4 IMPACT ASSESSMENT

The route of the amended proposed pipeline and the Stage 1 GFDA extension have in general been designed to either avoid areas of conservation significance or, where these could not be avoided, HDD has been proposed to mitigate against impacts associated with traditional trenching techniques. Nonetheless, there is the potential for a number of impacts as a consequence of construction and operation of this pipeline and these are discussed below.

4.1 Construction and Operational Disturbances

Table 5 outlines the major disturbances to terrestrial ecosystems that are likely to occur within the Stage 1 GFDA extension and along the amended pipeline route. Clearing of a 25 – 30 m right-of-way (ROW) would be undertaken along the majority of the amended pipeline route but this could be reduced to 15 m to lessen impacts to ecologically sensitive receptors such as intact bushland and creek crossings.

Table 5 Terrestrial disturbances associated with the proposal

Proposal Stage	Disturbance
Stage 1 GFDA Extension	
Site preparation	Clearance of existing groundcover and topsoil (to be stored for site rehabilitation).
	Import of gravel and erection of site fence around an area of up to 90 m x 90 m with a gravel hardstand of 65 x 65 m.
Preparation of access tracks and string line areas	Grading and improvement of access tracks for heavy vehicle access, maximum 4 m disturbance width.
Borehole drilling	Movement of vehicles to and from the established drill pad.
	Operational noise of drill rig and associated activities.
Amended Pipeline Route	
Site preparation	Clearance of vegetation for a width of 2 5 - 30 m with cleared vegetation stockpiled on the non-working side of the ROW. Width of ROW would be reduced in areas of significant conservation value.
	Removal of topsoil to a depth of 100 to 150 mm to be stockpiled adjacent to the cleared vegetation on the non-working side of the ROW.
Preparation of access tracks	Grading and improvement of access tracks for heavy vehicle access, maximum 4 m disturbance width.

Proposal Stage	Disturbance
Digging of trench	A trench would be dug to a depth of 750 mm to the top of trench. With subsoil stockpiled separate to topsoil in the non-working side of the ROW.
	Operational noise of trenching and other machinery and associated activities.
Additional working and lay down areas	AECOM (2009) recommend the following measures to minimise clearing of native vegetation required for construction purposes, including lay down areas. Adoption of the following locational principles to locate envelopes for gas wells, flowlines and CPF include: ▪ not within 100 m of existing residences or as required to meet project noise goals; ▪ minimum of 40 m from a watercourse; ▪ avoiding native vegetation (about 6% of GFDA) and riparian areas; ▪ avoiding Indigenous and European heritage places or items; ▪ located adjacent to existing fence lines and access tracks where possible; ▪ located on relatively flat ground (i.e. less than 10% gradient); ▪ considering visual effects and opportunistic use of natural screening such as vegetation; and ▪ considering land use and landowner preferences.
Note: ROW = right-of-way	

Construction activity will be confined to the pipeline route and adjoining land to which access is available for construction purposes. The pipeline requires a construction ROW of approximately 25 - 30 m wide plus temporary work space within the 100 m wide assessment corridor. Temporary extra work space will be required in areas such as watercourses (refer above table). The temporary work space will be leased for the duration of the construction phases of the project. Although a 25 – 30 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 15 m width for trenching, brush and spoil storage and vehicle movement in sensitive areas

4.1.1 Watercourse Crossings

Various methods for crossing watercourses are available depending on the sensitivity of the watercourse to be crossed. The least sensitive watercourses may be crossed using open trenching techniques, watercourses with larger water flows may be crossed using open trenching with stream flow diversions and sensitive watercourses may be crossed using HDD techniques. AECOM (2009) provides a description of each method and a summary is provided below.

Open Trench - Watercourse Crossings

Open trenching would be applied in dry or shallow low flow watercourses. This method involves standard trenching techniques using an excavator or backhoe, ensuring the watercourse bed and bank material and trench spoil would be stockpiled separately, clear of the watercourse channel. A prefabricated pipe would subsequently be placed across the watercourse, lowered and the trench immediately backfilled.

Open Trench with Stream Flow Diversion

Stream flow diversion techniques are used as a modification to the standard open trenching and are utilised where higher water volumes and flows are present (typically for flows up to 1000 L/s). This technique involves in-stream trenching and pipe laying undertaken within a temporarily dewatered section of the watercourse using temporary dams. Water flow would be maintained by pumping the water around the dewatered section of the watercourse or through the installation of a bypass flume. Temporary dams can be formed by a number of methods such as sheet piling, sandbags or water filled dams (e.g. AquadamTM). Dewatering may be required at the crossing area, and strategically located sumps may allow this to occur. Prefabricated pipes would be installed similarly as for open trench crossings, the trench backfilled with appropriate coating protection if required, followed by controlled removal of the downstream dam and subsequent removal of the upstream dam.

Thrust Boring

Thrust boring may be used for some watercourse crossings. Thrust boring involves drilling from below ground within an enlarged trench area, known as a bell hole, located on either side of the area to be bored. The bell hole in which the thrust bore rig operates is typically 25 m or more long and 4 – 5 m wide to allow for the thrust bore rig in addition to a full length of pipe. The receiving bell hole is typically 4-5 m long and 3 m wide.

Horizontal Directional Drilling (HDD)

HDD may be used to cross major watercourses or at sites where open cut methods are not suitable. This method involves drilling a hole at a shallow angle beneath the surface, then pulling the welded pipe string back through the drill hole. Excavation of a cuttings settlement pit and a mud pit may be required at each of the entry and exit points. Once the pipe string is installed and connected to the main sections of the pipeline, the entry and exit points would be remediated and excess material would be disposed of at a licensed waste facility. HDD requires the use of a specialist drill rig, equipment and operator which may vary in size depending on the length of the HDD and the site geology. Smaller HDD rigs may be self-contained (e.g. on the back of a semi-trailer) while larger HDD rigs may require a designated pad.

4.2 Direct Impacts

There are a number of direct impacts predicted to occur within the Stage 1 GFDA extension area and amended pipeline routes and these are discussed below.

The Stage 1 GFDA extension is characterised by cleared land which has been used for agriculture over a number of years. Well sites within the GFDA would be located so as to avoid the removal of remnant vegetation and paddock trees and consequently clearing would be confined to paddock areas.

Construction activities associated with the pipeline will be confined to the pipeline route and adjoining land to which access is available for construction purposes. The pipeline requires a construction ROW of approximately 25 - 30 m plus temporary work spaces within the 100 m wide assessment corridor. The anticipated vegetation removal along the length of the pipeline is shown in Table 6. The expected clearing along the length of the overall pipeline route is contained in *Appendix G Explanatory Note* of the overall Environmental Assessment Report.

Table 6 Vegetation clearance along the amended sections of the pipeline route

Vegetation Community	Direct Impacts
Introduced pastures	25 - 30 m ROW along the majority of the proposed pipeline route.
Spotted Gum – Ironbark Forest Between KPs 17.8 – 18, 18.5 – 18.9, 19.2 – 19.4, 19.6 – 20, 23 – 23.2, 24.2 – 24.4	Totalling 1.51 ha
Grey Gum – Stringybark - Bloodwood ± Spotted Gum Ironbark Forest Between KPs 71.5 – 71.7, 71.8 – 72.5, 72.6 – 73.4	Totalling 2.24 ha
Hunter Lowland Redgum Forest (EEC) Between KP 75.7 – 76.2	Totalling 0.23 ha
Riparian communities Ramstation Creek (KP 28.8) HDD - Deadmans Creek (KP 74.4)	 0.08 ha (reduced ROW of 10 m) No clearing of intact riparian communities at Deadmans Creek.
SEPP 14 Wetlands 830 and 831	No clearing (HDD – under both wetlands)
Wetlands	No clearing (HDD or under bore)
Note: ROW = right-of-way	

Paddock trees would be avoided where possible. Drainage line crossings have been directed to areas either lacking native vegetation or areas of less substantial vegetation with the aim of avoiding large trees wherever possible.

4.2.1 Loss of Fauna Habitat

The majority of fauna habitat which would be removed within the Stage 1 GFDA extension area and along the amended pipeline route is that provided by introduced pasturelands. This may temporarily affect species such as the Eastern Grey Kangaroo and Common Wombat (*Vombatus ursinus*), both of which are common 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 in the long term.

Wherever possible paddock trees would be avoided as would substantial vegetation within drainage lines thereby ensuring that as many trees as possible 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 dams would not be impacted by this proposal.

Some fauna habitat would be removed with the clearance of 1.51 ha *Spotted Gum – Ironbark Forest* and 2.24 ha *Grey Gum – Stringybark - Bloodwood* ± *Spotted Gum Ironbark Forest* and 0.23 ha *Forest Red Gum – Spotted Gum Woodland*. This habitat primarily occurs along edges of previously cleared areas such as paddocks and powerline easements. Nonetheless, fauna resources in the form of foraging and nesting habitat for a range of arboreal and ground dwelling mammals, woodland birds and reptiles would be lost and already cleared corridors would experience additional widening which may increase habitat fragmentation.

4.2.2 Impacts on aquatic habitats

Some changes to hydrological regimes along the pipeline route 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
- Creation of conditions conducive to invasion by exotic species.

Impacts on aquatic habitats are likely to be spatially and temporally limited. HDD would be used to pass under creek crossings which are considered to contain areas of intact and substantial vegetation and significant aquatic and estuarine environments, including:

- Hunter River North Arm at KP 92.3 and again at KP 94.5; and
- Deadmans Creek – KP 74.4.

Compounds housing the drill rig and associated infrastructure would also be placed well clear of the riparian zones (at least 40 m) further reducing potential impacts.

The more minor crossings including dry or low flow creeks 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 be temporally limited. If it is necessary to upgrade any drainage line or creek crossings along access tracks to allow truck movements during construction of the pipeline it is recommended that box culverts be used in accordance with the guidelines for requirements for waterway crossings (Fairfull and Witheridge 2003).

4.2.3 Impacts on SEPP 14 Coastal Wetlands

Potential impacts on the SEPP 14 Wetlands No. 830 and 831 at Tomago could include:

- Changes to the hydrological regime and / or water quality of the wetlands;
- Changes to the saltmarsh / mangrove associations within the wetlands and downstream;
- Effects on the habitat or lifecycle of native species dependent upon the wetland; and
- Invasion and establishment of non-native flora and fauna species in the wetland.

Direct impacts on SEPP 14 Wetlands No. 830 and 831 at Tomago are not expected as these areas would be avoided through the use of HDD. The drilling would start back from the northern bank of the Hunter River at KP 92.1, pass under the Hunter River and under the Tomago wetlands until KP 93.6 where it would be open trenched along the margins of the caravan park to Old Punt Road and then along Old Punt Road within a cleared road reserve. The pipeline would then continue by HDD from Fogacs Engineering Pty Ltd carpark, under the Hunter River at KP 94.5 and exit back from the southern bank of the Hunter River.

4.3 Indirect Impacts

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

4.3.1 Changes to Water Quality

Potential impacts during and following construction on water quality in drainage lines, down slope areas and farm dams are possible, from run-off and sedimentation through earthworks and the removal of vegetation. Measures to prevent stormwater runoff and sedimentation from entering waterways would be required and these may include silt curtains, or isolation construction using dam

and pump or flume pipe techniques. A Construction Environmental Management Plan (CEMP) including a Sediment and Erosion Control Plan should be prepared prior to construction. Provided appropriate stormwater and sediment trapping systems are implemented and that revegetation of the area is undertaken as soon as is practical after construction, then indirect impacts are not anticipated. However, it is also recommended that if possible, works be undertaken during the drier months of the year, i.e. June to September.

4.3.2 Edge Effects

Clearance of vegetation and the maintenance of a track for vehicular access along the length of the pipeline route have the potential to increase edge effects. Edge effects include the increased likelihood of weed establishment, changes in microclimates along the edges of vegetation communities and facilitate movement of feral animals (e.g. European Red Fox (*Vulpes vulpes*)) through an area. The pipeline route in general is an area that has undergone clearing and fragmentation over time, thereby gradually increasing edge effects. Clearing of these areas would It is unlikely that this proposal would substantially increase the existing edge effects.

4.3.3 Disturbance of fauna

Disturbance of fauna during construction could occur through an increase in noise and activity levels across the site, including increased traffic. Disturbance of fauna can result in changes to the behaviour and patterns of resource use by certain fauna species. The outcome of which may be increases in roadkill, which could include death or injury to threatened species including the Grey-crowned Babbler. Ways to avoid increased strike rate of the Grey-crowned Babbler should be included in the CEMP.

4.3.4 Hunter Estuary National Park

The Tomago Wetlands and the Hunter River north arm are upstream of the Hunter Estuary National Park which is formed partly by Kooragang Island, Hunter Estuary, Hexham Swam and Ash Island, an area which is internationally recognised for its migratory bird habitat. Indirect impacts could potentially affect this national park through changes in water quality as a consequence of the effects of sedimentation and disturbance of acid sulphate soils, resulting in fewer feeding resources. Stringent management measures should be incorporated into the CEMP and OEMP to avoid indirect impacts to these sensitive receptors.

4.4 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 Policy Statement 1.1 – Significant Impact Guidelines: Matters of National Environmental Significance* (DEH 2006). Details of this assessment are contained in Appendix B and the outcomes briefly outlined below.

Species assessed included:

- Trailing Woodruff (*Asperula asthenes*);
- Leafless Tongue Orchid (Cryptostylis hunteriana);

- Slaty Red Gum (*Eucalyptus glaucina*);
- Guthrie's Grevillea (*Grevillea guthrieana);*
- *Tall Knotweed (Persicaria elatior*);
- Eastern Australian Underground Orchid (*Rhizanthella slateri);*
- Black-eyed Susan *(Tetratheca juncea);*
- Green and Golden Bell Frog (*Litoria aurea*);
- Regent Honeyeater (*Xanthomyza phrygia*);
- Swift Parrot (*Lathamus discolor*);
- Painted Snipe (*Rostratula benghalensis*);
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*);
- Long-nosed Potoroo (*Potorous tridactylus tridactylusis)*;
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- Painted Snipe (*Rostratula benghalensis*);
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*);
- Great Egret (*Ardea alba*);
- Cattle Egret (Ardea ibis);
- Latham's Snipe (*Gallinago hardwickii*);
- Ruddy Turnstone (*Arenaria interpres*);
- Sharp-tailed Sandpiper (*Calidris acuminate*);
- Curlew Sandpiper (*Calidris ferruginea*);
- Pacific Golden Plover (*Pluvialis fulva*);
- Bar-tailed Godwit (*Limosa lapponica*);
- Eastern Curlew (*Numenius madagascariensis*);
- Whimbrel (*Numenius phaeopus*);
- Fork-tailed Swift (*Apus pacificus*);
- White-throated Needletail (*Hirundapus caudacutus*);
- Rainbow Bee-eater (*Merops ornatus*);
- Black-faced Monarch (*Monarcha melanopsis*);
- Spectacled Monarch (*Monarcha trivirgatus*);
- Satin Flycatcher (*Myiagra cyanoleuca*); and
- Rufous Fantail (*Rhipidura rufifrons*).

It was concluded that with the implementation of stringent mitigation measures and environmental management, that the Stage 1 GFDA extension and the amended sections of the pipeline route would be unlikely to significantly impact any species, population or habitat along the pipeline route and within the locality as:

- In general, the proposed pipeline route 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;
- In unavoidable areas of high conservation status, (e.g. SEPP 14 Wetlands, Hunter River Estuary, substantial riparian areas), HDD techniques would be undertaken to avoid direct impacts on these areas; and
- Potential impacts could be managed and mitigated with stringent environmental management.

