Jemena Northern Gas Pipeline Pty Ltd

Northern Gas Pipeline

Draft Environmental Impact Statement

CHAPTER 12 – MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

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12. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The Commonwealth Department of the Environment (DoE) has decided that the NGP Project is a controlled action requiring assessment and approval under the Environment Protection and Biodiversity Conservation Act (1999) (*Cth*) (EPBC Act) before it can proceed. The relevant controlling provision is listed threatened species and communities.

This chapter addresses the information requirements for assessing whether the NGP Project is likely to have a significant impact upon listed threatened species and communities. It is to be read in conjunction with Chapter 2 – Project Description. Much of the content of this chapter is mirrored in Chapter 6 – Biodiversity.

12.1 OVERVIEW

There are nine matters of national environmental significance (MNES) protected under the EPBC Act:

- world heritage properties
- national heritage places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

This chapter assesses the potential risks to MNES from NGP Project activities, and documents the management framework that will be established to mitigate the potential impacts of the Project on MNES. The purpose of this chapter is to demonstrate that Jemena has fully considered all of the risks to MNES, and has strategies in place to ensure that the prevention and mitigation of these risks is properly addressed through each Project phase.

The content of this chapter has been developed to address Section 5.4 of the *Terms of Reference* (ToR) for the preparation of an EIS for the Jemena NGP. This chapter provides details of the:

- MNES known or likely to occur within the Project footprint (namely threatened species).
- potential impacts to MNES by Project activities.
- mitigation and management measures that will be implemented to address those potential impacts through each Project phase.
- conclusions in relation to whether the Project will have a significant impact on MNES, and whether there are any residual risks that need to be offset and/or managed.

The information presented in this chapter is taken primarily from the Threatened Species Survey Report (Appendix G) and Biodiversity Management Plan (Appendix H). The chapter also cross-references other management plans that are appendices of the EIS. The ecological surveys that informed the Threatened Species Survey Report were planned and undertaken by experienced and suitably-qualified ecologists who have specific expertise in surveying and detecting the species targeted. Management plans have been developed by professionals with qualifications relevant to the environmental aspect being managed. Details of personnel involved in the assessments, their experience and qualifications are provided in Appendix D.

The abbreviations, acronyms and terminology used throughout this chapter are defined in the Acronyms and Glossary section of this EIS.

12.2 RELEVANT MNES

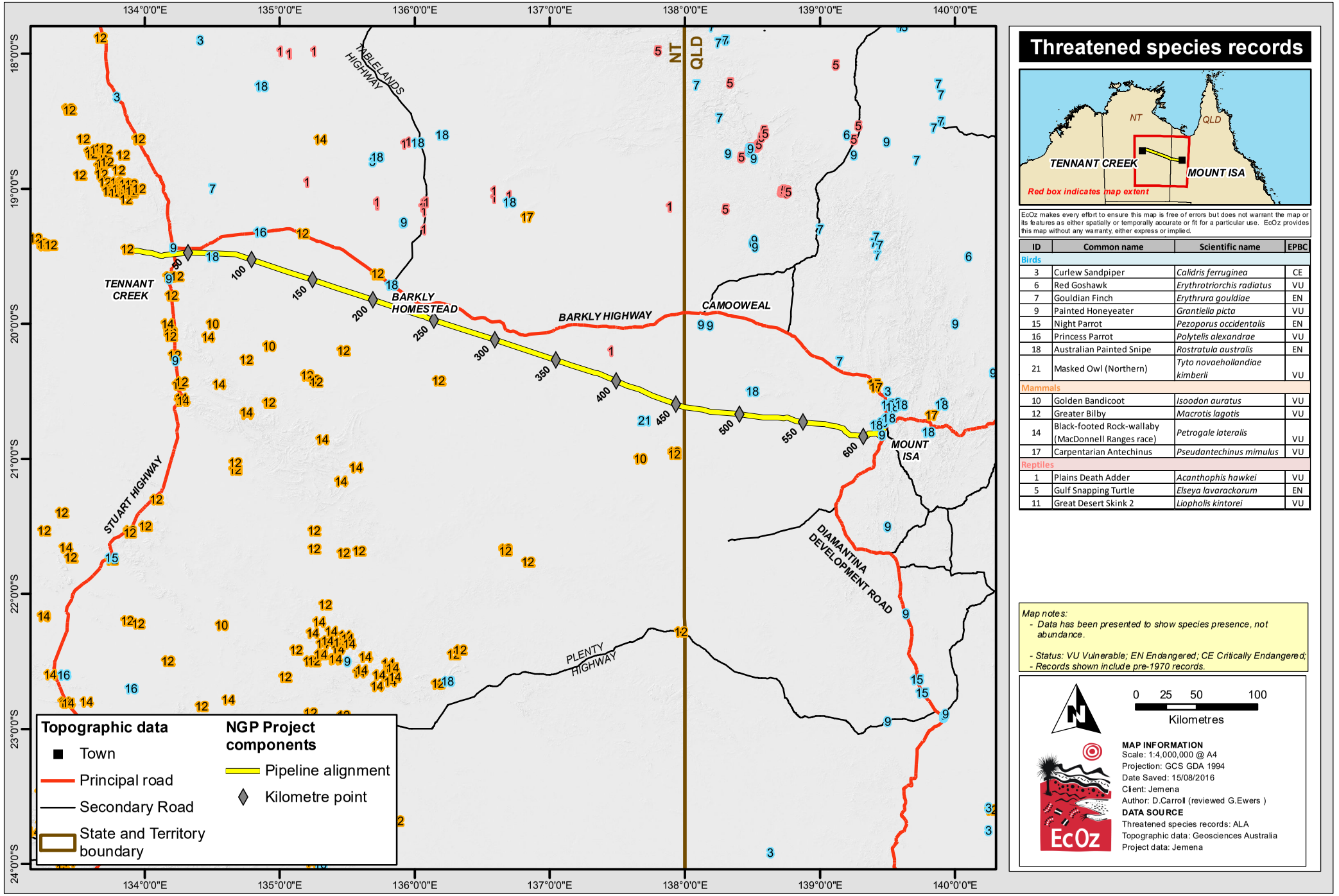
This overview of the MNES relevant to this Project has been derived from the Threatened Species Survey Report (Appendix G).

To determine which MNES may occur within the Project footprint, the DoE Protected Matters Search Tool was applied within a 50 km buffer of the pipeline route (most recently undertaken 9 May 2016) – see Appendix C of the Threatened Species Survey Report (Appendix G). This identified that 15 threatened species have the potential to occur in the region of the Project footprint. A map of historic MNES threatened species records is presented in Figure 12-1.

No other MNES were identified as potentially occurring within the Project footprint.

12.2.1 THREATENED SPECIES

This section describes the process for determining which threatened species are likely to occur in important populations within the Project footprint. A desktop 'likelihood of occurrence' assessment is undertaken for all the species listed by the Protected Matters Search Tool. This assessment resulted in a list of species with a realistic chance of occurring within the Project footprint; these species were the focus of field studies (some targeted to detect presence/absence and some to quantify areas of suitable habitat within the Project footprint). The results of the field surveys were then used to determine which species are known to, or are likely to, occur within the Project footprint in an 'important population' defined in *EPBC Significant Impact Guidelines 1.1* (DOE 2013).



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\JEMENA\EIS (NT)\01 Project Files\Chapter 12 MNES\Figure 12-1. Map of historic threatened species records.mxd

Figure 12-1. Map of historic MNES threatened species database records

12.2.1.1 Preliminary likelihood of occurrence assessment

The Protected Matters Search Tool resulted in a list of 15 threatened species that have the potential to occur in the region of the Project footprint.

For each of these, the likelihood that the species occurs within the Project footprint was assessed based on habitat requirements, distribution, and the number and dates of proximate records. The purpose of such an assessment was to identify those species that required further consideration, and those that can be reasonably excluded from further assessment because they are unlikely to occur within the Project footprint.

The following procedure was used:

1) identify potential habitat features within the Project footprint using available desktop information (i.e. land unit mapping, existing vegetation mapping, aerial imagery, fire history etc.).

2) collate the following details for each of the 15 threatened species listed by the Protected Matters Search Tool – conservation status, habitat requirements, distribution and number of records within the search area.

3) analyse the likelihood that each species will occur in the Project footprint by applying the following likelihood classifications:

    a. HIGH – it is expected that this species will be within the Project footprint because of the presence of suitable habitat, and/or there are recent proximate records (i.e. post-2000).

    b. MEDIUM – this species may occur within the Project footprint; however, there is evidence that lowers its likelihood of occurrence (i.e. lack of core habitat, no recent records with the search area, habitat degradation etc.).

    c. LOW – it is not expected that this species will occur within the Project footprint, as there is no suitable habitat for the species and/or current threats in the region are known to have significantly impacted the species.

    d. NONE – there is strong evidence that this species will not occur within the Project footprint.

The resultant ‘likelihood of occurrence’ assessment is presented in Table 12-1.

