSC Act = <i>Threatened Species Conservation Act 1995</i>; EPBC Act = <i>Environment Protection and Biodiversity Conservation Act 1999</i>, V = Vulnerable, E = Endangered, M = Migratory, Mar = Marine. Bold indicates those species with the potential to occur on, or directly adjacent to the pipeline corridor. Source: Churchill 1998, DECC 2005, Pizzey & Knight 1999, Barker <i>et al.</i> 1995			

Table 8 Recognised threats for threatened species and populations likely to occur within the locality

Community / Population / Species	Status	Recognised Threats
Populations		
<i>Cymbidium canaliculatum</i> population in the Hunter Catchment	EP-TSC	Clearing
River Red Gum population in the Hunter Catchment	EP-TSC	- Clearing. - Local extinctions of small populations. - Lack of regeneration due to changes in hydrology, cropping, grazing and weeds.
Flora		
<i>Diuris tricolor</i> Pine Donkey Orchid	EP-TSC V-TSC V-EPBC	- Habitat clearing and modification. - Feral animal impacts. - Weed infestations. - Lack of adequate assessment.
<i>Eucalyptus glaucina</i> Slaty Red Gum	V-TSC V-EPBC	- Clearing for agriculture and development. - Lack of regeneration through grazing pressure.
Amphibians		
<i>Heleioporus australiacus</i> Giant Burrowing Frog	V-TSC V-EPBC	- Habitat loss through clearing for residential, agricultural and urban infrastructure development. - High intensity fires. - Disease (chytrid fungus). - Reduction of water quality generally in the vicinity of urban development.
<i>Litoria aurea</i> Green & Golden Bell Frog	E- TSC V- EPBC	- Destruction of wetlands. - Alteration of drainage patterns and stormwater runoff. - A fungal pathogen known as Frog Chytrid Fungus. - Predation by feral animals such as foxes and Plague Minnow. - Road mortality, where populations are already small due to other threats. - Loss of suitable breeding habitat through alteration by infilling and destruction of wetlands.

Community / Population / Species	Status	Recognised Threats
Water-dependent Birds		
<i>Rostratula benghalensis</i> Painted Snipe	V-TSC M-EPBC	▪ Drainage of breeding sites in wetlands. ▪ Reduced water quality - siltation & pollution. ▪ Predation by foxes and feral cats. ▪ Use of herbicides, insecticides and other chemicals near wetlands. ▪ Grazing and associated frequent burning of wetlands
Woodland Birds		
<i>Lathamus discolor</i> Swift Parrot	E-TSC E-EPBC Mar-EPBC	▪ Loss of habitat through clearing for agriculture, and urban and industrial development. ▪ Collisions with wire netting fences, windows and cars, during the breeding season and winter migration (especially where such obstacles are in close proximity to suitable habitat).
<i>Xanthomyza phrygia</i> Regent Honeyeater	E-TSC E-EPBC M-EPBC	▪ Historical loss, fragmentation and degradation of habitat from clearing for agricultural and residential development. ▪ Continuing loss of key habitat tree species and remnant woodlands from strategic agricultural developments, timber gathering and residential developments. ▪ Suppression of natural regeneration of overstorey tree species and shrub species from overgrazing. ▪ Competition from larger aggressive honeyeaters. ▪ Egg and nest predation by native birds.
<i>Melanodryas cucullata</i> Hooded Robin	V-TSC	▪ Clearing of woodlands, resulting in loss and fragmentation of habitat. ▪ Modification and destruction of ground habitat through heavy grazing and compaction by stock, removal of litter and fallen timber, introduction of exotic pasture grasses and frequent fire.
<i>Pyrholaemus sagittatus</i> Speckled Warbler	V-TSC	▪ Susceptible to catastrophic events and localised extinctions due to the fragmented nature of the populations and their small size ▪ Clearance of remnant grassy woodland habitat for paddock management reasons and for firewood. ▪ Poor regeneration of grassy woodland habitats. ▪ Modification and destruction of ground habitat. ▪ Nest failure due to predation by native and non-native birds, cats, dogs and foxes.

Community / Population / Species	Status	Recognised Threats
<i>Neophema pulchella</i> Turquoise Parrot	V-TSC	- Clearing of grassy-woodland and open forest habitat. - Loss of hollow-bearing trees. - Degradation of habitat through heavy grazing, firewood collection and establishment of pastures. - Predation by foxes and cats. - Illegal trapping of birds and collection of eggs which also often results in the destruction of hollows.
<i>Melithreptus gularis gularis</i> Black-chinned Honeyeater	V-TSC	- Clearing of remnant open forest and woodland habitat. - Poor regeneration of open forest and woodland habitats because of intense grazing. - May be excluded from smaller remnants by aggressive species such as the Noisy Miner.
<i>Stagonopleura guttata</i> Diamond Firetail	V-TSC	- Clearing and fragmentation of woodland, open forest, grassland and mallee habitat for agriculture and residential development, and firewood collection. - Poor regeneration of open forest and woodland habitats. - Invasion of weeds, resulting in the loss of important food plants. - Modification and destruction of ground- and shrub layers within habitat. - Predation of eggs and nestlings by increased populations of native predators. - Risk of local extinction due to small, isolated populations.
<i>Pomatostomus temporalis temporalis</i> Grey-crowned Babbler	V-TSC	- Clearing of woodland remnants. - Heavy grazing and removal of coarse, woody debris within woodland remnants. - Nest predation by species such as ravens and butcherbirds..
<i>Calyptorhynchus lathamii</i> Glossy Black-cockatoo	V-TSC	- Reduction of suitable habitat through clearing for development. - Loss of tree hollows. - Excessively frequent fire which reduces the abundance and recovery of she-oaks.
Owls		
<i>Ninox connivens</i> Barking Owl	V-TSC	- Clearing and degradation of habitat, mostly through cultivation, intense grazing and the establishment of exotic pastures. - Inappropriate forest harvesting practices that have changed forest structure and removed old

Community / Population / Species	Status	Recognised Threats
		growth hollow-bearing trees. ▪ Firewood harvesting resulting in the removal of old trees. ▪ Too-frequent fire which causes degradation of understorey vegetation which provides habitat and foraging substrate for prey species.
Mammals (other than bats)		
<i>Petaurus norfolcensis</i> Squirrel Glider	V-TSC	▪ Loss and fragmentation of habitat. ▪ Loss of hollow-bearing trees. ▪ Loss of flowering understorey and midstorey shrubs in forests. ▪ Individuals can get caught in barbed wire fences while gliding.
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	V-TSC	▪ Loss and fragmentation of habitat. ▪ Loss of hollow-bearing trees. ▪ Predation by foxes and cats. ▪ Competition for nesting hollows with the introduced honeybee.
<i>Cercartetus nanus</i> Eastern Pygmy-possum	V-TSC	▪ Loss and fragmentation habitat through land-clearing for agriculture, forestry and urban development. ▪ Changed fire regimes that affect the abundance of flowering myrtaceous shrubs, particularly banksias. ▪ Declining shrub diversity in forests and woodlands due to overgrazing by stock and rabbits. ▪ Predation from cats, dogs and foxes.
<i>Dasyurus maculatus maculatus</i> Spotted-tailed Quoll	V – TSC E – EPBC	▪ Loss, fragmentation and degradation of habitat. ▪ Accidental poisoning during wild dog and fox control programs. Deliberate poisoning, shooting and trapping may also be an issue. ▪ Competition with introduced predators such as cats and foxes.
Microchiropteran Bats		
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	V-TSC V-EPBC	▪ Clearing and isolation of forest and woodland habitats near cliffs, caves and old mine workings for agriculture or development. ▪ Loss of foraging habitat close to cliffs, caves and old mine workings from forestry activities and too-frequent burning, usually associated with grazing.

Community / Population / Species	Status	Recognised Threats
		- Damage to roosting and maternity sites from mining operations, and recreational caving activities. - Use of pesticides.
<i>Miniopterus australis</i> Little Bent-wing Bat	V-TSC	- Disturbance of colonies, especially in nursery or hibernating caves may be catastrophic. - Destruction of caves that provide seasonal or potential roosting sites. - Changes to habitat, especially surrounding maternity caves. - Use of pesticides.
<i>Miniopterus schreibersii oceanensis</i> Eastern Bent-wing Bat	V-TSC	- Damage to or disturbance of roosting caves, particularly during winter or breeding. - Loss of foraging habitat. - Application of pesticides in or adjacent to foraging areas. - Predation by feral cats and foxes.
<i>Mormopterus norfolkensis</i> Eastern Freetail-bat	V-TSC	- Loss of hollow-bearing trees. - Loss of foraging habitat. - Application of pesticides in or adjacent to foraging areas.
<i>Vespadelus trougtoni</i> Eastern Cave Bat	V-TSC	- Clearing and isolation of dry eucalypt forest and woodland. - Loss of suitable feeding habitat near roosting and maternity sites. - Use of pesticides. - Damage to roosting and maternity sites from mining operations, and recreational activities such as caving. - Probable predation by cats and foxes.
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	V-TSC	- Disturbance to roosting and summer breeding sites. - Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions. - Loss of hollow-bearing trees. - Use of pesticides. - Changes to water regimes are likely to impact food resources, as is the use of pesticides and herbicides near waterways.