4.5 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 *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007). In accordance with a specific request from the Department of Planning, Assessments of Significance were undertaken for endangered ecological communities and populations, and threatened species. Details of this assessment are contained in Appendix C and the outcomes briefly outlined below.

The species, populations and ecological communities addressed included:

Endangered Ecological Communities

- *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions*; and
- *Swamp oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner bioregions*.

Endangered Populations

- *Cymbidium canaliculatum* population in the Hunter Catchment; and
- *Rhizanthella slateri* population in the Great Lakes LGA.

Flora

- Trailing Woodruff (*Asperula asthenes*);
- Netted Bottle Brush (*Callistemon linearifolius);*
- Leafless Tongue Orchid (Cryptostylis hunteriana);
- Slaty Red Gum (*Eucalyptus glaucina*);
- Guthrie's Grevillea (*Grevillea guthrieana*);
- Small-flower Grevillea (*Grevillea parviflora* subsp*. parviflora*);
- *Maundia triglochinoides;*
- Tall Knotweed *(Persicaria elatior*);
- Scant Pomaderris (*Pomaderris queenslandica);*
- Eastern Australian Underground Orchid (*Rhizanthella slateri);*
- Black-eyed Susan *(Tetratheca juncea);* and
- *Zannichellia palustris.*

Amphibian

- Green and Golden Bell Frog (*Litoria aurea*).

Reptile

- Pale-headed Snake (*Hoplocephalus bitorquatus*).

Water-dependent Birds

- Magpie Goose (*Anseranas semipalmata*);
- Australasian Bittern (*Botaurus poiciloptilus*);
- Black-necked Stork (*Ephippiorhynchus asiaticus*);
- Black Bittern (*Ixobrychus flavicollis*); and
- Painted Snipe (*Rostratula benghalensis*).

Woodland Birds

- Bush Stone-curlew (*Burhinus grallarius);*
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoria*);
- Barred Cuckoo-shrike (*Coracina lineata*);
- Swift Parrot (*Lathamus discolor*);
- Square-tailed Kite (*Lophoictinia isura*);
- Hooded Robin (*Melanodryas cucullata*);
- Black-chinned Honeyeater (*Melithreptus gularis gularis)*;
- Turquoise Parrot (*Neophema pulchella*);
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis)*;
- Speckled Warbler (*Pyrrholaemus saggitatus);*
- Diamond Firetail (*Stagonopleura guttata*);
- Regent Honeyeater (*Xanthomyza phrygia*); and
- Glossy Black-cockatoo (*Calyptorhynchus lathami*).

Owls

- Grass Owl (*Tyto capensis*);
- Barking Owl (*Ninox connivens*);
- Powerful Owl (*Ninox strenua*);
- Masked Owl (*Tyto novaehollandiae*); and
- Sooty Owl (*Tyto tenebricosa*).

Arboreal Mammals

- Squirrel Glider (*Petaurus norfolcensis*);
- Eastern Pygmy-possum (*Cercartetus nanus*);
- Yellow-bellied Glider (*Petaurus australis*); and
- Koala (*Phascolarctos cinereus*).

Ground-dwelling Mammals

- Parma Wallaby (*Macropus parma*);
- Long-nosed Potoroo (*Potorous tridactylus tridactylus*);
- Brush-tailed Phascogale (*Phascogale tapoatafa*); and
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*).

Microchiropteran Bats

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Little Bentwing-bat (*Miniopterus australis);*
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Large-footed Myotis (*Myotis macropus*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii);* and
- Large-eared Pied Bat (*Chalinolobus dwyeri)*.

Megachiropteran Bat

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

Conclusion

It was concluded that with the implementation of stringent mitigation measures and environmental management the proposal would be unlikely to significantly impact any species, population or habitat along the amended sections of the pipeline route and within the locality as:

- In general, the proposed pipeline route 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;
- In unavoidable areas of high conservation status, HDD techniques would be used to avoid direct impacts on these areas; and
- Potential impacts could be managed and mitigated with stringent environmental management.

4.6 Threatening Processes

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

4.6.1 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 relatively narrow strip of agricultural paddocks and 4.78 ha of native vegetation along 26 km of amended pipeline which is unlikely to provide the only important habitat for a species or to impede gene flow through this area even for small isolated populations. Major waterways, or creeks with substantial vegetation, 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. Although the majority of the amended sections of the pipeline route are weed infested, the native woodland areas being traversed by the amended sections of the pipeline route are relatively weed free in sections and these should be monitored to ensure that weed species do not become established along the ROW.

4.6.2 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.

4.6.3 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 route 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 the current modification of this landscape it is unlikely that this proposal would substantially exacerbate this KTP.

4.7 Impacts on SEPP 14 Coastal Wetlands

Direct impacts on SEPP 14 Wetlands No. 830 and 831 at Tomago are not expected as these areas would be avoided through HDD beginning back from the northern bank of the Hunter River at KP 92.1, under the Hunter River and under the Tomago Wetlands until KP 93.6 where it would be open trenched along the margins of the caravan park to Old Punt Road and then along Old Punt Road within a cleared road reserve. The pipeline would then continue by HDD from Fogacs Engineering Pty Ltd carpark, under the Hunter River at KP 94.5 before exiting back from the southern bank of the Hunter River in a disused industrial site.

4.8 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 amended sections of the pipeline route would substantially disrupt large scale corridors and fragment connectivity as the proposed route generally traverses introduced pastures and the ROW required for construction is narrow (i.e. 30 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.

4.9 Cumulative Impacts

Construction of the proposed pipeline route is not likely to substantially increase cumulative impacts. The route selected for the proposed pipeline is predominately through pastures and only relatively 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 route is small and impacts associated with construction and operation are predicted to be relatively minor and manageable.

5 MITIGATION RECOMMENDATIONS

The current overall condition and biodiversity along the amended sections of the pipeline route 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 Construction and Operational Environmental Management Plans (CEMP and OEMP) and Sediment and Erosion Control Plan.

Sensitive receptors and recommendations and mitigation measures specific to each section are listed below in Table 7. These should be incorporated into the overall management plan relating to protection of biodiversity for the entire project including those measures detailed by AECOM (2009).

Table 7 Key Ecological features and recommendations

Key Ecological Features	Recommendation / Management
Stage 1 GFDA Extension	
▪ Native vegetation nearby	▪ All well sites should be located outside of these areas.
▪ Drainage lines	▪ Routes for access tracks and gathering lines should be located along existing tracks and should avoid drainage lines where possible.
▪ Grey-crowned Babbler	▪ Recorded in vegetation adjacent to GFDA and likely to be relatively common within this area. The CEMP and OEMP should specifically address protection and management regimes for this species.
Amended Pipeline KP 17 – 25	
▪ Route passes through native vegetation	▪ Limit clearing within areas of remnant and regrowth vegetation.
▪ Drainage lines	▪ Pipeline route and access tracks should be located along existing tracks and should avoid drainage lines where possible.
Amended Pipeline KP 27.5	
▪ Ramstation Creek	▪ If open trenching is proposed then clearing should be confined to as narrow a corridor as possible (15 m). ▪ Water flows should be maintained and stringent measures to avoid erosion and downstream sedimentation and spread of weeds should be implemented.

Key Ecological Features	Recommendation / Management
Amended Pipeline KP 71.5 – 83	
▪ Intact remnant vegetation	▪ Although the pipeline largely follows a powerline easement additional clearing along this easement should be limited. ▪ Where possible the already cleared easement should be used for laydown areas, spoil storage and tracks.
▪ *Hunter Lowland Redgum Forest* (EEC) ▪ Mapped as 'Marginal" habitat for Koala under the Port Stephens Council CKPoM.	▪ Where the proposed pipeline route traverses the *Hunter Lowland Redgum Forest* a path should be chosen so as to avoid trees where possible. ▪ Clearing should also be minimised to an average of 5 m throughout. ▪ The provision of habitat offsets may be required. ▪ Where the proposed pipeline route passes to the north of the *Hunter Lowland Redgum Forest* stringent management measures to avoid indirect impacts should be implemented, e.g. fencing of the northern boundary of the woodland, ensuring siltation curtains are in place and regularly checked.
▪ Deadmans Creek ▪ Mapped as 'Preferred" Koala habitat for Koala under the Port Stephens Council CKPoM.	▪ HDD should be used to pass under this creek and riparian area.
Amended Pipeline KP 89.5 – 96	
▪ Hunter River ▪ Hunter Estuary National Park is located downstream of the crossing points of the Hunter River north arm. ▪ SEPP 14 Coastal Wetlands No. 830 and 831. ▪ Water bird habitat and saltmarsh. ▪ Other TSC and EPBC Act listed species.	▪ HDD to be used for Hunter River crossing and SEPP 14 wetlands. ▪ Where the pipeline route traverses the caravan park and Old Punt Road stringent management measures to avoid indirect impacts on wetlands and estuary should be implemented. ▪ Goal for construction and operation – no direct or indirect impacts on the Hunter River and SEPP 14 wetlands.

Key Ecological Features	Recommendation / Management
Laydown Areas	AECOM (2009) recommend the following measures to minimise clearing of native vegetation required for construction purposes, including lay down areas. Adoption of the following locational principles to locate envelopes for gas wells, flowlines and CPF include: ▪ not within 100 m of existing residences or as required to meet project noise goals; ▪ minimum of 40 m from a watercourse; ▪ avoiding native vegetation (about 6% of GFDA) and riparian areas; ▪ avoiding Indigenous and European heritage places or items; ▪ located adjacent to existing fence lines and access tracks where possible; ▪ located on relatively flat ground (i.e. less than 10% gradient); ▪ considering visual effects and opportunistic use of natural screening such as vegetation; and ▪ considering land use and landowner preferences.

Mitigation measures should be aimed at meeting the following performance objectives and goals:

5.1.1 Performance Objectives

- To minimise impacts on remaining biodiversity values of the site; and
- Protect biodiversity values across the locality.

5.1.2 Goals

Goals for the proposed works should be to:

- Minimise the amount of vegetation to be removed;
- Protect the remaining vegetation and fauna habitat;
- Ensure that erosion of the works areas does not occur and that sedimentation of adjacent areas is avoided; and
- Ensure that impacted areas are protected from erosion and weed invasion and restored to their current levels at the completion of the drilling operations.

The recommendations and mitigation measures detailed in AECOM (2009) should also be implemented in the Stage 1 GFDA extension and along the sections of amended pipeline route.

Particular attention should be focussed on avoiding direct and indirect impacts to the *Hunter Lowland Redgum Forest* and indirect impacts to occurrences of *Swamp oak floodplain Forest* which occur adjacent to the amended pipeline route. Of particular importance will be the need to minimise changes to natural flow regimes of rivers, streams, floodplains and wetlands as much of the southern section of the amended pipeline route traverses low lying water-logged areas. Central to these measures should be the preparation and implementation of a CEMP and OEMP.

5.2 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 route and / or in adjacent areas, including:

i) The placement of well sites within vegetated areas should be avoided;

ii) A path should be chosen through woodland areas which requires the least amount of trees to be removed;

iii) Top soil (< 100 mm) should be stockpiled when clearing vegetation and this should then be spread over the surface once the trench has been backfilled;

iv) Pre-trenching surface levels should be restored once backfilling is complete to retain current surface hydrology;

v) Where possible, removed native vegetation should be stockpiled and spread back over the work area on completion of the project;

vi) Weedy vegetation should not be spread but instead removed off site;

vii) Paddock trees should be avoided;

viii) A no impact zone around large trees especially those containing hollows, twice the radius of the tree canopy should be maintained; and

ix) Use pre-existing tracks to avoid further damage to vegetation.

6 CONCLUSIONS

The route of the amended proposed pipeline and Stage 1 GFDA extension have in general been designed to either avoid areas of conservation significance or where these could not be avoided then horizontal directional drilling has been proposed to mitigate against impacts associated with traditional trenching techniques of watercourse crossings, and areas of native vegetation clearance have largely been confined to the edges of already fragmented ecosystems.

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 given the modified nature of the Stage 1 GFDA extension area and the amended pipeline route, as long as stringent environmental management measures are implemented. Similarly, it is concluded that matters of NES listed under the Commonwealth EPBC Act would not be significantly impacted as long as stringent management and mitigation measures are also implemented.

To ensure the protection of native vegetation communities, a range of measures to manage risks to the neighbouring native vegetation communities 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 and it is recommended that those mitigation measures recommended in AECOM (2009) be adopted for the amended sections of the pipeline route and Stage 1 GFDA extension. With these measures 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 8.

Table 8 Environmental outcomes of the proposal

Environmental Outcome	Does the Proposal Deliver?
Maintain or improve biodiversity values	Biodiversity values are unlikely to be substantially altered from their current values as the majority of the proposed pipeline route is cleared agricultural / mining lands. Areas of native vegetation removal would be confined to relatively narrow linear strips of either regrowth or remnant vegetation communities. Native vegetation removal would total 4.78 ha over 26 km. 0.23 ha of these are the EEC, *Hunter Lowland Redgum Forest*. Without the provision of offsets this proposal is unlikely to maintain or improve biodiversity values.
Conserve biological diversity and promote Ecologically Sustainable Development (ESD)	The pipeline route was designed with due consideration to the significant biological diversity in the area. Where possible native vegetation has been avoided as have areas of high biological diversity and significance. Where these areas could not be avoided modified construction techniques would be implemented including HDD and reduced width of clearing. Stringent environmental management measures would be implemented further assisting in the

Environmental Outcome	Does the Proposal Deliver?
	conservation of biological diversity and the promotion of Ecologically Sustainable Development.
Prevent the extinction of threatened species.	The proposed pipeline route 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. In unavoidable areas of high conservation significance alternate construction methods would be utilised. Taken together it is considered that these measures would prevent the extinction of threatened species.
Protect the long-term viability of local populations of a species, population or community.	The area of direct impact is relatively small and with the implementation of stringent mitigation and environmental management measures it is considered that the long-term viability of local species, populations and communities would be protected.

7 REFERENCE MATERIALS

AECOM 2009 **Gloucester Coal Seam Gas Project. Ecological Assessment. Gloucester to Hexham.** Report prepared for Lucas Energy, Gloucester NSW.

Botanic Gardens Trust 2009 **PlantNET - The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (version 2)**. http://plantnet.rbgsyd.nsw.gov.au. Accessed 18 June 2008.

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

Clarke A, MacNally R, Bond N & Lake PS 2008 **Macroinvertebrate diversity in headwater streams: a review.** Freshwater Biology 53, 1707–1721.

DEC 2005a **Threatened Species Profiles.** NSW Department of Environment and Climate Change, Hurstville**.** http://www.threatenedspecies.environment.nsw.gov.au/index.aspx

DEC 2005b **Draft Recovery Plan for the Green and Golden Bell Frog (*Litoria aurea*).** Department of Environment and Conservation (now NSW Department of Conservation and Climate Change, Hurstville)

DEC 2006 **NSW Recovery Plan for the Large Forest Owls: Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*), Masked Owl (*Tyto novaehollandiae*).** NSW Department of Environment and Conservation, Hurstville**.**

DECC 2007 **Threatened Species Assessment Guidelines: The Assessment of Significance.** NSW Department of Environment and Climate Change, Hurstville**.**

DECC 2008a **Threatened Species Database Records**. NSW Department of Environment and Climate Change, Hurstville. (ENSR Australia Pty Ltd 14 August 2008).

DECC 2008b **Recovery Plan for the Koala (*Phascolarctos cinereus*).**. NSW Department of Environment and Climate Change, Hurstville.

DEH 2006 **EPBC Act Policy Statement 1.1 – Significant Impact Guidelines: Matters of National Environmental Significance**. Department of the Environment and Heritage, (now Department of the Environment, Water, Heritage and the Arts, Canberra). Online http://www.environment.gov.au/epbc/publications/pubs/nes-guidelines.pdf

DEWHA 2008 **Protected Matters Search Tool – Matters of National Environmental Significance.** Department of the Environment, Water, Heritage and the Arts, Canberra. Online http://www.environment.gov.au/erin/ert/epbc/index.html (ENSR Australia Pty Ltd 14 August 2008).

