Appendix A

Species of plant recorded within the study area

Appendix A: Species of plant recorded within the study area

This appendix lists the species of plant recorded within the study area by Parsons Brinckerhoff (2008).

Class Name	Scientific Name	Common Name	Native
Acanthaceae			
	Brunoniella australis	Blue Trumpet	Y
Adiantaceae			
	Cheilanthes distans	Bristly Cloak Fern	Y
	Cheilanthes sieberi ssp. sieberi		Y
Aizoaceae			
	Galenia pubescens	Galenia	N
Amaranthaceae			
	Alternanthera denticulata	Lesser Joyweed	Y
	Alternanthera pungens	Khaki Weed	N
Anacardiaceae			
	Schinus areira	Pepper Tree	N
Anthericaceae			
	Laxmannia gracilis		Y
Apiaceae			
	Centella asiatica	Pennywort	Y
	Foeniculum vulgare	Fennel	N
	Hydrocotyle laxiflora	Stinking Pennywort	Y
Asclepiadaceae			
	Gomphocarpus fruticosus	Narrow-leaved Cotton Bush	N
Asteraceae			
	Ambrosia artemisiifolia	Annual Ragweed	N
	Arctotheca calendula	Capeweed	N
	Bidens pilosa	Cobbler's Pegs	N
	Calotis cuneifolia	Purple Burr-Daisy	Y
	Calotis lappulacea	Yellow Burr-daisy	Y
	Carthamus lanatus	Saffron Thistle	N
	Cassinia quinquefaria		Y
	Cassinia uncata	Sticky Cassinia	Y
	Chrysocephalum apiculatum	Common Everlasting	Y
	Cirsium vulgare	Spear Thistle	N
	Conyza albida	Tall Fleabane	N
	Conyza bonariensis	Flaxleaf Fleabane	N
	Gamochaeta americana	American Cudweed	N
	Glossogyne tannensis	Cobbler's Tack	Y

Class Name	Scientific Name	Common Name	Native
	Gnaphalium involucratum		Y
	Hypochaeris radicata	Catsear	N
	Lactuca serriola	Prickly Lettuce	N
	Ozothamnus diosmifolius	White Dogwood	Y
	Senecio madagascariensis	Fireweed	N
	Tagetes minuta	Stinking Roger	N
	Vittadinia cuneata	Fuzzweed	Y
	Xanthium occidentale	"Noogoora Burr, Cockle Burr"	N
Bignoniaceae			
	Pandorea pandorana	Wonga Wonga Vine	Y
Boraginaceae			
	Heliotropium amplexicaule	Blue Heliotrope	N
Brassicaceae			
	Brassica sp.		N
	Capsella bursa-pastoris		N
Cactaceae			
	Opuntia aurantiaca	Tiger Pear	N
	Opuntia stricta	Prickly Pear	N
Campanulaceae			
	Wahlenbergia communis	Tufted Bluebell	Y
	Wahlenbergia gracilis	Sprawling or Australian Bluebell	Y
Caryophyllaceae			
	Petrorhagia velutina		N
Casuarinaceae			
	Allocasuarina littoralis	Black Sheoak	Y
	Allocasuarina luehmannii	Bulloak	Y
	Casuarina cunninghamiana ssp. cunninghamiana	"River Oak, River Sheoak"	Y
	Casuarina glauca	Swamp Oak	Y
Chenopodiaceae			
Chloanthaceae			
	Spartothamnella juncea		Y
Clusiaceae			
	Hypericum gramineum	Small St John's Wort	Y
Convolvulaceae			
	Convolvulus erubescens		Y
	Dichondra repens	Kidney Weed	Y

Class Name	Scientific Name	Common Name	Native
Crassulaceae			
	Crassula sieberiana	Australian Stonecrop	Y
Cyperaceae			
	Cyperus gracilis		Y
	Cyperus sp.		Y
	Fimbristylis dichotoma		Y
	Schoenus apogon	Fluke Bogrush	Y
Dilleniaceae			
	Hibbertia obtusifolia		Y
Euphorbiaceae			
	Chamaesyce drummondii	Caustic Weed	Y
	Chamaesyce prostrata	Red Caustic Weed	N
	Phyllanthus hirtellus	Thyme Spurge	Y
	Phyllanthus virgatus		Y
	Ricinus communis	Castor Oil Plant	N
Fabaceae			
	Melilotus sp.		N
Fabaceae (Caesalpinioideae)			
	Senna barclayana	Smooth Senna	Y
Fabaceae (Faboideae)			
	Daviesia ulicifolia ssp. stenophylla		Y
	Desmodium varians	Slender Tick-trefoil	Y
	Glycine clandestina		Y
	Glycine tabacina		Y
	Hardenbergia violacea	False Sarsaparilla	Y
	Indigofera australis		Y
	Medicago sp.		Y
	Pultenaea microphylla		Y
	Trifolium repens	White Clover	N
Fabaceae (Mimosoideae)			
	Acacia cultriformis	Knife-leaved Wattle	Y
	Acacia decora	Western Golden Wattle	Y
	Acacia falcata		Y
	Acacia falciformis	Broad-leaved Hickory	Y
	Acacia gunnii	Ploughshare Wattle	Y
	Acacia longifolia	Sydney Golden Wattle	Y
	Acacia paradoxa	Kangaroo Thorn	Y
	Acacia parvipinnula	Silver-stemmed Wattle	Y

Class Name	Scientific Name	Common Name	Native
	Acacia podalyriifolia	Queensland Silver Wattle	Y
	Acacia salicina	Cooba	Y
	Acacia spectabilis	Mudgee Wattle	Y
	Vachellii farnesiana	Mimosa Bush	Y
Geraniaceae			
	Erodium crinitum	Blue Storksbill	Y
	Geranium molle		N
	Geranium solanderi var. solanderi		Y
	Pelargonium inodorum		Y
Hydrocharitaceae			
	Ottelia ovalifolia	Swamp Lily	Y
Juncaceae			
	Juncus acutus		N
	Juncus continuus		Y
	Juncus usitatus		Y
Lomandraceae			
	Lomandra confertifolia		Y
	Lomandra filiformis ssp. filiformis		Y
	Lomandra longifolia	Spiny-headed Mat-rush	Y
	Lomandra multiflora ssp. multiflora	Many-flowered Mat-rush	Y
Loranthaceae			
	Amyema cambagei		Y
	Amyema congener ssp. congener		Y
Malvaceae			
	Sida corrugata	Vaiable Sida	Y
	Sida rhombifolia	Paddy's Lucerne	N
Myoporaceae			
	Eremophila debilis	Amulla	Y
	Myoporum montanum	Western Boobialla	Y
Myrtaceae			
	Angophora floribunda	Rough-barked Apple	Y
	Callistemon salignus	Willow Bottlebrush	Y
	Corymbia maculata		Y
	Eucalyptus blakelyi	Blakely's Red Gum	Y
	Eucalyptus crebra	Narrow-leaved Ironbark	Y
	Eucalyptus dawsonii	Slaty Gum	Y
	Eucalyptus moluccana	Grey Box	Y

Class Name	Scientific Name	Common Name	Native
	Eucalyptus punctata	Grey Gum	Y
	Eucalyptus sideroxylon	Mugga Ironbark	Y
	Eucalyptus tereticornis	Forest Red Gum	Y
	Melaleuca styphelioides	Prickly-leaved Tea Tree	Y
Oleaceae			
	Notelaea microcarpa var. microcarpa		Y
	Olea europaea ssp. africana		N
Orchidaceae			
	Pterostylis sp.		Y
Oxalidaceae			
	Oxalis corniculata	Creeping Oxalis	N
Phormiaceae			
	Dianella caerulea		Y
	Dianella longifolia		Y
	Dianella revoluta		Y
Pittosporaceae			
	Bursaria spinosa	Native Blackthorn	Y
Plantaginaceae			
	Plantago debilis		Y
	Plantago lanceolata	Lamb's Tongues	N
Poaceae			
	Aristida calycina		Y
	Aristida ramosa		Y
	Austrodanthonia fulva		Y
	Austrostipa scabra	Speargrass	Y
	Austrostipa verticillata		Y
	Axonopus affinis	Narrow-leaved Carpet Grass	N
	Bothriochloa decipiens	Red Grass	Y
	Bothriochloa macra	Red Grass	Y
	Bromus catharticus	Prairie Grass	N
	Chloris gayana	Rhodes Grass	N
	Chloris truncata	Windmill Grass	Y
	Chloris ventricosa	Tall Chloris	Y
	Cymbopogon refractus	Barbed Wire Grass	Y
	Cynodon dactylon	Common Couch	Y
	Dichelachne micrantha	Shorthair Plumegrass	Y
	Echinopogon caespitosus		Y

Class Name	Scientific Name	Common Name	Native
	Echinopogon ovatus	Forest Hedgehog Grass	Y
	Ehrharta erecta	Panic Veldtgrass	N
	Entolasia stricta	Wiry Panic	Y
	Eragrostis brownii	Brown's Lovegrass	Y
	Eragrostis curvula	African Lovegrass	N
	Eragrostis leptostachya	Paddock Lovegrass	Y
	Hyparrhenia hirta	Coolatai Grass	N
	Lolium perenne	Perennial Ryegrass	N
	Melinis repens	Red Natal Grass	N
	Microlaena stipoides var. stipoides		Y
	Panicum effusum	Poison or Hairy Panic	Y
	Paspalum dilatatum	Paspalum	N
	Paspalum distichum	Water Couch	Y
	Pennisetum clandestinum	Kikuyu Grass	N
	Phalaris sp.		N
	Phragmites australis	Common Reed	Y
	Setaria sphacelata	South African Pigeon Grass	N
	Sporobolus creber	Slender Rat's Tail Grass	Y
	Sporobolus indicus var. africanus		N
	Stipa scabra		Y
	Themeda australis	Kangaroo Grass	Y
Polygonaceae			
	Persicaria decipiens	Slender Knotweed	Y
	Rumex brownii	Swamp Dock	Y
Primulaceae			
	Anagallis arvensis	Scarlet/Blue Pimpernel	N
Rhamnaceae			
	Cryptandra amara var. longiflora		Y
	Cryptandra buxifolia		Y
Rosaceae			
	Rubus fruticosus	Blackberry	N
Rubiaceae			
	Asperula conferta	Common Woodruff	Y
	Canthium buxifolius	Stiff Canthium	Y
	Richardia stellaris		N
Salicaceae			

Class Name	Scientific Name	Common Name	Native
	Salix sp.	Willow	N
Santalaceae			
	Exocarpos cupressiformis	Native Cherry	Y
Sapindaceae			
	Dodonaea viscosa		Y
Scrophulariaceae			
	Verbascum virgatum	Twiggy Mullein	N
Solanaceae			
	Cestrum parqui	Green Cestrum	N
	Datura stramonium	Common Thornapple	N
	Lycium ferocissimum	African Boxthorn	N
	Solanum brownii	Violet Nightshade	Y
	Solanum cinereum	Narrawa Burr	Y
	Solanum nigrum	Black-berry Nightshade	N
	Solanum prinophyllum	Forest Nightshade	Y
Sterculiaceae			
	Brachychiton populneus ssp. populneus		Y
Thymelaeaceae			
	Pimelea curviflora		Y
Typhaceae			
	Typha orientalis	Broad-leaved Cumbungi	Y
Verbenaceae			
	Verbena bonariensis	Purpletop	N
	Verbena officinalis	Common Verbena	N
	Verbena rigida	Veined Verbena	N
Vitaceae			
	Cayratia clematidea	Slender Grape	Y

Appendix B

Threatened species of plant

Appendix B: Threatened species of plant within the locality

This appendix details the threatened species of plant recorded or predicted to occur within 10 km of the site.

Latin Name (Common Name)	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Potential habitat Assessment	Impact Assessment Required
Olearia cordata	V	V	Occurs chiefly from Wiseman's Ferry to Wollombi where it grows on sandstone in dry sclerophyll forest and open shrubland (Harden 1992). Specifically this species occurs on exposed Hawkesbury Sandstone ridges in shallow or skeletal soils. Occurs on Gymea and Hawkesbury soil types and may be associated with shale. Associated species include Angophora costata, A. bakeri, Eucalyptus punctata and Corymbia eximia with understorey including Allocasuarina torulosa, Acacia linifolia, Persoonia linearis, Leucopogon muticus and grasses. Also been recorded with E.eugenioides or near Wollemi with E. oblonga, E. notabilis and Leptospermum trinervium. Corymbia gummifera and Angophora euryphylla also noted in northern areas (NSW National Parks and Wildlife Service 2000).	No	No
Acacia pendula (Weeping Myall)		E2	Weeping Myall is an erect or spreading tree 5-13 metres high. A disjunct population of this species occurs in the Hunter Valley at the eastern distributional limit of the species' range. Within the Hunter catchment, the species typically occurs on heavy soils, sometimes on the margins of small floodplains. All known sites within the Hunter population occur on private or non-conservation land and are potentially vulnerable to clearing. The species occurs on the western slopes, western plains and far western plains of NSW, and south into Victoria and north into Queensland. The Hunter population is known to occur naturally as far east as Warkworth, and extends northwest to Muswellbrook and to the west of Muswellbrook at Wybong. The population has only been recorded to date at six locations: Jerrys Plains, Edderton, Wybong, Appletree Creek, Warkworth and Appletree Flat. These locations occur within the Muswellbrook and Singleton Local Government areas, with the population potentially also occurring within the Mid-Western Regional and Upper Hunter LGA's.	Yes, marginal habitat present. However, this species was not observed within the subject site during targeted surveys and is considered unlikely to occur.	No
Eucalyptus camaldulensis (River Red Gum)		E2	Occurs in the western slopes, western plains, far western plains and in the North Coast (Hunter Catchment). It is typically dominant, occurring within grassy woodland or forest on deep rich alluvial soils adjacent to large permanent water bodies (Harden 2002). In the Hunter it may occur with Eucalyptus tereticornis, Eucalyptus melliodora, Casuarina cunninghamiana subsp. Cunninghamiana and Angophora floribunda (NSW Scientific Committee 2005).	Yes, marginal habitat present. However, this species was not observed within the subject site during targeted surveys and is considered unlikely to occur.	No
Eucalyptus glaucina (Slaty Red Gum)	V	V	Occurs from Taree to Broke where it is locally frequent but very sporadic and grows in grassy woodland on deep, moderately fertile and well-watered soil (Harden 2002). Endemic on low coastal ranges and tablelands of central NSW, Taree to Broke, also near Casino (Brooker & Kleinig 1999).	Yes, marginal habitat present. However, this species was not observed within the subject site during targeted surveys and is considered unlikely	No