Table 12-1. MNES 'likelihood of occurrence' assessment

Species	EPBC Act	Species details	Likelihood of occurrence
BIRDS			
Red Goshawk *Erythrotriorchis radiatus*	VU	**Habitat:** Prefers tall, open Eucalypt forest and riparian areas. Nests in large trees, frequently the tallest and most massive in a tall stand, nest trees are invariably within 1 km of permanent water (Debus et al. 1988; Aumann et al. 1991). **Distribution:** Sparsely distributed across much of the northern Australia, from the Kimberley to south-eastern Qld. Within this range, generally occurs in taller forests characteristic of higher rainfall areas, but there are some isolated records from central Australia. However, no breeding has been recorded in central Australia and these records are thought to be of dispersive individuals (Czechura cited in DoE 2016a). **Records:** There is a single, undated record from within the Mount Isa township 9.7 km north of the construction ROW.	**LOW (NT & Qld)** • There is no suitable habitat within the Project footprint. It is not near to any tall open Eucalypt forests and, although it intersects riparian vegetation along major rivers, these do not contain, or are not near, permanent water. • The single record for the region has no date associated with it and is well outside the usual range of this species. There are a few records across arid Australia, but these are almost certainly vagrants. • The Project footprint is outside the *expert distribution (likely)* but within the *expert distribution (maybe).* This is probably due to the single record discussed above.
Gouldian Finch *Erythrura gouldiae*	EN	**Habitat:** Prefers annual and perennial grasses (especially Sorghum), a nearby source of surface water and – in the breeding season – unburnt, hollow-bearing Eucalyptus trees (especially *E. tintinnans, E. brevifolia* and *E. leucophloia*) (Tidemann 1996; O'Malley 2006). **Distribution:** Sparsely across northern Australia from the Kimberley to north-central QLD (Dostine 1998; Franklin 1999; Barrett et al. 2003; Franklin et al. 2005). Non-breeding birds disperse widely (Garnett et al. 2011), greatly increasing the possible range of this species. **Records:** Approximately 14 birds were observed at Lady Loretta Mine Rd, approximately 100 km NW of Mount Isa in 2011. There is a second record (with a high degree of spatial uncertainty) of the species approximately 25 km north east of the construction ROW – potentially associated with Lake Moondarra. These are the nearest records to the Project footprint.	**NONE (NT) / MEDIUM (Qld)** • There is no suitable habitat within the Project footprint in the NT. • In Qld, vegetation mapping indicates the Project footprint passes rocky slopes containing *E. leucophloia* near Mount Isa which could provide suitable habitat. • The Project footprint is outside the *expert distribution (likely)* except for a small section at the Mount Isa end – probably due to the record discussed in Species details. The rest of the Project footprint is outside the *expert distribution (maybe).* • This species' core distribution is many hundreds of kilometres to the north of the Project footprint. The Mount Isa end of the Project footprint is the nearest to the southern extent of this species' distribution (although still a few hundred kilometres away). Therefore, the two records near to Mount Isa are likely to be dispersing, non-breeding birds.
Night Parrot *Pezoporus occidentalis*	EN	**Habitat:** Flat spinifex (*Triodia* spp.) grasslands in stony or sandy environments; and samphire and chenopod shrublands – including genera such as *Atriplex, Bassia* and *Maireana* – on floodplains and claypans, and on the	**LOW (NT & Qld)** • There are no recent or historical records of the species within the Project footprint. • The Project footprint is outside the *expert distribution (likely)* and *expert*

Species	EPBC Act	Species details	Likelihood of occurrence
		margins of salt lakes, creeks or other sources of water (from a variety of sources cited in DoE 2016b). **Distribution:** Extremely sparsely distributed through central arid regions. In the NT sightings were made up to 1923 in the Alice Springs region (Whitlock 1924). Recently recorded in western Qld (undisclosed location). **Records:** There are no records from the Barkly Tablelands. The closest record (from 1993) to the Project footprint is 110 km to the south-east of the Project footprint in Qld.	*distribution (maybe)*. • The *Triodia* spp. grasslands within the construction ROW are generally 'young hummock' due to relatively high frequency of fire (every 5 to 7 years) rather than the preferred dense and old *Triodia* hummocks.
Australian Painted Snipe *Rostratula australis*	EN	**Habitat:** Fringes of permanent and temporary wetlands, swamps and inundated grasslands (Taylor et al. 2013). **Distribution:** Nomadic and scattered across Australia with no predictable occurrence (Rogers 2001) but could occur at any wetland or inundated grassland across its distribution, including nearly all of the NT and Qld (Garnett et al. 2011). **Records:** Apart from records within Mount Isa township, there is one spatially-generalised record within the region attributed to nearby Barkly Homestead in Queensland.	**LOW (NT & Qld)** • There are suitable permanent and ephemeral wetlands within the region; however, there are no wetlands within the Project footprint. • The Project footprint is outside the *expert distribution (likely)* but within the *expert distribution (maybe)*. • There is a record for this species proximate to the Project footprint, likely from one of the seasonal wetlands between the construction ROW and the Barkly Highway.
Masked Owl (Northern) *Tyto novaehollandiae kimberli*	VU	**Habitat:** Mainly in Eucalyptus tall open forests (especially those dominated by *Eucalyptus miniata* and *E. tetrodonta*), but also roosts in monsoon rainforests and forages in more open vegetation types, including grasslands (Woinarski & Ward 2006). **Distribution:** Poorly known, with few records from across its broad range in northern Australia. In the NT records known from the Top End, Kakadu, Coburg Peninsula (majority of records) and south-west Gulf country (Woinarski & Ward 2006). In Qld, records are confined to the northern coastal forests and woodlands. **Records:** There is a single Masked Owl record from the Barkly Tablelands (at Dead Dog Waterhole), approximately 20 km south of the Project footprint (KP425).	**NONE** • There is no suitable habitat within the Project footprint. • The Project footprint is well outside the *expert distribution (likely)* and *expert distribution (maybe).* • The only proximate record is considerably outside the expert distribution of this species, and is more than 500 km south of the next nearest record. This record could be a misidentification of the similar Barn Owl.
Painted Honeyeater *Grantiella picta*	VU	**Habitat:** *Acacia* and *Eucalyptus*-dominated woodlands and open forest, preferring habitats with more mature trees that host more mistletoe. Breeding times and seasonal movements (south to north) are likely governed by the fruiting of mistletoe (Garnett et al. 2011). **Distribution:** Across eastern and	**LOW (NT) / HIGH (Qld)** • There is no suitable habitat within the Project footprint in the NT. The records from the NT are generally accepted to be irregular visitors. • There is suitable habitat at the Mount Isa end of the Project footprint in the Qld.

Species	EPBC Act	Species details	Likelihood of occurrence
		northern parts of the country – but nowhere very numerous (Ward 2012b). Many birds move after breeding to semi-arid regions such as north-eastern SA, central and western Qld, and central NT (TSSC 2015). Few NT records – most from the Barkly Tablelands – but no evidence of a breeding population in the NT, and the records are thought to be of irregular visitors from the south-east (Ward 2012b). **Records:** There are two records from the NT – one in 2014 from Three Ways, one in 2016 from south of Tennant Creek, that are 4.8 km and 20 km from the construction ROW respectively. There is one spatially-verified record within the Project footprint at Mica Creek (from 2006), and two other records (1932 and date unknown) from the Mount Isa region.	• The Project footprint is within the *expert distribution* at the Mount Isa • There is a record for this species in the Project footprint at Mica Creek.
Princess Parrot *Polytelis alexandrae*	VU	**Habitat:** Occurs in swales between sand dunes with a shrub layer of vegetation and scattered trees (Pavey 2006a). **Distribution:** Confined to arid regions of Western Australia, the Northern Territory, and South Australia (Barrett et al. 2003; Blakers et al. 1984; Higgins 1999). There have been unconfirmed reports of the species from western Queensland (Britton 1992; Higgins 1999). **Records:** There is one record from the Barkly Highway, 21 km north of KP 98.	**LOW (NT & Qld)** • There is no suitable habitat within the Project footprint. • The Project footprint is well outside of the *expert distribution*. • There is a single proximate record; however, this species is highly nomadic. It is noted in DoE (2016c) that the species is an irregular visitor (sometimes at intervals of more than 20 years) to most sites in its range and its movements are largely unknown. For these reasons, it is not possible or practical to provide an estimate of the number of locations at which the species occurs.
Curlew Sandpiper *Calidris ferruginea*	CE	**Habitat:** Mostly inhabits coasts and estuaries, but also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand (DoE 2016d). **Distribution:** A summer migrant from the northern hemisphere. Mostly widespread around the northern Australian coast, less common in the south, with few inland records (Chatto 2003). **Records:** There are no current records from the NT close to the construction ROW. In Qld, there are six recent and records around Mount Isa – all from Lake Moondarra. Another three undated or old (1968) records are from west of Mount Isa approximately 10 km from the construction ROW.	**LOW (NT & Qld)** • There is no suitable habitat within the Project footprint. • The Mount Isa end of the Project footprint is within the *expert distribution (likely)*. • The records near Mount Isa are associated with Lake Moondarra – which presents the most suitable habitat within the region but is outside the construction ROW.