Community / Population / Species	Status	Recognised Threats
<i>Myotis adversus</i> Large-footed Myotis	V-TSC	▪ Loss or disturbance of roosting sites. ▪ Clearing adjacent to foraging areas. ▪ Application of pesticides in or adjacent to foraging areas. ▪ Reduction in stream water quality affecting food resources
Megachiropteran Bat		
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	V-TSC V-EPBC	▪ Loss of foraging habitat. ▪ Disturbance of roosting sites.
Note: TSC Act = <i>Threatened Species Conservation Act 1995</i> ; EPBC Act = <i>Environment Protection and Biodiversity Conservation Act 1999</i> , V = Vulnerable, E = Endangered, M = Migratory, Mar = Marine. Source: DECC 2005.		

5 IMPACT ASSESSMENT

Potential impacts as a consequence of the proposed pipeline are likely to be minimal as the corridor has generally been designed to avoid areas of high conservation, such as the Warkworth Sands Woodland through which the initial pipeline corridor traversed. Nonetheless, a number of impacts have the potential to occur as a consequence of construction and operation of this proposal and these are discussed below.

5.1 Direct Impacts

5.1.1 Vegetation Clearance

The proposed corridor is characterised by cleared land which has been used for agriculture and mining over a number of years. A key aim of the proposal has been to locate the pipeline and associated infrastructure in such a way as to avoid the removal of important vegetation and this has been achieved. Construction activity will be confined to the pipeline corridor and adjoining land to which access is available for construction purposes. The pipeline requires a construction right-of-way (ROW) of approximately 20 m wide plus temporary work space within the 50 m wide assessment corridor. Temporary extra work space will be required in areas such as watercourse and road crossings. Although a 20m construction ROW is required for the majority of the pipeline length, it is intended wherever possible to confine the high disturbance zone to a 10 m to 12 m width for trenching, brush and spoil storage and vehicle movement. The anticipated vegetation removal along the length of the pipeline is shown in Table 9.

Table 9 Vegetation clearance along the proposed pipeline corridor

Vegetation Community	Direct Impacts
Introduced pastures	20 m ROW along the vast majority of the proposed pipeline corridor.
Planted areas	None – will be avoided
Central Hunter Box – Ironbark Woodland	1.02 ha
Central Hunter Ironbark – Spotted Gum – Grey Box Forest	0.57 ha
Hunter Valley River Oak Forest	None – would be under bored from outside of vegetated areas.
Note: ROW = right of way	

The use of a flexible pipe means that all paddock trees could be avoided as would all substantial vegetation within drainage lines including River Red Gums which are a part of an endangered

population. A maximum of 1.59 ha of native vegetation communities would be removed as a consequence of this 51 km proposed pipeline corridor.

5.1.2 Loss of Fauna Habitat

The majority of fauna habitat which would be removed is that provided by introduced pasturelands. This may temporarily affect species such as the Eastern Grey Kangaroo and Common Wombat, both of which are prevalent in this area. This is unlikely to have a long term impact on these species as the trench would be backfilled almost simultaneously with laying of the pipe and so movement for foraging and dispersal throughout the area would not be restricted long term.

All paddock trees would be avoided as would substantial vegetation within drainage lines thereby ensuring that trees with hollows are retained. It is unlikely that amphibian habitat would be substantially disturbed as the majority of drainage lines traversed by the pipeline are ephemeral and they lack native vegetation. Farm and / or mine dams would not be impacted by this proposal.

Some fauna habitat would be removed with the clearance of 1.02 ha Central Hunter Box – Ironbark Woodland and 0.57 ha Central Hunter Ironbark – Spotted Gum – Grey Box Forest. This habitat primarily consists of small trees with a very sparse groundlayer and open gravelly soils lacking in fallen timber and basking sites for reptiles. Whilst these areas would not provide high quality fauna habitat due to lack of habitat complexity they would provide potential habitat for a range of woodland birds, small mammals and common reptiles.

5.1.3 Impacts on aquatic habitats

Some changes to hydrological regimes along the pipeline corridor have the potential to occur. Changes to hydrological processes can have a number of potential effects including:

- Alteration of the ecology of an area including the vegetational composition and loss of fauna habitat;
- Increased run off rates and hence erosion;
- Changes in soil moisture content; and
- May create conditions conducive to invasion by exotic species.

Impacts on aquatic habitats are likely to be spatially and temporally limited. The major river crossings (i.e. Hunter River and Wollombi Brook) would be under bored and consequently direct impacts on these waterways are unlikely to occur. Compounds housing the drill rig and associated infrastructure would also be placed well clear of the riparian zones further reducing potential impacts.

The more minor crossings, including Wambo Creek and ephemeral drainage lines, would be trenched at locations which do not require removal of substantial native vegetation or emergent aquatic vegetation. This would be achievable as the drainage lines and creeks are largely highly eroded,

weed infested and ephemeral in nature. To ensure that water quality is not further impacted through erosion and sedimentation, measures such as silt curtains, would be used to control impacts. The trench would be backfilled once the pipeline is laid and hence any disruption to flow or fauna movement would not be long term. If it is necessary to upgrade any drainage line or creek crossings along access tracks to allow construction of the pipeline it is recommended that box culverts be used in accordance with the guidelines for requirements for waterway crossings (Fairfull & Witheridge 2003).

5.2 Indirect Impacts

Indirect impacts on biodiversity during construction and operation are possible and these are discussed below.

5.2.1 Changes to Water Quality

Changes to water quality could occur during construction if erosion, runoff and sedimentation are not adequately controlled. Measures to prevent stormwater runoff and sedimentation from entering waterways would need to be installed and these may include silt curtains, or isolation construction using dam and pump or flume pipe techniques. A Construction Environment Management Plan (CEMP) including a Sediment and Erosion Control Plan would need to be prepared prior to construction and the management techniques and measures would need to be detailed in this plan.

5.2.2 Edge Effects

Clearance of vegetation and the maintenance of a track for vehicular access along the length of the pipeline corridor would increase edge effects. Edge effects are known to increase the chances of weed establishment, cause changes in microclimates along the edges of vegetation communities and allow for ease of movement of feral animals (e.g. European Red Fox) through an area. The locality is currently impacted by clearing and fragmentation which has significantly increased edge effects throughout the area. It is unlikely that this proposal would substantially increase these effects.

5.2.3 Disturbance of Fauna

Disturbance of fauna during construction could occur through an increase in noise and activity levels across the site. Disturbances may occur as a consequence of vehicular traffic causing noise and an increased risk of vehicle strike, and drilling causing noise and vibration. Disturbance of fauna can result in changes to the behaviour and patterns of usage of resources by some fauna species and / or increases in roadkill. As the majority of construction activities would be within the highly modified paddock areas of the site it is anticipated that the proposed pipeline would provide few risks to fauna above current levels.

5.3 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

An assessment of the impacts of the proposal on ecological communities, populations and species listed under the EPBC Act has been undertaken using the Significant Impact Criteria detailed in the *EPBC Act Administrative Guidelines for Significance* (Commonwealth of Australia 2006). Details of this assessment are contained in Appendix C and the outcomes briefly outlined below.

Species assessed included:

- Slaty Red Gum (*Eucalyptus glaucina*);
- Pine Donkey Orchid (*Diuris tricolor*);
- Green and Golden Bell Frog (*Litoria aurea*);
- Giant Burrowing Frog (*Heleioporus australiacus*);
- Regent Honeyeater (*Xanthomyza phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Cattle Egret (*Ardea ibis*);
- Latham's Snipe (*Gallinago hardwickii*);
- Painted Snipe (*Rostratula benghalensis*);
- Rainbow Bee-eater (*Merops ornatus*);
- White-throated Needletail (*Hirundapus caudacutus*).
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*); and
- Large-eared Pied Bat (*Chalinolobus dwyeri*).

It was concluded that the proposed pipeline corridor is unlikely to have a real chance or a possibility to significantly impact any species, population or habitat along the pipeline corridor and within the locality as:

- The proposed pipeline corridor has been located so as to avoid areas of high biodiversity which would be most likely to provide habitat to listed species and endangered ecological communities;
- Disturbance would be temporary and confined to a narrow and currently degraded ROW; and
- Potential impacts could be managed and mitigated (refer to Section 1).

Macquarie Generation does not consider that the proposed pipeline Project will adversely impact matters of NES and will thus not submit a referral for assessment or approval under the EPBC Act.

5.4 NSW Environmental Planning and Assessment Act 1979

An assessment of the impacts of this proposal on species, populations and ecological communities listed under Schedules 1, 1A and 2 of the TSC Act was undertaken in accordance with the *Draft Part 3A Guidelines for Threatened Species Assessment* (DEC & DPI 2005). Details of this assessment are contained at Appendix D and the outcomes briefly outlined below.

The species addressed included:

Endangered Populations

- *Cymbidium canaliculatum* population in the Hunter Catchment; and
- River Red Gum population in the Hunter Catchment.