Latin Name (Common Name)	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Potential habitat Assessment	Impact Assessment Required
				to occur.	
Melaleuca groveana (Grove's Paperbark)	V		Occurs in coastal districts north from Port Stephens and at Torrington where it is restricted to higher areas. It grows in heath, often in exposed sites (Harden 2002).	No	No
Cymbidium canaliculatum (Tiger Orchid)	P13	E2	In the Hunter Catchment, the endangered population of this species grows singularly or in clumps in tree hollows, commonly between two to six metres above the ground. Found in woodlands and dry sclerophyll forests dominated by Eucalyptus albens, and less commonly found on E. dawsonii, E. crebra, E. moluccana, Angophora floribunda and Acacia salicina. Scattered, non-endangered populations of this species exist across northern Australia, from NSW to Western Australia (NSW Scientific Committee 2006).	Yes, marginal habitat present. However, this species was not observed within the subject site during targeted surveys and is considered unlikely to occur.	No
Diuris tricolor	V	V, E2	Grows in sclerophyll forest among grass, often with Callitris (Royal Botanic Gardens 2005), or in grassy Callitris woodland (Bishop 2000). It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Soils include gritty orange-brown loam on granite, shallow red loamy sand on stony porphyry, skeletal lateritic soil and alluvial grey silty loam. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats (NSW Scientific Committee 2007). Within the Upper Hunter it is known to occur in Eucalyptus albens/Eucalyptus crebra/Eucalyptus blakelyi/Corymbia maculata woodland complexes and grasslands (Parsons Brinckerhoff 2004).	Yes, marginal habitat present. Considered unlikely to occur, however this species requires targeted seasonal surveys for detection.	Yes
Pterostylis gibbosa	E1	E	Occurs in the southern part of the Central Coast region with a disjunct population in the Hunter Valley. Grows among grass in sclerophyll forest (Harden 2002). In the Illawarra it grows in Coastal Grassy Red Gum Forest and in Lowland Woolybutt-Melaleuca forest (NSW National Parks and Wildlife Service 2003).	No	No
Bothriochloa biloba		V	Has a widespread distribution and grows in woodland on poorer soils (Harden 1993). Occurs on basaltic hills and grassland on drainage slopes on a variety of soils in association with Eucalyptus punctata, E. albens, E. camaldulensis E. tereticornis, E. populnea ssp bimbil and Angophora floribunda (DLWC, 2001).	Yes, marginal habitat present. Considered unlikely to occur, however this species requires targeted seasonal surveys for detection.	Yes
Digitaria porrecta	E	E	In NSW it occurs in north western slopes and north western plains subdivisions (Royal Botanic Gardens 2004) where it grows in native grassland, woodlands or open forest with a grassy understorey, on richer soils. It is often found along roadsides and travelling stock routes where there is light grazing and occasional fire (Department of Envioronment Conservation and Climate Change 2008).	No, Given the high levels of disturbance and that the subject site is not considered to be with the general distributional limits.	No
Thesium australe (Austral Toadflax)	V	V	Grows in grassland or woodland often in damp sites. It is a semi-parasitic herb and hosts are likely to be Themeda australis and Poa spp. (Harden 1992).	No, Given the high levels of disturbance, relatively low abundance of	No

Latin Name (Common Name)	TSC Act[1]	EPBC Act[2]	ROTAP[3]	Potential habitat Assessment	Impact Assessment Required
				Themeda or Poa species.	

Notes:
1. V = Vulnerable, E1 = Endangered; E2 = Endangered Population, E4 = Extinct *(Threatened Species Conservation Act 1995)*
2. V = Vulnerable, E = Endangered; X = Extinct *(Environment Protection and Biodiversity Conservation Act 1999)*.

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Attachment C

Species of animal recorded in the study area

Appendix C: Vertebrate fauna recorded within the study area during the current and previous surveys

This appendix details the animals recorded during the current field surveys of the study area (PB 2008). Also included are the results of a fauna survey carried out by Biosis Research in 2007 as part of the previous North South pipeline route, which incorporates the subject site.

Family Name	Common Name	Latin Name	TSC Act1	EPBC Act2	Habitat Type (Parsons Brinckerhoff 2008) 3				Biosis Research (2007)
					Dry Forest/ Woodland	Riparian	Aquatic	Grassland	
Amphibians									
Hylidae	Peron's Tree Frog	*Litoria peronii*							X
Myobatrachidae	Common Eastern Froglet	*Crinia signifera*				O	O		X
Myobatrachidae	Haswell's Frog	*Paracrinia haswelli*							X
Myobatrachidae	Smooth Toadlet	*Uperoleia laevigata*							X
Myobatrachidae	Spotted Grass Frog	*Limnodynastes tasmaniensis*							X
Reptiles									
Chelidae	Eastern Long-necked Tortoise	*Chelodina longicollis*					O		X
Scincidae	Striped Skink	*Ctenotus robustus*			O			O	
Native Birds									
Accipitridae	Blackshouldered Kite	*Elanus axillaris*		M	O				X
Anatidae	Australian Wood Duck	*Chenonetta jubata*		M			O		X
Ardeidae	Whitefaced Heron	*Egretta novaehollandiae*				O			
Artamidae	Australian Magpie	*Gymnorhina tibicen*			O	O		O	X
Artamidae	Dusky Woodswallow	*Artamus cyanopterus*			O			O	X

Family Name	Common Name	Latin Name	TSC Act1	EPBC Act2	Habitat Type (Parsons Brinckerhoff 2008) 3				Biosis Research (2007)
					Dry Forest/ Woodland	Riparian	Aquatic	Grassland	
Artamidae	Pied Butcherbird	*Cracticus nigrogularis*			O				X
Cacatuidae	Galah	*Cacatua roseicapilla*			O				
Campephagidae	Blackfaced Cuckooshrike	*Coracina novaehollandiae*			O	O			X
Charadriidae	Masked Lapwing	*Vanellus miles*		M		O		O	X
Columbidae	Crested Pigeon	*Ocyphaps lophotes*			O				X
Corcoracidae	Whitewinged Chough	*Corcorax melanorhamphos*			O				X
Corvidae	Australian Raven	*Corvus coronoides*			O			O	
Dicaeidae	Mistletoebird	*Dicaeum hirundinaceum*			O				X
Dicruridae	Grey Fantail	*Rhipidura fuliginosa*				O			X
Dicruridae	Magpielark	*Grallina cyanoleuca*			O				X
Dicruridae	Willie Wagtail	*Rhipidura leucophrys*			O	O			X
Falconidae	Brown Falcon	*Falco berigora*		M				O	X
Falconidae	Nankeen Kestrel	*Falco cenchroides*		M					X
Falconidae	Peregrine Falcon	*Falco peregrinus*		M					X
Halcyonidae	Laughing Kookaburra	*Dacelo novaeguineae*			O				X
Hirundinidae	Welcome Swallow	*Hirundo neoxena*			O			O	X
Maluridae	Superb Fairywren	*Malurus cyaneus*			O	O			X
Meliphagidae	Brownheaded Honeyeater	*Melithreptus brevirostris*			O	O			X

Family Name	Common Name	Latin Name	TSC Act1	EPBC Act2	Habitat Type (Parsons Brinckerhoff 2008) 3				Biosis Research (2007)
					Dry Forest/ Woodland	Riparian	Aquatic	Grassland	
Meliphagidae	Eastern Spinebill	*Acanthorhynchus tenuirostris*				O			X
Meliphagidae	Fuscous Honeyeater	*Lichenostomus fuscus*			O				
Meliphagidae	Noisy Friarbird	*Philemon corniculatus*			O	O		O	
Meliphagidae	Noisy Miner	*Manorina melanocephala*							
Meliphagidae	Red Wattlebird	*Anthochaera carunculata*							X
Meliphagidae	Whitecheeked Honeyeater	*Phylidonyris nigra*				O			X
Meliphagidae	Whiteeared Honeyeater	*Lichenostomus leucotis*							X
Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*			O				X
Pachycephalidae	Golden Whistler	*Pachycephala pectoralis*				O			X
Pachycephalidae	Grey Shrikethrush	*Colluricincla harmonica*			O	O			
Pardalotidae	Spotted Pardalote	*Pardalotus punctatus*			O				X
Pardalotidae	Striated Pardalote	*Pardalotus striatus*			O				X
Pardalotidae	Yellow Thornbill	*Acanthiza nana*			O	O			X
Pardalotidae	Yellowrumped Thornbill	*Acanthiza chrysorrhoa*							X
Passeridae	Doublebarred Finch	*Taeniopygia bichenovii*			O				
Passeridae	Redbrowed Finch	*Neochmia temporalis*			O				
Pelecanidae	Australian Pelican	*Pelecanus conspicillatus*						O	
Petroicidae	Eastern Yellow Robin	*Eopsaltria australis*				O			X

Family Name	Common Name	Latin Name	TSC Act1	EPBC Act2	Habitat Type (Parsons Brinckerhoff 2008) 3				Biosis Research (2007)
					Dry Forest/ Woodland	Riparian	Aquatic	Grassland	
Petroicidae	Jacky Winter	*Microeca fascinans*			O	O			X
Petroicidae	Redcapped Robin	*Petroica goodenovii*							X
Phasianidae	Brown Quail	*Coturnix ypsilophora*						O	
Pomatostomidae	Greycrowned Babbler	*Pomatostomus temporalis*	V		O				X
Psittacidae	Australian King Parrot	*Alisterus scapularis*			O				
Psittacidae	Eastern Rosella	*Platycercus eximius*			O	O		O	X
Psittacidae	Rainbow Lorikeet	*Trichoglossus haematodus*							X
Threskiornithidae	Strawnecked Ibis	*Threskiornis spinicollis*					O		
Zosteropidae	Silvereye	*Zosterops lateralis*			O				X
Introduced Birds									
Sturnidae	Common Myna	*Acridotheres tristis*	U					O	
Native Mammals									
Macropodidae	Common Wallaroo	*Macropus robustus*			O				
Macropodidae	Eastern Grey Kangaroo	*Macropus giganteus*			O	O		O	
Phalangeridae	Common Brushtail Possum	*Trichosurus vulpecula*							X
Rhinolophidae	Eastern Horseshoebat	*Rhinolophus megaphyllus*							X
Vespertilionidae	Eastern Bentwing Bat	*Miniopterus schreibersii*	V	C					X

Family Name	Common Name	Latin Name	TSC Act1	EPBC Act2	Habitat Type (Parsons Brinckerhoff 2008) 3				Biosis Research (2007)
					Dry Forest/ Woodland	Riparian	Aquatic	Grassland	
Vespertilionidae	Eastern Cave Bat	*Vespadelus troughtoni*	V						X
Vespertilionidae	Little Forest Bat	*Vespadelus vulturnus*							X
Vespertilionidae	Southern Forest Bat	*Vespadelus regulus*							X
Vombatidae	Common Wombat	*Vombatus ursinus*			S				X
Introduced Mammals									
Canidae	Fox	*Vulpes vulpes*							X
Leporidae	Brown Hare	*Lepus capensis*	U		O			O	
Leporidae	Rabbit	*Oryctolagus cuniculus*	U					O	X

Notes:
1. V = Vulnerable *(Threatened Species Conservation Act 1995)*
2. E = Endangered, V = Vulnerable M= Migratory *(Environment Protection and Biodiversity Conservation Act 1999)*
3. Observation Type O = Observed = Trapped/handheld W = Heard H= Hair tube analysis A= Anabat II.

Appendix D

Threatened species of animal within the locality

Appendix D: Threatened and migratory fauna in the locality

This appendix details the Threatened and migratory species of animal that have either been recorded, or that have the potential to occur within the project locality and local Catchment management areas, based on the Department of Environment and Climate Change Atlas of NSW Wildlife (Department of Environment and Climate Change 2008a), and Bionet (Department of Environment and Climate Change 2008b) and the *Environment Protection and Biodiversity Conservation Act 1999* Protected Matters Search Tool (Department of the Environment Water Heritage and the Arts 2008).