Species	EPBC Act	Species details	Likelihood of occurrence
MAMMALS			
Greater Bilby *Macrotis lagotis*	VU	**Habitat:** In the NT, hummock grasslands on sandy soils with a preference for palaeo-drainage lines (Southgate 1990). Has large foraging area and will move home range in search for food (Johnson 2008). In Qld, it occurs on clay plains dominated by Mitchell Grass. **Distribution:** Historically widespread in arid Australia. Currently, a NT stronghold is the Tanami Desert (Pavey 2006a). There are also small populations in far south-western Qld. **Records:** In the NT, there are 25 records within 50 km of the Project footprint – 12 of which have occurred between 1990 and 2004. It is unknown whether these records are burrows or sightings. There are no recent records within the vicinity of the Qld Project footprint, as currently known populations have retracted to the south-west of Qld (approximately 350 km from the Project footprint).	**MEDIUM (NT) / NONE (Qld)** • A large area of the Project footprint in the NT contains suitable habitat. • None of the Qld Project footprint contains suitable habitat. • The entire Project footprint is within the *expert distribution (likely)*. • The range of this species has contracted considerably since the last proximate records, such that it is suspected the Wakaya Desert population is now extinct.
Black-footed Rock-wallaby *Petrogale lateralis (MacDonnell Ranges race)*	VU	**Habitat:** Upland rocky areas with associated steep slopes (Pavey 2006c). **Distribution:** In the NT, this species is mostly found in the MacDonnell Ranges, but also occurs throughout the arid southern end of the NT (Pavey 2006c) and may be found in the Davenport and Murchison Ranges. There are no Qld records for this species. **Records:** There are two records from 1987 approximately 50 km south of the Project footprint.	**LOW (NT) / NONE (Qld)** • There is no suitable habitat within the Project footprint. • The Project footprint is outside the *expert distribution (likely),* but within the *expert distribution (maybe).* • The nearest records are approximately 50 km to the south of the Project footprint, and in habitat that does not occur within the Project footprint.
Carpentarian Antechinus *Pseudantechinus mimulus*	VU	**Habitat:** A range of vegetation types, consistently associated with a high cover of rocks and boulders (Johnson et al. 2008). Within Qld, the records come from rocky habitat with open woodland dominated by *Eucalyptus leucophloia*, *E. normantonensis* and *Corymbia terminalis* with a grass layer dominated by *Triodia* spp. and *Enneapogon* spp. **Distribution:** Only known from Sir Edward Pellew group of islands in the NT (Kitchener 1991; Johnson & Kerle 1991; Taylor et al. 2004) and from a few records north and east of Mount Isa (Woinarski 2004, Woinarski & Ward 2012). **Records:** The closest records are from Qld (at three locations) and are all approximately 38 km from the construction ROW.	**NONE (NT) / HIGH (Qld)** • There is suitable habitat within the sandstone hills and boulders to the west of the Mount Isa end of the Project footprint. • The Mount Isa end of the Project footprint is within the *expert distribution (likely).* • There are no records proximate to the Project footprint; however, this is a poorly surveyed species.
Golden Bandicoot	VU	**Habitat:** Mainly in heathland and shrubland on sandstone sheets, avoiding	**NONE** This species is likely regionally extinct.

Species	EPBC Act	Species details	Likelihood of occurrence
Isoodon auratus		vegetation with greater tree cover (Palmer et al. 2012; Southgate et al. 1996) **Distribution:** Formerly across most of northern, central and western Australia (across a broad range of habitats), but now only recorded population on mainland Australia is within the Kimberley (Palmer et al. 2012). Within the NT the species is confined to the offshore islands of Arnhem Land. **Records:** The only records from mainland NT are from the north-east corner of Arnhem Land between 1950 and 1980.	
REPTILES			
Plains Death Adder *Acanthophis hawkei*	VU	**Habitat:** Floodplains and cracking soil plains (Webb et al. 2002). **Distribution:** Habitat mapping suggests the potential geographic range extends from western Qld, across the north of the NT to north-eastern Western Australia. Fragmented populations occur in the Mitchell Grass Downs of western Qld, the Barkly Tablelands on the NT/Qld border and east of Darwin in the NT (TSSC 2012). **Records:** Only one record from 1978 south of the Barkly Highway and north of the Project footprint. There are, however, many records in similar habitat to the north of the Barkly Highway.	**HIGH (NT & Qld)** • There is suitable habitat within the Project footprint. • The Project footprint is within the *expert distribution (likely)* for the eastern half of the pipeline. • There is a record for this species proximate to, and in similar habitat to that within, the Project footprint.
Great Desert Skink *Liopholis kintorei*	VU	**Habitat:** Generally tall open shrubland and hummock grasslands on red sandplains and sand ridges (Cogger et al. 1993; Pavey 2006d). However, in some locations (e.g. the Gibson Desert) found on sandplains with fine gravel. **Distribution:** Originally within a broad range extending from the desert parts of south-western NT, eastern interior of WA and north-western South Australia (Cogger et al. 1993). Currently known from seven populations (McAlpin 2001), three of which occur in the NT –the Tanami Desert, Uluru-Kata Tjuta National Park and the Yulara lease lands. **Records:** Two records near Tennant Creek from 1906 are the nearest to the Project footprint.	**NONE** • The current distribution of the species is confined to the western and southern NT. • The only records near the construction ROW are from 1906. • The Project footprint is within the *expert distribution (maybe)* at the Tennant Creek end of the pipeline.
Gulf Snapping Turtle *Elseya lavarackorum*	EN	**Habitat:** Large rivers and their associated overflow lagoons and oxbow lakes (Cogger 2000; Woinarski 2006). Found in deeper permanent pools most often with muddy, sandy or rocky bottoms. Also found in the middle	**NONE** • The Project footprint primarily lies in drainages flowing south away from the majority of river systems that this species uses. • There is no suitable habitat within

Species	EPBC Act	Species details	Likelihood of occurrence
		reaches of rivers, upstream of saline regions and downstream of escarpments, including plunge pools. Steep rocky gorges, and river reaches with intact river banks seem to be preferred habitats (Thomson et al. 1997). **Distribution:** From the Calvert River to the Nicholson River systems, including the Roper, Limmen Bight, Robinson and Nicholson Rivers all of which discharge into the Gulf of Carpentaria (Georges & Adams 1996; Thomson et al. 1997; Woinarski 2006). **Records:** None in the region.	the Project footprint. The only area where the Project footprint overlaps with potential habitat is the Leichardt River near Mount Isa. However, these upper reaches are upstream of where the river is dammed to form Lake Moondarra, and so have no connectivity with the Leichardt River downstream of the lake. • The Leichardt River section of the Project footprint is within the *expert distribution* at the Mount Isa end, which is unusual because there are no records of the species within the Leichardt River. The closest records are from the Lawn Hill area approximately 200 km from the Project footprint.

Note: For many threatened species, the Atlas of Living Australia provides 'likely' and 'possible' modelled expert distributions. These mostly come from the Species of National Environmental Significance Database maintained by the federal Department of the Environment.

The location of some threatened species records from the Atlas of Living Australia has been generalised to 0.1 degree (introducing a location variance of up to 11 km) due to concerns that revealing the actual location may lead to poaching. Spatially-generalised records have been considered in this assessment; however, use of these records has been noted where relevant.

A summary of the desktop 'likelihood of occurrence' assessment is presented in Table 12-2. It can be seen that:

- five species were ranked as having a 'high' or 'medium' chance of occurring within the Project footprint. Therefore, these species were the focus of field studies (some targeted to detect presence/absence and some to quantify areas of suitable habitat within the Project footprint).
- six species were ranked as having a 'low' chance of occurring within the Project footprint and so no specific surveys were carried out.
- four species were considered to not occur within the Project footprint as it does not support important habitat features for the species.

Table 12-2. Desktop MNES threatened species' likelihood of occurrence assessment

Likelihood	Common name	Scientific name	EPBC status
High	Carpentarian Antechinus*	*Pseudantechinus mimulus*	VU
	Plains Death Adder	*Acanthophis hawkei*	VU
	Painted Honeyeater†	*Grantiella picta*	VU
Medium	Gouldian Finch*	*Erythrura gouldiae*	EN
	Greater Bilby**	*Macrotis lagotis*	VU
Low	Red Goshawk	*Erythrotriorchis radiata*	VU
	Australian Painted Snipe	*Rostratula australis*	EN
	Curlew Sandpiper	*Calidris ferruginea*	CE
	Black-footed Rock-wallaby (MacDonnell Ranges race)	*Petrogale lateralis*	VU
	Night Parrot	*Pezoporus occidentalis*	EN
	Princess Parrot	*Polytelis alexandrae*	VU
None	Masked Owl (Northern)	*Tyto novaehollandiae kimberli*	VU
	Golden Bandicoot	*Isoodon auratus*	VU
	Great Desert Skink	*Liopholis kintorei*	VU
	Gulf Snapping Turtle	*Elseya lavarackorum*	EN

*† In Qld only (likelihood is 'Low' in NT), * In Qld only (likelihood is 'None' in NT), ** In NT only (likelihood is 'None' in Qld)*

12.2.1.2 Targeted habitat assessments and field surveys

In April, May and June of 2016, habitat assessments and/or field surveys were undertaken for the MNES threatened species assessed as having a 'high or 'medium' likelihood of occurrence within the Project footprint.

The species assessed, and the surveys and/or habitat assessments applied, are summarised in Table 12-3. Where species-specific survey guidelines exist and were appropriate for this form of development, they were used. In other instances, alternative methods were developed in concert with threatened species' experts, whose qualifications and experience are provided in Appendix D. These assessments are comprehensively documented in the Threatened Species Survey Report (Appendix G).