DEWHA 2009 **Register of Critical Habitat.** Department of the Environment, Water, Heritage and the Arts, Canberra. Online http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl

DPI 2008 **Protected Species Geographic Region Search** Department of Primary Industries. Online http://pas.dpi.nsw.gov.au/Species/Species_byRegion.aspx

DPI 2009 **Noxious Weed Declarations.** Department of Primary Industries. Online http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed

Fairfull S & Witheridge G 2003 **Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings.** NSW Department of Primary Industries, Cronulla.

GHD 2008 **Report on Gloucester Coal Seam Gas Project. Land and Approvals – Task 4.** Prepared for Lucas Energy.

Keith D. 2002 **A Compilation map of Native Vegetation for NSW**. NSW National Parks and Wildlife Service, Hurstville.

Keith D 2004 **Ocean shores to desert dunes: The Native Vegetation of New South Wales and the ACT.** NSW Department of Environment and Conservation, Hurstville.

Menkhorst P, Schedvin N & Geering D 1999 **Regent Honeyeater (*Xanthomyza phrygia*) Recovery Plan 1999-2003** Department of Natural Resources and Environment, Victoria.

NPWS 1999 **Forest ecosystem Classification and Mapping of the Upper and Lower North East Comprehensive Regional Assessment (CRA) regions.** CRA Unit, Northern Zone National Parks and Wildlife Service.

NPWS. 2000. **Vegetation Survey, Classification and Mapping - Lower Hunter and Central Coast Region.** Undertaken for the Lower Hunter and Central Coast Regional Environment Management Strategy by NSW National Parks and Wildlife Service, Hurstville, NSW.

NPWS. 2003a. **Draft Recovery Plan for the Barking Owl.** NSW National Parks and Wildlife Service, Hurstville, NSW.

NPWS. 2003b. **Recovery Plan for the Yellow-bellied Glider (*Petaurus australis*).** NSW National Parks and Wildlife Service, Hurstville, NSW.

NSW Scientific Committee 2003 **Final Determination: Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast bioregions - endangered ecological community listing.** Department of Environment and Climate Change, Hurstville.

NSW Scientific Committee 2006 ***Cymbidium canaliculatum* R. Br. - endangered population listing.** Department of Environment and Climate Change, Hurstville.

Parsons Brinckerhoff 2005 **Grey-crowned Babbler Retention Plan.** Prepared for Gloucester Shire Council.

Pizzey G & Knight F 2001 **The Field Guide to the Birds of Australia.** Harper Collins Publishers Pty Ltd, Sydney.

Port Stephens Council 2002 **Port Stephens Council Comprehensive Koala Plan of Management (CKPoM) – June 2002**. Prepared by Port Stephens Council with the Australian Koala Foundation.

Robinson L 2003 **Field Guide to the Native Plants of Sydney.** Kangaroo Press, Pymble.

Simpson & Day 2004 **Field Guide to the Birds of Australia.** Penguin Group (Australia), Victoria.

Swift Parrot Recovery Team 2001 **Swift Parrot Recovery Plan.** Department of Primary Industries, Water and Environment, Hobart.

Weeds in Australia 2009 **Weeds of National Significance (WONS).** Australian Government, Canberra. Online http://www.weeds.gov.au/weeds/lists/wons.html

APPENDIX A

Dominant Flora Species Recorded Within Amended Areas

APPENDIX A

Gloucester Coal Seam Gas Project - Gloucester to Hexham

Ecological Addendum Report

Dominant Flora Species Recorded in June 2009

			Amended Areas Rev E			
Family	**Scientific Name**	**Common Name**	**KP 18-26**	**KP 29**	**KP 73-84**	**KP 90-95**
Acanthaceae	*Avicennia marina*	Grey Mangrove				x
Adiantaceae	*Adiantum aethiopicum*	Maidenhair Fern	x	x	x	
	Cheilanthes sieberi subsp. *sieberi*	Mulga Fern	x		x	
Amygdalaceae	*Prunus* sp. *		x		x	
Apocynaceae	*Parsonsia straminea*	Common Silkpod			x	
Asteraceae	*Bidens pilosa**	Cobblers Peg	x		x	x
	*Cirsium vulgare**	Spear Thistle	x			
	Euchiton involucratus	Star Cudweed				
	Senecio madagascariensis *	Fireweed	x		x	x
	Sigesbeckia orientalis subsp. *orientalis* *	Indian Weed	x		x	
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	Wonga Wonga Vine			x	
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell			x	
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak	x		x	
	Casuarina cunninghamiana	River Oak	x	x	x	x
	Casuarina glauca	Swamp Oak				x
Convolvulaceae	*Dichondra repens*	Kidney Weed	x		x	x
Cyperaceae	*Carex* sp.	A sedge	x	x		x
	Gahnia aspera	Rough Saw-sedge	x		x	
	Schoenoplectus mucronatus				x	
Dennstaedtiaceae	*Pteridium esculentum*	Common Bracken	x		x	
Dilleniaceae	*Hibbertia* sp.	Guinea-flower	x			
Droseraceae	*Drosera* sp.	Sundew			x	
Ericaceae - Styphelioideae	*Lissanthe strigosa*	Peach-heath	x		x	
	Leucopogon juniperinus	Prickly Beard-heath	x		x	
Euphorbiaceae	*Glochidion ferdinandi*	Cheese Tree	x		x	

			Amended Areas Rev E			
Family	**Scientific Name**	**Common Name**	**KP 18-26**	**KP 29**	**KP 73-84**	**KP 90-95**
Fabaceae - faboideae	*Daviesia ulicifolia*	Gorse Bitter Pea	x		x	
	Glycine clandestina		x			
	Glycine tabacina				x	
	Hardenbergia violacea	Purple Coral Pea		x	x	
	Jacksonia scoparia	Dogwood			x	
	Kennedia rubicunda	Dusky Coral Pea	x		x	
	Podolobium ilicifolium	Prickly Shaggy Pea			x	
	Pultenaea ferruginea	Large Bronze Bush-pea			x	
Fabaceae - mimosoideae	*Acacia parramattensis*	Parramatta Wattle	x		x	
	Acacia parvipinnula	Silver-stemmed Wattle	x		x	
	Acacia ulicifolia	Prickly Moses	x		x	
Juncaceae	*Juncus acutus*	Sharp Rush				x
	Juncus pallidus		x	x		
Lauraceae	*Cassytha glabella*				x	
Lobeliaceae	*Pratia purpurascens*	Whiteroot	x		x	
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		x	x	
	Lomandra multiflora		x		x	
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily			x	
Malvaceae	*Hibiscus heterophyllus*	Native Rosella		x		
Moraceae	*Ficus rubiginosa*	Port Jackson Fig	x			
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle	x	x		
	Corymbia maculata	Spotted Gum	x		x	
	Eucalyptus crebra	Narrow-leaved Ironbark	x		x	
	Eucalyptus eugenioides	Thin-leaved Stringybark			x	
	Eucalyptus moluccana	Grey Box	x		x	
	Eucalyptus propinqua	Small-fruited Grey Gum	x		x	
	Eucalyptus punctata	Grey Gum	x		x	
	Eucalyptus siderophloia	Grey Ironbark	x	x	x	
	Eucalyptus teretecornis	Forest Red Gum	x	x	x	
	Eucalyptus umbra	Broad-leaved White Mahogany	x	x	x	
	Melaleuca linariifolia	Flax-leaved Paperbark	x	x	x	x
	Melaleuca styphelioides	Prickly-leaved Tea Tree	x	x	x	
Oleaceae	*Ligustrum sinense **	Small Leaved Privet			x	

			Amended Areas Rev E			
Family	**Scientific Name**	**Common Name**	**KP 18-26**	**KP 29**	**KP 73-84**	**KP 90-95**
	Notelaea venosa	Veined Mock-olive		x		
Orchidaceae	*Dendrobium aemulus*	Ironbark Orchid	x			
Phormiaceae	*Dianella caerulea* var. *producta*	Blue Flax-lily			x	
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	x			x
Pinaceae	*Pinus radiata* *	Radiata Pine				x
Pittosporaceae	*Bursaria spinosa*	Blackthorn	x		x	
Plantaginaceae	*Plantago lanceolata* *	Lamb's Tongue	x	x	x	
Poaceae	*Andropogon virginicus* *	Whisky Grass			x	x
	Aristida vagans	Threeawn Speargrass	x		x	
	Cortaderia selloana *	Pampas Grass				x
	Corymbia gummifera	Red Bloodwood			x	
	Cymbopogon refractus	Barbed Wire Grass	x		x	
	Cynodon dactylon	Couch	x	x	x	x
	Echinopogon ovatus	Forest Hedgehog Grass			x	
	Entolasia marginata	Bordered Panic	x		x	
	Entolasia stricta	Wiry Panic			x	
	Imperata cylindrica	Blady Grass	x		x	
	Microlaena stipoides	Weeping Grass	x	x	x	x
	Oplismenus aemulus				x	
	Pennisetum clandestinum *	Kikuyu	x		x	x
	Phragmites australis	Common Reed				x
	Sporobolus fertilis *	Giant Parramatta Grass	x			
	Stenotaphrum secundatum *	Buffalo Grass			x	
	Themeda australis	Kangaroo Grass	x		x	
Polygonaceae	*Persicaria decipiens*	Slender knotweed			x	
	Persicaria strigosa				x	
Proteaceae	*Grevillea robusta* *	Silky Oak				x
Ranunculaceae	*Clematis aristata*	Old Man's Beard		x	x	
Rhamnaceae	*Alphitonia excelsa*	Red Ash		x	x	
Rosaceae	*Rubus fruiticosus* *	Blackberry	x	x	x	x
Rosaceae	*Rubus parvifolius*	Native Raspberry	x			
Salicaceae	*Salix babylonica* *	Weeping Willow				x
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart	x		x	

			Amended Areas Rev E			
Family	**Scientific Name**	**Common Name**	**KP 18-26**	**KP 29**	**KP 73-84**	**KP 90-95**
Solanaceae	*Solanum linnaeanum* *	Apple of Sodom		x	x	
Sterculiaceae	*Brachychiton acerifolius*	Flame Tree	x			
	Brachychiton populneus	Kurrajong			x	
Urticaceae	*Pennisetum clandestinum*	Stinging Nettle		x		
Verbenaceae	*Lantana camara* *	Lantana	x		x	x
	Verbena rigida	Veined Verbena	x			x
Note: * denotes introduced species						

APPENDIX B

ASSESSMENT UNDER THE EPBC ACT

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The removal of 4.78 ha of native vegetation along 26 km of amended pipeline is required and this vegetation may provide habitat for some species listed under the EPBC Act 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: Matters of National Environmental Significance* (DEH 2006) were used to assess the significance of likely impacts as a consequence of the proposed pipeline and this assessment is detailed below.

Significant Impact Criteria for Endangered Species

Endangered species assessed include:

- Eastern Australian Underground Orchid (*Rhizanthella slateri)*;
- Guthrie's Grevillea (*Grevillea guthrieana)*;
- Regent Honeyeater (*Xanthomyza phrygia*);
- Swift Parrot (*Lathamus discolor*); and
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*).

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 Stage 1 GFDA extension consists predominantly of agricultural pastures and the well sites within this area will all be placed within existing cleared land and consequently few direct impacts are expected. Indirect impacts during construction and operation are most likely to also be minimal. However, impacts associated with increased vehicle movements and disturbance are possible.

  The 26 km amended pipeline route has been chosen to avoid areas of intact biodiversity that are most likely to provide habitat for threatened species. There would be a 4.78 ha of remnant / regrowth vegetation removed over the amended pipeline route and some of this could provide habitat for endangered species in the form of small winter flowering trees and habitat, such as fallen logs. However, impacts are unlikely to be substantial given the available surrounding habitat 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 4.78 ha of potential habitat would be removed. However, high quality resources for these species are available in the adjacent national parks, state forests and other areas of intact vegetation. 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 any endangered species.

- Fragment an existing population into two or more populations;

  The GFDA is located within paddocks and the majority of the proposed amended pipeline route traverses introduced pastures through long established agricultural lands 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 (DEWHA 2009).

- 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 substantially 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 Stage 1 GFDA extension and amended pipeline route has largely been chosen to avoid areas of intact biodiversity that are most likely to provide habitat for endangered species. There would be a relatively small amount (4.78 ha along a 26 km linear pipeline) of potential habitat removed for any of these species and this would include removal of eucalypt woodlands and forests along the edges of already cleared vegetation. However, a decrease in the quality of the habitat available along the pipeline route is unlikely to be substantial given the current highly modified nature of the proposed route.

- 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 or within the GFDA 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 so as to minimise the risk of invasive species establishment.

- 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 additional GFDA and proposed well sites have been chosen to avoid areas of intact native vegetation;
- The pipeline route was selected to, where possible, avoid areas of biodiversity which would be likely to provide habitat for endangered species; and
- Potential impacts could be managed and mitigated.

Significant Impact Criteria for Vulnerable Species

Vulnerable species assessed include:

- Trailing Woodruff (*Asperula asthenes*);
- Leafless Tongue Orchid (Cryptostylis hunteriana);
- Slaty Red Gum (*Eucalyptus glaucina*);
- Tall Knotweed *(Persicaria elatior*);
- Black-eyed Susan *(Tetratheca juncea)*;
- Green and Golden Bell Frog (*Litoria aurea*);
- Long-nosed Potoroo (*Potorous tridactylus tridactylusis)*;
- Grey-headed Flying-fox (*Pteropus poliocephalus*); and
- Large-eared Pied Bat (*Chalinolobus dwyeri*).

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 Stage 1 GFDA extension consists predominantly of agricultural pastures and the well sites within this area will all be placed within existing cleared land and consequently few direct impacts are expected. Indirect impacts during construction and operation are most likely to also be minimal. However, impacts associated with increased vehicle movements and disturbance are possible.

  The amended pipeline route 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 30 m ROW with many of the 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 25 - 30 m ROW along the amended pipeline route the majority of which traverses introduced pastures but also some woodland and forested areas. On completion of laying of the pipeline, the pipeline trench would be backfilled and the current level of habitat restored in the paddock areas. Clearing within areas of native vegetation would be minimised where possible especially where hollow-bearing trees and creeklines occur. Therefore, it is unlikely that this proposal would substantially reduce the area of occupancy of an important population.

- Fragment an existing important population into two or more populations;

  The majority of the proposed pipeline route traverses introduced pastures through long established agricultural lands and consequently the locality is currently heavily fragmented. It is unlikely that this proposal would further substantially fragment an existing important population into two or more populations but clearing would be minimised where possible to reduce risk of this occurring.

- 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 (DEWHA 2009).

- 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 substantially disrupted within the locality and the breeding habitat of species is unlikely to be substantially 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 route has been chosen to avoid areas of intact biodiversity that are most likely to provide habitat for threatened species. However, this proposal does require clearing of around 4.78 ha of native vegetation in a 25 – 30 ROW although this mostly occurs along the edges of already fragmented habitat. Higher quality habitat is available within the locality. 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.

- 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 modified landscapes and any disruption to species is likely to be relatively minor.

Conclusion

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

- The additional GFDA and proposed well sites have been chosen to avoid areas of intact native vegetation;
- The pipeline route was selected so as to avoid areas of biodiversity which would be likely to provide habitat for vulnerable species;
- Potential impacts could be managed and mitigated.