Flora

- Slaty Red Gum (*Eucalyptus glaucina*); and
- Pine Donkey Orchid (*Diuris tricolor*) (also an Endangered Population).

Amphibian

- Giant Burrowing Frog (*Heleioporus australiacus*); and
- Green and Golden Bell Frog (*Litoria aurea*).

Water-dependent Birds

- Painted Snipe (*Rostratula benghalensis*).

Woodland Birds

- Swift Parrot (*Lathamus discolor*);
- Hooded Robin (*Melanodryas cucullata*);
- Black-chinned Honeyeater (*Melithreptus gularis gularis*);
- Turquoise Parrot (*Neophema pulchella*);
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*);
- Speckled Warbler (*Pyrrholaemus sagittatus*);
- Diamond Firetail (*Stagonopleura guttata*);
- Regent Honeyeater (*Xanthomyza phrygia*); and
- Glossy Black-cockatoo (*Calyptorhynchus lathamii*).

Owl

- Barking Owl (*Ninox connivens*).

Mammals (other than bats)

- Squirrel Glider (*Petaurus norfolcensis*);
- Brush-tailed Phascogale (*Phascogale tapoatafa*); and
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*).

Microchiropteran Bats

- Little Bent Wing Bat (*Miniopterus australis*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Large-footed Myotis (*Myotis adversus*);
- Eastern Cave Bat (*Vespadelus troughtoni*); and
- Large-eared Pied Bat (*Chalinolobus dwyeri*).

Microchiropteran Bats

- Grey-headed Flying-fox (*Pteropus poliocephalus*).

Conclusion

It is unlikely that the proposed pipeline corridor would significantly affect any population or species which occurs, or with the potential to occur, along the pipeline corridor as:

- The pipeline corridor was selected so as to avoid areas which would be likely to provide habitat to biodiversity of conservation significance;
- Disturbance would be temporary and confined to a narrow and currently degraded ROW; and
- Potential impacts on those species which do occur could be adequately managed and mitigated.

5.5 Threatening Processes

Key threatening processes (KTP) listed under the TSC Act / EPBC Act which may be relevant to this proposal include:

5.5.1 Clearing of native vegetation / land clearance

The clearing of native vegetation may result in:

- Destruction of habitat causing a loss of biological diversity, and may result in total extinction of species or loss of local genotypes;
- Fragmentation of populations resulting in limited gene flow between small isolated populations, reduced potential to adapt to environmental change and loss or severe modification of the interactions between species;
- Riparian zone degradation, such as bank erosion leading to sedimentation that affects aquatic communities;
- Disturbed habitat which may permit the establishment and spread of exotic species which may displace native species; and
- Loss of leaf litter, removing habitat for a wide variety of vertebrates and invertebrates.

The nature of the proposal is unlikely to result in total extinction of species or loss of local genotypes as the area to be cleared is a narrow strip of mostly introduced species, which is unlikely to provide

the important habitat for a species or to impede gene flow through this area even for small isolated populations. Major waterways would be under bored while more minor creeks and drainage lines would be trenched in areas that lack native vegetation. A CEMP would be prepared and this would address measures to avoid further erosion and sedimentation. The vast majority of sites are weed infested. However, the two native woodland areas being traversed by the pipeline are relatively weed free and these should be monitored to ensure that weed species do not become established along the ROW.

5.5.2 Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands

Riparian zone degradation may occur where changes to flows increases erosion, leading to sedimentation impacts on aquatic communities. This proposal would not result in long term changes to flows as works associated with trenching would be temporary and the banks would be reinstated to ensure that further erosion and degradation does not occur. Measures to prevent erosion and sedimentation would be detailed in the CEMP which would be prepared before commencement of the works.

5.5.3 Predation by the European Red Fox

It is possible that this proposal may result in increased predation by the European Red Fox. A track would be maintained along the length of the pipeline corridor which would allow increased movement of this species as the European Red Fox prefers to move through landscapes along tracks and along edges of habitat. Considering the extent of current modification of this landscape it is unlikely that this proposal would substantially exacerbate this KTP.

5.6 Corridors and Connectivity

Linear structures can cause disruptions to movement corridors as some fauna and the propagules of some plants are unable to move across areas which are cleared and / or have barriers that physically hinder movement. This can create isolation and fragmentation of landscapes.

However, it is unlikely that the proposed pipeline corridor would substantially disrupt large scale corridors and fragment connectivity as the proposed pipeline corridor generally traverses introduced pastures and the ROW required for construction is narrow (i.e. 20 m). It may marginally disrupt fine scale movement corridors for less mobile species but this would largely be over a very short time frame as backfilling of the trench would take place directly after laying the pipe.

5.7 Cumulative Impacts

Construction of the proposed pipeline corridor is not likely to not substantially increase cumulative impacts within the Hunter Valley. The corridor selected for the proposed pipeline is predominately through pastures and only small amounts of native vegetation would be removed and these are along the edges of existing tracks and roads. Therefore, it is considered that the scale of the impact of the proposed corridor is small and impacts associated with construction and operation are predicted to be relatively minor and manageable.

6 MITIGATION RECOMMENDATIONS

The current overall condition and diversity of biodiversity along the proposed pipeline corridor could be protected and maintained by implementing a range of management measures to mitigate and ameliorate any potential impacts and these should be incorporated into management plans and rehabilitation plans for the site. Central to these measures should be the implementation of a Construction Environmental Management Plan and Sediment and Erosion Control Plan.

6.1 Environmental Management

A number of mitigation measures are recommended to protect adjacent biodiversity and in particular those areas within the near locality including the Hunter River and Wollombi Brook and these are included below.

6.1.1 Performance Objectives

- Protect adjacent and nearby high conservation areas.

6.1.2 Goals

Goals for the proposed works should be to:

- Protect adjacent ecosystems;
- Ensure that erosion of the works areas does not occur and that sedimentation of adjacent ecosystems is avoided; and
- Ensure that impacted areas are protected from erosion and weed invasion at the completion of the pipeline installation.

6.1.3 Mitigation Measures

Recommended mitigation measures include:

- i) Preparation and implementation of a Construction Environmental Management Plan for the works on site which includes:
 - a) Project induction to include environmental awareness to advise machinery operators and other on-site personal on ways of minimising ecological impacts; and
 - b) Delineated construction ROW to ensure that large machinery or other construction activities do not impact on adjacent vegetation.

- ii) Preparation and implementation of an Erosion and Sediment Control Management Plan prepared for the proposed demolition which includes:
 - a) Installation of sediment and water quality control measures, such as silt curtains, or where open cut crossing techniques are used isolation using dam and pump or flume pipe techniques should be used;
 - b) Stockpiling of soil that may contain seeds of exotic species away from creeks, drainage lines and areas of native vegetation to prevent transportation to adjacent areas during rainfall or wind events; and
 - c) Measures to ensure that erosion and movement of sediments down slope do not occur following construction and these should include protection of bare ground (on slopes) with the use of jute mats or similar, weed control and revegetation of disturbed areas with locally endemic species.

6.2 Specific Conservation Measures Relating to Biodiversity

A number of measures are recommended to be implemented to specifically protect threatened species, populations and endangered ecological communities along the proposed pipeline corridor and / or in adjacent areas, including:

- i) A path should be chosen through woodland areas which requires the least amount of trees to be removed;
- ii) Top soil (< 100 mm) should be stockpiled when clearing within the Central Hunter Ironbark – Spotted Gum – Grey Box (Figure 2 – Q1) and Central Hunter Box – Ironbark Woodland (**Error! Reference source not found.** – Q2). This should then be spread over the surface once the trench has been backfilled;
- iii) Pre-trenching surface levels should be restored once backfilling is complete to retain current surface hydrology;
- iv) Where possible, removed native vegetation should be stockpiled and spread back over the work area on completion of the project;
- v) Weedy vegetation should not be spread but instead removed off site;
- vi) Paddock trees should be avoided;
- vii) A no impact zone around River Red Gums twice the radius of the tree canopy should be maintained;
- viii) Use pre-existing tracks to avoid further damage to vegetation; and
- ix) The areas of the proposed corridor which have not previously been assessed should be assessed before construction begins.

7 CONCLUSIONS

The revised proposed pipeline corridor has been specifically located to avoid intact remnant or regrowth vegetation and areas of high conservation significance including the Warkworth Sands Woodland which is listed as an EEC under the TSC Act and EPBC Act. The corridor traverses highly modified environments including coal mines, a power station, road reserves (predominately mown grassy strips) and agricultural lands. It crosses a number of shallow drainage lines and these would be trenched through in locations which would allow trees to be retained. The major drainage line crossings, including the Hunter River and Wollombi Brook, are substantial and important rivers and these would be under bored using horizontal directional drilling.

Assessments under the Part 3A of the NSW EP&A Act including those species, populations and communities listed under the TSC Act, concluded that significant impacts are unlikely due to the highly modified nature of the pipeline corridor. Similarly, it is concluded that matters of NES listed under the Commonwealth EPBC Act would not be significantly impacted.