Table 12-3. Summary of field survey methods for threatened species

Species name	Summary of survey methods
Carpentarian Antechinus (*Pseudantechinus mimulus*)	Field habitat assessment between KP 510 and KP 622. Elliot trapping at potential sites as per Commonwealth mammal survey guidelines for this species. Camera trapping as per Northern Territory survey guidelines (in the absence of Commonwealth camera trapping guidelines).
Painted Honeyeater (*Grantiella picta*)	Field identification of potentially-suitable habitat based on regional ecosystem mapping. Field assessment of potential riparian habitat between KP 590 and KP 622. There are no Commonwealth survey guidelines for the species, consequently the Queensland survey guidelines (Roland 2012) were used; this method requires transect surveys within selected areas of potential habitat along the construction ROW. These were undertaken in May and again in June.
Plains Death Adder (*Acanthophis hawkei*)	Following consultation with DLRM, desktop habitat mapping along the construction ROW, focussing on areas between KP 355 and KP 561. Validation of habitat using high-resolution aerial footage and field ground-truthing. Targeted surveys not undertaken on advice from DLRM due to low detection probability.
Gouldian Finch (*Erythrura gouldiae*)	Existing survey guidelines not deemed appropriate for the linear nature of the impact by this project. Alternative method for breeding and foraging habitat assessment developed by Associate Professor Sarah Legge (see Appendix D for Associate Professor Sarah Legge's qualifications and experience for this species). Field sites were selected by Legge using high-resolution aerial footage.
Greater Bilby (*Macrotis lagotis*)	Existing survey guidelines not deemed appropriate for the linear nature of the impact and vast area of possible habitat traversed by this project. Alternative method developed based on Commonwealth mammal survey guidelines and other landscape-scale surveys, with Dr Rick Southgate (see Appendix D for Dr Southgate's qualifications and experience for this species). Aerial transects between KP 0 and KP 350, and along the seven access tracks within potential Greater Bilby area. Track plot surveys over 2 ha at 53 aerially-identified sites.

The results of the targeted field surveys were that:

- one EPBC-listed threatened species – Carpentarian Antechinus (*Pseudantechinus mimulus*) – was recorded within the Project footprint. This species 'likelihood of occurrence' was revised to 'known'.
- one EPBC-listed threatened species – Plains Death Adder (*Acanthophis hawkei*) – was not recorded during the surveys. However, based on habitat assessment, it was considered that there is a high chance it could occur at some locations within the Project footprint at some time. The species' 'likelihoods of occurrence' were revised to 'likely'.
- three EPBC-listed threatened species – Painted Honeyeater (*Grantiella picta*), Gouldian Finch (*Erythrura gouldiae*) and Greater Bilby (*Macrotis lagotis*) – were not recorded during the

surveys and, based on field habitat assessments, it was considered that there is a low chance they occur. These species 'likelihoods of occurrence' were revised to 'unlikely'.

For each threatened species that is 'known' or 'likely' to occur within the Project footprint, the following sections provide more detail in relation to that species ecology and habitat requirements, existing threatening processes, survey results and discussion.

Each section concludes with a determination of whether or not, for that species, there is likely to be within the Project footprint an 'important' population as defined in *EPBC Significant Impact Guidelines 1.1* (DOE 2013). All the threatened species that are 'known' or 'likely' to occur within the Project footprint are listed as Vulnerable under Northern Territory and/or Commonwealth legislation. In accordance with the guidelines, for Vulnerable species, an 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity
- Populations that are near the limit of the species' range.

12.2.2 PLAINS DEATH ADDER (*ACANTHOPHIS HAWKEI*)

This species is listed as Vulnerable under the TPWC Act and under the EPBC Act.

The Plains Death Adder is a snake with a short, stout body, with a head that is triangular and distinct from the neck. The species' coloration varies but usually has wide, lighter bands across the body. The end of its tail tapers rapidly – becoming thin and worm-like – and is used to lure prey within striking distance (Hagman et al. 2008). Adults grow to a maximum length of approximately 1.2 m (Wells and Wellington 1985).

The nocturnal Plains Death Adder occurs on floodplains and cracking soil plains (Webb et al. 2002). According to Ward and Phillips (2012):

> *During the Wet season, individuals move every three to ten days, in apparently random directions, distances ranging from a few metres to a kilometre (Phillips and Webb, unpublished data). When it floods, they simply float in debris or rest on emergent vegetation. During the Dry season, movement is less frequent and they often retreat into deep soil cracks. Radio-tracking suggests that they are nomadic and do not have definable home ranges.*

Plains Death Adder generally breeds from October to November, and produces live young from February to March (TSSC 2012).

The exact distribution of Plains Death Adder is unclear. Based upon field experience and encounter rates across its range, the species can be locally common (in the absence of Cane Toads) on the highly productive floodplains of northern Australian rivers. On the Barkly Tableland and Mitchell Grass Downs (where the NGP Project is located), however, the species is less-commonly encountered and can probably be considered scarce in this habitat (TSSC 2012). There are many records for this species in similar habitat to the north of the Barkly Highway, but only one record south of the Barkly Highway. This 1978 record is approximately 22 km north of the construction ROW (Figure 12-3). According to TSSC (2012), the Plains Death Adder extent of occurrence is estimated to be approximately 720,000 km^2 and its area of occupancy is estimated to be approximately 233,480 km^2.

The main identified threat to the Plains Death Adder is death by ingestion of the introduced Cane Toad (TSSC 2012). Other potential threats to the Plains Death Adder are habitat modification due to over-grazing by cattle and inappropriate fire regimes.

The potential Plains Death Adder habitat within the Project footprint comprises five land systems (four of which are black soil clay plains), as shown in Figure 12-3. A selection of photographs that represent black soil plains along the construction ROW are provided in Figure 12-2. Habitat mapping conducted at a scale of 1:10,000 indicates that the Project footprint intersects approximately 820.1 ha of suitable habitat for Plains Death Adder (see Table 12-4 and Table 12-5 for breakdown of habitat types specific to Plains Death Adder in the Northern Territory and Queensland, respectively).

Table 12-4. Potential habitat extent for Plains Death Adder within the Project footprint (Northern Territory)

Landscape & landform class	Disturbance area (ha)			Total (ha)
	ROW	Access tracks	Other	
ALLUVIAL FLOODPLAINS	**64.5**	**13.7**	**28.6**	**106.7**
Alluvial Plains	*(61.6)*	*(12.8)*	*(28.6)*	*(103.0)*
Drainage Systems	*(2.9)*	*(0.8)*	*(0.0)*	*(3.7)*
CLAY PLAINS	**243.5**	**71.3**	**29.2**	**344.0**
Downs Plains	*(200.0)*	*(33.3)*	*(29.2)*	*(262.5)*
Plains	*(35.9)*	*(37.4)*	*(0.0)*	*(73.3)*
Inland Wetlands	*(7.7)*	*(0.6)*	*(0.0)*	*(8.3)*
TOTAL	**308.0**	**85.0**	**57.8**	**450.7**

Table 12-5. Potential habitat extent for Plains Death Adder within the Project footprint (Queensland)

Land zone	Disturbance area (ha)			Total (ha)
	ROW	Access tracks	Other	
Alluvium (river and creek flats)	34.4	11.4	23.2	**69.0**
Clay plains not associated with current alluvium	246.5	44.6	9.2	**300.4**
TOTAL	**280.9**	**56**	**32.4**	**369.4**

There are no records of Plains Death Adder within the Project footprint. Field surveys confirmed that there are 206 km of Plains Death Adder habitat within the construction ROW between KP 355 and KP 561. This is part of a continuous band of potentially-suitable habitat for the species which continues for many hundreds of kilometres to the north-west (see Figure 12-3). Within that habitat, there is one record (from 1978) approximately 22 km north of the construction ROW from the Wonardo land system, the only record from that land system. There are also many records 100+ km to the north-west of where the construction footprint intersects with suitable Plains Death Adder habitat. A high proportion of these records occur within the Barkly land system which is relatively uncommon in the construction footprint.

The presence – within the Project footprint – of suitable habitat to that known to support Plains Death Adder indicates a reasonable likelihood that the species occurs within the Project footprint. This would represent an extension (to the southwest) of the known range of an existing population this species. It seems reasonable to infer that such an occurrence would be part of the same population as that containing

the record proximate to the construction footprint. What is unclear is whether that population is contiguous with the population that hosts the occurrence records from 100+ km further north in a different land system. Applying the precautionary principle, it is assumed that, if extant, occurrences of Plains Death Adder within the construction footprint would constitute a separate population (i.e. no gene flow) to that containing the multiple records of the species 100+ km to the north. This population of Plains Death Adder within the Project footprint can therefore be considered near the limit of the species' known range and, as such, necessary for maintaining the species genetic diversity.

For these reasons, a population of this species within the Project footprint would be considered 'important' (as defined in *EPBC Significant Impact Guidelines 1.1*).

Acknowledging the many uncertainties associated with determining the area of occupancy of this population, a conservative estimate of suitable habitat is 1.6 million ha (16 000 km^2). This is based on the area of habitat containing the Wonardo land system and all other suitable black soil country to the south of that land system, as per Figure 12-3.