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
Amphibians							
Giant Burrowing Frog	Heleioporus australiacus	V	V	Appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin, from Wollemi National Park in the north and extending south to Jervis Bay; and a southern population occurring in disjunct pockets from about Narooma south into eastern Victoria. In the northern population there is a marked preference for sandstone ridgetop habitat and broader upland valleys. In these locations the frog is associated with small headwater creeklines and along slow flowing to intermittent creeklines. The vegetation is typically woodland, open woodland and heath and may be associated with 'hanging swamp' seepage lines and where small pools form from the collected water. They have also been observed occupying artificial ponded structures such as fire dams, gravel 'borrows', detention basins and box drains that have naturalised over time and are still surrounded by other undisturbed habitat. In the southern population, records from Narooma, Bega, Bombala and eastern Victoria appear to be associated with Devonian igneous and sedimentary formations and Ordovician metamorphics and are generally from more heavily timbered areas. However, again there appears to be an association with ridgetops, headwaters and slow flowing streams. Do not appear to inhabit areas that have been cleared for agriculture or for urban development. Breed in summer and autumn in burrows in the banks of small creeks. Often spends significant periods of time underground during unfavourable conditions and to avoid detection during the day. (Cogger 2000; NSW National	10 (Atlas of NSW Wildlife 2008)	Low. There is no potential breeding habitat within the study area. The study area has already been disturbed by agriculture and urban development. There are no ridgetops within the study area.	No

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
				Parks and Wildlife Service 2001a).			
Litoria aurea	Green and Golden Bell Frog	E1	V	Has a fragmented distribution of mainly near coastal locations from Lakes Entrance (Victoria) to south of the NSW-Queensland border; as far west as Bathurst in the more elevated southern tablelands and central slopes of NSW. Various types of habitat utilised has been documented. For breeding utilises a wide range of waterbodies, including both natural and man-made structures, such as marshes, dams and stream sides, and ephemeral locations that are more often dry than wet. Is found in various small pockets of habitat in otherwise developed areas and has the tendency of often turning up in highly disturbed sites. Lotic situations such as fast flowing streams appear to be one of the few water bodies not utilised, at least for breeding purposes. Habitat attributes associated with the various waterbodies occupied by the GGBF, and that appear to make such habitat more likely to be occupied, include that the water body is shallow, still or slow flowing, ephemeral and/or widely fluctuating, unpolluted and without heavy shading. Permanent waterbodies are also known to be used and there is historical evidence of occupation of large, often deep and permanent bodies of water. There is a clear preference shown by GGBF for sites with a complexity of vegetation structure and associated terrestrial habitat attributes that appear to favour the species include extensive grassy areas and an abundance of shelter sites such as rocks, logs, tussock forming vegetation and other cover, considered to be used for foraging and shelter. Over-wintering sites may be adjacent to or some distance away from breeding sites; such sites include the bases of dense vegetation tussocks, beneath rocks, timber, within logs or beneath ground debris, including human refuse such as sheet iron, but the full range of possible habitat used for this purpose is not yet well understood (Department of Environment and Conservation 2004, 2005).	5 (Atlas of NSW Wildlife 2008)	Low. There is marginal habitat for this species available within the study area.	Yes
Litoria daviesae	Davies' Tree Frog	V		Litoria daviesae is a newly described species, occurring from central-eastern New South Wales to the state's lower north-east. It is known from 18 locations between	1 (Atlas of	Low. There is no habitat for this species	No

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
				the northern catchment of the Hunter River north to the catchment of the Hastings River. All records of the species are from permanently flowing streams and adjacent riparian vegetation at elevations above 400 metres (NSW National Parks and Wildlife Service 2002).	NSW Wildlife 2008)	available within the study area.	
Litoria littlejohni	Heath Frog	V	V	Distributed along the eastern slopes of the Great Dividing Range from Watagan State Forest near Wyong, south to Buchan in north-eastern Victoria. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude. It forages both in the tree canopy and on the ground, and it has been observed sheltering under rocks on high exposed ridges during summer. It is not known from coastal habitats (NSW Scientific Committee 2000).	1 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
MixophYes balbus	Stuttering Frog	E1	V	Terrestrial species, found in rainforest, Antarctic beech forest or wet sclerophyll forest. The species depends on freshwater streams and riparian vegetation for breeding and habitation. No records are known from riparian habitat that has been disturbed (Cogger 2000; NSW Scientific Committee 2003).	4 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Philoria sphagnicolus	Sphagnum Frog	V		Ranges from near Ebor and Dorrigo to Barrington Tops. Often found in cracks and other cavities behind and beside both large and small waterfalls where the environment remains saturated with moisture (Cogger 2000).	1 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Pseudophryne australis	Red-crowned Toadlet	V		Occurs within 160 km of Sydney where it is restricted to Hawkesbury Sandstone. It breeds in deep grass and debris adjacent to ephemeral drainage lines. When not breeding individuals are found scattered on sandstone ridges under rocks and logs (Cogger 2000).	31 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Native Birds							
Callocephalon fimbriatum	Gang-gang Cockatoo	V		Occurs in wetter forests and woodland from sea level to an altitude over 2000 metres, timbered foothills and valleys, coastal scrubs, farmlands and suburban gardens (Pizzey & Knight 1997).	119 (Atlas of NSW Wildlife	Low. There is no habitat for this species available	No

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
					2008)	within the study area.	
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Occurs in eucalypt woodland and forest with Casuarina/Allocasuarina spp. Characteristically inhabits forests on sites with low soil nutrient status, reflecting the distribution of key Allocasuarina species. The drier forest types with intact and less rugged landscapes are preferred by the species. Nests in tree hollows (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 1999a).	99 (Atlas of NSW Wildlife 2008)	Low. There is very little foraging habitat and no evidence of foraging within the study area.	No
Climacteris picumnus	Brown Treecreeper	V		Occurs in eucalypt woodland and adjoining vegetation. Feeds on ants, beetles and larvae on trees and from fallen timber and leaf litter. Usually nests in hollows (Garnett & Crowley 2000).	52 (Atlas of NSW Wildlife 2008)	High. There is habitat for this species available within the study area. This species was previously recorded approximately 500 metres north of the study area (Biosis 2007).	Yes
Ephippiorhynchus asiaticus	Black-necked Stork	E1		Feed in shallow water up to 0.5 m deep on fish, reptiles and frogs. Build nests in trees close to feeding sites (Garnett & Crowley 2000).	11 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Grantiella picta	Painted Honeyeater	V		Lives in dry forests and woodlands. Primary food is the mistletoes in the genus *Amyema*, though it will take some nectar and insects. Its breeding distribution is dictated by presence of mistletoes which are largely restricted to older trees. Less likely to be found in strips of remnant box-ironbark woodlands, such as occur along roadsides and in windbreaks, than in wider blocks (Garnett & Crowley 2000).	2 (Atlas of NSW Wildlife 2008)	Low. This species is distribution is generally outside of the study area with only isolated	No

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
						possibility as a vagrant.	
Hamirostra melanosternon	Black-breasted Buzzard	V	M	Distributed throughout most of inland Australia and prefers arid scrubland, and open woodlands. Feeds on small mammals and birds (Garnett & Crowley 2000).	1 (Atlas of NSW Wildlife 2008)	Low. There is No habitat for this species available within the study area.	No
Ixobrychus flavicollis	Black Bittern	V		Usually found in dense vegetation in and fringing streams, swamps, tidal creeks and mudflats, particularly amongst swamp she-oaks and mangroves. Feeds on aquatic fauna along streams, in estuaries and beside billabongs and pools. Breeding occurs in summer in secluded places in densely vegetated wetlands. It nests in trees that overhang the water (Garnett & Crowley 2000; NSW National Parks and Wildlife Service 2002).	1 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Lathamus discolor	Swift Parrot	E1	EM	Breeding occurs in Tasmania, majority migrates to mainland Australia in autumn, over-wintering, particularly in Victoria and central and eastern NSW, but also south-eastern Queensland as far north as Duaringa. Until recently it was believed that in New South Wales, swift parrots forage mostly in the western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region, but new evidence indicates that the forests on the coastal plains from southern to northern NSW are also extremely important. In mainland Australia is semi-nomadic, foraging in flowering eucalypts in eucalypt associations, particularly box-ironbark forests and woodlands. Preference for sites with highly fertile soils where large trees have high nectar production, including along drainage lines and isolated rural or urban remnants, and for sites with flowering Acacia pycnantha, is indicated. Sites used vary from year to year. (Garnett & Crowley 2000),(Swift Parrot Recovery Team 2001).	10 (Atlas of NSW Wildlife 2008)	Low. This species is distribution is generally outside of the study area with only isolated possibility as a vagrant. May utilise forested areas during migration.	No
Melanodryas Cucullata	Hooded Robin	V		Found in south-eastern Australia, generally east of the Great Dividing Range. Found in eucalypt woodland and mallee and acacia shrubland. This is one of a suite of	21 (Atlas of NSW	High. There is habitat for this species	Yes

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
				species that has declined in woodland areas in south-eastern Australia (Garnett & Crowley 2000; Traill & Duncan 2000).	Wildlife 2008)	available within the study area.	
Melithreptus gularis gularis	Black-chinned Honeyeater	V		Found in dry eucalypt woodland particularly those containing ironbark and box. Occurs within areas of annual rainfall between 400-700 mm. Feed on insects, nectar and lerps (Garnett & Crowley 2000).	13 (Atlas of NSW Wildlife 2008)	Moderate. There is habitat for this species available within the study area.	Yes
Neophema pulchella	Turquoise Parrot	V		Occurs in the foothills of the great dividing range in eucalypt woodlands and forests with a grassy or sparsely shrubby understorey. Nests in hollows in trees, stumps or even fence posts. It feeds on seeds of both native and introduced grass and herb species (Garnett & Crowley 2000).	8 (Atlas of NSW Wildlife 2008)	Low. This species distribution is generally outside of the study area with only isolated possibility as a vagrant. May utilise forested areas during migration.	No
Ninox connivens	Barking Owl	V		Occurs in dry sclerophyll woodland. In the south west it is often associated with riparian vegetation while in the south east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett & Crowley 2000).	10 (Atlas of NSW Wildlife 2008)	Low. There is habitat for this species available within the study area.	Yes
Ninox strenua	Powerful Owl	V		A sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, casuarina or callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more	30 (Atlas of NSW Wildlife 2008)	Low. There is marginal habitat for this species available within the study area.	Yes

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
				often found in areas with more old trees and hollows than average stands (Garnett & Crowley 2000).			
Oxyura australis	Blue-billed Duck	V	M	Relatively sparse throughout species range. Regularly found breeding in south-east Queensland, north-east South Australia and throughout New South Wales. Found on temperate, fresh to saline, terrestrial wetlands, and occupies artificial wetlands. Prefers deep permanent open water, within or near dense vegetation. Nest in rushes, sedge, Lignum Muehlenbeckia cunnighamii and paperbark Melaleuca (Garnett & Crowley 2000).	2 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for This species available within the study area.	No
Pachycephala olivacea	Olive Whistler	V		Distributed from Queensland to South Australia, and occurs across the altitudinal range from coastal to alpine areas. In NSW, found north of the Hunter River, NSW, extending just into the Lamington Plateau in far south-east Queensland. There are isolated populations in the Macpherson Range, New England NP, Mt. Boss and Barrington Tops areas, and possibly in the Gibraltar Range and Walcha-Nundle areas. Occurs in tall wet sclerophyll forest, rainforest, woodland, alpine heaths (Simpson & Day 1996). In NE NSW, occurs in cool temperate rainforest and cool, moist sclerophyll forest at elevations of >=800 metres asl. Also recorded in warm temperate and sub tropical rainforests. South of Sydney, the species inhabits rainforest, moist eucalypt forest, coastal, moist thickets and mountain scrubs. Microhabitat is areas with a dense, moist understorey (NSW National Parks and Wildlife Service 1999e).	2 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Pomatostomus temporalis	Grey-crowned Babbler	V		Found throughout western slopes and plains, southern and central tablelands and occurring in Northern Rivers area, mid-north coast and the Hunter Valley of NSW. Lives in open forest and woodland, acacia shrubland and adjoining farmland. Large stick dome nest with spout-like entrance (Pizzey & Knight 1997).	186 (Atlas of NSW Wildlife 2008)	High. Observed within Open forest woodland habitats within the study area.	Yes
Pyrrholaemus sagittatus	Speckled Warbler	V		Occurs in a wide range of eucalypt dominated vegetation with a grassy understorey and is often found on rocky ridges or in gullies. It feeds on seeds and insects and builds domed nests on the ground (Garnett & Crowley	105 (Atlas of NSW	High Observed adjoining the study area.	Yes

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
				2000).	Wildlife 2008)	Within open forest woodland habitats.	
Stagonopleura guttata	Diamond Firetail	V		Occurs in a range of eucalypt dominated communities with a grassy understorey including woodland, forest and mallee. Most populations occur on the inland slopes of the dividing range. Feed on seeds, mostly of grasses (Garnett & Crowley 2000).	32 (Atlas of NSW Wildlife 2008)	High. Observed adjoining the study area Within Open forest woodland habitats.	Yes
Stictonetta naevosa	Freckled Duck	V	M	In most years this species appear to be nomadic between ephemeral inland wetlands. In dry years they congregate on permanent wetlands while in wet years they breed prolifically and disperse widely, generally towards the coast. In inland eastern Australia, they generally occur in brackish to hyposaline wetlands that are densely vegetated with Lignum (Muehlenbeckia cunninghamii) within which they build their nests (Garnett & Crowley 2000).	1 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Turnix maculosa	Red-backed Button-quail	V		The Red-backed Button-quail is a cryptic species and its specific ecology is poorly documented. The species is nocturnal and crepuscular and feeds on insects and seeds. They normally hide and freeze rather than flushing, although individuals will fly for short distances before dropping back to cover. Red-backed Button-quail may be encountered individually, in pairs or in small family groups .Red-backed Button-quail inhabit grasslands, woodlands and cropped lands of warm temperate areas that annually receive 400 mm or more of summer rain. Observations of populations in other parts of its range suggest the species prefers sites near water, including grasslands and sedgelands near creeks, swamps and springs, and wetlands. Red-backed Button-quail usually breed in dense grass near water, and nests are made in a shallow depression sparsely lined with grass and ground litter (Marchant & Higgins 1993).	1 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
Tyto novaehollandiae	Masked Owl	V		Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett & Crowley 2000).	15 (Atlas of NSW Wildlife 2008)	Moderate. There is marginal habitat for this species available within the study area.	Yes
Tyto tenebricosa	Sooty Owl	V		Occurs in wet eucalypt forest and rainforest on fertile soils with tall emergent trees. Typically found in old growth forest with a dense understorey but also occurs in younger forests if nesting trees are present nearby. It nests in large hollows within eucalypts and occasionally caves. It hunts in open and closed forest for a range of arboreal and terrestrial mammals including introduced species and sometimes birds (Garnett & Crowley 2000).	14 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Xanthomyza phrygia	Regent Honeyeater	E1	EM	Occurs mostly in box-ironbark forests and woodland and prefers the wet, fertile sites such as along creek flats, broad river valleys and foothills. Riparian forests with *Casuarina cunninghamiana* and *Amyema cambagei* are important for feeding and breeding. Important food trees include *Eucalyptus sideroxylon* (Mugga Ironbark), *E. albens* (White Box) *, E. melliodora* (Yellow Box) and *E. leucoxylon* (Yellow Gum) (Garnett & Crowley 2000).	82 (Atlas of NSW Wildlife 2008)	Low. This species core distribution is generally outside of the study area with only isolated possibility as a vagrant.	No
Native Mammals							
Aepyprymnus rufescens	Rufous Bettong	V		Distribution: From Cooktown in north Queensland, to north-east NSW, where it occurs east of the Dividing Range. In Queensland, it still occurs on both sides of the Great Divide. Macrohabitat: Found in a variety of forest types from wet sclerophyll to dry open woodland, where grass tussocks or fallen timber are present. Also known to occupy a mosaic of open forest and grasslands. Microhabitat: It appears to prefer a more open forest structure, with a sparse shrub layer and a diverse ground cover. Builds nests in grass tussocks and under logs. Strongly associated with dry sclerophyll forest particularly	16 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
				those dominated by Spotted Gum (NSW National Parks and Wildlife Service 1999e).			
Cercartetus nanus	Eastern Pygmy-possum	V		Found in a range of habitats from rainforest through sclerophyll forest to tree heath. It feeds largely on the nectar and pollen of banksias, eucalypts and bottlebrushes and sometimes soft fruits. It nests in very small tree holes, between the wood and bark of a tree, abandoned birds nests and shredded bark in the fork of trees (Turner & Ward 1995).	7 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Occurs in moderately wooded habitats and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. Thought to forage below the forest canopy for small flying insects (Churchill 1998).	46 (Atlas of NSW Wildlife 2008)	High. There is foraging habitat for this species available within the study area.	Yes
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Occurs from the Bundaberg area in south-east Queensland, south through NSW to western Victoria and Tasmania. In NSW, it occurs on both sides of the Great Dividing Range and north-east NSW represents a national stronghold (NSW National Parks and Wildlife Service 1999e). Occurs in wide range of forest types, although appears to prefer moist sclerophyll and rainforest forest types, and riparian habitat. Most common in large unfragmented patches of forest. It has also been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in riparian areas, it also ranges over dry ridges. Nests in rock caves and hollow logs or trees. Feeds on a variety of prey including birds, terrestrial and arboreal mammals, small macropods, reptiles and arthropods (NSW National Parks and Wildlife Service 1999c, 1999e).	1 (Atlas of NSW Wildlife 2008)	Low. No habitat for this species available within the study area.	No
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings. Forages within the canopy of dry sclerophyll forest. It prefers wet habitats where trees are	21 (Atlas of NSW	High. There is foraging habitat for this species	Yes