To ensure the protection of native vegetation communities, a range of measures to manage risks to the neighbouring and aquatic environments during construction and operation, are recommended with the aim of protecting existing biodiversity. It is important that a Sediment and Erosion Management Plan be prepared for the proposed construction works as there is the risk of spread of weeds and erosion during construction. With this measure in place it is unlikely that this proposal would have significant impacts on threatened species, population or ecological communities listed under the TSC Act and EPBC Act. Consequently, it is considered that the guiding principles of the proposal deliver the environmental outcomes shown in Table 10.

Table 10 Environmental outcomes of the proposal

Environmental Outcome	Does the Proposal Deliver?
Maintain or improve biodiversity values	Biodiversity values would not be substantially altered from their current values as the vast majority of the proposed pipeline route is highly degraded and areas of native vegetation removal would be confined to narrow strips of disturbed regrowth. This is unlikely to result in the overall loss of biodiversity values within these woodland patches and biodiversity values are unlikely to be significantly altered.
Conserve biological diversity and promote ESD	Yes. The pipeline corridor was specifically designed to avoid areas of high biological diversity and significance.
Prevent the extinction of threatened species.	Yes. The proposal would not exacerbate any factor which could result in the extinction of threatened species.
Protect the long-term viability of local populations of a species, population or community.	Yes. The pipeline corridor was specifically designed to avoid areas of high biological diversity and significance.
Note: ESD = Environmentally Sustainable Development	

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APPENDIX A

Director-General's Requirements for Environmental Assessment



NSW GOVERNMENT
Department of Planning

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Mr Glenn Keevers
Macquarie Generation
34 Griffiths Road
LAMBTON NSW 2299

Our ref: S08/00496
Your ref:

Dear Mr Keevers

Proposed Coal Seam Methane Gas Pipeline (North-South Route), Liddell Power Station, Singleton and Muswellbrook Local Government Areas (Application Reference: 08_0061)

I refer to your submission of the project application and request for Director-General's requirements for the abovementioned proposal.

The Director-General's Environmental Assessment Requirements are attached, pursuant to section 75F(2) of the *Environmental Planning and Assessment Act 1979*. It should be noted that the Director-General's requirements have been prepared based on the information provided to date. Under section 75F(3) of the Act, the Director-General may alter or supplement these requirements if necessary and in light of any additional information that may be provided prior to the Proponent seeking approval for the project.

The Environmental Assessment should be prepared using valid and accepted technical and scientific tools and methodologies, focussing on key environmental impacts and robust mitigation measures to address potential impacts from the project. You should also ensure that you consult with the Department prior to submission of an Environmental Assessment to determine:

- fees applicable to the application;
- consultation and public exhibition arrangements that will apply; and
- number and format (hard-copy and/or CD-ROM) of the Environmental Assessments that will be required.

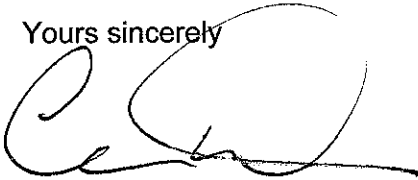
Once you have lodged the Environmental Assessment, the Department will consult with relevant authorities to determine the adequacy of the Environmental Assessment. Following this review period the Environmental Assessment will be made publicly available for a minimum period of 30 days.

If your proposal contains any actions that could have a significant impact on matters of National Environmental Significance, it will require an additional approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This approval would be in addition to any approvals required under NSW legislation and it is your responsibility to contact the Commonwealth Department of the Environment, Heritage, Water and the Arts to determine if an approval under the EPBC Act is required for your proposal (02 6274 1111 or www.environment.gov.au).

Please note that the Commonwealth Government has accredited the NSW environmental assessment process for assessing impacts on matters of National Environmental Significance. As a result, if it is determined that an approval is required under the EPBC Act, please contact the Department immediately as supplementary Director-General's requirements will need to be issued.

You should keep the contact officer for this project, Keiran Thomas ((02) 9228 6325 or keiran.p.thomas@planning.nsw.gov.au), up to date with the progress of preparation of the Environmental Assessment, and seek clarification of any issues that may be unclear or may arise during this process.

Yours sincerely



S.F. &

Chris Wilson
Executive Director
As delegate for the Director-General

**PROPOSED COAL SEAM METHANE GAS PIPELINE (NORTH-SOUTH ROUTE),
SINGLETON AND MUSWELLBROOK LOCAL GOVERNMENT AREAS**

**ENVIRONMENTAL ASSESSMENT REQUIREMENTS UNDER PART 3A OF THE ENVIRONMENTAL
PLANNING AND ASSESSMENT ACT 1979**

Project	Construction and operation of a coal seam methane gas pipeline (north-south route) to the Liddell Power Station.
Site	Land within the Singleton and Muswellbrook local government areas.
Proponent	Macquarie Generation
Date of Issue	2 May 2008
Date of Expiration	2 May 2010
General Requirements	The Environmental Assessment must be prepared to a high technical and scientific standard and must include: • an executive summary; • a description of the proposal, including construction, operation, and staging; • an assessment of the environmental impacts of the project, with particular focus on the key assessment requirements specified below; • justification for undertaking the project with consideration of the benefits and impacts of the proposal; • a draft Statement of Commitments detailing measures for environmental mitigation, management and monitoring for the project; and • certification by the author of the Environmental Assessment that the information contained in the Assessment is neither false nor misleading.
Key Assessment Requirements	The Environmental Assessment must include assessment of the following key issues: • Strategic Justification - the Environmental Assessment must include a strategic planning consideration of the project and an analysis of the suitability of the gas pipeline route with respect to potential land use conflicts with existing and future surrounding land users. The Environmental Assessment must clearly identify the proposed route for the coal seam gas pipeline and clearly describe the ownership, land use and zoning provisions for the land along the route. Consideration must also be given to how the proposal would interact with any existing approvals or licences that may be in operation for any mines or power stations affected by the proposal. • Ecological Impacts - the Environmental Assessment must include a flora and fauna impact assessment in accordance with the DEC's <i>Guidelines for Threatened Species Assessment</i>. The Environmental Assessment must specifically identify and consider any critical habitats, threatened species, populations or ecological communities listed under State and Commonwealth legislation recorded along the gas pipeline route or in the surrounding area. This must include assessment of impacts on any Warkworth Sands Woodlands potentially affected by the proposal. The Environmental Assessment must also detail measures to avoid or mitigate impacts associated with the siting and construction of any access roads and other infrastructure. An assessment of the feasibility, effectiveness and reliability of proposed measures and any residual impacts after these measures have been implemented must be included. • Heritage Impacts - the Environmental Assessment must include an assessment of impacts on Aboriginal heritage, in accordance with draft <i>Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation</i> (DEC, 2005). The Environmental Assessment must demonstrate that effective community consultation with Aboriginal communities has been undertaken in determining and assessing impacts, developing options and making final recommendations. The Environmental Assessment must detail measures to avoid or mitigate any impacts on any items of Aboriginal heritage identified. An assessment of the feasibility, effectiveness and reliability of proposed measures and any residual impacts after these measures have been implemented must be

	included. • Hazards and Risk Impacts – the Environmental Assessment must include a screening of potential hazards associated with the gas supply infrastructure to determine the potential for off site impacts and any requirement for a Preliminary Hazard Analysis (PHA). The PHA, should potential off-site impacts be identified, must be prepared in accordance with the Department's <i>Hazardous Industry Planning Advisory Paper No. 3</i>, <i>Hazardous Industry Planning Advisory Paper No. 6</i> and <i>Multi-level Risk Assessment</i>. • Surface and Groundwater Impacts – the Environmental Assessment must include an assessment of the water quality impacts associated with the construction and operation of the proposal, with particular reference to impacts on aquatic ecology, riparian zones, surface water and groundwater impacts along the proposed route. The Environmental Assessment must identify all surface water bodies and watercourses that may be impacted by the project and give consideration to groundwater transmission zones within creek crossings. Detailed information must be provided which describes how those water bodies or watercourses would be traversed and what mitigation measures would be used to minimise any predicted impacts. Specific reference to how erosion and sedimentation would be managed during construction and operation of the project must also be included. Where mitigation or management measures have been proposed, an assessment of the feasibility, effectiveness and reliability of proposed measures and any residual impacts after these measures have been implemented must be included. • Traffic Impacts – the Environmental Assessment must include an assessment of the traffic impacts associated with the construction of the proposal, with particular reference to impacts on dedicated public roads. • General Environmental Risk Analysis – notwithstanding the above key assessment requirements, the Environmental Assessment must include an environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of these additional key environmental impacts must be included in the Environmental Assessment.
Consultation Requirements	You must undertake an appropriate and justified level of consultation with the following parties during the preparation of the Environmental Assessment: • NSW Department of Environment and Climate Change; • NSW Department of Water and Energy; • NSW Department of Primary Industries; • NSW Roads and Traffic Authority; • Commonwealth Department of Environment, Water, Heritage and the Arts; • Mine Subsidence Board; • Muswellbrook Shire Council; • Singleton Shire Council; and • the local community. The Environmental Assessment must clearly indicate issues raised by stakeholders during consultation, and how those matters have been addressed in the Environmental Assessment.