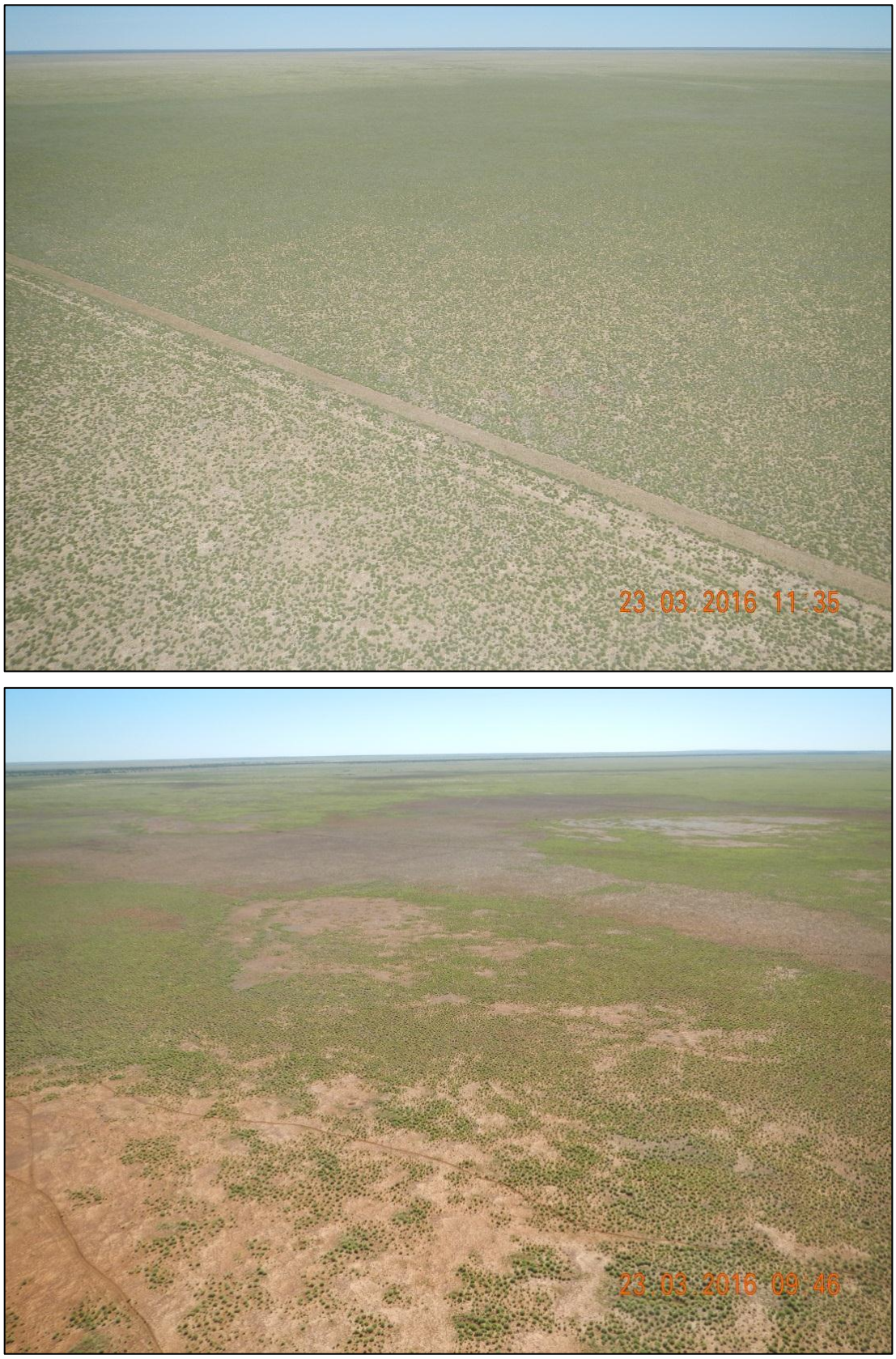
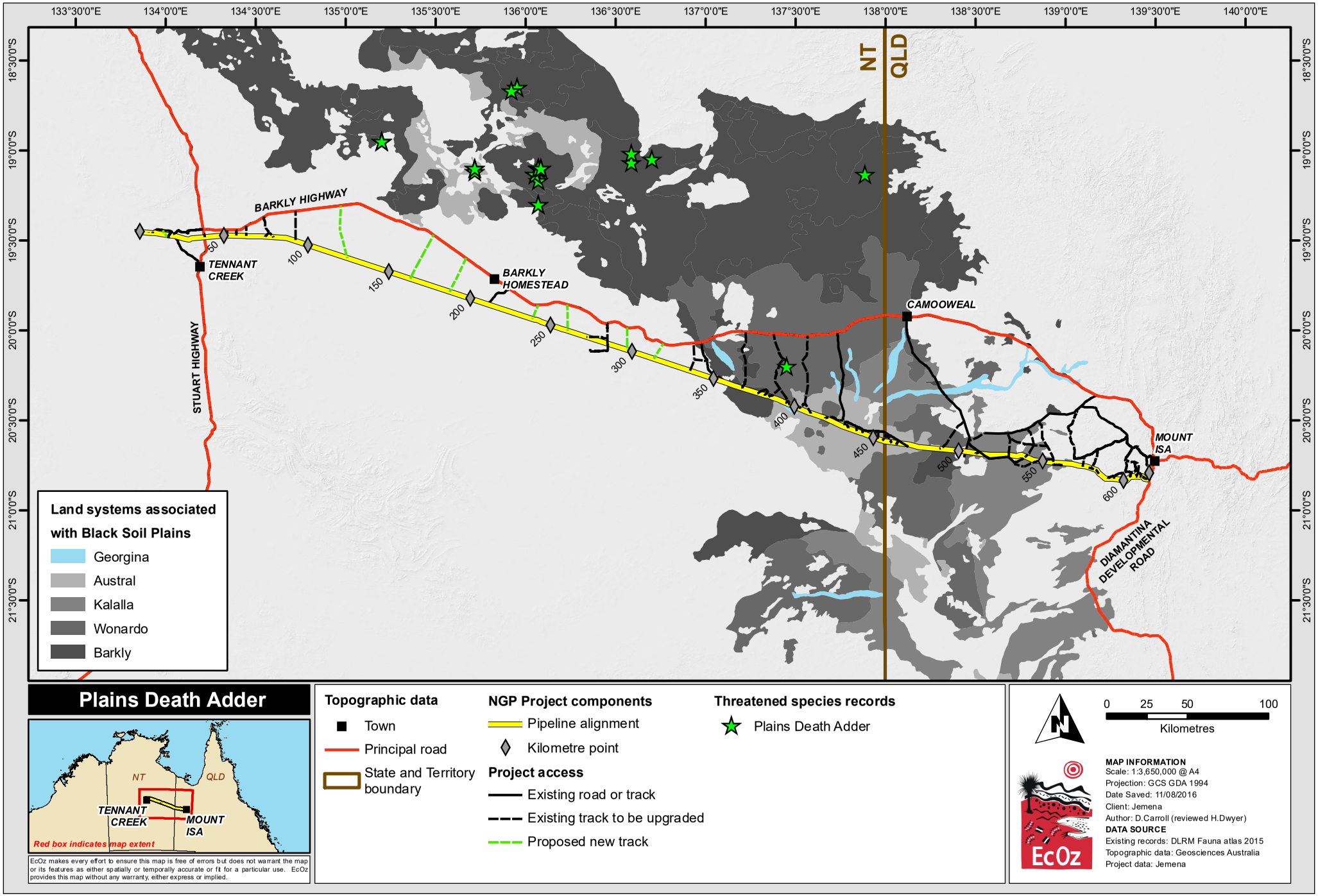


Figure 12-2. Photographs of potential habitat (clay plains) for Plains Death Adder, construction ROW



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\JEMENA\EIS (NT)\01 Project Files\Ch6\Figure 6□14. Map of Plains Death Adder habitat and records.mxd

Figure 12-3. Map of Plains Death Adder habitat and records in the greater region

12.2.3 CARPENTARIAN ANTECHINUS (*PSEUDANTECHINUS MIMULUS*)

The Carpentarian Antechinus is a brown, mouse-sized, dasyurid marsupial with a white underside. It has large ears with reddish fur behind them. The species stores fat in its tail, and an individual in good condition has a tail that is swollen to carrot-shaped. Individuals have a head and body length of 63 – 91 mm and a tail length of 56 – 76 mm (Johnson et al. 2008).

Carpentarian Antechinus occur in a range of vegetation types that are consistently associated with a high cover of rocks and boulders (Johnson et al. 2008; Perry et al. 2011). According to Woolley (2011), the species occurs in open woodland in rocky areas, particularly the side-slopes or bases of sandstone outcrops or hills, and featuring a scattered tree layer that typically includes *Eucalyptus* spp. and a ground layer dominated by spinifex (*Triodia* spp.) hummock grasses. Carpentarian Antechinus is nocturnal, feeds on insects, hides (roosts/dens) amongst rocks during the day, and does not appear to build a distinctive nest (Van Dyck and Strahan 2008). The breeding season is thought to be short, occurring sometime between August and October (Curtis et al. 2012). Little else is known about the ecology of this species, although antechinus typically roost communally.

The distribution of Carpentarian Antechinus is poorly understood. In the Northern Territory, this species is only known from Sir Edward Pellew group of islands (Kitchener 1991; Johnson & Kerle 1991; Taylor et al. 2004; Woinarski et al. 2011) and southern Arnhem Land near Borroloola. The species was first reported from Queensland in 1997, and was previously known from only three sites north and east of Mount Isa (Griffiths 1998).