Significant Impact Criteria for Migratory Species

Species listed as migratory that were assessed:

- Painted Snipe (*Rostratula benghalensis*);
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*);
- Great Egret (*Ardea alba*);
- Cattle Egret (Ardea ibis);
- Latham's Snipe (*Gallinago hardwickii*);
- Ruddy Turnstone (*Arenaria interpres*);
- Sharp-tailed Sandpiper (*Calidris acuminate*);
- Curlew Sandpiper (*Calidris ferruginea*);
- Pacific Golden Plover (*Pluvialis fulva*);
- Common Greenshank (*Tringa nebularia*);
- Bar-tailed Godwit (*Limosa lapponica*);
- Eastern Curlew (*Numenius madagascariensis*);
- Whimbrel (*Numenius phaeopus*);
- Fork-tailed Swift (*Apus pacificus*);
- White-throated Needletail (*Hirundapus caudacutus*);
- Rainbow Bee-eater (*Merops ornatus*);
- Black-faced Monarch (*Monarcha melanopsis*);
- Spectacled Monarch (*Monarcha trivirgatus*);
- Satin Flycatcher (*Myiagra cyanoleuca*);
- Rufous Fantail (*Rhipidura rufifrons*);

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;

  To avoid impacts on migratory and / or marine wader bird populations the proposed amended pipeline route, HDD would be used to pass under the major wader bird habitats of the Hunter River and the Tomago SEPP 14 Coastal Wetlands. Stringent environmental management regimes would also be implemented to protect these habitats against indirect impacts associated with construction and operation. Consequently, it is unlikely that this proposal would modify, destroy or isolate area of important habitat for migratory and / or marine wader bird populations.

- 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

  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 so as to minimise the risk of invasive species establishment.

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

  To avoid disruption to the lifecycle of migratory and / or marine wader bird populations the proposed amended pipeline route would use HDD to pass under the major wader bird habitats of the Hunter River and the Tomago SEPP 14 Coastal Wetlands. Stringent environmental management regimes would also be implemented to protect these habitats against indirect impacts associated with construction and operation. Consequently, it is unlikely that this proposal would modify, destroy or isolate area of important habitat for migratory and / or marine wader bird populations.

Conclusion

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

- The construction of the amended pipeline route which has the potential to impact on habitat for these species would be horizontally directionally drilled so as to avoid direct impacts; and
- Potential impacts could be managed and mitigated.

APPENDIX C

ASSESSMENT OF SIGNIFICANCE UNDER THE EP&A ACT

APPENDIX C

Assessment of Significance

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. Although the proposal would be assessed under Part 3A of the EP&A Act, Assessments of Significance were undertaken to determine the significance of impacts of the proposal on endangered ecological communities and populations, and threatened species listed on Schedules of the NSW *Threatened Species Conservation Act 1995* (TSC Act) as requested by the Department of Planning. Assessments have been undertaken for guilds of species which have similar habitat requirements. The Grey-crowned Babbler has been considered separately as this species was recorded during this assessment and this species has an extensive population at the eastern end of the project area around the GFDA.

Endangered Ecological Communities

- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions; and
- Swamp oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner bioregions.

Endangered Populations

- *Cymbidium canaliculatum* population in the Hunter Catchment; and
- *Rhizanthella slateri* population in the Great Lakes LGA.

Flora

- Trailing Woodruff (*Asperula asthenes*);
- Netted Bottle Brush (*Callistemon linearifolius)*;
- Leafless Tongue Orchid (*Cryptostylis hunteriana*);
- Slaty Red Gum (*Eucalyptus glaucina*);
- Guthrie's Grevillea (*Grevillea guthrieana*);
- Small-flower Grevillea (*Grevillea parviflora* subsp*. parviflora*);
- *Maundia triglochinoides*;
- Tall Knotweed *(Persicaria elatior*);
- Scant Pomaderris (*Pomaderris queenslandica)*;
- Eastern Australian Underground Orchid (*Rhizanthella slateri)*;
- Black-eyed Susan *(Tetratheca juncea)*; and
- *Zannichellia palustris.*

Amphibian

- Green and Golden Bell Frog (*Litoria aurea*).

Reptile

- Pale-headed Snake (*Hoplocephalus bitorquatus*).

Water-dependent Birds

- Magpie Goose (*Anseranas semipalmata*);
- Australasian Bittern (*Botaurus poiciloptilus*);
- Black-necked Stork (*Ephippiorhynchus asiaticus*);
- Black Bittern (*Ixobrychus flavicollis*); and
- Painted Snipe (*Rostratula benghalensis*).

Woodland Birds

- Bush Stone-curlew (*Burhinus grallarius)*;
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoria*);
- Barred Cuckoo-shrike (*Coracina lineata*);
- Swift Parrot (*Lathamus discolor*);
- Square-tailed Kite (*Lophoictinia isura*);
- Hooded Robin (*Melanodryas cucullata*);
- Black-chinned Honeyeater (*Melithreptus gularis gularis)*;
- Turquoise Parrot (*Neophema pulchella*);
- Grey-crowned Babbler (*Pomatostomus temporalis temporalis)*;
- Speckled Warbler (*Pyrrholaemus saggitatus)*;
- Diamond Firetail (*Stagonopleura guttata*);
- Regent Honeyeater (*Xanthomyza phrygia*); and
- Glossy Black-cockatoo (*Calyptorhynchus lathami*).

Owls

- Grass Owl (*Tyto capensis*);
- Barking Owl (*Ninox connivens*);
- Powerful Owl (*Ninox strenua*);
- Masked Owl (*Tyto novaehollandiae*); and
- Sooty Owl (*Tyto tenebricosa*).

Arboreal Mammals

- Squirrel Glider (*Petaurus norfolcensis*);
- Eastern Pygmy-possum (*Cercartetus nanus*);
- Yellow-bellied Glider (*Petaurus australis*); and
- Koala (*Phascolarctos cinereus*).

Ground-dwelling Mammals

- Parma Wallaby (*Macropus parma*);
- Long-nosed Potoroo (*Potorous tridactylus tridactylus*);
- Brush-tailed Phascogale (*Phascogale tapoatafa*); and
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*).

Microchiropteran Bats

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Little Bentwing-bat (*Miniopterus australis)*;
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Large-footed Myotis (*Myotis macropus*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii)*; and
- Large-eared Pied Bat (*Chalinolobus dwyeri)*.

Megachiropteran Bat

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

Endangered Ecological Communities

Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions

This vegetation community is listed as an endangered ecological community (EEC) under the TSC Act. It is an open forest which characterises the gentle slopes of depressions and drainage flats on the Hunter Valley floor. It has been recorded from the local government areas of Maitland, Cessnock and Port Stephens (in the Sydney Basin Bioregion) and Muswellbrook and Singleton (in the NSW North Coast Bioregion) but may occur elsewhere in these bioregions (NSW Scientific Committee 2003). Currently only a small area (less than 2% of total) of *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions* is included in NPWS estate in the Lower Hunter (Wereketa) National Park. Modelling shows that much of the pre-1750 extent of the community has been cleared. Only about 27% (less than 500 ha) of the original distribution survives and this is highly fragmented. Although much of the clearing occurred early in European settlement, clearing still continues at a high rate. Between 1988 and 2001 approx 2380 ha were approved for clearing. In

addition to clearing and fragmentation other threats include grazing, weed invasion, altered fire frequency and, locally, rubbish dumping (NSW Scientific Committee 2003).

Swamp oak floodplain forest of the NSW North Coast; Sydney Basin and South East Corner Bioregions.

This vegetation community is listed as an endangered ecological community (EEC) under the TSC Act. It is known from parts of widely distributed LGAs including Great Lakes, Port Stephens, Maitland and Newcastle. The extent of the *Swamp oak floodplain forest* prior to European settlement has not been mapped across its entire range. However, the remaining area of *Swamp oak floodplain forest* is likely to represent much less than 30% of its original range. Major occurrences include: less than 350 ha on the Tweed lowlands; less than 650 ha on the lower Clarence floodplain; less than 400 ha on the lower Macleay floodplain; less than 3,200 ha in the lower Hunter - central Hunter region; less than 5,200 ha in the Sydney - South Coast region; and less than 1,000 ha in the Eden region. Small areas of *Swamp oak floodplain forest* are contained within existing conservation reserves which are unevenly distributed throughout its range and therefore are unlikely to represent the full diversity of the community (DEC 2005a).

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

Not a threatened species.

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

Not an endangered population.

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

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

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Two remnant patches of Hunter Lowland Redgum Forest occur between KP 75.3 and 76.2. One patch is located adjacent to the pipeline route at approximately KP 75.3 to 75.4. The other is along the pipeline route from KP 75.7 to 76.2. Both are isolated from other areas of vegetation by Clarence Town Road and Brandy Hill Drive. A 0.23 ha area near the eastern boundary of a patch of remnant Hunter Lowland Redgum Forest (KP 75.7 to 76.2) would be removed for this proposal. This remnant patch contains mature canopy trees but lacks an intact shrub and groundlayer. A path through the trees would be chosen so as to have minimal impact although some trees would need to be removed. This activity is unlikely to have an adverse effect on the extent of the EEC such that its local occurrence is likely to be placed at risk of extinction nor would it be likely to substantially and adversely modify the composition as the shrub and groundlayer are missing and the removal of trees would be minimised. The second remnant

patch (KP 75.8) would not be directly impacted. Indirect effects on the two remnant patches would be controlled through fencing, the installation of sedimentation fences and the control of weeds.

Swamp oak floodplain forest occurs adjacent to the proposed pipeline route at around KP 89.5. There would be no direct impacts on this EEC. Indirect impacts would be controlled through the implementation of a stringent Sedimentation and Erosion Control Plan and ensuring that the work areas is fenced off from this vegetation community.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

A 0.23 ha area, near the eastern boundary of a patch of remnant *Hunter Lowland Redgum Forest* (KP 75.7 to 76.2) would be removed for this proposal. This would result in further fragmentation of this patch of the EEC as the pipeline route traverses the south-eastern corner. This remnant patch contains mature canopy trees but lacks an intact shrub and groundlayer which probably reflects its grazing history. Removal and fragmentation of this relatively small amount of habitat is unlikely to affect the long-term survival of this EEC. However, only 27% of the original distribution of this EEC remains and this would contribute to the cumulative impacts on the survival of this EEC. The remnant patch along Clarence Town Road (KP 75.3 – 75.4) is already isolated from tracts of vegetation to the north and consequently the laying the pipeline to the north of this patch would not result in further isolation.

The proposed action would not result in the *Swamp oak floodplain forest* being removed or altered and habitat would not become fragmented or isolated from other areas as all proposed works are to be undertaken within pasture improved paddocks to the south of its occurrence.

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

Critical habitat has not been declared for either EEC.

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

For the *Hunter Lowland Redgum Forest* there are 19 priority action statements (PAS) proposed to help recover this EEC (DEC 2005a). This proposal is unlikely to impede the implementation of any of these priority actions.

For the *Swamp oak floodplain forest* there are 11 priority action statements (PAS) proposed to help recover this EEC (DEC 2005a). This proposal is unlikely to impede the implementation of any of these priority actions.

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

Of the 31 key threatening processes identified in NSW one is of relevance to this proposal and this is:

- Clearing of Native Vegetation. A 0.23 ha area of *Hunter Lowland Redgum Forest* would be removed as a part of this proposal. This remnant patch (KP 76.5) of EEC is comprised of mature trees without an intact native understorey due to its history of grazing.

Conclusion

Impacts on *Swamp oak floodplain forest* are not anticipated as a consequence of this proposal. This proposal would however, result in the removal of a 0.23 ha area of *Hunter Lowland Redgum Forest*. The implementation of stringent mitigation measures including a CEMP and OEMP would mitigate against indirect impacts on the remaining *Hunter Lowland Redgum Forest* and *Swamp Oak Floodplain Forest* which occurs adjacent to the pipeline route.

Endangered Populations

Cymbidium canaliculatum population in the Hunter Catchment is listed as an Endangered Population under the TSC Act. The population of *C. canaliculatum* in the Hunter Catchment is at the south-eastern limit of the geographic range for this species. It is most commonly found in White Box (*Eucalyptus albens*) dominated woodlands, usually occurring singly or as a single clump, typically between two and six metres above the ground. It has been found, less commonly, to grow on Slaty Box (*E. dawsonii*), Narrow-leaved Ironbark (*E. crebra*), Grey Box (*E. moluccana*), Rough-barked Apple (*Angophora floribunda*), and Cooba (*Acacia salicina*). The number of plants of *C. canaliculatum* in the Hunter Catchment is currently estimated to be very low, as few as 90. Threats to the population of *C. canaliculatum* in the Hunter Catchment include land clearing and the associated fragmentation of habitat, on-going removal of remnant trees, and illegal collecting (NSW Scientific Committee 2006).

Rhizanthella slateri population in the Great Lakes LGA. *Rhizanthella slateri* is restricted to NSW where it is currently known from fewer than 10 locations including Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. The *Rhizanthella slateri* population in the Great Lakes LGA occurs at the known northern limit of the species' range and is disjunct from other known populations of the species. This population is currently the largest known population of this species (DEC 2005a).

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

Not a threatened species.

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

Cymbidium canaliculatum was not recorded along the proposed pipeline route although another epiphytic orchid, *Dendrobium aemulus*, was recorded on an Ironbark. Whilst it is unlikely that this species occurs along the amended pipeline route, where it is known to occur it occurs at such low densities that retention of each specimen is important. Consequently, it is recommended that each tree be assessed for the presence of this species before removal is undertaken.

Although the amended pipeline route traverses the Great Lakes LGA the pipeline route is outside of the known area of occurrence of this population of *Rizanthella slateri*. Consequently the construction of this amended route of the pipeline is unlikely to place this population at risk of extinction.

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

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

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not a community.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

It is unlikely that *Cymbidium canaliculatum* occurs along the amended pipeline route due to its rarity in the region. However, this species occurs at such low population densities within the Hunter Catchment that removal of any specimen may be important to the ongoing survival of this population. Therefore, it is recommended that all trees be assessed for the occurrence of this species before removal.

Known habitat for the *Rhizanthella slateri* population in the Great Lakes LGA would not be altered or removed as a consequence of this proposal.

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

No critical habitat has been listed for either of these endangered populations in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change or the Register of Critical Habitat kept by the Director General of Department of Primary Industries.

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

DECC has not prepared a recovery plan, threat abatement plan or PAS for these endangered populations. .

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

Of the 31 key threatening processes identified in NSW one is of relevance and this is:

- Clearing of Native Vegetation. Around 4.78 ha of native remnant or regrowth vegetation along 26 km of pipeline route would be removed for this project.

Conclusion

Impacts on either of these endangered populations are unlikely. The occurrence of the known population of *Rizanthella slateri* in the Great Lakes LGA is outside of the impact area of this proposal and because the *Cymbidium canaliculatum* population could occur within the amended pipeline route it is recommended that each tree be assessed for the occurrence of this species before removal.

Flora

Species information: DEC 2005a (Threatened Species Profiles)

Trailing Woodruff (*Asperula asthenes*) is listed as Vulnerable under the TSC Act. It is a low, trailing perennial herb which grows in damp soils often along river banks. It is found in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens/Wallis Lakes area. This species was not recorded. However, a previous record of this species has been made from within a 5 km buffer of the project area (AECOM 2009).

Netted Bottle Brush (*Callistemon linearifolius*) is listed as Vulnerable under the TSC Act. It grows in dry sclerophyll forest on the coast and adjacent ranges and is recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. *Callistemon linearifolius* was not recorded during the field surveys. The desktop survey revealed three previous records from within a 5 km buffer of the project area (AECOM 2009).