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
				more than 20 metres high (Churchill 1998).	Wildlife 2008)	available within the study area.	
Macropus parma	Parma Wallaby	V		Now extinct south of Gosford, and confined to high rainfall areas in the coast and ranges of central and northern NSW; from the Watagan Mountains to the Richmond and Border Ranges area, with the Washpool - Gibraltar Range and Bulga - Dingo Tops areas being areas of greatest importance. Occurs in wet sclerophyll forest and rainforest patches in moist sclerophyll forest, with a moist shrubby understorey, often associated with grassy areas. They are occasionally found in dry sclerophyll forest and rainforest edges are considered important refugia. Ecotones between open and closed forest are favoured, open areas are used for foraging, while areas of dense ground cover provide areas for shelter and protection from predators (NSW National Parks and Wildlife Service 1999e).	4 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Miniopterus australis	Little Bent-wing Bat	V		Feeds on small insects beneath the canopy of well timbered habitats including rainforest, Melaleuca swamps and dry sclerophyll forests. Roosts in caves and tunnels and has specific requirements for nursery sites. Distribution becomes coastal towards the southern limit of its range in NSW. Nesting sites are in areas where limestone mining is preferred (Strahan 1995).	5 (Atlas of NSW Wildlife 2008)	Low. There is foraging habitat for this species available within the study area.	Yes
Miniopterus schreibersii	Eastern Bent-wing Bat	V	C	Usually found in well timbered valleys where it forages on small insects above the canopy. Roosts in caves, old mines, stormwater channels and sometimes buildings and often return to a particular nursery cave each year (Churchill 1998).	51 (Atlas of NSW Wildlife 2008)	High. There is foraging habitat for this species available within the study area.	Yes
Mormopterus norfolkensis	Eastern Freetail-bat	V		Thought to live in sclerophyll forest and woodland. Small colonies have been found in tree hollows or under loose bark. It feeds on insects above the forest canopy or in clearings at the forest edge (Churchill 1998).	41 (Atlas of NSW Wildlife 2008)	High. There is foraging habitat for this species available within the	Yes

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
						study area.	
Myotis adversus	Large-footed Myotis	V		Colonies occur in caves, mines, tunnels, under bridges and buildings. Colonies always occur close to bodies of water where this species feeds on aquatic insects (Churchill 1998).	7 (Atlas of NSW Wildlife 2008)	High. There is foraging habitat for this species available within the study area.	Yes
Nyctophilus bifax	Eastern Long-eared Bat	V	V	Occurs in a range of tropical habitats from rainforest to dry sclerophyll woodland and is often found in riparian vegetation. It catches prey in the air and also takes insects from foliage and the ground or other hard surfaces. It roosts in tree hollows and in the roofs of buildings (Strahan 1995).	2 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Petaurus australis	Yellow-bellied Glider	V		Restricted to tall, mature eucalypt forest in high rainfall areas of temperate to sub-tropical eastern Australia. Feeds on nectar, pollen, the sap of eucalypts and sometimes insects. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide helter and nesting hollows and year round food resources are available from a mixture of eucalypt species (NSW National Parks and Wildlife Service 1999f, 2003b).	121 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Petaurus norfolcensis	Squirrel Glider	V		Found in dry sclerophyll forest and woodland but not found in dense coastal ranges. Nests in hollows and feeds on gum of acacias, eucalypt sap and invertebrates (NSW National Parks and Wildlife Service 1999d).	38 (Atlas of NSW Wildlife 2008)	High. There is habitat for this species available within the study area.	Yes
Phascogale tapoatafa	Brush-tailed Phascogale	V		Largely arboreal it occurs in a range of habitats which have reliable rainfall (500-2000mm), but has preference for open dry sclerophyll forest on ridges (up to 600 m alt) with little/sparse ground cover. It nests in tree hollows and feeds at dusk on arthropods and small vertebrates (Strahan 1995).	13 (Atlas of NSW Wildlife 2008)	Low, there is only marginal habitat for this species available within the study area.	No
Phascolarctos cinereus	Koala	V		Found in sclerophyll forest. Throughout New South Wales, Koalas have been observed to feed on the leaves	61 (Atlas of	Low, there is only marginal	No

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
				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. The preferred tree species vary widely on a regional and local basis. Some preferred species in NSW include Forest Red Gum Eucalyptus tereticornis, Grey Gum E. punctata, Monkey Gum E. cypellocarpa and Ribbon Gum E. viminalis. In coastal areas, Tallowwood E. microcorys and Swamp Mahogany E. robusta are important food species, while in inland areas White Box E. albens, Bimble Box E. populnea and River Red Gum E. camaldulensis are favoured (NSW National Parks and Wildlife Service 1999b, 2003a).	NSW Wildlife 2008)	habitat for this species available within the study area.	
Potorous tridactylus	Long-nosed Potoroo	V	V	Disjunct distribution along coastal south-east Australia from near Gladstone in Queensland, to south-west Victoria and in Tasmania. Found from sea level up to 1500 metres in altitude generally in areas with rainfall greater than 760 millimetres. In NSW, it is found throughout coastal and subcoastal areas. Occurs in a range of habitats: coastal forest and woodland with a moderately dense heathy understorey, dense coastal scrubs or heath, wet and dry sclerophyll forest and sub-tropical, warm temperate and cool temperate rainforest of the eastern slopes and highlands. Often associated with gullies and forest ecotones. Open areas are used for foraging while areas of dense groundcover or understorey provide areas for shelter and protection from predators. Relatively thick ground cover is a major habitat requirement and it seems to prefer areas with light sandy soils. Feeds at dusk on roots, tubers, fungi, insects and their larvae and other soft bodied animals in the soil. Moves up and down slope as food resources become seasonally available (Johnston 1995; NSW National Parks and Wildlife Service 1999e).	17 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Pseudomys oralis	Hastings River Mouse	E1	E	Recent sightings of the species has been made near low creek banks in tall, open eucalypt forest with dense ground cover of sedges, grasses and/or ferns (Strahan 1995).	15 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Urban gardens and cultivated fruit crops also provide habitat for this species. Feeds on the flowers and nectar of eucalypts and native fruits including lilly pillies. It roosts in the branches of large trees in forests or mangroves (Churchill 1998; NSW National Parks and Wildlife Service 2001b).	63 (Atlas of NSW Wildlife 2008)	High. There is foraging habitat for this species available within the study area.	Yes
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat	V		Occurs in eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts in tree hollows. Thought to be a migratory species (Churchill 1998).	2 (Atlas of NSW Wildlife 2008)	High. There is foraging habitat for this species available within the study area.	Yes
Scoteanax rueppellii	Greater Broad-nosed Bat	V		The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. Typically it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Churchill 1998).	17 (Atlas of NSW Wildlife 2008)	High. There is foraging habitat for this species available within the study area.	Yes
Thylogale stigmatica	Red-legged Pademelon	V		Distribution: Restricted to the coastal and subcoastal strip of eastern Australia, from the tip of Cape York in north Queensland, south to the Hunter Valley, just north of Newcastle in NSW. Populations are confined mainly to areas of high rainfall. Macrohabitat is coastal and sub-coastal rainforests and wet sclerophyll forest. Dense understorey and ground cover is important. Ecotones between open and closed forest are favoured. Microhabitat is open areas are used for foraging while areas of dense ground cover / understorey provide areas for shelter and protection from predators (NSW National Parks and Wildlife Service 1999e).	5 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Vespadelus troughtoni	Eastern Cave Bat	V		A cave-dwelling species found in eastern Australia from Cape York to NSW. They inhabit tropical mixed woodland	8 (Atlas of	Low. There is no habitat for	No

Latin Name	Common Name	TSC Act[1]	EPBC Act[2]	Habitat	Number of Records (source)	Likelihood of occurrence[3]	Impact Assessment Required
				and wet sclerophyll forests on the coast and the dividing range, but extend into drier forests on the western slopes (Churchill 1998).	NSW Wildlife 2008)	this species available within the study area.	
Reptiles							
Hoplocephalus bungaroides	Broad-headed Snake	E1	V	A nocturnal species that occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer (Webb, J.K. & Shine 1994; Webb, J.K & Shine 1998).	2 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No
Varanus rosenbergi	Heath Monitor	V		Found in coastal heaths, humid woodlands, wet and dry sclerophyll forests. Mostly a terrestrial species it shelters in burrows, hollow logs and rock crevices (Cogger 2000).	1 (Atlas of NSW Wildlife 2008)	Low. There is no habitat for this species available within the study area.	No

Notes:
1. P = Protected, V = Vulnerable, E1 = Endangered, *(Threatened Species Conservation Act 1995)*
2. V = Vulnerable, E = Endangered, M = Migratory, C = Conservation Dependent *(Environment Protection and Biodiversity Conservation Act 1999)*
3. Likelihood of Occurrence - High = Recorded during survey within or adjoining the site, Medium = Suitable habitat and/or has been previously recorded within the project locality, Low = No suitable habitat and/or has not been recorded within the project locality.

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Appendix E

Significance assessments

Significance assessments

For Threatened biodiversity listed under the *Threatened Species Conservation Act 1995*, this section details the heads of consideration for Threatened species assessment as suggested in the Department of Environment and Climate Change/ Department of Primary Industries draft Guidelines for Threatened Species Assessment (Department of Environment and Conservation 2005a). The guidelines present methods to consider the impacts on biodiversity of projects assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*, including presenting heads of consideration for determining the significance of impacts.

For Threatened biodiversity listed under the *Environment Protection and Biodiversity Conservation Act 1999* significance assessment have been completed in accordance with the EPBC Act Significant Impact Guidelines (Department of the Environment and Heritage 2006a). Species listed under both the *Threatened Species Conservation Act 1995* and the *Environment Protection and Biodiversity Conservation Act 1999* have been assessed using both assessment guidelines separately. The following threatened biodiversity have been assessed for the Project:

Table 0-1 Summary of impact assessments

Threatened species, or communities	EPBC Act[1]	TSC ACT[2]
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions		E
Diuris tricolor (Pine Donkey Orchid) population in the Muswellbrook LGA		E2
Diuris tricolor	V	V
Bothriochloa biloba	V	
Speckled Warbler		V
Grey-crowned Babbler		V
Brown Treecreeper		V
Black-chinned Honeyeater		V
Hooded Robin		V
Diamond Firetail		V
Large Forest Owls		V
Squirrel Glider		V
Grey-headed Flying Fox	V	V
Microchiropteran Bats (excluding Large-eared Pied Bat)		V
Large-eared Pied Bat	V	V
Green and Gold Bell Frog	V	V

Notes: 1 – Threatened Species Conservation Act 1995, V = Vulnerable, E = Endangered. 2 – Environment Protection and Biodiversity Conservation Act 1999, V = Vulnerable.

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

Significance Assessment - *Environmental Planning and Assessment Act 1979*

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

The Project would result in a reduction of the overall extent of Hunter Lowland Redgum Forest within the study area. Approximately 0.02 hectares of this community are located within the proposed 20 m construction corridor, predominately as small linear fringes on the periphery of a larger remnant. This represents 2% of the remaining extant of the vegetation community within the study area and only 0.02% of the community remaining in the locality.

The extent of this community within the subject site largely consists of regrowth vegetation on the periphery of a larger remnant already affected by edge effects from the adjoining disturbed lands. It is considered likely that the majority of this community's extent within the subject site will be incorporated into vegetation protection zones within the 20 metre construction corridor and as such impacts can be avoided.

How is the project likely to affect current disturbance regimes?