APPENDIX B

Species Recorded Along the Pipeline Corridor

NORTH SOUTH LIDDELL GAS PIPELINE			
FLORA SPECIES LIST			
Family	Botanical Name	Common Name	Occurrence at Route Sequence
Ferns			
Adiantaceae	<i>Cheilanthes sieberi</i> ssp. <i>sieberi</i>	Mulga Fern	Q1, 5-6, 13-22, 47
Monocots			
Cyperaceae	<i>Schoenoplectus validus</i>		13-22
Cyperaceae	<i>Gahnia aspera</i>		47
Juncaceae	<i>Juncus acutus</i> *	Sharp Rush	1, 23-46, 54-64
Juncaceae	<i>Juncus usitatus</i>		23-46
Juncaceae	<i>Juncus</i> sp.		23-46
Lomandraceae	<i>Lomandra filiformis</i> ssp. <i>filiformis</i>	Wattle Mat-rush	Q1, Q2, 47
Lomandraceae	<i>Lomandra glauca</i>	Pale Mat-rush	Q1
Lomandraceae	<i>Lomandra filiformis</i> ssp. <i>coriacea</i>		Q1, 47
Loranthaceae	<i>Amyema</i> sp.	Mistletoe	13-22, 47
Phormiaceae	<i>Dianella caerulea</i> var. <i>caerulea</i>	Blue Flax-lily	Q1
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass	47
Poaceae	<i>Entolasia stricta</i>	Wiry Panic	Q1
Poaceae	<i>Austodanthonia tenuior</i>	Wallaby Grass	Q1
Poaceae	<i>Sporobolus creber</i>	Western Rat-tail Grass	54-64
Poaceae	<i>Cynodon dactylon</i>	Couch	13-22, 23-46, 54-64, 50-53
Poaceae	<i>Nassella trichotoma</i> *^	Serrated Tussock	Q2, 13-22, 23-46, 54-64
Poaceae	<i>Aristida ramosa</i>	Purple Wiregrass	Q1, Q2, 5-6
Poaceae	<i>Cymbopogon refractus</i>	Barbed Wire Grass	23-46, 54-64
Poaceae	<i>Andropogon virginicus</i> *	Whisky Grass	54-64
Poaceae	<i>Themeda australis</i>	Kangaroo Grass	5-6
Poaceae	<i>Chloris gayana</i> *		8-11, 23-46, 54-64, 50-53, 47
Poaceae	<i>Chloris ventricosa</i>		23-46, 54-64, 50-53
Poaceae	<i>Pennisetum clandestinum</i>	Kikuyu	23-46, 54-64, 50-53
Poaceae	<i>Digitaria</i> sp. *	Summer Grass	13-22, 50-53
Poaceae	<i>Chloris tuncata</i>		54-64
Dicots			
Anacardiaceae	<i>Schinus areira</i> *	Pepper Tree	12, 13-22, 50-53
Apiaceae	<i>Foeniculum vulgare</i> *	Fennel	8-11, 12, 54-64, 50-53
Asteraceae	<i>Xanthium occidentale</i> *	Noogoora Burr	54-64, 50-53

Family	Botanical Name	Common Name	Occurrence at Route Sequence
Asteraceae	<i>Xanthium spinosum</i> *^	Bathurst Burr	54-64
Asteraceae	<i>Silybum marianum</i> *	Variegated Thistle	54-64, 50-53
Asteraceae	<i>Onopordum acanthium</i> *	Scotch Thistle	8-11, 13-22, 54-64, 47
Asteraceae	<i>Conyza bonariensis</i> *	Flaxleaf Fleabane	8-11, 13-22, 54-64, 47
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	54-64, 50-53
Asteraceae	<i>Calotis cuneifolia</i>	Purple Burr-daisy	Q2, 47
Asteraceae	<i>Brachyscome</i> sp.		Q2
Asteraceae	<i>Taraxacum officinale</i> *	Dandelion	13-22, 54-64, 50-53
Asteraceae	<i>Bidens pilosa</i> *	Cobblers Peg	8-11, 13-22, 23-46, 54-64, 50-53
Asteraceae	<i>Senecio madagascariensis</i> *	Fireweed	13-22, 23-46, 54-64, 50-53, 47
Asteraceae	<i>Carthamus lanatus</i> *	Saffron Thistle	54-64
Asteraceae	<i>Vittadinia pustulata</i>		Q1
Asteraceae	<i>Solenogyne bellioides</i>		54-64
Asteraceae	<i>Vittadinia cuneata</i>	Fuzzweed	54-64
Asteraceae	<i>Tagetes minuta</i> *	Stinking Roger	50-53
Boraginaceae	<i>Echium plantagineum</i> *^	Paterson's Curse	23-46
Brassicaceae	<i>Sisymbrium officinale</i> *	Hedge Mustard	50-53
Aizoaceae	<i>Galenia pubescens</i> *	Galenia	54-64, 50-53
Cactaceae	<i>Opuntia stricta</i> *^	Common Prickly Pear	8-11, 54-64, 50-53
Campanulaceae	<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	54-64, 47
Casuarinaceae	<i>Casuarina cunninghamiana</i>	River Oak	4, 13-22, 23-46, 50-53
Casuarinaceae	<i>Allocasuarina luehmannii</i>	Bulloak	1, 23-46, 54-64, 47
Chenopodiaceae	<i>Einadia trigonos</i> ssp. <i>trigonos</i>	Fishweed	50-53
Convolvulaceae	<i>Cuscuta campestris</i> *^	Golden Dodder	50-53
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	47
Cucurbitaceae	<i>Cucumis myriocarpus</i> ssp. <i>leptodermis</i> *	Paddy Melon	50-53
Euphorbiaceae	<i>Ricinus communis</i> *	Castor Oil Plant	13-22, 54-64, 50-53
Fabaceae - faboideae	<i>Glycine microphylla</i>	Small-leaf glycine	47
Fabaceae - faboideae	<i>Glycine tabacina</i>		54-64
Fabaceae - faboideae	<i>Daviesia genistifolia</i>	Broom Bitter Pea	23-46
Fabaceae - faboideae	<i>Vicia sativa</i> *	Common Vetch	47
Fabaceae - mimosoideae	<i>Acacia filicifolia</i>	Fern-leaved Wattle	47
Fabaceae - mimosoideae	<i>Acacia decurrens</i>	Black Wattle	13-22, 23-46, 47
Fabaceae - mimosoideae	<i>Acacia salicina</i>	Cooba	54-64, 47

Family	Botanical Name	Common Name	Occurrence at Route Sequence
Fabaceae - mimosoideae	<i>Acacia amblygona</i>	Fan Wattle	47
Geraniaceae	<i>Erodium</i> sp. *	A Storksbill	54-64
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium	54-64
Geraniaceae	<i>Geranium</i> sp.	A Geranium	47
Lamiaceae	<i>Stachys arvensis</i> *	Stagger Weed	54-64
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne	54-64
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	23-46
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum	Q1, 47
Myrtaceae	<i>Eucalyptus amplifolia</i>	Cabbage Gum	23-46
Myrtaceae	<i>Eucalyptus camaldulensis</i>	River Gum	13-22, 23-46
Myrtaceae	<i>Eucalyptus moluccana</i>	Grey Box	23-46, 54-64, 50-53
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum	13-22, 54-64
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	Q1, 23-46, 54-64, 50-53, 47
Oleaceae	<i>Ligustrum lucidum</i> *	Large Leaved Privet	13-22
Oleaceae	<i>Ligustrum sinense</i> *	Small Leaved Privet	13-22
Pittosporaceae	<i>Bursaria spinosa</i>	Blackthorn	Q1, 5-6, 54-64, 47
Plantaginaceae	<i>Plantago lanceolata</i> *	Lamb's Tongues	54-64, 50-53, 47
Polygonaceae	<i>Persicaria decipiens</i>	Slender knotweed	13-22
Portulacaceae	<i>Portulaca oleracea</i> *	Pigweed	8-11, 13-22, 23-46 54-64, 50-53
Ranunculaceae	<i>Clematis aristata</i>	Old Man's Beard	47
Rosaceae	<i>Rubus fruticosus</i> * ^	Blackberry	8-10, 13-22
Rubiaceae	<i>Asperula conferta</i>	Common Woodruff	47
Rubiaceae	<i>Opercularia</i> sp.		Q1
Salicaceae	<i>Salix babylonica</i> *^	Weeping Willow	50-53
Sapindaceae	<i>Dodonaea viscosa</i> ssp. <i>cuneata</i>	Wedge-leaf Hop-bush	Q1, 47
Solanaceae	<i>Datura ferox</i> *	Fierce Thornapple	50-53
Solanaceae	<i>Solanum nigrum</i> *	Black-berry Nightshade	54-64
Solanaceae	<i>Solanum linnaeanum</i>	Apple of Sodom	54-64, 50-53
Solanaceae	<i>Solanum rostratum</i> *^	Buffalo Burr	54-64
Thymelaeaceae	<i>Pimelea linifolia</i> ssp. <i>linifolia</i>	Slender Rice Flower	47
Verbenaceae	<i>Verbena rigida</i> *	Veined Verbena	13-22, 23-46, 54-64, 50-53
Note: * - introduced species, ^ Noxious Weed, Bold = Species belonging to an endangered population.			