Leafless Tongue Orchid (*Cryptostylis hunteriana*) is listed as Vulnerable under the TSC Act. It does not have a particularly well defined habitat preference although it is known from swampy heath environments and dry sclerophyll grassy woodlands, mostly in coastal areas. This species was not recorded during the surveys and there are no past records within a 5 km buffer of the site (AECOM 2009).

Slaty Red Gum (*Eucalyptus glaucina*) is listed as Vulnerable under the TSC Act. It is a medium-sized tree to 30 m tall which grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils. This species was not recorded during this study although two records are known from within a 5 km buffer of the project area (AECOM 2009).

Guthrie's Grevillea (*Grevillea guthrieana*) is listed as Endangered under the TSC Act. It grows along creeks and cliff lines in eucalypt forest, on granitic or sedimentary soil. This species was not recorded

during this study and there are no records of its occurrence with 5 km buffer of the project area (AECOM 2009).

Small-flower Grevillea (*Grevillea parviflora* subsp*. parviflora*) is listed as Vulnerable in Schedule 2 of the TSC Act It is distributed sporadically within the central NSW coastal region from south of Sydney to the lower Hunter. It occurs in a range of vegetation types from heath and shrubby woodland to open forest. It generally grows in sandy or light clay soils, usually over thin shales. It often occurs in open, slightly disturbed sites such as along tracks and infrastructure easements. This species was not recorded during this assessment although it was recorded by AECOM (2009) along a section of the pipeline route.

Maundia triglochinoides is listed as Vulnerable under the TSC Act. It grows in swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients and is restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. This species was not recorded during this study and there are no records of its occurrence with 5 km buffer of the project area (AECOM 2009).

Tall Knotweed (*Persicaria elatior*) is listed as Vulnerable under the TSC Act. It grows in damp sites, especially beside streams and lakes and occasionally in swamp forest. This species was not recorded during this assessment and there are no previous records from within a 5 km buffer of the project area (AECOM 2009).

Scant Pomaderris (*Pomaderris queenslandica*) is listed as Endangered under the TSC Act. It grows in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks. Scant Pomaderris is widely scattered but not common in north-east NSW but is known from several locations on the NSW north coast. This species was not recorded during this study and there are no records of its occurrence with 5 km buffer of the project area (AECOM 2009).

Eastern Australian Underground Orchid (*Rhizanthella slateri*) is listed as Vulnerable under the TSC Act. Habitat requirements are not well understood but it is known to grow in sclerophyll forest in shallow to deep loams. This species was not recorded during this study and there are no records of its occurrence with 5 km buffer of the project area (AECOM 2009).

Black-eyed Susan (*Tetratheca juncea*) is listed as Vulnerable under the TSC Act. It grows in sandy, occasionally swampy heath and in dry sclerophyll forest; mostly in coastal districts. *Tetratheca juncea* is confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. This species was not recorded during this study although two records are known from within a 5 km buffer of the project area (AECOM 2009).

Zannichellia palustris is listed as Endangered under the TSC Act. It is known only from the lower Hunter Region where it grows submerged in fresh or slightly saline stationary or slowly flowing water. This species was not recorded during this study although two records are known from within a 5 km buffer of the project area (AECOM 2009).

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

There would be no direct impacts on known habitat for any of the flora species listed under the Act. Although the amended pipeline route passes through some suitable habitat for these species it is unlikely to have an adverse effect on the life cycle of any of these species such that a local population would be placed at risk of extinction. Environmental management of the site during construction could ensure that adjacent habitat would be protected from the affects of run-off and sedimentation during construction.

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

None of these are endangered populations.

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

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

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

None of these are endangered ecological communities.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Around 4.78 ha of dry sclerophyll forest in a 25 - 30 m wide strip would be removed as a consequence of this proposal. For those species reliant on creeks for habitat around 0.08 ha would be removed or altered and for *Zannichellia palustris* no suitable habitat would be directly impacted as any potential habitat would be underbored. Any habitat that would be removed for these species would be as a relatively narrow strip (25 – 30 m) and is unlikely to act as a barrier to dispersal for the flora species.

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

No areas of critical habitat have been declared for any of these species.

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

There is currently no recovery plan or threat abatement plan for any of these species although PAS have been prepared to recover the majority of these species. Provided that clearing of timbered and / or riparian habitat is kept to a minimum, the proposed development will not be inconsistent with any of the priority action statements.

However for *Rhizanthella slateri* and *Zannichellia palustris* there have been no PAS prepared to assist with the recovery of these two species. If clearing is kept to a minimum then the proposed development will not be inconsistent with assisting in recovery of these species.

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

Of the 31 key threatening processes identified in NSW two are of relevance and these are:

- Clearing of Native Vegetation. Around 4.78 ha of native remnant or regrowth vegetation along 26 km of amended pipeline route would be removed for this project. To minimise any potential impacts clearing of native vegetation should be kept to a minimum.
- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands. A number of the threatened flora species are, or may be, dependent on creeks, streams or areas of ponded water. Clearing of riparian vegetation and alteration of flows would be minimised. Significant water bodies and creeks would be horizontally directionally drilled. For other areas, clearing and changes to water flows would be minimised in line with the Construction and Operational Environmental Management Plans for the project.

Conclusion

This proposal is unlikely to significantly alter habitat for any of these plant species to such an extent that at local population would be placed at risk of extinction. The Stage 1 GFDA extension and altered pipeline route have been chosen to avoid areas of intact vegetation where possible. In areas of intact vegetation clearing for the ROW would be minimised to reduce the risk of impacts to any species.

Amphibian

The Green and Golden Bell Frog (GGBF) (*Litoria aurea*) is listed as Endangered under the TSC Act. This species inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available (DEC 2005a). There have been 140 records from within 5 km of the project site (AECOM 2009).

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

There would be no direct impacts on potential GGBF habitat as all suitable farm dams and waterbodies would be avoided. Environmental management of the site during construction could ensure that such areas would be protected from the affects of run-off and sedimentation during construction through the use of sedimentation fences and revegetation. Consequently, should the GGBF occur in adjacent areas it is unlikely that this species would be impacted by this proposal.

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

Not an endangered population.

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

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

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not an endangered ecological community.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Stage 1 GFDA extension area is located within paddocks and the majority of the proposed amended pipeline route traverses introduced pastures through long established agricultural lands 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 for the GGBF.

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

This area has not been identified as critical habitat for this species.

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

A Draft Recovery Plan (DEC 2005b) for the GGBF has been prepared. This plan lists habitat loss, modification and disturbance, fragmentation and isolation of habitat, disease, predation by introduced fish and water quality as threats. The plan consists of five specific objectives including prevention of further habitat loss. GGBF habitat will not be removed as a result of this proposal and the proposal does not contravene the specific objectives of the draft recovery plan.

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

Two Key Threatening Processes have potential relevance to this proposal. These are *Predation by Gambusia holbrooki (Plague Minnow)* and *Infection of Frogs by Amphibian Chytrid Causing the disease Chytridiomycosis*. This proposal is unlikely to introduce the Plague Minnow into areas of potential habitat and this proposal would not involve the moving of frogs or tadpoles, exposing frogs to infected water or handling of frogs in any way and consequently it is unlikely that infection in amphibians would be exacerbated.

Conclusion

The Green and Golden Bell Frog is unlikely to be impacted by this proposal as GGBF habitat would not be impacted and with the implementation of stringent environmental management during construction and operation the proposal is unlikely to impact the ecology of the study area and locality.

Reptile

The Pale-headed Snake (*Hoplocephalus bitorquatus*) is listed as Vulnerable under the TSC Act. It is generally found in dry eucalypt forests and woodlands, cypress woodland and occasionally rainforest or moist eucalypt forest. It prefers streamside areas, particularly in drier habitats. During the day, it shelters between loose bark and tree trunks, or in hollow trunks and limbs of dead trees (DEC 2005a). This species was not recorded during the survey and no records exist within 5 km of the project site (AECOM 2009).

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

Around 4.78 ha of potential foraging and nesting habitat for this species would be removed. It is unlikely that this proposal would place a local population of this species at risk of extinction as the woodland which would be removed occurs along already cleared margins of habitat. More extensive and higher quality habitat would occur in neighbouring intact vegetation communities.

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

Not an endangered population.

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

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

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not an endangered ecological community.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Around 4.78 ha in a 25 - 30 m wide strip of potential habitat would be removed. It is unlikely that this habitat would represent important habitat as it is already fragmented and isolated from higher quality habitat in nearby intact vegetation. 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

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

Critical habitat has not been declared for this species.

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

There are 13 priority action statements (PAS) proposed to help recover this species (DEC 2005a). This proposal is unlikely to impede the implementation of any of these priority actions.

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

Of the 31 key threatening processes identified in NSW one is of relevance and this is:

- Clearing of Native Vegetation. Around 4.78 ha of native remnant or regrowth vegetation along 26 km of amended pipeline route would be removed for this project.

Conclusion

Although around 4.78 ha of potential is to be removed for the implementation of the project it is unlikely to on this species to such an extent that a local population would be put at risk of extinction as vegetation removal would occur in a relatively narrow strip and along mostly disturbed margins.

Water-dependent Birds

Species information: DEC 2005a (Threatened Species Profiles), Pizzey and Knight 2001.

The Magpie Goose (*Anseranas semipalmata*) is listed as Vulnerable under the TSC Act. It is still relatively common in the Australian tropics, but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Since the 1980s, there have been an increasing number of records in central and northern NSW. Vagrants can still follow food sources to south-eastern NSW. It is mainly found in shallow wetlands (60-100 cm deep) with dense growth of rushes or sedges. It is equally at home in aquatic or terrestrial habitats, where it is often seen walking and grazing on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off. This species was not recorded during the survey but 17 previous records exist within 5 km of the project site (AECOM 2009).

The Black-necked Stork (*Ephippiorhynchus asiaticus*) is listed as Endangered under the TSC Act. The Black-necked Stork is increasingly uncommon in southern Australia. It inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands. This species was not recorded during the survey but 81 previous records exist within 5 km of the project site (AECOM 2009).

The Black Bittern (*Ixobrychus flavicollis*) is listed as Vulnerable under the TSC Act. In NSW, records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. It inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. This species was not recorded during the survey but two previous records exist within 5 km of the project site (AECOM 2009).

The Painted Snipe (*Rostratula benghalensis*) is listed as Endangered under the TSC Act. It prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. It nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. This species was not recorded during the survey but two previous records exist within 5 km of the project site (AECOM 2009).

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

The impacts on creeks, drainage lines and or wetland areas would be spatially and temporally limited with 0.08 ha of riparian vegetation proposed for removal. Areas of particular sensitivity would be underbored using HDD, including the major creek and river crossings and the SEPP 14 wetlands. Therefore it is unlikely that this proposal would impact these species such that a local viable population is likely to be placed at risk of extinction.

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

None of these are endangered populations.

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

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

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

None of these are endangered ecological communities.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The habitat for water dependent birds would be protected as major drainage lines and creeks would be underbored and SEPP 14 wetlands which are likely to provide habitat for a range of waders would also be HDD. The removal or disturbance of other habitat would be minimal and temporary and is unlikely to substantially remove, modify, fragment or isolate habitat over current levels.

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

No areas of critical habitat have been declared for any of these species.

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

There is currently no recovery plan or threat abatement plan for any of these species although PAS have been prepared to recover the majority of these species. Provided that clearing of creek lines and wetland areas is kept to a minimum, the proposed development will not be inconsistent with any of the priority action statements.

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

Of the 31 key threatening processes identified in NSW two are of relevance and these are:

- Clearing of Native Vegetation. Around 0.08 ha of riparian vegetation along the 26 km of amended pipeline route would be removed for this project. To minimise potential impacts clearing of native vegetation should be kept to a minimum; and

- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands. A number of the threatened flora species are, or may be, dependent on creeks, streams or areas of ponded water. Clearing of riparian vegetation and alteration of flows would be minimised. Significant water bodies and creeks would be horizontally directionally drilled. For other areas, clearing and changes to water flows would be minimised in line with the Construction and Operational Environmental Management Plans for the project.

Conclusion

With the implementation of stringent environmental management measures it is considered that this proposal is unlikely to significantly alter habitat for any of these water bird species to such an extent that a local population would be placed at risk of extinction as areas with significant resources for water dependent birds would be underbored using HDD.

Woodland Birds

Species information: DEC 2005a (Threatened Species Profiles), Pizzey and Knight 2001.

Bush Stone-curlew (*Burhinus grallarius*) is listed as Endangered under the TSC Act. Habitat for this species occurs in open forests and woodlands with sparse grassy ground layer and fallen timber. It is nocturnal and is especially active on moonlit nights. In south-east Australia, it is either rare or extinct throughout its former range. This species was not recorded during the survey but one previous record exists within 5 km of the project site (AECOM 2009).

Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoria*) is listed as Vulnerable under the TSC Act. The eastern subspecies lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands, such as the Hunter Valley and Clarence Valley. This species was not recorded during the survey but two previous records exist within 5 km of the project site (AECOM 2009).

Barred Cuckoo-shrike (*Coracina lineata*) is listed as Vulnerable under the TSC Act. It inhabits a wide range of habitats including rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses. This species is rare in NSW and would normally occur north of the study area. This species was not recorded during the survey but one previous record exists within 5 km of the project site (AECOM 2009).

Swift Parrot (*Lathamus discolor*) is listed as Endangered under the TSC Act. The Swift Parrot migrates to the Australian South East mainland between March and October to feed on winter flowering species such as Swamp Mahogany, Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*). They commonly use lerp infested trees including Grey Box (*E. macrocarpa*), Grey Box (*E. moluccana*) and Blackbutt (*E. pilularis*). This species was not recorded during the survey but two previous records exist within 5 km of the project site (AECOM 2009).

Square-tailed Kite (*Lophoictinia isura*) is listed as Vulnerable under the TSC Act. It is found in a variety of timbered habitats including dry woodlands and open forests especially along timbered watercourses. This kite's home range is estimated to occupy around 100 km2. This species was not recorded during the survey but one previous record exists within 5 km of the project site (AECOM 2009).

Hooded Robin (*Melanodryas cucullata*) is listed as Vulnerable under the TSC Act. It inhabits structurally diverse drier eucalypt woodlands, forests, scrubs with fallen timber. This species was not recorded during the survey but no previous records exist within 5 km of the project site (AECOM 2009).

Black-chinned Honeyeater (*Melithreptus gularis gularis*) is listed as Vulnerable under the TSC Act. It occurs in open forests and woodlands dominated by box and ironbark eucalypts generally west of the Great Dividing Range. This species was not recorded during the survey but two previous records exist within 5 km of the project site (AECOM 2009).

Turquoise Parrot (*Neophema pulchella*) is listed as Vulnerable under the TSC Act. It lives on the edge of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. This parrot

prefers to feed in the shade of a tree and spends majority of day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. This species was not recorded during the survey but four previous records exist within 5 km of the project site (AECOM 2009).

Speckled Warbler (*Pyrrholaemus saggitatus*) is listed as Vulnerable under the TSC Act. It inhabits Eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. This species was not recorded during the survey but five previous records exist within 5 km of the project site (AECOM 2009).

Diamond Firetail (*Stagonopleura guttata*) is listed as Vulnerable under the TSC Act. It occurs in open eucalypt forest, mallee and acacia scrubs. It is widely distributed in NSW although it is not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species was not recorded during the survey and no previous records exist within 5 km of the project site (AECOM 2009).

Regent Honeyeater (*Xanthomyza phrygia*) is listed as Endangered under the TSC Act. It inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak (*Casuarina cunninghamiana*). Regent Honeyeaters inhabit woodlands with a significantly high abundance of bird species. Potential habitats should have large numbers of mature trees, high canopy cover and abundance of mistletoes. This species was not recorded during the survey and no previous records exist within 5 km of the project site (AECOM 2009).