Remnants of this community within the study area have been highly modified by past land uses and edge effects from the adjoining disturbed environments. The project is unlikely to significantly alter these microhabitat conditions. The project will not have an impact on the fire regime in the study area. Minor changes to the surface hydrology may occur as result of the project, but not to an extent that are likely to affect the survival of the ecological community in the area.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The extent of this community within the subject site largely consists of regrowth vegetation adjoining road easements and landscaped mine rehabilitation on the periphery of larger remnant vegetation patches. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is unlikely that the project would further create a barrier for this community within the subject site.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for Hunter Lowland Redgum Forest to date..The subject site is already highly

fragmented by land clearing for industrial and agricultural practices and as such would not be considered habitat critical for the survival of the community.

Conclusion

The proposed upgrade would result in a very small reduction in the extent of a disturbed remnant of Hunter Lowland Redgum Forest within the subject site, however this area comprises only 2% of the remaining extant of the vegetation community within the study area and only 0.02% of the community remaining in the locality. As such it is unlikely that the project will have a significant impact on this endangered community.

2. *Diuris tricolor* (Pine Donkey Orchid) population in the Muswellbrook LGA & *Diuris tricolor* as a Threatened species

This endangered population is listed under Schedule 1, Part 2 of the *Threatened Species Conservation Act 1995.* This species is also listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995.*

Diuris tricolor is an endemic Australian orchid that has been described as a terrestrial herb, as it grows from the ground rather than from rocks or vegetation. The Muswellbrook LGA (Hunter Valley) population of *Diuris tricolor* comprises the large-flowered form of the species.

The endangered population of *Diuris tricolor* in the Muswellbrook LGA consists of a number of occurrences, which range from a few scattered individuals to a few thousand individuals. The geographic distribution of the population is estimated to be highly restricted as the populations area of occupancy is less than 50 km^2.

In the Muswellbrook LGA, the population of *Diuris tricolor* is at the eastern limit of the geographic range of the species. All other populations of the species are located west of the Great Dividing Range, with the nearest population of the species occurring about 100 km to the west of the Muswellbrook population.

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

Based on a construction corridor width of 20 m it is assumed that approximately 0.94 ha of potential habitat will be affected. This would result in a reduction of 6% of the remaining habitat within the study area (50 m buffer) and only 0.01% of the similar habitat remaining in the locality (10 km buffer). The majority of potential habitat within the subject site largely consists of regrowth vegetation on the periphery of a larger remnant patches already impacted by edge effects from the adjoining disturbed lands. These areas are considered to only form marginal potential habitat and are unlikely to be significant to this species.

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

This species was not observed within the subject site however; if present, would be near the eastern most limit of its distribution.

How is the project likely to affect current disturbance regimes?

Remnants of this species habitat within the study area have been highly modified by past land uses and edge effects from the adjoining disturbed environments. The project is unlikely to significantly alter these microhabitat conditions. The project will not have an impact on the fire regime in the study area. Minor changes to the surface hydrology may occur as result of the project, but not to an extent that are likely to affect the survival of the species in the area.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is unlikely that the project would further create a barrier for this species.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of the Department of Environment and Climate Change. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for *Diuris tricolor* to date.The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical for the survival of the species.

Conclusion

Although the project will remove approximately 0.94 ha of marginal potential habitat for *Diuris tricolor*, this area is relatively small (0.01%) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

2.1 *Environment Protection and Biodiversity Conservation Act 1999* significance assessment for *Diuris tricolor*

Diuris tricolor which may potentially occur within the study area is unlikely to be considered an 'important population' because:

- there is no known population within the site for breeding or dispersal
- the populations of the species that may potentially occur within the subject site would be restricted to highly disturbed marginal habitat and the genetic diversity of the species can still be maintained by other populations throughout the wider area.
- Any occurrence of this species within the subject site would not extend the current distribution or be significant to the species distribution limits as there are known records to the north of the site and within the locality suggesting the eastern limit of distribution will be retained.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following

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

Diuris tricolor that may potentially occur within the study area would not be considered an important population. Although the project will remove approximately 0.94 ha of marginal potential habitat for *Diuris tricolor*, this area is relatively small (0.01 %) in relation to similar habitats available in the local area.

Reduce the area of occupancy of an important population

Diuris tricolor that may potentially occur within the study area would not be considered an important population. This species has not been recorded from the subject site. Although the project will remove approximately 0.94 ha of marginal potential habitat for *Diuris tricolor*, this area is relatively small (0.01 %) in relation to similar habitats available in the local area.

Fragment an existing important population into two or more populations

Diuris tricolor that may potentially occur within the study area would not be considered an important population. Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is unlikely that the project would further fragment a population of this species.

Adversely affect habitat critical to the survival of a species

No critical habitat has been listed for this species, nor is the study area critical for the survival of the *Diuris tricolor.*

Habitat critical to the survival of threatened species may, however, also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006).

The extent of the habitat that would be cleared as a result of the project does not represent habitat critical to the survival of the *Diuris tricolor*.

Disrupt the breeding cycle of an important population

The population of the species that may potentially occur within the subject site would be restricted to highly disturbed marginal habitat and the breeding cycle of the species can still be maintained by other populations throughout the wider area.

The *Diuris tricolor* which may potentially occur within the study area would not be considered an important population.

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

Remnants of this species habitat within the study area have been highly modified by past land uses and edge effects from the adjoining disturbed environments. The project is unlikely to significantly alter these microhabitat conditions. The project will not have an impact on the fire regime in the study area. Minor changes to the surface hydrology may occur as result of the project, but not to an extent that are likely to affect the survival of the species in the area.

This area represents a small proportion (0.01%) of similar available habitat in the region and is unlikely to result in the decline of the species in the area.

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

The project would not increase the likelihood of an invasive species becoming established to harm the habitat of the *Diuris tricolor*.

Introduce disease that may cause the species to decline

The project would not increase the likelihood of a disease becoming established or proliferating in the local population that would result in a decline of the species.

Interfere substantially with the recovery of the species

The project is unlikely to interfere with the recovery of the *Diuris tricolor*.

Conclusion

Although the project will remove approximately 0.94 ha of marginal potential habitat for the *Diuris tricolor*, this area is relatively small (0.01%) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

3. Environment Protection and Biodiversity Conservation Act 1999 significance assessment for *Bothriochloa biloba*

Bothriochloa biloba that may potentially occur within the study area is unlikely to be considered an 'important population' because:

- there is no known population within the site for breeding or dispersal
- the populations of the species that may potentially occur within the subject site would be restricted to highly disturbed marginal habitat and the genetic diversity of the species can still be maintained by other populations throughout the wider area.
- the subject site is not at the limit of this species range.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following

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

Bothriochloa biloba that may potentially occur within the study area would not be considered an important population. Although the project will remove approximately 0.94 ha of marginal potential habitat for *Bothriochloa biloba*, this area is relatively small (0.01 %) in relation to similar habitats available in the local area.

Reduce the area of occupancy of an important population

Bothriochloa biloba that may potentially occur within the study area would not be considered an important population. This species has not been recorded from the subject site. Although the project will remove approximately 0.94 ha of marginal potential habitat for *Bothriochloa biloba*, this area is relatively small (0.01 %) in relation to similar habitats available in the local area.

Fragment an existing important population into two or more populations

Bothriochloa biloba which may potentially occur within the study area would not be considered an important population. Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is unlikely that the project would further fragment a population of this species.

Adversely affect habitat critical to the survival of a species

No critical habitat has been listed for this species, nor is the study area critical for the survival of the *Bothriochloa biloba.*

Habitat critical to the survival of threatened species may, however, also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal

- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006).

The extent of the habitat that would be cleared as a result of the project does not represent habitat critical to the survival of the *Bothriochloa biloba*.

Disrupt the breeding cycle of an important population

This species is known to occur to the west of the subject site and locality (Umwealt Pty Ltd 2006). The population of the species that may potentially occur within the subject site would be restricted to highly disturbed marginal habitat and the breeding cycle of the species can still be maintained by other populations throughout the wider area.

The *Bothriochloa biloba* which may potentially occur within the study area would not be considered an important population

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

Remnants of this species habitat within the study area have been highly modified by past land uses and edge effects from the adjoining disturbed environments. The project is unlikely to significantly alter these microhabitat conditions. The project will not have an impact on the fire regime in the study area. Minor changes to the surface hydrology may occur as result of the project; however not to an extent that are likely to affect the survival of the species in the area. This area represents a small proportion (0.01%) of similar available habitat in the region and is unlikely to result in the decline of the species in the area.

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

The project would not increase the likelihood of an invasive species becoming established to harm the habitat of the *Bothriochloa biloba*.

Introduce disease that may cause the species to decline

The project would not increase the likelihood of a disease becoming established or proliferating in the local population that would result in a decline of the species.

Interfere substantially with the recovery of the species

The project is unlikely to interfere with the recovery of the *Bothriochloa biloba*.

Conclusion

Although the project will remove approximately 0.94 ha of suitable habitat for the *Bothriochloa biloba*, this area is relatively small (0.01%) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on these species.

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

The Green and Golden Bell Frog has a fragmented distribution of mainly coastal populations within its former known range, which extended from the NSW north coast to Victoria and as far west as Bathurst in the more elevated southern tablelands and central slopes of NSW (White & Pyke 1996; Gillespie 1996). This frog species inhabits marshes, dams and stream sides, and ephemeral locations that are more often dry than wet (DECC 2008). Lotic situations such as fast flowing streams appear to be one of the few water bodies not utilised, at least for breeding purposes (DECC 2008). Habitat attributes associated with this species include a shallow water body, still or slow flowing, ephemeral or widely fluctuating and without heavy shading. Preference is also shown to habitats with vegetation complexity and associated terrestrial habitat including, extensive grassy areas and an abundance of shelter sites such as rocks, logs, tussock forming vegetation etc. Green and Golden Bell Frogs are a voracious insect eater as well as being cannibalistic. They are frequently diurnal and are usually summer breeders (Cogger 1992).

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

The nearest record for this species is approximately 3 km to the south of the subject site. This species was not recorded during the current surveys of the subject site or recent targeted surveys in better quality habitats adjoining the study area. (Umwealt Pty Ltd 2006, 2007, ERM 2008). Recent surveys for this species at its nearest known population failed to relocate the species (ERM 2008).

While the construction corridor width of 20 m is assumed to impact on approximately 2.8 ha of native vegetation, no dams or permanent creeklines will be affected by the proposed pipeline alignment. It is proposed that under boring techniques will be utilised in situations were the pipeline alignment will dissect the permanent creekline(s), thereby minimising any potential affect on the lifecycle of this species.**How is the project likely to affect the habitat of a threatened species, population or ecological community?**

While the construction corridor width of 20 m is assumed to impact on approximately 2.8 ha of native vegetation, no dams or creeklines will be affected by the proposed pipeline alignment. It is proposed that under boring techniques will be utilised in situations were the pipeline alignment will dissect the permanent creekline(s), thereby minimising any impact on potential habitat for this species. Ephemeral drainage lines and soaks in grasslands that may provide marginal disturbed refuge for this species may be impacted.

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

Within the study area, this species is not at the limit of its distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment. It is proposed that permanent creeklines will be under bored, limiting any disturbance to creek banks, environmental flows and riparian vegetation. The project will increase several disturbance regimes including loss of native vegetation and dead wood.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is estimated that 2.8 ha of native vegetation along a 25 km linear pipeline will be affected, thus not exacerbating loss of habitat connectivity that already occurs in the locality. It is unlikely that the project would further create a barrier for this species.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for the Green and Golden Bell Frog to date. The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

The project will have minimal impact on potential Green and Golden Bell Frog habitat. No dams will be affected and the permanent creeklines will be under bored, minimising disturbance to creek banks, environmental flows, and riparian vegetation. A small number of ephemeral drainage lines and soaks within the derived grassland community may be affected by the project, however these areas provide only marginal disturbed habitat. As such it is unlikely that the project will have a significant impact on this species.

4.1 *Environment Protection and Biodiversity Conservation Act 1999* significance assessment for Green and Golden Bell Frog

Green and Golden Bell Frog which may potentially occur within the study area are unlikely to be considered an 'important population' because:

- there is no known population within the site for breeding or dispersal
- the populations of the species that may potentially occur within the subject site would be restricted to highly disturbed marginal habitat and the genetic diversity of the species can still be maintained by other populations throughout the wider area.
- the subject site is not at the limit of this species range

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following

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

Although not recorded in the study area, Green and Golden Bell Frog that may potentially occur within the study area would not be considered an important population. A small number of ephemeral drainage lines and soaks within the derived grassland community may be affected by the project, however these areas provide only marginal disturbed habitat. Although the project will remove marginal potential habitat for Green and Golden Bell Frog, this area is relatively small in relation to similar habitats available in the local area and is unlikely to result in a long term decrease in the size of a population.

Reduce the area of occupancy of an important population

Green and Golden Bell Frog that may potentially occur within the study area would not be considered an important population. This species has not been recorded from the subject site. A small number of ephemeral drainage lines and soaks within the derived grassland community may be affected by the project, however these areas provide only marginal disturbed habitat. Although the project will remove marginal potential habitat for Green and Golden Bell Frog, this area is relatively small in relation to similar habitats available in the local area.

Fragment an existing important population into two or more populations

Green and Golden Bell Frog that may potentially occur within the study area would not be considered an important population. Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is unlikely that the project would further fragment a population of this species.

Adversely affect habitat critical to the survival of a species

No critical habitat has been listed for this species, nor is the study area critical for the survival of the Green and Golden Bell Frog.

Habitat critical to the survival of threatened species may, however, also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006).

The extent of the habitat that would be cleared as a result of the project does not represent habitat critical to the survival of the Green and Golden Bell Frog.

Disrupt the breeding cycle of an important population

The population of the species that may potentially occur within the subject site would be restricted to highly disturbed marginal habitat and the breeding cycle of the species can still be maintained by other populations throughout the wider area.

The Green and Golden Bell Frog that may potentially occur within the study area would not be considered an important population.