NORTH SOUTH LIDDELL GAS PIPELINE		
FAUNA SPECIES LIST		
Common Name	Scientific Name	Record Type
Reptiles		
Jacky Lizard	<i>Amphibolurus muricatus</i>	O
Amphibians		
Common Eastern Froglet	<i>Crinia signifera</i>	W
Peron's Tree Frog	<i>Litoria peroni</i>	W
Avifauna		
Australian Magpie	<i>Gymnorhina tibicen</i>	O,W
Australian Wood Duck	<i>Chenonetta jubata</i>	O
Black-fronted Dotterell	<i>Elseyornis melanops</i>	O
Black Swan	<i>Cygnus atratus</i>	O
Black-shouldered Kite	<i>Elanus axillaris</i>	O
Black-winged Stilt	<i>Himantopus himantopus</i>	O
Southern Boobook	<i>Ninox novaeseelandiae</i>	R
Brown Quail	<i>Coturnix ypsilophora</i>	O
Crested Pigeon	<i>Ocyphaps lophotes</i>	O
Eastern Rosella	<i>Platycercus eximius</i>	O, H
Galah	<i>Cacatua roseicapilla</i>	O
Grey Fantail	<i>Rhipidura fuliginosa</i>	O
Grey-crowned Babbler	<i>Pomatostomus temporalis temporalis</i>	O
Jacky Winter	<i>Microeca leucophaea</i>	O
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	O,H
Magpie-lark	<i>Grallina cyanoleuca</i>	O
Nankeen Kestrel	<i>Falco cenchroides</i>	O
Nosiy Miner	<i>Manorina melanocephala</i>	O,W
Australian Pelican	<i>Pelecanus conspicillatus</i>	O
Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	O, H
Red-browed finch	<i>Neochrnia temporalis</i>	O
Red Wattlebird	<i>Anthochaera carunculata</i>	O
Silvereye	<i>Zosterops lateralis</i>	O
Spotted Pardalote	<i>Pardalotus punctatus</i>	O
Superb Fairy-wren	<i>Malurus cyaneus</i>	O
Welcome Swallow	<i>Hirundo neoxena</i>	O
White-faced Heron	<i>Egretta novaehollandiae</i>	O
White-winged Cough	<i>Corcorax melanorhamphos</i>	O
Willie Wagtail	<i>Rhipidura leucophrys</i>	O,W
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>	O
Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>	O,W
Mammals		
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	O,P,R
Brush-tailed Possum	<i>Trichosurus vulpecula</i>	P
Cattle *	<i>Bos taurus</i>	O,P
Common Wombat	<i>Vombatus ursinus</i>	E
European Red Fox *	<i>Vulpes vulpes</i>	P
Rabbit *	<i>Oryctolagus cuniculus</i>	O,P
Note: O=observed, W=heard call, P=scat, R=roadkill, E=Burrow		
Bold =species listed as threatened		

APPENDIX C

Assessment under the EPBC Act

APPENDIX C

Assessment under the EPBC Act

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The proposed pipeline corridor supports limited habitat for native fauna and flora as it is located in a highly modified environment. However, habitat for some species listed under the EPBC Act does occur and some adjacent areas have the potential to support a number of species listed under the EPBC Act. The criteria detailed in the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (DEH 2006) were used to assess the significance of likely impacts as a consequence of the proposed pipeline and this assessment is detailed below. Habitat requirements and threats for each species are contained in Table 5, Table 6 and Table 7.

Significant Impact Criteria for Endangered Species

Endangered species assessed include:

- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*);
- Regent Honeyeater (*Xanthomyza phrygia*); and
- Swift Parrot (*Lathamus discolor*).

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

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

The proposed pipeline corridor has been chosen to avoid areas of intact biodiversity that are most likely to provide habitat for threatened species. There would be a small amount (1.59 ha) of potential habitat removed for these species and this would include removal of some small trees which are winter flowering species and habitat, such as fallen logs. However, impacts are unlikely to be substantial given the available surrounding habitat within conservation areas and consequently it is considered that there is unlikely to be a real chance or possibility that this proposal would decrease the size of a population of any of these species.

- reduce the area of occupancy of the species;

Around 1.59 ha of potential habitat would be removed for these species. However, high quality resources for these species are available in the adjacent national parks and state forests. Therefore, this proposal is unlikely to have a real chance or possibility of reducing the area of occupancy of these species to such an extent as to impact on their populations.

- fragment an existing population into two or more populations;

The vast majority of the proposed pipeline corridor traverses introduced pastures through long established agricultural lands, mine sites and a power station and consequently the locality is currently heavily fragmented. It is unlikely that this proposal would fragment an existing important population into two or more populations as the pipeline trench would be backfilled and only a relatively small amount of vegetation would be cleared and consequently there would be few barriers to movement.

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

Habitat has not been identified as critical habitat within the recovery plan for these species or listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

- disrupt the breeding cycle of a population;

Disruption of the breeding cycle of a population is not anticipated as movement corridors are unlikely to be disrupted within the locality and breeding habitat of any species is unlikely to be altered.

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

The proposed pipeline corridor has been chosen to avoid areas of intact biodiversity that are most likely to provide habitat for endangered species. There would be a small amount (1.59 ha) potential habitat removed for these species and this would include removal of some small trees which are winter flowering species and habitat, such as fallen logs. However, a decrease in the quality of the habitat available along the pipeline corridor is unlikely to be substantial given the current highly modified nature of the proposed corridor.

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

The nature of the proposal is such that it is possible that weed species could further spread or invade along the cleared ROW and this could over time further degrade habitat. Consequently, it is recommended that weed management be addressed in the Construction Environmental Management Plan and Operational Environmental Management Plan (refer to Section 1).

- introduce disease that may cause the species to decline; or

Disease has not been identified as a threat to any of these endangered species and this proposal is unlikely to introduce or spread disease through these species.

- interfere with the recovery of the species.

There are no key habitat sites that would be disrupted by this proposal and consequently it is unlikely to interfere with the recovery of the species.

Conclusion

It is unlikely that any endangered species listed under the EPBC Act would be significantly impacted by this proposal as:

- The pipeline corridor was selected so as to avoid areas of biodiversity which would be likely to provide habitat for endangered species;
- Disturbance would be temporary and confined to a narrow and currently degraded ROW; and
- Potential impacts could be managed and mitigated.

Significant Impact Criteria for Vulnerable Species

Vulnerable species assessed include:

- Pine Donkey Orchid (*Diuris tricolor*); and
- Slaty Red Gum (*Eucalyptus glaucina*).
- Giant Burrowing Frog (*Heleioporus australiacus*);
- Green and Golden Bell Frog (*Litoria aurea*);
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)

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

- Lead to a long-term decrease in the size of an important population of a species;

The proposed pipeline corridor has been chosen to avoid areas of intact biodiversity that are most likely to provide habitat for threatened species. Additionally, the nature of the proposal is such that all activities would be undertaken within a 20 m ROW with current levels of habitat restored on completion of laying of the pipeline. Consequently, it is unlikely that this proposal would lead to a long-term decrease in the size of an important population of a species.
- Reduce the area of occupancy of an important population;

This proposal requires the construction of a 20 m ROW along 51 km, the majority of which traverses introduced pastures. On completion of laying of the pipeline, the pipeline trench would be backfilled and the current level of habitat restored. Therefore, it is unlikely that this proposal would reduce the area of occupancy of an important population as disturbance along the pipeline corridor would be temporary and current levels of habitat would be restored.
- Fragment an existing important population into two or more populations;

The vast majority of the proposed pipeline corridor traverses introduced pastures through long established agricultural lands, mine sites and a power station and consequently the locality is currently heavily fragmented. It is unlikely that this proposal would fragment an existing important

population into two or more populations as the pipeline trench would be backfilled and consequently there would be few barriers to movement.

- Adversely affect habitat critical to the survival of a species;

Habitat has not been identified as critical habitat within the recovery plan for these species or listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

- Disrupt the breeding cycle of an important population;

Disruption of the breeding cycle of an important population is not anticipated as movement corridors are unlikely to be disrupted within the locality and breeding habitat of any species is unlikely to be altered.

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

The proposed pipeline corridor has been chosen to avoid areas of intact biodiversity that are most likely to provide habitat for threatened species. Additionally, the nature of the proposal is such that all activities would be undertaken within a 20 m ROW with current levels of habitat restored on completion of laying of the pipeline. Consequently, it is unlikely that this proposal would lead to a reduction in quality of habitat to the extent that a species is likely to decline.

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

The nature of the proposal is such that it is possible that weed species could further spread or invade along the cleared ROW. Consequently, it is recommended that weed management be addressed in the Construction Environmental Management Plan and Operational Environmental Management Plan (refer to Section 1).

- Introduce disease that may cause the species to decline; or

The fungal pathogen, Frog Chytrid Fungus, is a known threat to amphibians. Chytrid fungus is probably transferred by direct contact between frogs and tadpoles, or through exposure to infected water. This proposal would not involve the moving of frogs or tadpoles, exposing frogs to infected water or handling of frogs in any way.