The eastern end of the construction ROW (between KP 522 and KP 622) falls within the *expert distribution (likely)* of the species (Commonwealth of Australia 2016). There are records of Carpentarian Antechinus to the north and east of the Mount Isa end of the Project footprint (see Figure 12-1), but none proximate. This species is not expected to occur in the Northern Territory portion of the Project footprint as that area falls outside of the known Northern Territory distribution (the closest known population of the species in the Northern Territory is approximately 420 km to the north), and no suitable habitat is traversed. The extent of occurrence of the Carpentarian Antechinus is 16 000 km² (Curtis et al. 2012). Woinarski et al., 2014 suggest that the mainland area of occupancy is probably >2000 km^2; however, this estimate is of low reliability.

According to TSSC (2015), potential threats to this species may be predation by Feral Cat; hot, extensive late dry season fires; and Buffel Grass invasion changing the ecology of the central Queensland ridges where the species occurs (Lloyd et al. 2013).

Field surveys found Carpentarian Antechinus in rocky ridges north and south of Mica Creek (KP 617), and in a granite boulder outcrop to the west of those ridges (KP 610) (see photographs in Figure 12-4 and Figure 12-6, and the map in Figure 12-8). Based on this evidence – and the ecology of the species – it is likely that Carpentarian Antechinus occupy any suitable rocky outcrops, boulder piles and rocky ridges/hills (see, e.g., Figure 12-5 and Figure 12-7) occurring with some regularity between KP 606 and KP 620 of the construction ROW (see Figure 12-8). Within this stretch, there are scattered granitic boulder piles and linear metamorphic ridges with varying levels of outcropping. It is expected that this rocky habitat – referred to henceforth as 'rocky refugia habitat' – provides daytime refuge, as well as night-time foraging habitat, and is critical habitat for the species.

The construction ROW intersects rocky refugia habitat on three occasions (see Table 12-6). The largest (and most significant) intersection occurs on a metamorphic ridgeline between KP 616 and KP 616.3 (1.01 ha), of which Carpentarian Antechinus was recorded during field surveys. This ridgeline is part of a large contiguous area of rocky habitat connected to areas where the species has been identified in previous studies in the region. As such, it seems reasonable to assume that Carpentarian Antechinus occur throughout the rocky hills and ridges to the north and south of Mica Creek. The remaining two intersections of rocky refugia habitat are small and the construction ROW only traverses the edge of these areas (cumulative total area of 0.03 ha).

The rocky ridge to the south of KP 567 was initially classified as potential habitat; however, due to its significant isolation from other rocky areas and the lack of evidence of Carpentarian Antechinus during field studies (trap site CA6), this location is now considered unlikely to support the species.

To maintain gene flow between rocky refugia habitat, it is likely that the species uses the large areas of flatter lowlands (sandy loams) surrounding the rocky habitat for dispersion habitat during the breeding season. This is inferred from the observation of the species on an isolated granite boulder pile at CA4 that is likely too small to support a population without any periodic new recruitment. These flatter areas have been termed 'dispersive habitat', and are more likely to be used during the breeding season (which is thought to occur between August and October, Curtis et al. 2012). Such movement would occur at night; however, there is no information regarding the distance to which the species can travel during dispersal periods.

Table 12-6. Rocky refugia habitat intersected by the construction ROW – Carpentarian Antechinus

KP	Area (ha)
610.2	0.01
610.6	0.02
617.0	1.01
Total	**1.04**

The detection of Carpentarian Antechinus within the Project footprint represents a range extension to the south and south-west of other known occurrences. It is expected that the species occurs in suitable habitat throughout the eastern end of the construction footprint (i.e. between KP 609.5 and KP 620.5) wherever there are rocky outcrops, boulder piles or rocky hills. There are a variety of rock types exposed in the region and it is not known whether some of these comprise more preferred habitat for Carpentarian Antechinus.

As noted above, it is not clear the degree to which occurrences of Carpentarian Antechinus are connected in this part of its distribution – i.e. whether there is a population extending north-south in the main range of rocky hills together with isolated populations in clusters of rocky outcrops to the west, or some level of dispersal and genetic flow between all these occurrences, and therefore one population within the construction footprint. Given how small and apparently isolated the area of habitat within which a Carpentarian Antechinus recorded in a camera trap was, the latter situation seems more likely in order for such habitat patches to remain populated.

Historically, Carpentarian Antechinus has not been widely surveyed for and may be locally common in the rocky country surrounding Mount Isa (given it has often been recorded when suitable habitat is surveyed – such as for this project). Nevertheless, the records of Carpentarian Antechinus within the construction footprint from the targeted survey represent an extension of the known range of this species and, applying the precautionary principle, it cannot be concluded that the population of the species within the construction footprint is contiguous with any other know populations in the Mt Isa area. The population of Carpentarian Antechinus within the construction footprint can therefore be considered near the limit of the species' known range and, as such, necessary for maintaining the species' genetic diversity.

For these reasons, the known population of this species within the Project footprint is considered 'important' (as defined in *EPBC Significant Impact Guidelines 1.1*).

Acknowledging the many uncertainties associated with determining the area of occupancy of this population, a conservative estimate of suitable habitat is 4 369 ha. This is based on the area of habitat depicted in Figure 12-8.

Figure 12-4. Photograph of Carpentarian Antechinus trapped at site CA1

Rocky scree slope at succesfull trapping site

Figure 12-5. Photograph of Carpentarian Antechinus capture site

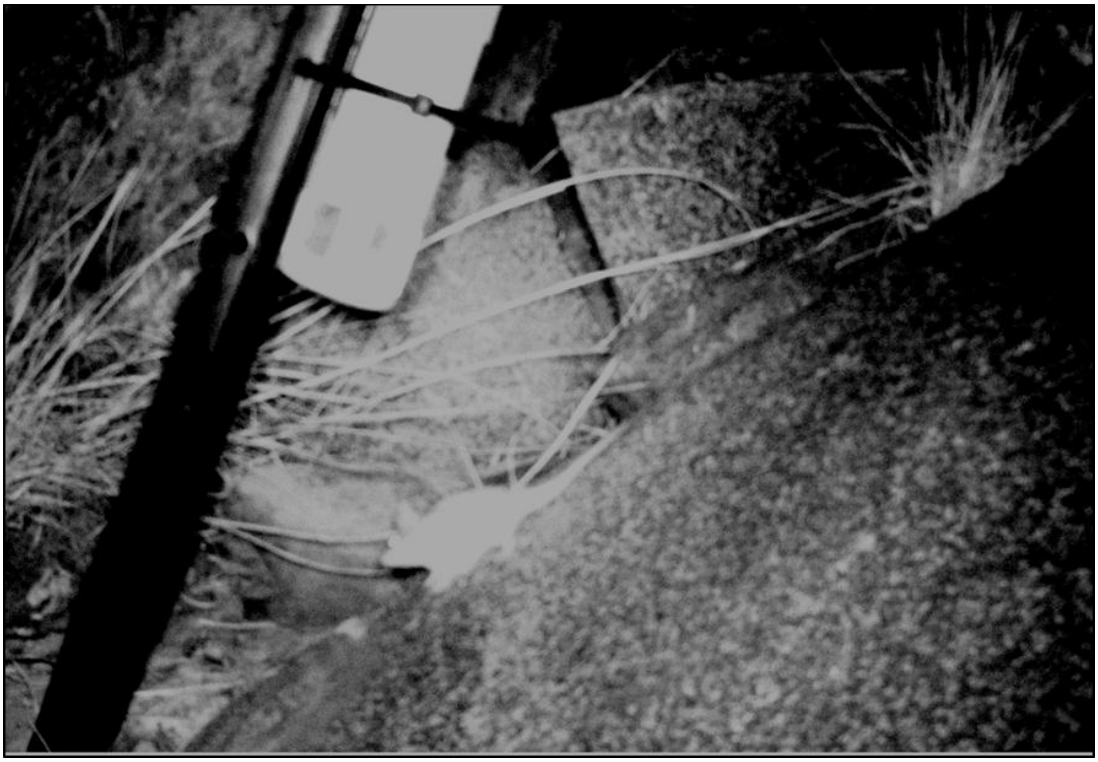


Figure 12-6. Photograph of camera-detected Carpentarian Antechinus

Figure 12-7. Photograph of where Carpentarian Antechinus was detected in camera trap