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

Remnants of this species habitat within the study area have been highly modified by past land uses and edge effects from the adjoining disturbed environments. The project is unlikely to significantly alter these microhabitat conditions. The project will not have an impact on the fire regime in the study area. Minor changes to the surface hydrology may occur as result of the project; however not to an extent that are likely to affect the survival of the species in the area.

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

The subject sites aquatic habitats already contained the species, *Gambusia holbrooki* (Mosquito Fish). This species is a significant invasive species that impacts on the breeding cycle and viability of Green and Gold Bell Frogs. The project would not increase the likelihood of an invasive species becoming established to harm the habitat of the Green and Golden Bell Frog.

Introduce disease that may cause the species to decline

The project would not increase the likelihood of a disease becoming established or proliferating in the local population that would result in a decline of the species.

Interfere substantially with the recovery of the species

The project is unlikely to interfere with the recovery of the Green and Golden Bell Frog.

Conclusion

A small number of ephemeral drainage lines and soaks within the derived grassland community may be affected by the project, however these areas provide only marginal disturbed habitat. Although the project will remove marginal potential habitat for Green and Golden Bell Frog, this area is relatively small in relation to similar habitats available in the local area.

5. Brown Treecreeper (*Climacteris picumnus* ssp *victoriae*)

The Brown Treecreeper is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995.*

The eastern subspecies of the Brown Treecreeper *Climacteris picumnus* ssp *victoriae* is distributed through central NSW and occurs in eucalypt forests and woodland of inland plains and slopes of the Great Dividing Range. It is sparsely scattered to the east of the divide in drier areas including the Cumberland Plain of western Sydney, and in parts of the hunter, Clarence, Richmond and Snowy river valleys. The population density of this subspecies has been greatly reduced over much of it s range. Declines have occurred in remnant vegetation fragments generally smaller than 300 ha, that have been isolated or fragmented for 50 years or more.

The Brown Treecreeper is a medium-sized insectivorous bird that frequents drier forests and woodlands, particularly open woodland lacking a dense understorey, but also grasslands where there are sufficient logs, stumps and dead trees nearby. It is spends up to half of its time on the ground and on fallen logs, often well away from cover, pecking and probing for insects amongst tussock grass, leaves, litter and fallen timber, most notably for ants.

This species is sedentary and considered to be resident in many locations throughout its range and is territorial year-round. They are gregarious, active, noisy and conspicuous (while foraging) and usually observed in pairs or small groups of eight to 12 birds. Hollows in standing trees, both dead and alive, and tree stumps are essential for nesting.

Brown Treecreepers are threatened by clearance and the fragmentation of the woodland habitat including removal of dead timber. Increased isolation decreases treecreeper vagility and increases the vulnerability of populations to extinction as a result of stochastic events. This species appears unable to maintain viable populations in remnants less than 200ha and its abundance decreases as remnant size decreases (NSW Scientific Committee, 2001). Fragmentation also leads to a skewed sex ratio in Brown Treecreepers because female birds are unable to disperse to isolated remnants, increasing the chance of local extinctions (NSW Scientific Committee, 2001). Habitat degradation, including loss of hollow bearing trees, threatens Brown Treecreeper populations. Grazing by stock in woodland areas leads to a decrease in diversity of ground-dwelling invertebrates decreasing the availability of food for the birds (NSW Scientific Committee, 2001).

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

This species was not observed during surveys of the subject site. Based on a construction corridor width of 20 m it is assumed that approximately 2.8 ha of native vegetation will be impacted on. This habitat may be used by this species for breeding, foraging and nesting purposes. However, this action is unlikely to have an adverse affect on the lifecycle of this species due to the relative small (0.03 %) loss of habitat and the availability of other potential habitat in the locality.

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

The project would result in a reduction of the overall extent of habitat within the study area. Approximately 2.8 ha of potential habitat would be impacted on within the subject site as a result of the project. This represents 9 % of the remaining extant of the vegetation within the study area (50 m buffer) but only 0.03 % of the vegetation remaining in the locality (10 km buffer).

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

Within the study area this species is not at the limit of its distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment. It is proposed that permanent creeklines will be under bored limiting any such disturbance to creek banks, environmental flows and riparian vegetation. The project will not have an impact on the fire regime in the study area.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is estimated that 2.8 ha of native vegetation along a 22 km linear pipeline will be affected, thus not exacerbating that the barrier effects that already occur in the locality. It is unlikely that the project would further create a barrier for this species.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for the Brown Treecreeper to date. The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable breeding, foraging and nesting habitat for the Brown Treecreeper, this area is relatively small (0.03 %) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

6. Hooded Robin (*Melanodryas cucullata*)

The Hooded Robin is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995.*

The south eastern subspecies of the Hooded Robin (*Melanodryas cucullata cucullata*) is distributed ranges from central Queensland, to Spencer Gulf, South Australia. It occurs throughout NSW except the north west of the state where it intergrades with the smaller northern form of the Hooded Robin. They occupy drier Eucalypt woodlands, open forests and Acacia scrub. The species also favours (in temperate woodlands) cleared paddocks in close proximity to wooded areas.

The species is a quiet, shy and largely sedentary bird. It is frequently observed in pairs or small groups and hunts. It feeds on the ground on invertebrates, and forages in areas with a mix of bare ground and grassy clearings, where rocks and fallen timber litter the ground (NSW Scientific Committee, 2001).

The Hooded Robin has declined significantly in range and population and id threatened by clearance and fragmentation of habitat including removal of dead timber. The species appears unable to survive in remnants smaller than 100-200 ha. Isolation and populations in small remnants increases vulnerability to local extinction as a result of stochastic events. Low population densities and relatively large home ranges also exacerbate their vulnerability within a highly fragmented and predominately cleared landscape.

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

This species was not observed during surveys of the subject site. Based on a construction corridor width of 20 m it is assumed that approximately 2.8 ha of native vegetation will be impacted on. This habitat may be used by this species for breeding, foraging and nesting purposes. However, this action is unlikely to have an adverse affect on the lifecycle of this species due to the relative small (0.03 %) loss of habitat and the availability of other potential habitat in the locality.

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

The project would result in a reduction of the overall extent of habitat within the study area. Approximately 2.8 ha of potential habitat would be impacted on within the subject site as a result of the project. This represents 9% of the remaining extant of the vegetation within the study area (50 m buffer) but only 0.03% of the vegetation remaining in the locality (10 km buffer).

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

Within the study area this species is not at the limit of its distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment. It is proposed that permanent creeklines will be under bored, limiting any such disturbance to creek banks, environmental flows and riparian vegetation. The project will increase several disturbance regimes including, loss of native vegetation and dead wood, and a potential loss of hollow-bearing trees.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is estimated that 2.8 ha of native vegetation along a 25 km linear pipeline will be impacted on, thus not increasing the barrier effects already occurring in the locality. It is unlikely that the project would further create a barrier for this species.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for the Hooded Robin to date. The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable breeding, foraging and nesting habitat for the Hooded Robin, this area is relatively small (0.03%) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

7. Black-chinned Honeyeater (*Melithreptus gularis*)

The Black-chinned Honeyeater is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995.*

The eastern subspecies of the black-chinned Honeyeater, *Melithreptus gularis gularis*, is found predominantly along the tablelands and western slopes of the Great Dividing Range to the north west and central plains and the Riverina. Its range extends east to the coast but has only been recorded at a few scattered sites from drier coastal woodlands in the Hunter, Central Coast, Cumberland Plains and Richmond and Clarence Valleys (NSW Scientific Committee, 2001).

Black-chinned Honeyeaters occupy drier open forests and Eucalypt woodlands, particularly within associations containing box-ironbark species and River Red Gums, and generally within an approximate annual rainfall range of 400-700mm. Although often irregular and unpredictable, it's gregarious and often occurs in small groups of up to 12 birds. Feeding territories are large making the species locally nomadic where it searches foliage for such food as insects, nectar and lerp. Recent studies have suggested that the species utilises the largest woodland patches as the bird forage over large home ranges of at least 5 ha (NSW Scientific Committee, 2001).

Black-chinned Honeyeaters are threatened by clearance and fragmentation of woodland habitat. Reduction in remnant habitat size leads to the isolation of honeyeater populations, which increases their vulnerability to extinction from stochastic events. This species occurs at low densities and is only found in relatively large remnants, as such, this further exacerbates the species vulnerability.

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

This species was not observed during surveys of the subject site. Based on a construction corridor width of 20 m it is assumed that approximately 2.8 ha of native vegetation will be impacted on. This habitat may be used by this species for breeding, foraging and nesting purposes. However, this action is unlikely to have an adverse affect on the lifecycle of this species due to the relative small (0.03 %) loss of habitat and the availability of other potential habitat in the locality.

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

The project would result in a reduction of the overall extent of habitat within the study area. Approximately 2.8 ha of potential habitat would be impacted on within the subject site as a result of the project. This represents 9% of the remaining extant of the vegetation within the study area (50 m buffer) but only 0.03% of the vegetation remaining in the locality (10 km buffer).

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

Within the study area this species is not at the limit of its distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment. It is proposed that permanent creeklines will be under bored, limiting any such disturbance to creek banks, environmental flows and riparian vegetation. The project will increase several disturbance regimes including, loss of native vegetation and dead wood, and a potential loss of hollow-bearing trees.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is estimated that 2.8 ha of native vegetation along a 25 km linear pipeline will be impacted on, thus not increasing the barrier effects already occurring in the locality. It is unlikely that the project would further create a barrier for this species.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for the Hooded Robin to date. The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable breeding, foraging and nesting habitat for the Black-chinned Honeyeater, this area is relatively small (0.03 %) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

8. Grey-crowned Babbler (*Pomatostomus temporalis*)

The Grey-crowned Babbler is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995.*

The eastern subspecies of the Grey-crowned Babbler, *Pomatostomus temporalis temporalis*, occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Hay. Isolated populations are known form several locations on the North Coast, in the Hunter Valley and from the South Coast near Nowra.

The Grey-crowned Babbler inhabits open Eucalypt woodlands with an intact grassy groundcover and sparse, tall shrub layer. The species may also be observed along streams, in cleared areas (farmlands) and grassy road verges in outer suburbs (Pizzey & Knight, 2006). Grey-crowned Babblers are insectivorous and spend most of their time foraging for invertebrates in leaf litter and tussock grasses, as well as on the trunks of and branches of eucalypt and other woodland trees. They are sedentary and live in extended families usually consisting of a pair and offspring and breed cooperatively between July and February (Davidson & Robinson, 1992). The group as a whole defends a territory (usually about 12 ha) all year.

The Grey-crowned Babbler is one of several woodland birds known to be declining in South Eastern Australia. They are threatened by clearance and the highly fragmented nature of remnant habitat, including removal of dead timber. The Grey-crowned babbler habitat has been disproportionately cleared for agriculture, as the species occupies woodlands on fertile soils of plains and undulating terrain. Isolation of populations in scattered remnants is also exacerbated by the reluctance of birds to traverse tracts of cleared land, which increases their vulnerability to extinction via stochastic events. Likely increases in the abundance of competitors including, Noisy Miners and nest predators, such as the Pied Currawong and the Australian Raven threaten Babbler foraging efficiency and breeding success.

How is the project likely to affect the lifecycle of a threatened species and/or population?This species was observed during surveys of the subject site. Based on a construction corridor width of 20 m it is assumed that approximately 2.8 ha of native vegetation will be impacted on. This habitat may be used by this species for breeding, foraging and nesting purposes. However, this action is unlikely to have an adverse affect on the lifecycle of this species due to the relative small (0.03 %) loss of habitat and the availability of other potential habitat in the locality.

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

The project would result in a reduction of the overall extent of habitat within the study area. Approximately 2.8 ha of potential habitat would be impacted on within the subject site as a result of the project. This represents 9% of the remaining extant of the vegetation within the study area (50 m buffer) but only 0.03% of the vegetation remaining in the locality (10 km buffer).

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

Within the study area this species is not at the limit of its distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment. It is proposed that permanent creeklines will be under bored, limiting any such disturbance to creek banks, environmental flows and riparian vegetation. The project will increase several disturbance regimes including, loss of native vegetation and dead wood, and a potential loss of hollow-bearing trees.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is estimated that 2.8 ha of native vegetation along a 25 km linear pipeline will be impacted on, thus not increasing the barrier effects already occurring in the locality. It is unlikely that the project would further create a barrier for this species.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for the Hooded Robin to date. The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable breeding, foraging and nesting habitat for the Grey-crowned Babbler, this area is relatively small (0.03 %) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

9. Speckled Warbler (*Pyrrholaemus sagittatus*)

The Speckled Warbler is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995.*

The Speckled Warbler ranges throughout South eastern Australia, from south west Victoria through eastern NSW and to central Queensland, mostly on the western slopes of the Great Dividing Range. Populations also occur in drier coastal areas such as the Cumberland Plain, Western Sydney and the Hunter and Snowy River Valleys. Speckled Warblers occupy a wide range of Eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies.

The Speckled Warbler is a sedentary species with a home range that varies from 6- 12 ha. It is estimated that this species has declined in population density by more than 40 % through out its range, and appears to be extinct from areas where no vegetation fragments larger than 100 ha remain. This species appears to prefer woodland areas where groundcover consists of scattered native tussock grasses, a sparse shrub layer, leaf litter and bark. This ground foraging bird feeds in the understorey for arthropods and seeds and prefers foraging in areas with a combination of open grassy patches, leaf litter and shrub cover. They live in pairs or trios and nest on the ground in grass tussocks, dense leaf litter and fallen branches.

The Speckled Warbler is threatened by clearance and fragmentation of habitat including the removal of dead timber. Isolation of Speckled Warblers populations in small remnants increases their vulnerability to local extinction as a result of stochastic events and neting on the ground also makes them vulnerable to predation from exotic mammalian predators such as foxes and cats. Low population densities together with large home ranges also exacerbate their vulnerability to habitat loss.