- Interfere substantially with the recovery of the species.

It is unlikely that this proposal would interfere substantially with the recovery of any species as the proposed development traverses highly modified landscapes and any disruption to species is likely to be slight and temporary.

Conclusion

It is unlikely that any vulnerable species listed under the EPBC Act would be significantly impacted by this proposal as:

- The pipeline corridor was selected so as to avoid areas of biodiversity which would be likely to provide habitat for vulnerable species;
- Disturbance would be temporary and confined to a narrow and currently degraded ROW; and
- Potential impacts could be managed and mitigated.

Significant Impact Criteria for Migratory Species

Species listed as migratory that were assessed:

- Cattle Egret (*Ardea ibis*);
- Latham's Snipe (*Gallinago hardwickii*);
- Painted Snipe (*Rostratula benghalensis*);
- Rainbow Bee-eater (*Merops ornatus*); and
- White-throated Needletail (*Hirundapus caudacutus*).

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

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species;

The proposed pipeline corridor has been chosen to avoid areas of intact biodiversity that are most likely to provide habitat for migratory species. Additionally, the nature of the proposal is such that all activities would be undertaken within a 20 m ROW with current levels of habitat restored on completion of laying of the pipeline. Consequently, it is unlikely that this proposal would modify, destroy or isolate area of important habitat for migratory species.

- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or

There have been no areas identified along the pipeline corridor as important habitat. However, it is possible that this proposal could exacerbate existing weed invasions through disturbance. Consequently, it is recommended that weed management be addressed in the Construction Environmental Management Plan and Operational Environmental Management Plan (refer to Section 1).

- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The pipeline corridor is not known to provide important breeding, feeding, migration or resting habitat for these species and consequently it is unlikely that this proposal would seriously disrupt the lifecycle of an ecologically significant proportion of the population of any of these migratory species.

Conclusion

It is unlikely that any migratory species listed under the EPBC Act would be significantly impacted by the proposed pipeline corridor as:

- The pipeline corridor was selected so as to avoid areas of biodiversity which would be likely to provide habitat to migratory species;
- Disturbance would be temporary and confined to a narrow and currently degraded ROW; and
- Potential impacts could be managed and mitigated.

APPENDIX D

Assessment under Part 3A of the EP&A Act

APPENDIX D

Assessment under Part 3A of the EP&A Act

Background

An assessment of the impacts of this proposal on species, populations and ecological communities listed under Schedules 1, 1A and 2 of the TSC Act was undertaken. The proposal would be assessed under Part 3A of the EP&A Act and consequently this impact assessment was undertaken in accordance with the *Draft Part 3A Guidelines for Threatened Species Assessment* (DEC & DPI 2005) for a number of ecological communities, populations and species and these are listed below. Habitat requirements and threats for each of these species are contained in Table 5, Table 6 and Table 7. Assessments have been undertaken for guilds of species which have similar habitat requirements.

Endangered Populations

- *Cymbidium canaliculatum* population in the Hunter Catchment; and
- River Red Gum population in the Hunter Catchment.

Flora

- Slaty Red Gum (*Eucalyptus glaucina*); and
- Pine Donkey Orchid (*Diuris tricolor*) (also an Endangered Population).

Amphibian

- Giant Burrowing Frog (*Heleioporus australiacus*); and
- Green and Golden Bell Frog (*Litoria aurea*).

Water-dependent Birds

- Painted Snipe (*Rostratula benghalensis*).

Woodland Birds

- Swift Parrot (*Lathamus discolor*);
- Hooded Robin (*Melanodryas cucullata*);
- Black-chinned Honeyeater (*Melithreptus gularis gularis*);
- Turquoise Parrot (*Neophema pulchella*);
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis*);
- Speckled Warbler (*Pyrrholaemus sagittatus*);
- Diamond Firetail (*Stagonopleura guttata*);
- Regent Honeyeater (*Xanthomyza phrygia*); and

- Glossy Black-cockatoo (*Calyptorhynchus lathamii*).

Owl

- Barking Owl (*Ninox connivens*).

Mammals (other than bats)

- Squirrel Glider (*Petaurus norfolcensis*);
- Brush-tailed Phascogale (*Phascogale tapoatafa*); and
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*).

Microchiropteran Bats

- Little Bent Wing Bat (*Miniopterus australis*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Large-footed Myotis (*Myotis adversus*);
- Eastern Cave Bat (*Vespadelus troughtoni*); and
- Large-eared Pied Bat (*Chalinolobus dwyeri*).

Microchiropteran Bats

- Grey-headed Flying-fox (*Pteropus poliocephalus*).

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

Populations

All River Red Gums (*Eucalyptus camaldulensis*) would be protected and conserved. Consequently impacts on this population are unlikely provided all trenching or other construction activities are undertaken outside the root zone which is considered to be two times the radius of the canopy. Construction activities within this zone could damage the tree and result in death. This species is likely to be pollinated by highly mobile species, such as woodland birds and bats, and therefore it is unlikely that this proposal would disrupt this process. The seed bank is unlikely to currently be intact as these trees are located within highly eroded drainage lines. However, all soils removed during trenching would be replaced so if any propagules were present then this material would be replaced. There does not appear to be any recruitment of this species currently taking place as all trees recorded were very mature. Lack of recruitment is likely to be a consequence of herbivory by cattle, rabbits and macropods.

Cymbidium canaliculatum generally occurs in *Eucalyptus albens* but occasionally also in a range of other Eucalyptus and Acacia species. *E. albens* does not occur along the pipeline corridor. Other species used by this epiphyte do occur although none were recorded with this species located within them. No tree or large shrub would be removed during construction and consequently it is unlikely that this species would be impacted by this proposal.

Flora

Although Slaty Red Gum was not recorded during this assessment potential habitat may have been present along much of the proposed pipeline corridor in the past and consequently it is possible that remnant Slaty Red Gum trees could be present along, or directly adjacent to the pipeline corridor. This proposal would not require the removal of any large trees as the pipeline corridor would be realigned to avoid trees. Furthermore, trenching activities would not be undertaken in the 'drip line' of any tree and preferably not within the root zone which is considered to be two times the radius of the canopy. Should any of these trees occur along the pipeline corridor, this proposal would not affect the lifecycle of this threatened species.

The Pine Donkey Orchid is listed as Vulnerable under the TSC Act and also as an Endangered Population within the Muswellbrook LGA. This species has the potential to occur within the Central Hunter Box – Ironbark Woodland recorded on the Wambo Mining Area as this area has sandy soils. The reproductive and pollination mechanisms are not well known for this species but it is thought that bees are the pollinators and wind is the dispersal mechanism. There is also thought to be a mycorrhizal fungi associated with the soils in which this species grows. This proposal is unlikely to affect the movement and availability of the pollinator of this species and wind movement would not be affected. It is possible that fungi could be disturbed during construction and this may affect the lifecycle of a population that occurs in the area.

Amphibians

Habitat for the Green and Golden Bell Frog and the Giant Burrowing Frog is absent along the current pipeline corridor. However, the pipeline corridor could potentially disrupt movement of these species during construction although trenches for the pipe would be backfilled simultaneously with the laying of the pipe. Consequently, movement of these species between dams and other water sources particularly during breeding would be unimpeded and disruptions to breeding avoided. An Erosion and Sedimentation Plan would detail management measures which would mitigate against sedimentation of nearby water bodies due to erosion of drainage lines and the ROW during construction.

Water-dependent Birds

The Painted Snipe prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber and it nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (DECC 2005). The pipeline passes through some swampy areas but these areas are generally of low grass with isolated occurrences of Sharp Rush. Consequently this proposal is unlikely to disrupt breeding of this species.

Woodland Birds

A number of woodland birds have been recorded within the locality and have the potential to occur along the pipeline corridor or in adjacent habitat. The Grey Crowned Babbler was recorded on the Wambo Mining Area at Charlton Road. Habitat for this species, and the other potentially occurring species, would be retained and it is unlikely that the proposed pipeline would substantially disrupt their breeding patterns as no foraging habitat or nesting habitat would be removed. Noise and vibration associated with construction has the potential to disturb breeding of these birds. However, noise and vibration associated with the construction of the pipeline would be of short duration (i.e. several days). Grey Crowned Babblers are known to nest and breed successfully on roadside verges and in urbanised settings so it is unlikely that such short lived disturbance would disrupt the Grey Crowned Babbler, or any other woodland bird, to such an extent that breeding would be disrupted.

Owls

The Barking Owl may forage and breed near to the pipeline corridor. The construction and operation of the pipeline is unlikely to disrupt breeding of this species as trees suitable for breeding (i.e. trees with hollow of > 20 cm diameter) would not be removed.

Mammals (other than bats)

The majority of proposed pipeline corridor traverses highly modified pastures and road reserves and these would not be suitable breeding habitat for any of the threatened mammals with the potential to occur within the locality. Two small areas of woodland would be removed but these areas are also unlikely to provide high quality breeding habitat for any of these species as the woodland areas are comprised of regenerating trees which are too small to provide breeding habitat. The shrub layer is scarce as is fallen timber and other habitat resources which could provide habitat for the Spotted-tailed Quoll. Consequently, construction and operation of the pipeline is unlikely to disrupt breeding of these species.