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

Around 4.78 ha in a 25 - 30 m wide strip of Eucalypt woodland would be cleared as a part of this proposal and some of this could potentially provide foraging and some roosting habitat for these woodland species. Removal of this amount of potential foraging habitat on the edge of cleared and disturbed habitat is unlikely to result in a viable local population of any of these species being placed at risk of extinction as this is a relatively small amount of habitat compared to that available in nearby areas to the east and west of the amended pipeline route.

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

Not an endangered population.

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

- **I. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not an endangered ecological community.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The removal of up to 4.78 ha of woodland, which may form foraging habitat for these species, may marginally reduce the amount of foraging habitat available. However, this is unlikely to substantially impact foraging resources for these species as significant resources occur nearby. It is unlikely that habitat connectivity for any of these woodland bird species would be disturbed as these species are highly mobile and construction for the ROW would only require removal of 25 - 30 m of vegetation, the majority of which is introduced grasslands. Furthermore, current disturbance regimes are not likely to be substantially altered from existing levels as the Stage 1 GFDA extension and amended pipeline route traverse agricultural land, powerline easements and mine sites. .

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

Critical habitat has not been declared for any of these species.

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

PAS have been prepared for all species. Provided that clearing of creek lines and wetland areas is kept to a minimum, the proposed development would not be inconsistent with any of the for any of the species provided as much native forest as possible is kept particularly along roads and watercourses and that pre-clearance surveys ensure that no trees containing nests of the Square-tailed Kite are removed during construction.

A national Regent Honeyeater (*Xanthomyza phrygia*) Recovery Plan 1999-2003 has been prepared (Menkhorst *et al.* 1999). This proposal would not be inconsistent with the six objectives of this plan. There are also 32 PAS designed to help this species recover (DECC 2009) and this proposal would also be in alignment with the envisaged outcomes of these.

A national Swift Parrot (*Lathamus discolor*) Recovery Plan 2001-2005 has been prepared by the Swift Parrot Recovery Team (Swift Parrot Recovery Team 2001). Of the six objectives, *Objective 3 Reduce the incidence of collision*, is the most relevant to this proposal. To ensure that this objective is met within this context, speed limits would be stringently enforced across of the work sites to lessen the risk of death or injury of any birds from collision with vehicles or machinery. There are also 10 PAS designed to help this species recover (DEC 2005a) and this proposal would also be in alignment with the envisaged outcomes of these.

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

Of the 31 key threatening processes identified in NSW three are of relevance and these are:

- Clearing of Native Vegetation. Around 4.78 ha of woodland habitat along the 26 km of amended pipeline route would be removed for this project. To minimise potential impacts clearing of native vegetation should be kept to a minimum;
- Loss of Hollow-bearing Trees. It is inevitable that hollow-bearing trees would be lost during clearing for this project. Consequently, the final survey line for the pipeline route should take into consideration the importance of hollow-bearing trees and the need for their retention; and
- Removal of dead wood and dead trees. Some stag trees may be removed during construction of this proposal. Consequently, the final survey line for the pipeline route should take into consideration the importance of stag trees as nesting and roosting sites for some bird species and hence the need for their retention.

Conclusion

It is considered unlikely that this proposal would result in significant impacts on these species as disturbance to any potential foraging and / or roosting habitat would be relatively minimal given the substantial resources available in the locality. The implementation of stringent environmental management measures during construction and operation would ensure that remaining vegetation and creeklines are protected and conserved and that no current nest trees for the Square-tailed Kite are removed.

Grey-crowned Babbler

Grey-crowned Babbler (GCB) (*Pomatostomus temporalis temporalis*) (eastern subspecies) is listed as Vulnerable under the TSC Act. This species is found throughout large parts of northern Australia and in south-eastern Australia. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Hay. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. This species is a laborious flyer so birds prefer to hop to the top of a tree and glide down to the next one. Birds are generally unable to cross large open areas. GCBs feed on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses (DEC 2005a).

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

The proposal would not directly impact on any known breeding or foraging areas of this species but given that this species is relatively common especially in the northern section of the project area indirect impacts may occur. The Grey-crowned Babbler appears to be relatively disturbance tolerant as this bird has been observed foraging and nesting in gardens, parks and small remnants, along fence boundaries and man-made structures near major roads (Parsons Brinckerhoff 2005). However, this species is a laborious flyer and is known to feed on the ground

placing it at risk of being struck by construction traffic which would increase temporarily during drilling operations. To avoid bird strike stringent traffic management should be implemented and traffic flow, vehicle speed and vehicle numbers entering and leaving the sites should be controlled.

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

Not an endangered population.

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

- **I. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not an endangered ecological community.

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

- **I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

Although the amended pipeline route and the Stage 1 GFDA extension are likely to provide foraging habitat from time to time, the removal of some of this habitat would not substantially further fragment or isolate habitat for this species as habitat is already patchily distributed. Furthermore, current disturbance regimes are not likely to be substantially altered from existing levels as the Stage 1 GFDA extension and amended pipeline route traverse agricultural land, powerline easements and mine sites.

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

There is no critical habitat listed for this species.

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

Although the Grey-crowned Babbler Retention Plan – Gloucester Shire Council (Parsons Brinckerhoff 2005) deals with potential family groups outside of the study area, several of the management measures are applicable to management of the GCB within the study area and these are:

- Habitat protection and maintenance: to maintain and protect woodland remnants that form part of a corridor network and other habitats that have potential for regeneration for the longer term benefit of the species; and
- Road and traffic management: prevent / reduce the incidence of collision of GCB with motor vehicles through the implementation of go slow areas and increasing public awareness through signage.

A Construction Environment Management Plan would ensure that vegetated areas are protected, through fencing where appropriate and education of personnel to raise awareness of the importance of this species. Stringent traffic management would also be implemented to ensure that the incidence of collision does not increase due to the increase of traffic and it will address such matters as traffic numbers, traffic speed and traffic flow.

DECC have also identified five strategies to help recover the species (DEC 2005a) and these include community and land-holder awareness, development and implementation of protocols and guidelines, habitat rehabilitation / restoration, research and survey / mapping and habitat assessment. None of the actions of this proposal are inconsistent with any of the strategies or actions outlined in the PAS.

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

Of the 31 key threatening processes identified in NSW one is of relevance:

- Clearing of Native Vegetation. Around 4.78 ha of woodland habitat along 26 km of amended pipeline route would be removed for this project. To minimise potential impacts clearing of native vegetation should be kept to a minimum.

Conclusion

This proposal is unlikely to have a significant impact on foraging resources given that resources of equal or higher quality are available within the locality. The implementation of stringent environmental management measures during construction and operation would ensure that remaining vegetation is protected and conserved and stringent traffic management is enforced.

Cockatoos

Gang-gang Cockatoo (*Callocephalon fimbriatum*) is listed as Vulnerable under the TSC Act. In summer it is found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter it moves to lower altitudes in drier more open eucalypt forests and woodlands, and is often found in urban areas (DEC 2005a). This species was not recorded during the survey but two previous records exist within 5 km of the project site (AECOM 2009).

Glossy Black-cockatoo (*Calyptorhynchus lathami*) is listed as Vulnerable under the TSC Act. It inhabits open forest and woodlands and feeds on Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*). It requires large vertical hollows for nesting (DEC 2005a). This species was not recorded during the survey but eight previous records exist within 5 km of the project site (AECOM 2009).

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

Around 4.78 ha in a linear strip of Eucalypt woodland and riparian area would be cleared as a part of this proposal and this could potentially provide foraging habitat for these species as the majority of the wooded areas of the amended pipeline route comprised eucalypt woodland and Forest Oak, a preferred feed tree for the Glossy Black-cockatoo was recorded along some sections of the amended pipeline. Removal of this amount of potential foraging habitat on the edge of cleared and disturbed habitat is unlikely to result in a viable local population of any of these species being placed at risk of extinction as this is a relatively small amount of habitat compared to that available in nearby areas to the east and west of the amended pipeline route. Pre-clearance surveys for potential nest trees of the Glossy Black-cockatoo should be undertaken to ensure none are removed.

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

Not an endangered population.

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

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

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not an endangered ecological community.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The removal of up to 4.78 ha of woodland, which may form foraging habitat for these species, may marginally reduce the amount of foraging habitat available. However, this is unlikely to substantially impact foraging resources for these species as significant resources occur nearby. It is unlikely that habitat connectivity for any of these woodland bird species would be disturbed as these species are highly mobile and construction for the ROW would only require removal of 25 - 30 m of vegetation, the majority of which is introduced grasslands. Furthermore, current disturbance regimes are not likely to be substantially altered from existing levels as the Stage 1 GFDA extension and amended pipeline route traverse agricultural land, powerline easements and mine sites. .

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

Critical habitat has not been declared for either of these species.

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

There is currently no recovery plan or threat abatement plan for either of these species although PAS have been prepared . Provided that clearing of creek lines and wetland areas is kept to a minimum, the proposed development will not be inconsistent with any of the priority action statements.

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

Of the 31 key threatening processes identified in NSW three are of relevance and these are:

- Clearing of Native Vegetation. Around 4.78 ha of woodland habitat along the 26 km of amended pipeline route would be removed for this project. To minimise potential impacts clearing of native vegetation should be kept to a minimum;
- Loss of Hollow-bearing Trees. It is inevitable that hollow-bearing trees would be lost during clearing for this project. Consequently, the final survey line for the pipeline route should take into consideration the importance of hollow-bearing trees and the need for their retention and any potential nest trees for the Glossy Black-cockatoo should be retained; and
- Removal of dead wood and dead trees. Some stag trees may be removed during construction of this proposal. Consequently, the final survey line for the pipeline route should take into consideration the importance of stag trees as nesting and roosting sites for some bat species and hence the need for their retention.

Conclusion

It is considered unlikely that this proposal would result in significant impacts on these species as disturbance to any potential foraging habitat would be relatively minimal given the substantial resources available in the locality. The implementation of stringent environmental management measures during construction and operation would ensure that remaining vegetation and creeklines are protected and conserved and that no potential nest trees for the Glossy Black-cockatoo are removed.

Owls

Species information: DEC 2005a (Threatened Species Profiles), Pizzey and Knight 2001

The Grass Owl (*Tyto capensis*) is listed as Vulnerable under the TSC Act. Grass Owls have been recorded occasionally in all mainland states of Australia but appear to be more commonly recorded in northern and north-eastern Australia. In NSW they are more likely to be found in the north-east. Grass Owl numbers often increase when rodent numbers increase. They are found in areas of tall grass, including grass tussocks in swampy areas, grassy plains, swampy heath, and cane grass, or sedges on flood plains. They rest by day in a 'form' - a trampled platform in a large tussock or other heavy growth. They also nest in trodden-down grass.

The Barking Owl (*Ninox connivens*) is listed as Vulnerable under the TSC Act. It forages throughout woodlands, grassy woodlands, forests and into grasslands for about 250 m. It breeds in hollow-bearing trees with hollows >20 cm diameter. This species was not recorded during the survey but three previous records exist within 5 km of the project site (AECOM 2009).

The Powerful Owl (*Ninox strenua*) is listed as Vulnerable under the TSC Act. It inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It roosts in dense vegetation comprising species such as Turpentine, Black She-oak, Blackwood, Rough-barked Apple, Cherry Ballart and a number of eucalypt species and nests in large hollows in unlogged forests. The home range of a pair ranges from 300 - 1,500 ha depending on habitat type. This species was not recorded during the survey but 11 previous records exist within 5 km of the project site (AECOM 2009).

The Masked Owl (*Tyto novaehollandiae*) is listed as Vulnerable under the TSC Act. It occurs in dry eucalypt forests and woodlands. A pair's home-range is estimated to range between 500 to 1,000 ha. This owl roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. This species was not recorded during the survey but two previous records exist within 5 km of the project site (AECOM 2009).

The Sooty Owl (*Tyto tenebricosa*) is listed as Vulnerable under the TSC Act. It occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. This owl roosts by day in the hollow of a tall forest tree or in heavy vegetation. This species was not recorded during the survey and no previous records exist within 5 km of the project site (AECOM 2009).

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

Around 4.78 ha in a 23 - 30 m wide strip of eucalypt woodland would be cleared as a part of this proposal and this could potentially provide at least foraging habitat for all of the owls except the Grass Owl. Removal of this amount of potential foraging habitat is unlikely to result in a viable local population of any of these species being placed at risk of extinction as this is a relatively small amount of habitat compared to that available in nearby areas to the east and west of the amended pipeline route.

For the Grass Owl disturbance to grassed and tussocky areas within paddocks would be minimal and temporary. Substantial areas of foraging and nesting habitat would remain within the locality and consequently it is unlikely that this species would be adversely affected or placed at the risk of extinction as a consequence of this proposal.

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

Not an endangered population.

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

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

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not an endangered ecological community.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposal is such that the removal of habitat would be within a 25 to 30 m wide strip which although may fragment habitat for less mobile species it is unlikely to disrupt local populations of these owls. The proposal would only temporarily disrupt potential habitat for the Grass Owl as paddocks areas would be revegetated after laying of the pipeline.

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

Critical habitat has not been declared for any of these species.

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

A draft recovery plan for the Barking Owl (NPWS 2003a) has been prepared. It contains five objectives. Of relevance is Objective 3 which requires the undertaking of threat abatement and mitigation, and requires the protection of habitat and especially large hollow-bearing trees. This proposal may remove some potential habitat but is unlikely to remove nesting habitat due to the already modified nature of the woodlands and forests. There are also seven PAS designed to help recover this species (DEC 2005a). This proposal is not inconsistent with any of them.

A recovery plan for the Powerful Owl has been produced (DEC 2006). Removal of some foraging and habitat for this proposal would be inconsistent with Objective 4 which states *Manage and protect habitat off reserves and state forests*. However, although this proposal may remove some potential habitat it is unlikely to remove nesting habitat due to the already modified nature of the woodlands and forests.

A recovery plan for the Masked Owl has been prepared (DEC 2006). Removal of some foraging and habitat for this proposal would be inconsistent with Objective 4 which states *Manage and protect habitat off reserves and state forests*. However, although this proposal may remove some potential habitat it is unlikely to remove nesting habitat due to the already modified nature of the woodlands and forests.

A recovery plan for the Sooty Owl has been prepared (DEC, 2006). Removal of some foraging and habitat for this proposal would be inconsistent with Objective 4 which states *Manage and protect habitat off reserves and state forests*. However, although this proposal may remove some potential habitat it is unlikely to remove nesting habitat due to the already modified nature of the woodlands and forests and the primary habitat of the Sooty Owl, which is sheltered gullies, would not be directly impacted.

There has not been a recovery plan or threat abatement plan prepared for the Grass Owl. Five PAS have been prepared for the Grass Owl and this proposal would not be inconsistent with any of the objectives of these PAS (DEC 2005a).

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

Of the 31 key threatening processes identified in NSW three are of relevance and these are:

- Clearing of Native Vegetation. Around 4.78 ha of woodland habitat along the 26 km of amended pipeline route would be removed for this project. To minimise potential impacts clearing of native vegetation should be kept to a minimum;
- Loss of Hollow-bearing Trees. It is inevitable that hollow-bearing trees would be lost during clearing for this project. Consequently, the final survey line for the pipeline route should take into consideration the importance of hollow-bearing trees and the need for their retention; and
- Removal of dead wood and dead trees. Dead wood and some stag trees may be removed during construction of this proposal. It is recommended that deadwood be moved aside during construction and then replaced in a haphazard manner once the pipeline has been backfilled and restoration undertaken.

Conclusion

It is considered unlikely that this proposal would result in significant impacts on these species as disturbance to any potential foraging habitat would be relatively minimal. It is considered unlikely that roosting habitat for any of the woodland species of owl would be significantly altered as much of the woodland and forests along the amended pipeline route are currently degraded and suffer from edge effects. Grass Owl habitat would only be disrupted temporarily as the pasture sites would be returned to their current condition.