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

This species was not observed during surveys of the subject site. Based on a construction corridor width of 20 m it is assumed that approximately 2.8 ha of native vegetation will be impacted on. This habitat may be used by this species for breeding, foraging and nesting purposes. However, this action is unlikely to have an adverse affect on the lifecycle of this species due to the relative small (0.03 %) loss of habitat and the availability of other potential habitat in the locality.

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

The project would result in a reduction of the overall extent of habitat within the study area. Approximately 2.8 ha of potential habitat would be impacted on within the subject site as a result of the project. This represents 9% of the remaining extant of the vegetation within the study area (50 m buffer) but only 0.03% of the vegetation remaining in the locality (10 km buffer).

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

Within the study area this species is not at the limit of its distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment. It is proposed that permanent creeklines will be under bored, limiting any such disturbance to creek banks, environmental flows and riparian vegetation. The project will increase several disturbance regimes including, loss of native vegetation and dead wood, and a potential loss of hollow-bearing trees.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is estimated that 2.8 ha of native vegetation along a 25 km linear pipeline will be impacted on, thus not increasing the barrier effects already occurring in the locality. It is unlikely that the project would further create a barrier for this species.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for the Hooded Robin to date. The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable breeding, foraging and nesting habitat for the Speckled Warbler, this area is relatively small (0.03 %) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

10. Diamond Firetail (*Stagonopleura guttata*)

The Diamond Firetail is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act 1995.*

The Diamond Firetail is distributed through central and eastern NSW, extending north into Queensland and south through Victoria to the Eyre Peninsula in South Australia. They live in a wide range of Eucalypt-dominated vegetation communities that have a grassy understorey, including open forests, woodland and mallee. The species is also often found in riparian areas and sometimes in lightly wooded farmland. In NSW the species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas (Blakers et al. 1984, Schodde & Mason 1999).

As with most Australian Finch species, Diamond Firetails are highly sociable birds and as such, are generally found in flocks of between five to 40 birds. Although, between August and January groups separate into small colonies to breed. This species appears to be sedentary, though some populations may be locally nomadic when not breeding. The Diamond Firetail feeds exclusively on the ground, largely for ripe and partly ripe grass, herb seeds and other plant material, but also for insects. This species roost in dense shrubs or in smaller nests built especially for roosting (NSW Scientific Committee, 2001).

Much of the habitat for woodland birds, including the Diamond Firetail, has been cleared and remaining fragments are gradually becoming unstable. Habitat degradation, particularly through overgrazing of the grassy understorey, threatens the granivorous Diamond Firetail of foraging habitat, while isolation and reduction in remnant area inhibit dispersal and increase their vulnerability to local extinction through stochastic events. Furthermore, Diamond Firetail populations appear unable to persist in areas which lack remnants of native vegetation larger than 200 ha (NSW Scientific Committee, 2001).

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

This species was not observed during surveys of the subject site. Based on a construction corridor width of 20 m it is assumed that approximately 2.8 ha of native vegetation will be impacted on. This habitat may be used by this species for breeding, foraging and nesting purposes. However, this action is unlikely to have an adverse affect on the lifecycle of this species due to the relative small (0.03 %) loss of habitat and the availability of other potential habitat in the locality.

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

The project would result in a reduction of the overall extent of habitat within the study area. Approximately 2.8 ha of potential habitat would be impacted on within the subject site as a result of the project. This represents 9% of the remaining extant of the vegetation within the study area (50 m buffer) but only 0.03% of the vegetation remaining in the locality (10 km buffer).

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

Within the study area this species is not at the limit of its distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment. It is proposed that permanent creeklines will be under bored, limiting any such disturbance to creek banks, environmental flows and riparian vegetation. The project will increase several disturbance regimes including, loss of native vegetation and dead wood, and a potential loss of hollow-bearing trees.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is estimated that 2.8 ha of native vegetation along a 25 km linear pipeline will be impacted on, thus not increasing the barrier effects already occurring in the locality. It is unlikely that the project would further create a barrier for this species.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Climate Change. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for the Hooded Robin to date. The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable breeding, foraging and nesting habitat for the Diamond Firetail, this area is relatively small (0.03 %) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

11. Large Forest Owls (Barking Owl, Powerful Owl, Masked Owl)

The Masked Owl, Powerful Owl, and Barking Owl are all listed as Vulnerable under the *Threatened Species Conservation Act 1995*. While suitable habitat for the Large Forest Owls exists in the catchment areas, it is likely that the study area forms only part of a marginal foraging area for the owls. Individuals of these species have been recorded previously in the local area. The large forest owls occupy similar ecological niches and habitat requirements and therefore, they have been assessed together.

Table E-2 Details of threatened species of Large Forest Owl

Common name (Scientific name)	Threats	Habitat and distribution	TSC Act[1]
Powerful Owl (*Ninox strenua)*	Historical loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat. Road kills. Secondary poisoning.	A sedentary species with a home range of approximately 1000 ha it occurs within open Eucalypt, Casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett & Crowley 2000b). Endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria (Department of Environment and Conservation 2005).	V
Barking Owl (*Ninox connivens)*	Clearing and degradation of habitat, mostly through cultivation, intense grazing and the establishment of exotic pastures. Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat. Firewood harvesting resulting in the removal of old trees.	Occurs in dry Sclerophyll woodland. In the south west it is often associated with riparian vegetation while in the south east it generally occurs on forest edges. It nests in large hollows in live Eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett, 2000). Distributed throughout Australia except for central arid regions and Tasmania. Most frequently recorded on the western slopes and plains. Rarely recorded in the far west or in coastal and escarpment forests (NSW National Parks and Wildlife Service 2003).	V

Common name (Scientific name)	Threats	Habitat and distribution	TSC Act[1]
Masked Owl (*Tyto novaehollandiae)*	Loss of mature hollow-bearing trees and changes to forest and woodland structure Loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. Combination of grazing and regular burning Secondary poisoning from rodenticides.	Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett & Crowley 2000a). Distributed mainly throughout NSW from the coast where it is most abundant to the western plains (NSW Scientific Committee 2004).	V

Notes: [1] V= Vulnerable under the *Threatened Species Conservation Act 1995*

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

Based on a construction corridor width of 20 m it is assumed that approximately 2.8 ha of native vegetation will be impacted on. This habitat may be used by large forest owls for breeding, foraging and nesting purposes. However, this action is unlikely to have an adverse affect on the lifecycle of this species due to the relative small (0.03 %) loss of habitat and the availability of other potential habitat in the locality.

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

The project would result in a reduction of the overall extent of habitat within the study area. Approximately 2.8 ha of potential habitat would be impacted on within the subject site as a result of the project. This represents 9% of the remaining extant of the vegetation within the study area (50 m buffer) but only 0.03% of the vegetation remaining in the locality (10 km buffer). This habitat is likely to be used by owls for foraging, although the quality of the foraging habitat is likely to be low, given the generally low abundance of observed habitats for small mammal species.

The subject site does not contain any tree hollows large enough to be used for nesting and none were recorded in the study area or adjacent to the project.

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

Within the study area the large forest owls are not at the limit of their distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment. It is proposed that permanent creeklines will be under bored, limiting any such

disturbance to creek banks, environmental flows and riparian vegetation. The project will increase several disturbance regimes including, loss of native vegetation and dead wood, and a potential loss of hollow-bearing trees. This may lead to a small loss of potential foraging habitat through a decline in abundance of small mammals species utilising the sites existing habitats.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is estimated that 2.8 ha of native vegetation along a 25 km linear pipeline will be impacted on, thus not exacerbating loss of habitat connectivity that already occurs in the locality.

The large forest owls are highly mobile species with home ranges of up to 1000 ha (Garnett & Crowley 2000b). A 20 metre cleared corridor largely already located in disturbed areas is unlikely to create a barrier for these species.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for the large forest owls to date. The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable breeding, foraging and nesting habitat for the large forest owls, this area is relatively small (0.03 %) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on these species.

12. Microchiropteran Bats

Potential foraging and roosting habitat is present within the study area for species including:

- Eastern Freetail-bat *Mormopterus norfolkensis*
- Eastern Bent-wing Bat *Miniopterus schreibersii*
- Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*
- Eastern False Pipistrelle *Falsistrellus tasmaniensis*
- Large-eared Pied Bat *Chalinolobus dwyeri*
- Greater Broad-nosed Bat *Scoteanax rueppellii*
- Large-footed Myotis *Myotis adversus*
- Little Bent-wing Bat *Miniopterus australis*

These species have been considered as a group because of their similarity of habitats and habits, which are described in Table E-3.

Table E-3 Details of threatened species of microchiropteran bat

Common name (Scientific name)	Threats	Habitat and distribution	TSC Act[1]
Eastern Freetail-bat (*Mormopterus norfolcensis*)	Vulnerable to loss of tree hollows and loss of feeding grounds by forestry activities, clearing for agriculture and housing. Its population is suspected to have been reduced. It is an ecological specialist and depends on particular types of diet or habitat (Churchill 1998).	Thought to live in Sclerophyll forest and woodland. Small colonies have been found in tree hollows or under loose bark. It feeds on insects above the forest canopy or in clearings at the forest edge (Churchill 1998).	V
Eastern Bent-wing Bat (*Miniopterus schreibersii*)	Loss of habitat, feral predators such as cats and foxes, disturbances of winter roosts, relies on very few nursery caves at high density (Dwyer 1998).	Distributed across the east coast of Australia, rests in caves, old mines, stormwater channels and comparable structures including occasional buildings (Dwyer 1998),. Typically found in well-timbered valleys where it forages, above tree canopy on small insects (Churchill 1998).	V

Common name (Scientific name)	Threats	Habitat and distribution	TSC Act[1]
Little Bent-wing Bat (*Miniopterus australis*)	The species is an ecological specialist (it depends on particular types of diet or habitat) and it concentrates (individuals within populations of the species congregate or aggregate at specific locations).	Feeds on small insects beneath the canopy of well timbered habitats including rainforest, Melaleuca swamps and dry Schlerophyll forests. Roosts in caves and tunnels and has specific requirements for nursery sites. Distribution becomes coastal towards the southern limit of its range in NSW. Nesting sites are in areas where limestone mining is preferred (Strahan 1995).	V
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	Its population and distribution are suspected to be reduced It faces severe threatening processes It is an ecological specialist (it depends on particular types of diet or habitat).	Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings (Churchill 1998).	V
Large-footed Myotis (*Myotis adversus*)	Not certain. Is likely to be susceptible to changes in water quality, which may result from vegetation clearing and logging (sedimentation), sewage and fertilizer run-off (eutrophication), pesticide/herbicide leakage (chemical pollution) and altered flow regimes (changes to river ecology). Where populations concentrate in roosts which are susceptible to disturbance, human activities such as recreational use of caves and removal of old wooden bridges would also be a threat (Duncan *et al.* 1999). The species may have been subject of over-collection in the past (Richards 1998).	Found in roosting caves, tunnels, tree hollows and possibly dense vegetation (Churchill 1998). Roosts have been located in hanging trees. Buildings and underneath bridges have also been listed as roost sites for the species. The species is always associated with permanent, usually slow-flowing water bodies. Forages over small creeks, coastal rivers, estuaries lakes and inland rivers. Records come from a wide range of vegetation communities associated with water (Richards 1998).	V
Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris)*	Disturbance to roosting and summer breeding sites. Foraging habitats being cleared for residential and agricultural developments. Loss of hollow-bearing trees, clearing and fragmentation of forest and woodland habitat.	Occurs in Eucalypt forest where it feeds above the canopy and in mallee or open country where it feeds closer to the ground. Generally a solitary species but sometimes found in colonies of up to 10. It roosts in tree hollows. Thought to be a migratory species (Churchill 1998).	V

Common name (Scientific name)	Threats	Habitat and distribution	TSC Act[1]
Large-eared Pied Bat (*Chalinolobus dwyeri)*	Clearing and isolation of forest and woodland habitats near cliffs, caves and old mine workings for agriculture, forestry or development. Damage to roosting and maternity sites from mining operations and recreational caving activities. Use of pesticides.	Occurs in moderately wooded habitats and roosts in caves, mine tunnels and the abandoned, bottle-shaped mud nests of Fairy Martins. Thought to forage below the forest canopy for small flying insects (Churchill 1998).	V V[2]
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	Its population is suspected to have been reduced. It is an ecological specialist (it depends on particular types of diet or habitat).	The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. Typically it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Churchill 1998).	V

Notes: [1] V= Vulnerable under the Threatened Species Conservation Act 1995

[2] V= Vulnerable under the Environmental Protection and Biodiversity Conservation Act 1999

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

Based on a construction corridor width of 20 metres it is assumed that approximately 2.8 ha of native vegetation will be impacted on. This habitat may be used by this species for breeding, foraging and roosting purposes. However, this action is unlikely to have an adverse affect on the lifecycle of this species due to the relative small (0.03 %) loss of habitat and the availability of other potential habitat in the locality.

The loss of hollow-bearing trees has the potentially to reduce the available breeding habitat for some species of hollow-dependent Microchiropteran Bats. However, only relatively small numbers (<4) of hollow bearing trees were observed within the study area, most of which will be retained.

Given the retention of most of these trees and the likely presence of further hollow bearing trees within the better quality remnant forest habitats of the locality, the project is unlikely to significantly impact the life cycles of any hollow-dependent Microchiropteran Bat species.

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

The project would result in a reduction of the overall extent of habitat within the study area. Approximately 2.8 ha of potential habitat would be impacted on within the subject site as a result of the project. This represents 9% of the remaining extant of the vegetation within the study area (50 m buffer) but only 0.03% of the vegetation remaining in the locality (10 km buffer).

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

Within the study area these species are not at the limit of their distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment. It is proposed that permanent creeklines will be under bored, limiting any such disturbance to creek banks, environmental flows and riparian vegetation. The project will increase several disturbance regimes including, loss of native vegetation and dead wood, and a potential loss of hollow-bearing trees.

The loss of hollow-bearing trees has the potentially to reduce the available breeding habitat for some species of Microchiropteran Bats. However given the relatively small number (<4) of hollow bearing trees observed within the study area, and the likely presence of hollow bearing trees within the better quality remnant forest habitats of the locality and loss is unlikely to be significant.