Microchiropteran Bats

It is unlikely that breeding habitat for any of the potential microchiropteran bats would be disturbed as this proposal does not involve removal or disturbance of large trees with suitable bark or hollows, culverts, old buildings or caves.

Megachiropteran Bat

It is unlikely that this proposal would impact on the lifecycle of the Grey-headed Flying-fox as these species congregate in large numbers at roosting sites, known as camps, for breeding. No camps of this species were recorded adjacent to, or along, the pipeline corridor.

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

Populations

The habitat in which the River Red Gums occur along the proposed pipeline corridor is highly degraded through clearing, erosion, weed invasion and grazing and this species has survived as single remnant trees. Trenching for the pipeline would remove weeds and stringent management measures would be used to ensure that further erosion of the creek crossings does not result as a consequence of this proposal.

Cymbidium canaliculatum generally occurs in *Eucalyptus albens* but occasionally also in a range of other Eucalyptus and Acacia species. Habitat for this species would not be impacted by this proposal as potential habitat would be retained and the majority of the pipeline corridor traverses introduced pastures.

Flora

This species was not recorded along the pipeline corridor but habitat is present. Habitat for Slaty Red Gum is unlikely to be impacted by this proposal as the majority of the proposed pipeline corridor traverses paddocks and other highly modified habitats. Large trees, such as Slaty Gum should this species occur, would be avoided by realigning the corridor at the time. A CEMP would be prepared before construction begins and this would also include mitigation measures that would address habitat conservation.

It is possible that some potential habitat for the Pine Donkey Orchid could be disturbed during construction of this proposal. However, the potential habitat located within the Central Hunter Box – Ironbark Woodland located on the Wambo Mining Area is very degraded and is currently regenerating after being used as grazing land and is not likely to contain high quality habitat for this species. It is recommended that the ROW be reduced from 20 m to 10 m through this area to minimise risks against potential impacts on this species.

Amphibians

Habitat for the Green and Golden Bell Frog and Giant Burrowing Frog would not be disturbed or modified as a consequence of this proposal. An Erosion and Sedimentation Control Plan would detail management measures which would mitigate against sedimentation of nearby water bodies due to erosion of drainage lines and the ROW during construction.

Water-dependent Birds

The habitat of the Painted Snipe would not be directly affected. However, there is the potential that adjacent potential habitat could be impacted and consequently an Erosion and Sedimentation Control Plan would detail management measures which would mitigate against sedimentation of nearby water bodies due to erosion of drainage lines and the ROW during construction.

Woodland Birds

Up to 1.59 ha of woodland which potentially provides habitat for a range of woodland birds would be directly impacted through this proposal. The remainder of the corridor traverses introduced pastures or road reserves with few habitat resources for woodland birds.

Owls

Foraging habitat for the Barking Owl may be temporarily affected as this species is known to forage up to 250 m into grassland from woodland areas. The temporary removal of pastures in the ROW is unlikely to substantially affect foraging habitat for this species.

Mammals (other than bats)

Up to 1.59 ha of potential foraging habitat for threatened mammals would be directly impacted by this proposal. The remainder of the corridor could not be considered habitat for these species as it traverses introduced pastures or road reserves with few habitat resources.

Microchiropteran Bats

The removal of up to 1.59 ha of woodland, which may form foraging habitat for these species, may slightly reduce the amount of foraging habitat available for this species. However, this is unlikely to substantially impact foraging resources for these species as significant resources occur nearby along the Hunter River, Wollombi Brook and adjacent conservation areas.

Megachiropteran Bat

The removal of around 1.59 ha of woodland, which may form foraging habitat for this species, may result in a slight reduction of foraging habitat. However, this is unlikely to substantially impact foraging resources for this species as significant resources occur nearby along the Hunter River, Wollombi Brook and adjacent conservation areas.

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

Endangered Populations

The River Red Gum population in the Hunter Catchment which occurs at two sites along the corridor and the *Cymbidium canaliculatum* population in the Hunter Catchment are both restricted to the Hunter catchment and are therefore at the near limit of their known distribution.

Flora

The Pine Donkey Orchid is near the most eastern limit of its occurrence within the Hunter Valley and therefore this species and population are at the limit of its known occurrence.

Slaty Red Gums in the Hunter Valley are at the known limit of distribution for this species.

Amphibians

The Green and Golden Bell Frog and Giant Burrowing Frog are both known from numerous locations throughout NSW and therefore neither is at the limit of their distribution.

Water-dependent Birds

In NSW the Painted Snipe has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp but is most common in the Murray-Darling Basin. Therefore, it is not at the limit of its known distribution.

Woodland Birds

The Black-chinned Honeyeater, Grey-crowned Babbler and Diamond Firetail are all at the eastern limit of their known occurrence. All other woodland birds have broader distributions.

Owls

The Barking Owl is likely to be around the limit of its known occurrence as it is rarely found in coastal and escarpment forests.

Mammals (other than bats)

All of the mammals have a wider distribution than the Hunter Valley.

Bats

The Little Bent-wing Bat is at the southern limit of its distribution and the Large-footed Myotis rarely occurs further than 100 km inland unless along major rivers.

How is the proposal likely to affect current disturbance regimes?

Current disturbance regions are not likely to be substantially altered from existing levels as the Hunter Valley is a highly industrialised area and an agricultural centre. The proposed pipeline corridor traverses cleared agricultural paddocks, mine sites, a power station and road reserves and consequently the construction and operation of the buried pipeline would not substantially alter disturbance regimes over current levels.

How is the proposal likely to affect habitat connectivity?

Populations

Habitat connectivity for these species would not be further impacted over current levels. River Red Gums currently occur as isolated trees at two points along the pipeline corridor. Habitat for this species would not be removed. *Cymbidium canaliculatum* was not recorded along the pipeline

corridor although potential exists for its occurrence. Potential habitat for this species would not be removed and consequently it is unlikely that this species would be impacted by this proposal through disruption of habitat connectivity.

Flora

Habitat connectivity for the two species of flora that have the potential to occur along the corridor would not be further fragmented as the proposal only requires construction of a maximum of a 20 m wide ROW.

Amphibians

The Green and Golden Bell Frog and Giant Burrowing Frog are both known to travel across open ground during dispersal or during the breeding season and consequently there is potential for habitat connectivity to be temporarily disrupted as the pipeline is laid. However, the pipeline would be backfilled simultaneously with laying of the pipe and disruption is likely to occur over a short time-scale and habitat connectivity restored.

Water-dependent Birds

Habitat connectivity for the Painted Snipe would not be affected by this proposal as habitat along the pipeline is unlikely to be suitable for this species. Construction of the pipeline would not disrupt movement of this mobile species.

Woodland Birds

The construction of 20 m ROW through small and isolated woodlands is unlikely to substantially disrupt habitat connectivity for these highly mobile species. All other vegetation clearance would occur through pastures and degraded road reserves which would not provide high quality habitat for any of these species.

Owls

Habitat connectivity for the Barking Owl is unlikely to be affected by the construction and operation of the proposed pipeline as this species is highly mobile. Construction of a 20 m ROW is unlikely to further fragment habitat connectivity for this species.

Mammals (other than bats)

Removal of around 1.59 ha of vegetation along a narrow strip is unlikely to further disrupt habitat connectivity over current levels. Habitat within the Hunter Valley is already highly fragmented and degraded.

Microchiropteran Bats

It is unlikely that habitat connectivity for any of species of microchiropteran bats would be disturbed as these species are highly mobile and construction for the ROW would only require removal of 20 m of vegetation, the majority of which is introduced grasslands.

Megachiropteran Bat

The Grey-headed Flying-fox is a highly mobile species which is known to forage over large distances from their roost sites. Consequently construction of a 20 m ROW predominantly through introduced pastures is unlikely to disrupt habitat connectivity for this species.

How is the proposal likely to affect critical habitat?

Critical habitats have not been declared for any of the populations or species relevant to this proposal.

Conclusion

It is unlikely that this proposal would significantly affect any population or species which occurs, or with the potential to occur, along the pipeline corridor as:

- The pipeline corridor was selected so as to avoid areas of biodiversity which would be likely to provide habitat for species of conservation significance;
- Disturbance would be temporary and confined to a narrow and currently degraded ROW; and
- Potential impacts on those species which do occur could be adequately managed and mitigated.

APPENDIX E

Plates

Plate 1 Xstrata Mine site



Plate 2 Xstrata Mining Charlton Road crossing



Plate 3 Wollombi Brook crossing



Plate 4 Xstrata Land - Central Hunter Ironbark / Spotted Gum / Grey Box Forest



Plate 5 Typical Putty Road road reserve



Plate 6 Typical agricultural lands adjacent to Wollombi Brook



Plate 7 Wambo Coal – Central Hunter Box / Ironbark Woodland



Plate 8 Golden Highway typical grassed road reserve



Plate 9 Golden Highway typical vegetated road reserve



Plate 10 Wonderoi Farm



Plate 11 Typical creek crossing



Plate 12 Typical drainage line crossing



Plate 13 Macquarie Generation lands





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