Arboreal Mammals

Species information: DEC 2005a (Threatened Species Profiles)

Squirrel Glider (*Petaurus norfolcensis*) is listed as Vulnerable under the TSC Act. It inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest with heath understorey in coastal areas and it prefers mixed species stands with a shrub or *Acacia* midstorey. The Squirrel Glider requires abundant tree hollows for refuge and nest sites. This arboreal species has estimated home ranges of 0.65 to 8.55 ha. This species was not recorded during the survey but 12 previous records exist within 5 km of the project site (AECOM 2009).

Eastern Pygmy-possum (*Cercartetus nanus*) is listed as Vulnerable under the TSC Act. It inhabits a range of habitats including rainforest, sclerophyll forest and woodland to heath, with a preference for

heath and woodland. It forages on banksias, eucalypts and callistemon. This species was not recorded during the survey and no previous records exist within 5 km of the project site (AECOM 2009).

Yellow-bellied Glider (*Petaurus australis*) is listed as Vulnerable under the TSC Act. It occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soil. Family groups occupy home ranges of between 20 ha and 85 ha. This species was not recorded during the survey but one previous record exists from the larger pipeline area (AECOM 2009).

Koala (*Phascolarctos cinereus*) is listed as Vulnerable under the TSC Act. The Koala is patchily distributed in NSW. Koalas have been observed to feed on the leaves of approximately 70 species of eucalypt and 30 non-eucalypt species. However, in any one area, Koalas will feed almost exclusively on a small number of preferred species. This species was not recorded during the survey but 281 previous records exist from the 5 km of the project area (AECOM 2009).

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

Around 4.78 ha in a 25 - 30 m wide strip of eucalypt woodland would be cleared as a part of this proposal and this could potentially provide foraging habitat for these species as the majority of the wooded areas of the amended pipeline route comprised eucalypt woodland. Removal of this amount of potential foraging habitat on the edge of cleared and disturbed habitat is unlikely to result in a viable local population of any of these species being placed at risk of extinction as this is a relatively small amount of habitat compared to that available in nearby areas to the east and west of the amended pipeline route.

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

Not an endangered population.

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

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

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not an endangered ecological community.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The removal of up to 4.78 ha of woodland, which may form foraging habitat for these species, may slightly reduce the amount of foraging habitat available. However, this is unlikely to substantially impact foraging resources for these species as significant resources occur nearby. It is unlikely that habitat connectivity for any of these arboreal mammals would be disturbed as these species are mobile and construction for the ROW would only require removal of 25 - 30 m of vegetation, the majority of which is introduced grasslands. Furthermore, current disturbance regimes are not likely to be substantially altered from existing levels as the Stage 1 GFDA Extension and amended pipeline route traverse agricultural land, powerline easements and mine sites. .

Areas which have been mapped as 'Preferred' Koala Habitat along Deadmans Creek in the Port Stephens Council Comprehensive Koala Plan of Management (Port Stephens Council 2002) would be underbored to protect the integrity of these areas.

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

Critical habitat has not been declared for any of these species.

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

A recovery plan for the Yellow-bellied Glider has been prepared (NPWS 2003b). Of the five objectives only Objective 2 would be inconsistent with the outcomes of this project as this objective aims 'To encourage and assist in improving the protection and management of the Yellow-bellied Glider and its habitat'. Small areas of potential habitat for this species would be lost as a consequence of this proposal. Whilst specific feed trees were not recorded within these areas there is the potential that some of this area could form part of the home range of a family group. Therefore it is important to retain as much habitat for this species as possible including hollow-bearing trees.

Whilst a recovery plan has not been prepared for the Squirrel Glider there are nine PAS to assist in the recovery of this species (DEC 2005a). Two of the objectives address the retention of hollow-bearing trees. Therefore, the retention of hollow-bearing trees should be given high priority in areas of potential habitat along the amended pipeline route.

A recovery plan has been prepared for the Koala (DECC 2008b). It details seven objectives to assist with the recovery of the species. The proposal is not inconsistent with the stated outcomes of these objectives especially given that areas which have been mapped as 'Preferred' Koala Habitat along Deadmans Creek in the Port Stephens Council Comprehensive Koala Plan of Management (Port Stephens Council 2002) would be underbored to protect the integrity of these

areas. Other habitat along the amended pipeline route is marginal as much of it is already fragmented and isolated from larger tracts of wilderness.

Whilst a recovery plan has not been prepared for the Eastern Pygmy Possum there are seven PAS to assist in the recovery of this species (DEC 2005a). Two of the objectives address the retention of hollow-bearing trees. Therefore, the retention of hollow-bearing trees should be given high priority in areas of potential habitat along the amended pipeline route.

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

Of the 31 key threatening processes identified in NSW three are of relevance and these are:

- Clearing of Native Vegetation. Around 4.78 ha of woodland habitat along the 26 km of amended pipeline route would be removed for this project. To minimise potential impacts clearing of native vegetation should be kept to a minimum;
- Loss of Hollow-bearing Trees. It is inevitable that hollow-bearing trees would be lost during clearing for this project. Consequently, the final survey line for the pipeline route should take into consideration the importance of hollow-bearing trees and as many retained as is possible; and
- Removal of dead wood and dead trees. Some stag trees may be removed during construction of this proposal. Consequently, the final survey line for the pipeline route should take into consideration the importance of stag trees as potential denning sites for these species and hence the need for their retention.

Conclusion

It is considered unlikely that this proposal would result in significant impacts on these species as disturbance to any potential foraging habitat would be relatively minimal given the substantial resources available in the locality. The implementation of stringent environmental management measures during construction and operation would ensure that remaining vegetation and creeklines are protected and conserved and that as many hollow-bearing trees as possible are retained.

Ground-dwelling Mammals

Species information: DEC 2005a (Threatened Species Profiles)

Parma Wallaby (*Macropus parma*) is listed as Vulnerable under the TSC Act. It prefers moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. It was once widespread in southern NSW but now it is confined to the coast and ranges of central and northern NSW. This species was not recorded during the survey but three previous records exist from the 5 km of the project area (AECOM 2009).

Long-nosed Potoroo (*Potorous tridactylus tridactylus*) is listed as Vulnerable under the TSC Act. This potoroo inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of Tea-trees or *Melaleucas*. A sandy loam soil is also a common feature. This species was not recorded during the survey and no previous records exist within 5 km of the project site (AECOM 2009).

Brush-tailed Phascogale (*Phascogale tapoatafa*) is listed as Vulnerable under the TSC Act. It prefers dry sclerophyll open forest with sparse groundcover but is also found in heath, swamps, rainforest and wet sclerophyll forest. This species was not recorded during the survey but 30 previous records exist from the 5 km of the project area (AECOM 2009).

Spotted-tailed Quoll (*Dasyurus maculatus maculatus*) is listed as Vulnerable under the TSC Act. It has been recorded across a range of habitat types, including 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. This species was not recorded during the survey but 39 previous records exist from the 5 km of the project area (AECOM 2009).

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

Around 4.78 ha in a 25 - 30 m wide strip of Eucalypt woodland would be cleared as a part of this proposal and this could potentially provide foraging and nesting habitat for these species. Removal of this amount of potential habitat on the edge of cleared and disturbed habitat is unlikely to result in a viable local population of any of these species being placed at risk of extinction as this is a relatively small amount of habitat compared to that available in nearby areas to the east and west of the amended pipeline route.

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

Not an endangered population.

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

- **I. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not an endangered ecological community.

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

- **I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The removal of up to 4.78 ha of woodland, which may form foraging habitat for these species, may slightly reduce the amount of foraging habitat available. However, this is unlikely to substantially impact foraging resources for these species as significant resources occur nearby.

It is unlikely that habitat connectivity for any of these arboreal mammals would be disturbed as these species are mobile and construction for the ROW would only require removal of 25 - 30 m of vegetation, the majority of which is introduced grasslands. Furthermore, current disturbance regimes are not likely to be substantially altered from existing levels as the Stage 1 GFDA extension and amended pipeline route traverse agricultural land, powerline easements and mine sites. .

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

Critical habitat has not been declared for any of these species.

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

A recovery plan has not been prepared for the Long-nosed Potoroo. There are 19 PAS actions that have been identified to help recover this species (DEC 2005a). Of particular importance is the clearing of dense understorey as this provides preferred habitat. Habitat along the amended pipeline route is marginal for this species especially given the larger tracts of native vegetation within the locality. Protection and retention of vegetation along creeklines is a priority of this proposal and hence any potential habitat would be protected.

A recovery plan has not been prepared for the Brush-tailed Phascogale. However, there are seven PAS that have been identified to help recover this species (DEC 2005a). Of particular importance is the control of feral animals within this species habitat. Whilst the construction of another easement through this area is likely to marginally increase the ability of the European Red Fox to move through the landscape, the Construction Environmental Management Plan for this project would set out stringent management measures to ensure that the European Red Fox is not attracted to the construction sites to scrounge for food scraps.

A recovery plan has not been prepared for the Spotted-tailed Quoll. However, there are 32 PAS that have been identified to help recover this species (DEC 2005a). Provided that vegetation clearance is kept to a minimum the proposal would not be inconsistent with any of the priority action statements.

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

Of the 31 key threatening processes identified in NSW two are of relevance and these are:

- Clearing of Native Vegetation. Around 4.78 ha of woodland habitat along the 26 km of amended pipeline route would be removed for this project. To minimise potential impacts clearing of native vegetation should be kept to a minimum; and
- Removal of dead wood and dead trees. Dead wood may be temporarily displaced during construction of the amended pipeline route. After backfilling and fallen timber would be replaced haphazardly.

Conclusion

It is considered unlikely that this proposal would result in significant impacts on these species as disturbance to any potential foraging habitat would be relatively minimal given the substantial resources available in the locality. The implementation of stringent environmental management measures during construction and operation would ensure that remaining vegetation and creeklines are protected and conserved and that as many hollow-bearing trees as possible are retained.

Microchiropteran Bats

Species information: DEC 2005a (Threatened Species Profiles)

Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) is listed as Vulnerable under the TSC Act. It prefers moist habitats with trees larger than 20 m. It roosts in hollows in trees or under bark or in buildings. This species was not recorded during the survey and no previous records exist within 5 km of the project site (AECOM 2009).

Little Bentwing-bat (*Miniopterus australis)* is listed as Vulnerable under the TSC Act. It is found in well timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. It is known to roost in caves. This species was not recorded during the survey but 14 previous records exist from the 5 km of the project area (AECOM 2009).

Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) is listed as Vulnerable under the TSC Act. It roosts in caves, derelict mines, stormwater tunnels and buildings and is known to forage in forested areas. This species was not recorded during the survey but 14 previous records exist from the 5 km of the project area (AECOM 2009).

Eastern Freetail-bat (*Mormopterus norfolkensis*) is listed as Vulnerable under the TSC Act. It forages in dry sclerophyll forest and woodland and roosts in hollows and under bark or man-made structures. This species was not recorded during the survey but 10 previous records exist from the 5 km of the project area (AECOM 2009).

Large-footed Myotis (*Myotis macropus*) is listed as Vulnerable under the TSC Act. They generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. It forages over streams and pools catching insects and small fish by raking their feet across the water surface. This species was not recorded during the survey but 10 previous records exist from the 5 km of the project area (AECOM 2009).

Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) is listed as Vulnerable under the TSC Act. It roosts singly or in groups of up to six, in hollow-bearing trees and buildings but will use mammal burrows. It forages in most habitats across areas with and without trees and appears to defend an aerial territory. This species was not recorded during the survey but two previous records exist from the 5 km of the project area (AECOM 2009).

Greater Broad-nosed Bat (*Scoteanax rueppellii)* is listed as Vulnerable under the TSC Act. It occurs in woodland, moist and dry eucalypt forest and rainforest but prefers tall wet forest. It roosts in tree hollows but also buildings. This species was not recorded during the survey but seven previous records exist from the 5 km of the project area (AECOM 2009).

Large-eared Pied Bat (*Chalinolobus dwyeri)* is listed as Vulnerable under the TSC Act. It roosts near the entrance of caves, crevices in cliffs, derelict mines and in the disused, bottle-shaped mud nests of the Fairy Martin frequenting low to mid-elevation dry open forest and woodland close to these features. This species was not recorded during the survey but one previous record exists from the 5 km of the project area (AECOM 2009).

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

Around 4.78 ha in a 25 - 30 m wide strip of Eucalypt woodland would be cleared as a part of this proposal and this could potentially provide foraging and some roosting habitat for these species. Removal of this amount of potential habitat on the edge of cleared and disturbed habitat is unlikely to result in a viable local population of any of these species being placed at risk of extinction as this is a relatively small amount of habitat compared to that available in nearby areas to the east and west of the amended pipeline route.

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

Not an endangered population.

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

- **I. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not an endangered ecological community.

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

- **I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The removal of up to 4.78 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. 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 25 - 30 m of vegetation, the majority of which is introduced grasslands. Furthermore, current disturbance regimes are not likely to be substantially altered from existing levels as the Stage 1 GFDA extension and amended pipeline route traverse agricultural land, powerline easements and mine sites. .

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

Critical habitat has not been declared for any of these species.

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

There are currently no recovery plans or threat abatements plans which have been prepared for any of these microchiropteran bat species. However, PAS have been issued to help recover these species (DEC 2005a). Of importance for all species is the requirement to ensure the largest hollow-bearing trees, including dead trees and paddock trees are given highest priority for retention during land assessments. Consequently, the final survey line for the pipeline route should take into consideration the importance of hollow-bearing trees and the need for their retention.

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

Of the 31 key threatening processes identified in NSW three are of relevance and these are:

- Clearing of Native Vegetation. Around 4.78 ha of woodland habitat along the 26 km of amended pipeline route would be removed for this project. To minimise potential impacts clearing of native vegetation should be kept to a minimum;
- Loss of Hollow-bearing Trees. It is inevitable that hollow-bearing trees would be lost during clearing for this project. Consequently, the final survey line for the pipeline route should take into consideration the importance of hollow-bearing trees and the need for their retention; and
- Removal of dead wood and dead trees. Some stag trees may be removed during construction of this proposal. Consequently, the final survey line for the pipeline route should take into consideration the importance of stag trees as nesting and roosting sites for some bat species and hence the need for their retention.

Conclusion

It is considered unlikely that this proposal would result in significant impacts on these species as disturbance to any potential foraging and / or roosting habitat would be relatively minimal given the substantial resources available in the locality. The implementation of stringent environmental management measures during construction and operation would ensure that remaining vegetation and creeklines are protected and conserved.

Megachiropteran Bat

The Grey-headed Flying-fox (GHFF, *Pteropus poliocephalus*) is listed as vulnerable under the TSC Act and EPBC Act. It roosts in camps generally located within 20 km of a regular food source and are commonly found in gullies, close to water and in vegetation with a dense canopy. This species feeds on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia*, and fruits of rainforest trees and vines in areas supporting subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops (DEC 2005a).

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

Around 4.78 ha in a 25 - 30 m wide strip of eucalypt woodland would be cleared as a part of this proposal and this could potentially provide foraging and nesting habitat for these species. Removal of this amount of potential habitat on the edge of cleared and disturbed habitat is unlikely to result in a viable local population of any of these species being placed at risk of extinction as this is a relatively small amount of habitat compared to that available in nearby areas to the east and west of the amended pipeline route.