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is estimated that 2.8 ha of native vegetation along a 25 km linear pipeline will be impacted on, thus not exacerbating loss of habitat connectivity that already occurs in the locality.

The Microchiropteran Bats are highly mobile species with large home ranges. Many species utilise cleared corridors as foraging flight paths between and along the edges of remnant forest and woodlands. A 20 metre cleared corridor largely already located in disturbed areas is unlikely to create a barrier for these species.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for any Microchiropteran Bat species to date. The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable breeding, foraging and roosting habitat for Microchiropteran Bat species, this area is relatively small (0.03 %) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on these species.

12.1 Environment Protection and Biodiversity Conservation Act 1999 significance assessment for Large-eared Pied Bat

The Large-eared Pied Bat which may potentially forage or roost within the study area would not be considered an 'important population' because:

- there is no established breeding population that relies on maternity resources within the site for breeding or dispersal
- the populations of the species that may potentially forage in the area are not restricted to the habitat within the site due to the species large home range, therefore the genetic diversity of the species can still be maintained by interbreeding with other populations throughout the wider area
- the population of the species that may potentially forage or roost within the study area are not at the limit of the species range.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following

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

Although the project will remove approximately 2.8 ha of suitable roosting and foraging habitat for the eight threatened species of bat, this area is relatively small (0.03%) in relation to similar habitats available in the local area. The Large–eared Pied Bats that may potentially occur within the study area would not be considered an important population.

Reduce the area of occupancy of an important population

Although the project will remove approximately 2.8 ha of suitable roosting and foraging habitat for the eight threatened species of bat, this area is relatively small (0.03%) in relation to similar habitats available in the local area. The Large–eared Pied Bat that may potentially occur within the study area would not be considered an important population.

Fragment an existing important population into two or more populations

The Large–eared Pied Bat that may potentially occur within the study area would not be considered an important population.

The habitat to be removed is already fragmented by infrastructure for industrial and agricultural practices. The Large–eared Pied Bat is a highly mobile species, that is likely to utilise cleared corridors as foraging flight paths between and along the edges of remnant forest and woodlands. A 20 metre cleared corridor largely already located in disturbed areas is unlikely to create a barrier for this species.

Adversely affect habitat critical to the survival of a species

No critical habitat has been listed for this species, nor is the study area critical for the survival of the Large-eared Pied Bat.

Habitat critical to the survival of threatened species may, however, also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal

- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006).

The extent of the habitat that would be cleared as a result of the project does not represent habitat critical to the survival of the Large-eared Pied Bat.

Disrupt the breeding cycle of an important population

There were no potential maternity sites for the Large-eared Pied Bat observed within the subject site. The Large–eared Pied Bat which may potentially occur within the study area would not be considered an important population. The project is therefore unlikely to disrupt the breeding cycle of an important population.

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

The project will not impact any Large-eared Pied Bat roosting or maternity sites, as there are no caves, cliffs or mines within the study area, however, it will remove approximately 2.8 ha of foraging habitat. This area represents a small proportion (0.03%) of similar available habitat in the region and is unlikely to result in the decline of the species in the area.

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

The project would not increase the likelihood of an invasive species becoming established to harm the habitat of the Large-eared Pied Bat.

Introduce disease that may cause the species to decline

The project would not increase the likelihood of a disease becoming established or proliferating in the local population that would result in a decline of the species.

Interfere substantially with the recovery of the species

The project is unlikely to interfere with the recovery of the Large-eared Pied Bat.

Conclusion

Although the project will remove approximately 2.8 ha of suitable foraging habitat for the Large-eared Pied Bat, this area is relatively small (0.03%) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

13. Grey-headed Flying Fox

The Grey-headed Flying Fox is endemic to Australia and occurs primarily along the eastern coastal plain, generally within 200 km of the coast, from Bundaberg in Queensland, through NSW and south to Melbourne in Victoria. This species may make regular movements over the Great Dividing Range to the western slopes of NSW and Queensland.

The Grey-headed Flying Fox is a canopy feeding frugivore and nectarivore that occurs in rainforests, tall sclerophyll forest, woodlands, heaths, swamps, urban gardens and cultivated crops (Eby, 1995). Particular feed trees include Eucalyptus, Melaleuca, Banksia, and fruits of rainforest trees and vines.

Grey-headed Flying Foxes congregate in large numbers at roosting camps that are generally located within 20 km of a regular food source, although this species will travel up to 50 km in a night to forage. Camps are commonly found in gullies, close to water, in vegetation with a dense canopy, rainforest patches, melaleuca stands, mangroves and riparian woodland. This species generally exhibits a high fidelity to camps and return annually to give birth and rear offspring (Lunney and Moon 1997; Augee and Ford 1999). Annual mating commences in January and a single young is born each October or November.

The national population of flying foxes may have declined by up to 30 % over the past decade (Birt, 2000; Richards, 2000) and it has been estimated to abate by at least 20 % in the next three generations (Martin, 2000). Clearing and modification to native vegetation is the main threat to the Grey-headed Flying Fox in NSW. Urbanisation of the coastal plains of the eastern seaboard has seen the removal of camp habitat and the removal of reliable winter feeding sites.

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

Based on a construction corridor width of 20 m it is assumed that approximately 2.8 ha of native vegetation will be impacted on. This habitat may be used by this species for foraging and roosting purposes. However, this action is unlikely to have an adverse affect on the lifecycle of this species due to the relative small (0.03 %) loss of habitat and the availability of other potential habitat in the locality.

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

The project would result in a reduction of the overall extent of habitat within the study area. Approximately 2.8 ha of potential habitat would be impacted on within the subject site as a result of the project. This represents 9% of the remaining extant of the vegetation within the study area (50 m buffer) but only 0.03% of the vegetation remaining in the locality (10 km buffer).

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

Within the study area, this species is not at the limit of its distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment. It is proposed that permanent creeklines will be under bored, limiting any such disturbance to creek banks, environmental flows and riparian vegetation. The project will increase several disturbance regimes including, loss of native vegetation and dead wood .

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already cleared areas including, roadsides, fire trails and paddocks. It is estimated that 2.8 ha of native vegetation along a 25 km linear pipeline will be impacted on, thus not exacerbating loss of habitat connectivity that already occurs in the locality.

The Grey-headed Flying-fox is a highly mobile species that travels in the order of 50 km from camps to feed each night (NSW National Parks and Wildlife Service 2001). The vegetation clearing would not create a barrier to the movement of the species between other foraging habitats or otherwise fragment Grey-headed Flying-fox habitat.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for the Grey-headed Flying-fox to date. The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable foraging and roosting habitat for the Grey-headed Flying-fox, this area is relatively small (0.03 %) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

13.1 *Environment Protection and Biodiversity Conservation Act 1999* significance assessment Grey-headed Flying-fox

The Grey-headed Flying-fox that may potentially forage along the subject site are not considered an 'important population' because:

- there is no established breeding population that relies on maternity resources within the site for breeding or dispersal
- the populations of the species that forage in the area are not restricted to the habitat within the site due to the species' large home range, therefore the genetic diversity of the species can still be maintained by interbreeding with other populations throughout the wider area
- the population of the species that forage in the site are not at limit of the species range.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following

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

The Grey-headed Flying-fox that may potentially forage within the site are not considered an important population. The subject site provides only a small area of relatively poor quality foraging habitat for this species.

Reduce the area of occupancy of an important population.

The project will not impact any Grey-headed Flying-fox camp, however it will remove approximately 2.8 ha of foraging habitat for Grey-headed Flying-fox. This area represents only 0.03% of the available habitat that occurs within a 10 km buffer of the study area

The Grey-headed Flying-fox that may potentially forage within the site are not considered an important population.

Fragment an existing important population into two or more populations.

The Grey-headed Flying-fox is a highly mobile species that travels in the order of 50 km from camps to feed each night (NSW National Parks and Wildlife Service 2001). The vegetation clearing would not create a barrier to the movement of the species between other foraging habitats or otherwise fragment Grey-headed Flying-fox habitat.

The Grey-headed Flying-fox that may potentially forage within the site are not considered an important population.

Adversely affect habitat critical to the survival of a species.

No critical habitat has been listed for this species, nor is the study area critical for the survival of the Grey-headed Flying-fox.

Habitat critical to the survival of threatened species may, however, also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006).

The extent of the habitat that would be cleared (2.8 ha) as a result of the project, does not represent habitat considered critical to the survival of Grey-headed Flying-fox.

Disrupt the breeding cycle of an important population.

The subject site does not contain any breeding/roosting habitat in the form of camps utilised by this species. The nearest breeding habitat (camp) is located in the Singleton town centre (>10 km away) and is unlikely to be affected by the project. The Grey-headed Flying-fox that may potentially forage within the site are not considered an important population.

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

The project will not impact any Grey-headed Flying-fox camps; however, it will remove approximately 2.8 ha of foraging habitat. This area represents a small proportion (0.03%) of similar available habitat in the region and is unlikely to result in the decline of the species in the area.

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

The project would not increase the likelihood of an invasive species becoming established to harm the habitat of Grey-headed Flying-fox.

Introduce disease that may cause the species to decline.

The project would not increase the likelihood of a disease becoming established or proliferating in the local population that would result in a decline of the species.

Interfere substantially with the recovery of the species.

The project is unlikely to interfere with the recovery of Grey-headed Flying-fox.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable foraging and roosting habitat for the Grey-headed Flying-fox, this area is relatively small (0.03 %) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

14. Squirrel Glider (*Petaurus norfolcensis*)

The Squirrel Glider is listed as Vulnerable under Schedule 2 of the *Threatened Species Conservation Act*. Whilst targeted surveys were not performed, suitable habitat was present and the species has been recorded previously in the locality.

Squirrel Gliders inhabit mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Suitable vegetation communities include at least one species of plant that flowers heavily in winter and one or more of the smooth-barked eucalypts (NSW National Parks and Wildlife Service 1999).

Tree hollows greater than five centimetres diameter, in both living and dead trees as well as hollow stumps, are used as den sites for refuge and nesting (Gibbons & Lindenmayer 2000). Studies in Queensland showed that Squirrel Gliders used ironbark eucalypts and stags more than the hollows of smooth barked eucalypts and non-eucalypt tree species (Rowston 1998).

Squirrel Gliders utilise tree hollows for diurnal shelter either alone or in family groups of up to six individuals and offspring that occupy the same hollow simultaneously. The size and composition of groups of gliders occupying a particular hollow varies from day to day because gliders regularly swap den trees (Van de Ree 2002). The nests are bowl-shaped and lined with leaf within tree hollows (Triggs 1996).

Squirrel Gliders are nocturnal and display seasonal trends in feeding behaviour that are in accordance with phenological patterns consisting of trees and shrubs (Goldingay & Sharpe 1998). Their diet includes acacia gum, eucalypt sap, nectar, honeydew and manna, lichens with invertebrates and pollen providing protein (NSW National Parks and Wildlife Service 1999).

Squirrel Gliders are agile climbers and can glide for more than 50 m in one movement. Nightly movements are estimated as between 300 and 500 m. Home-ranges have been estimated as between 0.65 and 8.55 ha and movements tend to be greater for males than females. The home-range of a family group is likely to vary according to habitat quality and availability of resources, with more productive forests attributed to smaller home ranges (Quin 1995).

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

Based on a construction corridor width of 20 m it is assumed that approximately 2.8 ha of native vegetation will be impacted on. This habitat may be used by this species for breeding, foraging and nesting purposes. However, this action is unlikely to have an adverse affect on the lifecycle of this species due to the relative small (0.03 %) loss of habitat and the availability of other potential habitat in the locality.

The loss of hollow-bearing trees has the potentially to reduce the available breeding habitat and den sites for the Squirrel glider. Only relatively small numbers (<4) of hollow bearing trees were observed within the study area, most of which will be retained. Given the retention of most of these trees and the likely presence of further hollow bearing trees within the better quality remnant forest habitats of the locality, the project is unlikely to significantly impact the life cycles of the Squirrel glider.

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

The project would result in a reduction of the overall extent of habitat within the study area. Approximately 2.8 ha of potential habitat would be impacted on within the subject site as a result of the project. This represents 9 % of the remaining extant of the vegetation within the study area (50 m buffer) but only 0.03 % of the vegetation remaining in the locality (10 km buffer).

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

Within the study area, this species is not at the limit of its distribution.

How is the project likely to affect current disturbance regimes?

Remnants of vegetation within the study area have been highly modified by past and present land uses and the project is unlikely to significantly alter microhabitat conditions along the alignment.. The project will increase several disturbance regimes including, loss of native vegetation and dead wood, and a potential loss of hollow-bearing trees. The increase of these disturbances will be restricted to only a very small area (2.8 ha) of potential habitat within the subject site. This represents only 9 % of the remaining extant of the vegetation within the study area (50 m buffer) and only 0.03 % of the vegetation remaining in the locality (10 km buffer).

How is the project likely to affect habitat connectivity?

Vegetation within the study area is already highly fragmented by infrastructure and land clearing for industrial and agricultural practices. The proposed gas pipeline alignment will not have a significant impact on habitat connectivity in the locality as the pipeline alignment will as far as possible traverse already be located in cleared areas including, roadsides, fire trails and paddocks. Squirrel Gliders are agile climbers and can glide for more than 50 m in one movement (Quin 1995). A 20 metre cleared corridor largely already located in disturbed areas is unlikely to create a further barrier for these species within the subject site.

How is the project likely to affect critical habitat?

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of Department of Environment and Conservation. There are four listed critical habitats and three habitats pending finalisation to date. No critical habitat has been listed for the Squirrel Glider to date . The subject site is already highly fragmented by land clearing for industrial and agricultural practices and as such would not be considered critical to the survival of this species.

Conclusion

Although the project will remove approximately 2.8 ha of potentially suitable breeding, foraging and nesting habitat for the Squirrel Glider, this area is relatively small (0.03 %) in relation to similar habitats available in the local area. As such it is unlikely that the project will have a significant impact on this species.

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