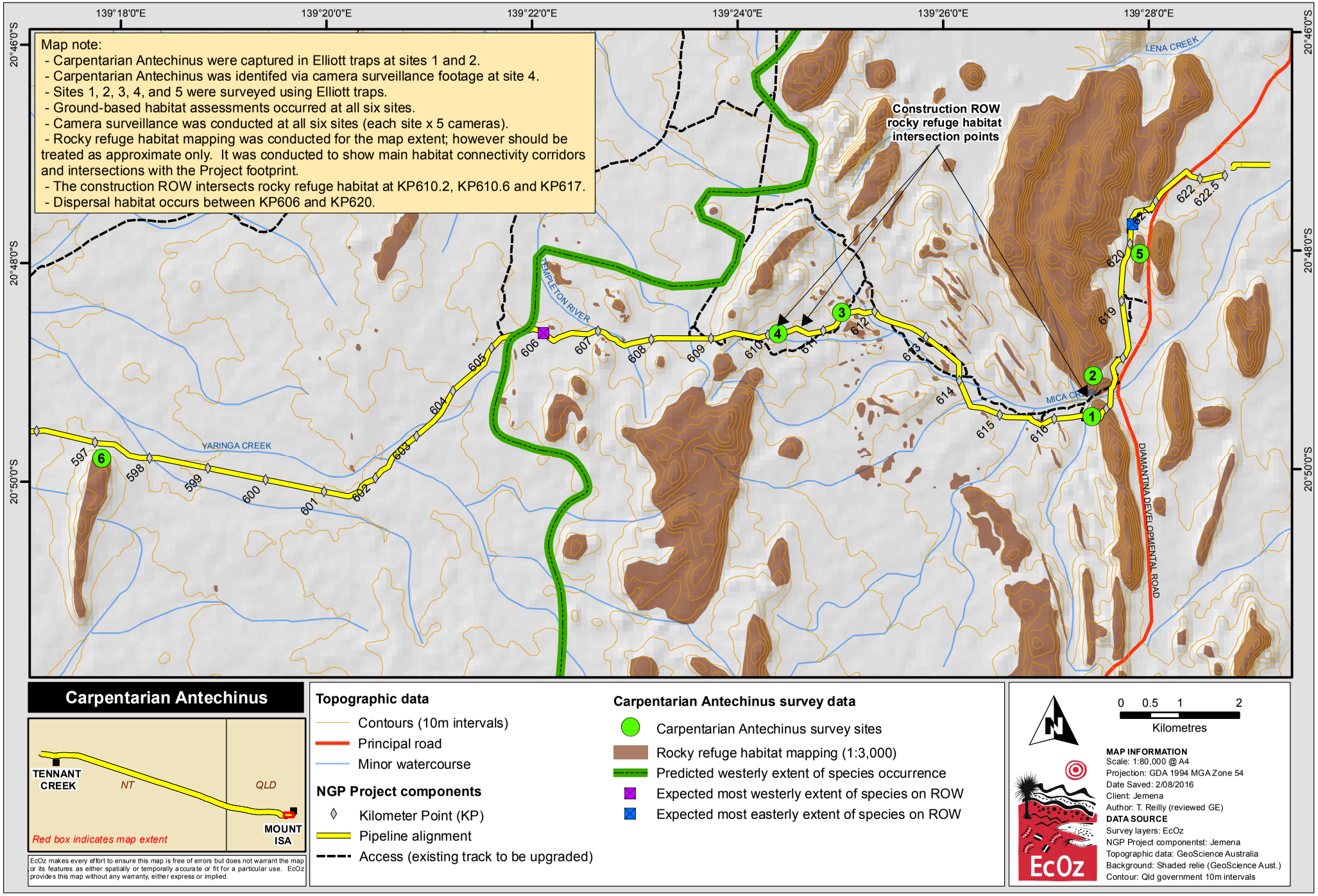


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Figure 12-8. Map of Carpentarian Antechinus survey sites and suitable rocky habitat nearby to the ROW

12.2.4 THREATENED SPECIES CONCLUSION

After due assessment, important populations of two threatened species are considered to occur, or likely to occur, within the Project footprint:

- Plains Death Adder (*Acanthophis hawkei*) in the black soil country between KP 355 and KP 561
- Carpentarian Antechinus (*Pseudantechinus mimulus*) in the rocky country between KP 609.5 and KP 620.5.

12.3 RISK ASSESSMENT

Risks associated with each potential impact to threatened species were assessed using the procedures and criteria described in Chapter 5. The complete environmental risk register is documented in Appendix F1.

The likelihood and consequences of each potential impact to Threatened species – specifically Plains Death Adder and Carpentarian Antechinus – is assessed at a population level. As explained in Sections 12.2.2 and 12.2.3, it is assumed that within the Project footprint there is one Plains Death Adder population and one Carpentarian Antechinus population.

In the instances where the inherent risk for a particular potential impact was assessed as Low or Moderate (i.e. tolerable), no specific controls are required. Consequently, no further analysis is given unless some additional elaboration is required.

12.3.1 POTENTIAL IMPACTS

Assessment of risks to threatened species first involved identifying potential causes of impact associated with the Project activities described in Chapter 2, and subsequent impacts that could occur to ecosystems that are known or expected to occur within the Project footprint and surrounds. The key references used to identify potential impacts were the EIS ToR (Appendix A), Project description (Chapter 2), Threatened Species Survey Report (Appendix G) and the contextual information presented earlier in this chapter.

With respect to existing environmental values, almost the entire construction footprint (apart from existing access tracks) is remnant native vegetation. Much of that footprint is pastoral country and so has experienced degradation in quality typical of that associated with pastoral activities in semi-arid areas. Two EPBC-listed threatened species are considered to occur, or likely to occur, within the Project footprint – Plains Death Adder (*Acanthophis hawkei*) in the black soil country between KP 355 and KP 561, and Carpentarian Antechinus (*Pseudantechinus mimulus*) in the rocky country between KP 609.5 and KP 620.5.

The NGP Project planning phase has and will continue to involve survey works for the purpose of identifying important flora and fauna habitats, mapping the occurrence of weeds and refining design and construction details. Through this process, potential impacts to biodiversity can be avoided by making changes to the construction approach and/or implementing specific controls in areas potentially more susceptible to impacts. The planning phase surveys did not recommend any further changes to the route required for the purpose of avoiding impacts to biodiversity or threatened species; however, the surveys did identify requirements for site-specific controls to minimise impacts in relation to watercourse crossings, which are further addressed in Chapter 7. Further surveys planned for late 2016 will map weed distribution within the Project area.

The Project construction phase will occur over a period of 12 – 18 months. Construction of the pipeline and facilities will involve removal of approximately 2,470 ha of vegetation, of which nearly 96 per cent will be progressively reinstated following completion of construction. During construction there will be earthworks, noise and vibration, dust emissions, which could directly impact fauna, reduce habitat quality and temporarily reduce habitat availability within a localised area. Construction activities also have potential to introduce and spread weeds, and cause erosion and sedimentation, both of which could negatively impact on biodiversity.

Operational activities will not involve any additional disturbance outside of the areas already disturbed during the construction phase. Routine operations and maintenance are not expected to cause air emissions, noise and vibration that would impact on ecological receptors. Progressive rehabilitation of the Project construction footprint is expected to reinstate habitat values for most species, although the removal of trees may degrade habitat quality within a localised area within the immediate Project footprint for some species.

Based on the above context, Project activities have potential to give rise to direct and indirect impacts on biodiversity and threatened species as follows:

- direct impacts associated with clearing of vegetation and habitat for construction of the pipeline, above-ground facilities, compressor stations, and for the establishment of temporary construction facilities such as access tracks, camps and dams.
- indirect impacts associated with mortality of fauna in the pipeline trench, effects of noise and vibration, vehicle strikes, dust, erosion and the introduction of weeds.

These potential impacts are listed below according to the Project phase in which they may occur.

12.3.2 PLANNING

Activities during the planning phase have potential to cause the following impacts to threatened species:

- loss of threatened species due to an inadequate assessment of the existing environment leading ill-informed risk assessment and inadequate impact avoidance.
- reduction in habitat quality (long-term) for threatened species due to weed introduction and/or proliferation caused by pre-construction survey activities.

12.3.3 CONSTRUCTION

Activities during the construction phase have potential to cause the following impacts to threatened species:

- loss of threatened species' habitat due to land clearing.
- reduction in the quality of threatened species' habitats (temporary) due to:
    - dust
    - noise and vibration
    - bushfire.
- reduction in the quality of threatened species' habitats (long term or permanent) due to:
    - inadequate reinstatement causing erosion and/or failure of rehabilitation
    - weed introduction and/or proliferation

    - habitat fragmentation
    - edge effects
    - reduced water quality caused by
        - sedimentation from erosion
        - pollution
        - improper disposal of contaminated water during hydrostatic testing.
- loss of threatened species due to disruption of a breeding cycle caused by the construction ROW or trench creating a barrier to dispersal.
- loss of threatened species due to:
    - interaction with construction traffic and earth-moving equipment (fauna strike)
    - trench excavation
    - entrapment in the open trench and/or stored pipes
    - the introduction or proliferation of feral fauna species
    - bushfire caused by:
        - construction activities
        - the proliferation of weeds creating higher fuel loads and therefore more intense fires.
- loss of threatened species due to reduced water availability because of extraction of water for construction activities from natural sources and/or because of altered surface water flows due to construction activities.

12.3.4 OPERATIONS

Activities during the operations phase have potential to cause the following impacts to threatened species:

- reduction in the quality of threatened species' habitats (long term or permanent) due to
    - weed introduction and/or proliferation caused by operational usage of vehicles
    - failure of rehabilitation (because of insufficient natural revegetation).
- reduction in the quality of threatened species' habitats (temporary) due to noise.
- reduction in the quality of threatened species habitats (temporary) due to a bushfire caused by pipeline failure.

12.3.5 DECOMMISSIONING

Activities during the decommissioning phase have potential to cause the following impacts to threatened species:

- reduction in the quality of threatened species' habitats (either long term or permanent) due to disturbance caused by removal of above-ground infrastructure.