The amended pipeline route and the Stage 1 GFDA extension provides potential foraging habitat for the Grey-headed Flying-fox but does not contain a camp site and consequently it is unlikely that this proposal would adversely affect the life cycle of this species as no breeding habitat would be removed or modified. The area of vegetation to be removed is relatively small and furthermore, foraging habitat of equal quality is located nearby. Consequently it is unlikely that the proposed vegetation clearance would result in isolation of habitat as the GHFF is highly mobile. Therefore it is unlikely that the proposal would place a local population of this species at risk of extinction.

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

Not an endangered population.

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

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

II. Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not an endangered ecological community.

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

I. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

II. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

III. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Although the amended pipeline route and the Stage 1 GFDA extension are likely to provide foraging habitat from time to time, the removal of some of this habitat would not substantially further fragment or isolate habitat for this species as habitat is already patchily distributed. Furthermore the site does not provide breeding habitat for this species and therefore removal of some habitat is unlikely to interfere with the long-term survival of this species especially as habitat of equal quality is provided in neighbouring areas. Furthermore, current disturbance regimes are not likely to be substantially altered from existing levels as the Stage 1 GFDA extension and amended pipeline route traverse agricultural land, powerline easements and mine sites.

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

Critical habitat has not been declared for this species.

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

DECC has not prepared a recovery plan or threat abatement plan for this species. However, 10 PAS have been developed (DEC 2005a). Of particular relevance to this proposal is the retention of foraging resources over the species range. Whilst this proposal would remove a small amount of foraging habitat it is unlikely to significantly impact the recovery of this species due to the higher quality resources available in the locality. Consequently, this proposal is unlikely to impede the implementation of any of these priority actions.

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

Of the 31 key threatening processes identified in NSW one is of relevance:

- Clearing of Native Vegetation. Around 4.78 ha of woodland habitat along the 26 km of amended pipeline route would be removed for this project. To minimise potential impacts clearing of native vegetation should be kept to a minimum.

Conclusion

This proposal would not impact on any known breeding habitat for this species and it is unlikely to have a significant impact on foraging resources given that resources of equal or higher quality are available within the locality. The implementation of stringent environmental management measures during construction and operation would ensure that remaining vegetation and creeklines are protected and conserved and that as many hollow-bearing trees as possible are retained.

APPENDIX D

SITE PHOTOGRAPHS

Plate 1 Gas Field Development Area – typical view

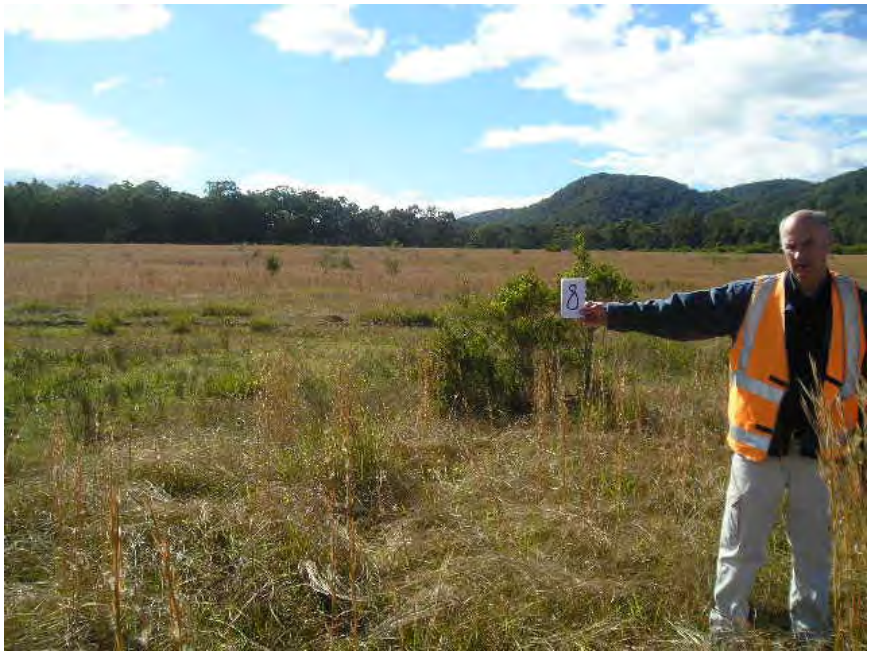


Plate 2 Typical view of paddock habitat (KP 18.5)

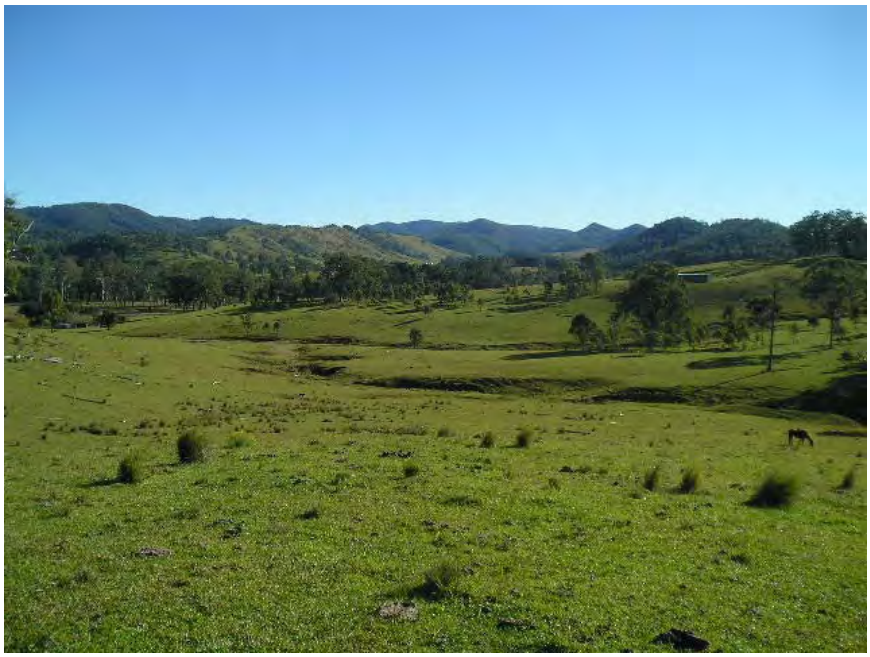


Plate 3 Pipeline route through *Corymbia maculata* and *Eucalyptus crebra* at KP 19

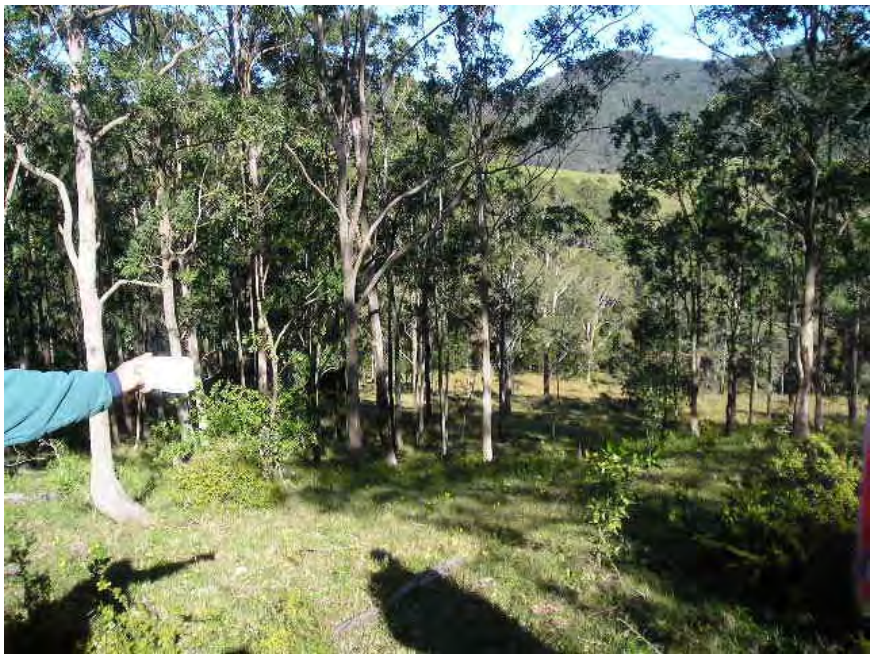


Plate 4 Cattle camp at KP 24.2

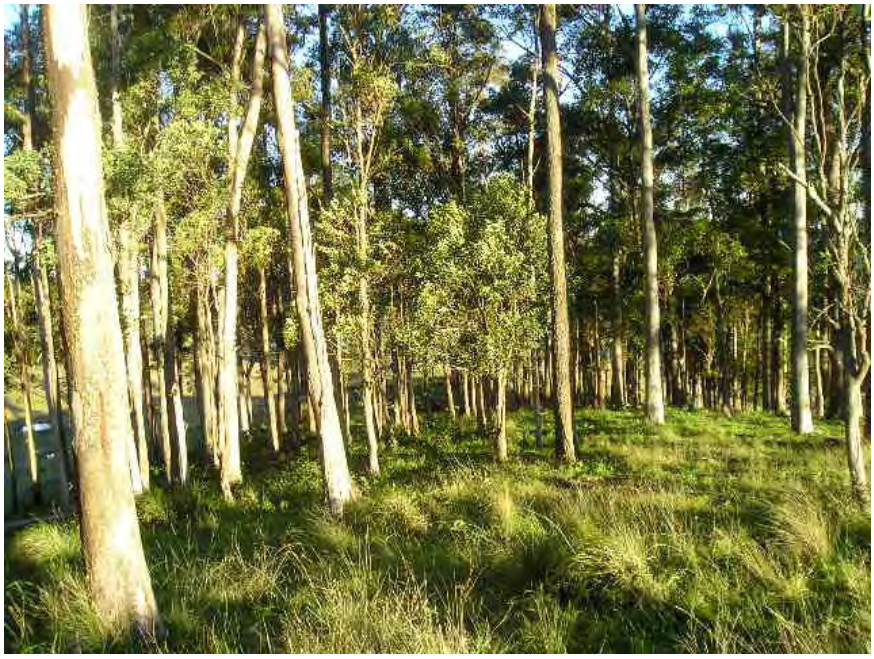


Plate 5 Powerline easement at KP 71.5 and 73.8

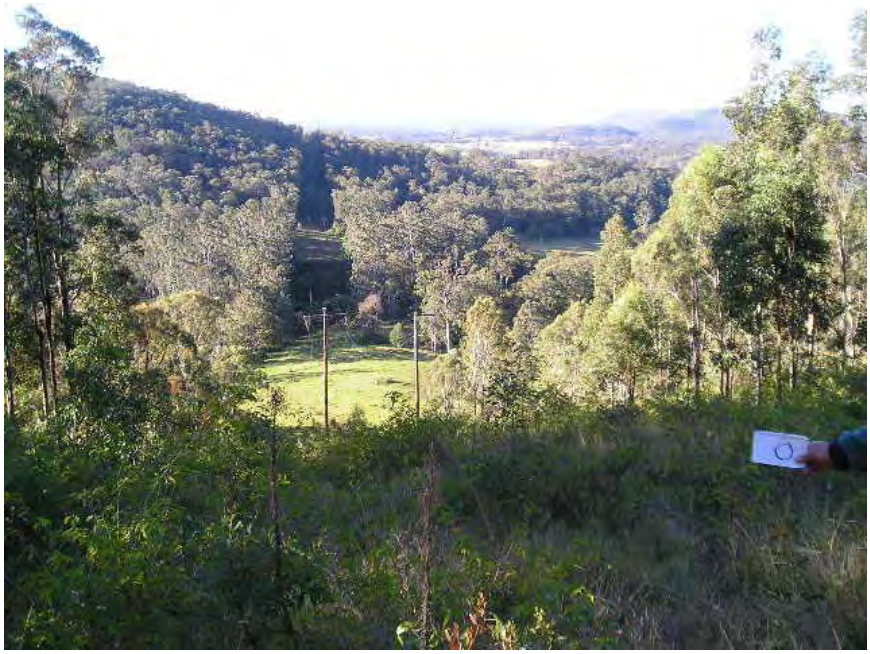


Plate 6 Hunter Lowland Redgum Forest (EEC) at KP 76.

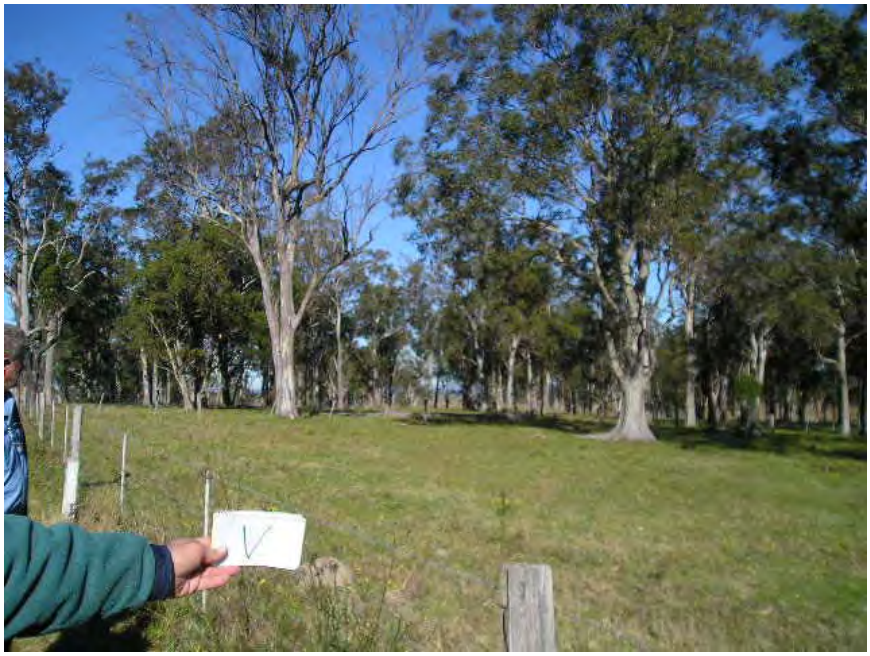
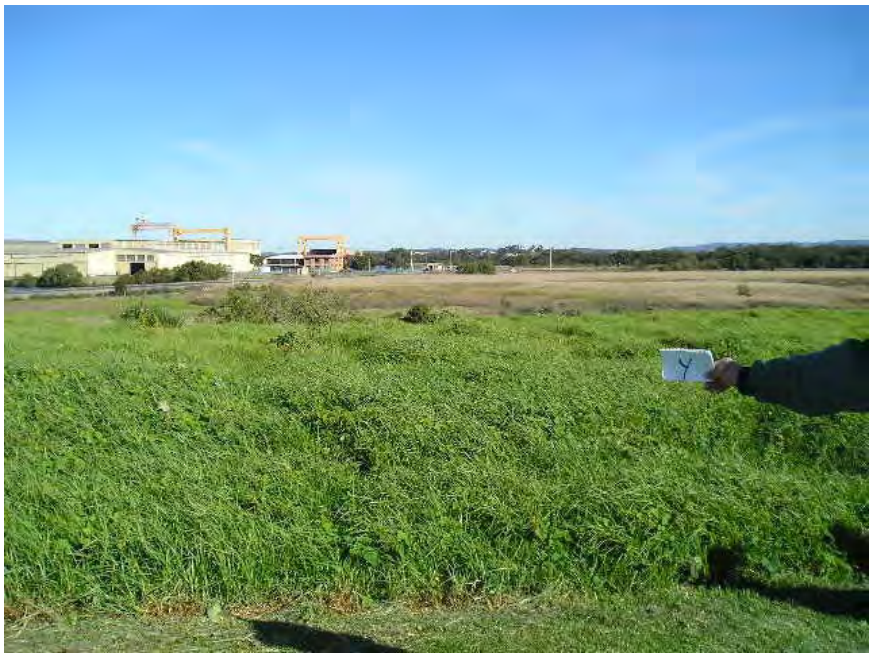


Plate 7 View of SEPP 14 Wetland from caravan Park



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