These potential impacts are noted; however, no further assessment is undertaken in this chapter. Details of the decommissioning process and legislative requirements that will be applicable at the time (forecast to be in excess of 30 years from now) are not known with enough certainly to inform assessment of risk.

12.4 PLANNING PHASE RISKS

The planning phase for the Project extends across 2016 and the early part of 2017. This phase aims to collect all the information required for project approvals. One of the permitted activities during this phase is low-impact ecological, heritage and geotechnical surveying.

12.4.1 INADEQUATE ASSESSMENT OF EXISTING BIODIVERSITY VALUES

Context and assumptions

Loss of threatened species could occur due to an inadequate assessment of the existing environment leading ill-informed risk assessment and inadequate impact avoidance.

For the purpose of assessing the inherent risk (without controls), it is assumed that:

a) there are important populations of threatened species within the Project footprint that could be deleteriously impacted by the Project,

b) the biodiversity survey work was either incomplete, or the methods used were incorrect, leading to inaccurate conclusions of the risks to threatened species from this Project.

c) the consequence would be that the assessment of impacts and resultant mitigation approach may significantly impact threatened species.

Inherent risk

If ecological surveys are inadequate there is a **SIGNIFICANT** risk that some important threatened species populations will not be identified, and therefore will not be adequately protected. The likelihood and consequences of this impact occurring are discussed below.

Risk component	Ranking	Explanation
Consequence	Catastrophic	Inadequate assessment of the existing environment could mean that certain threatened species are not considered, leading to substantial or long-term damage to them.
Likelihood	Rare	Because of the rigorous scrutiny applied to an EIS by the Northern Territory Environment Protection Authority (NT EPA) and Commonwealth Department of Environment (DoE), (in consultation with departmental experts) prior to approval, and the opportunity in the EIA process for further information requests, this impact would occur only in exceptional circumstances.

Controls

To reduce the risk to ALARP the following steps were put in place:

- a desktop analysis of all possible threatened species using all available datasets and acceptable analysis methods was undertaken.

- prior to field surveys, the outcomes of the 'likelihood of occurrence assessment' for threatened species were discussed with Northern Territory government scientists to ensure that the appropriate species were being targeted.
- field surveys were undertaken by ecologists with relevant expertise in surveying (see Appendix G).
- for those species that require targeted field surveys, and where survey guidelines either did not exist or were not suitable for this type of long-linear development, well-respected experts were engaged to develop survey methods, and review results and interpretation.

Assessment of effectiveness

The desktop review undertaken to characterise the existing environment utilised best-available information, and was compiled by ecologists with appropriate qualifications and experience in undertaking similar assessments across the Northern Territory (refer Appendix D).

The methods adopted for the purpose of surveying threatened species were either established guidelines, or Project-specific methods developed by people with appropriate qualifications and experience in Threatened species surveys. The effectiveness of the surveys will be subject to further assessment by DLRM and DoE, and clearances/approvals will not be issued unless the level of consultation and survey is deemed to have been undertaken in accordance with accepted standards.

That some threatened species were detected during field surveys attests to the proficiency of the surveyors. There is a high degree of confidence that all occurrences of threatened species populations have been identified through the field surveys documented in the Threatened Species Survey Report (Appendix G).

Residual risk

The residual risk is assessed as **LOW**. Justification for the reduced risk rating is provided below.

Risk component	Ranking	Explanation
Consequence	Minor	By ensuring that the locations of threatened species populations are known, they can be protected through implementation of controls. The field surveys therefore reduce potential consequences to minor effects to the identified populations.
Likelihood	Rare	Minor localised impacts to individuals of listed threatened species are not expected to cause impacts at the ecosystem level.

12.4.2 WEEDS

Context and assumptions

Reduced habitat quality (long-term) for threatened species could occur due to weed introduction and/or proliferation caused by pre-construction survey activities. Low-impact activities such as threatened species and weed surveys, heritage surveys, geotechnical investigations and land condition assessments will be undertaken during the planning phase. These involve driving on existing tracks and cross-country, as well as the use of helicopters for access. It is possible that, in particular, the use of vehicles during these activities could introduce new weeds or spread existing weeds.

For the purpose of assessing the inherent risk (without controls), it is assumed that there will be low traffic volumes associated with survey work; and that are common within the project footprint, are easily transported, and that no weed hygiene activities are undertaken prior to, and during, land access.

Weeds are not considered a threatening process for Plains Death Adder (TSSC 2012). For Carpentarian Antechinus, one invasive plant species (but not a declared weed listed under Queensland or Northern Territory legislation) is identified in the *Approved Conservation Advice for Carpentarian Antechinus* (TSSC 2015a) as a possible threat: Buffel Grass (*Cenchrus ciliaris*). An invasion of that species could significantly change the ecology of the central Queensland ridges where the Carpentarian Antechinus occurs (Lloyd et al. 2013), especially in relation to increasing fuel loads and therefore fire impacts. Buffel Grass is common in previously-disturbed flat areas and sandy soils near watercourses at the Mount Isa end of the ROW in the area – but is not present in rocky country that constitutes critical Carpentarian Antechinus habitat. This is possibly due to a combination of factors – cattle (which spread Buffel Grass) do not graze the scree slopes, and Buffel Grass is outcompeted by spinifex in the rockier soils. As such – and because only very small areas of critical Carpentarian Antechinus habitat will be traversed during the planning phase – the introduction or proliferation of weeds is not considered a significant threat to that species.

For these reasons, a risk assessment of the potential impact of weeds to threatened species has not been undertaken.

12.5 CONSTRUCTION PHASE RISKS

The construction phase is when the greatest amount of the Project activities and the largest area of disturbance will occur. Consequently, it is the phase that will have the greatest chance of environmental impact. Most disturbed areas will be reinstated during this phase (except for aboveground facilities, dams and access tracks that landholders have requested are retained).

12.5.1 LAND CLEARING

Context and assumptions

Loss of threatened species habitat could occur due to land clearing. The construction of the pipeline, compressor stations and above-ground facilities will require clearing 2,449.7 ha of vegetation – 1,742.4 ha in the Northern Territory and 707.3 ha in Queensland (see Chapter 2 – Section 2.6). This includes 1.04 ha of Carpentarian Antechinus critical habitat and 820.1 ha of Plains Death Adder habitat. Progressive reinstatement and rehabilitation will be undertaken for 2,347.5 ha (95.8 per cent). Therefore, only 102.2 ha will remain cleared for operational purposes. All Carpentarian Antechinus habitat, and the vast majority of Plains Death Adder habitat, will undergo progressive reinstatement and rehabilitation.

There are three consequences associated with land clearing that need to be considered when determining the risk of potential impacts to biodiversity values:

- the temporary loss of approximately 2,470 ha during construction – 96 per cent of which will be progressively reinstated and rehabilitated post-construction.
- the permanent loss of approximately 102.2 ha that will remain cleared for operational purposes.
- the permanent reduction in habitat quality if reinstatement and rehabilitation are, to some significant degree, unsuccessful (further discussed in section 12.5.15).

For the purpose of assessing the inherent risk (without controls), it is assumed that reinstatement and rehabilitation will be effective in returning habitats to close to pre-disturbance condition. Note that the

reinstatement of rocky habitats will involve the return of any side-lined rocks and scree, therefore quickly re-creating functionally-similar habitat for the Carpentarian Antechinus to that disturbed.

Inherent risk

There is a **LOW** risk that, without controls, land clearing could result in impacts to EPBC-listed threatened species. The likelihood and consequences of this impact occurring are discussed below.

Risk component	Ranking	Explanation
Consequence	Minor	The estimated temporary loss of critical habitat for the Plains Death Adder is 820.1 ha and for Carpentarian Antechinus is 1.04 ha. The estimated total area of critical habitat for the populations of these two species is 1.6 million ha and 4,369 ha respectively. Therefore, there will be less than 0.01 per cent loss of the critical habitat supporting either species' populations. Damage will be recoverable through rehabilitation.
Likelihood	Rare	Significant harm to either of the two species in question as consequence of the temporarily clearance of a negligible area of critical habitat would only occur in exceptional circumstances.

Controls

Notwithstanding the low level of inherent risk, a range of routine clearing controls will be implemented in accordance with the *Code of Environmental Practice – Onshore Pipelines* (APIA 2013). In particular, clearing will only be undertaken within the specified construction footprint, and clearing boundaries will be delineated prior to clear and grade activities being undertaken.

These controls are expected to ensure that vegetation clearing is confined to within the designated Project footprint, and habitat loss is therefore minimised.

A Vegetation Clearing Procedure will also be developed prior to commencing construction that describes best practice vegetation clearing procedures to minimise harm to wildlife during land clearing activities.

Assessment of effectiveness

The clearing controls and reinstatement procedures prescribed by the *Code of Environmental Practice – Onshore Pipelines* (APIA 2013) are considered best-practice for pipeline projects in Australia. The NGP Construction Contractor has Standard Operating Procedures that address the code requirements and extensive experience in applying these requirements on pipeline projects. The controls are therefore expected to be effective in maintaining a low level of risk.

12.5.2 FAUNA STRIKE

Context and assumptions

Loss of threatened species could occur due to interaction with construction traffic and earth-moving equipment (vehicle strike). Project activities will involve increased movement of vehicles, equipment and plant along highways, access tracks and the pipeline construction ROW. For human health and safety reasons, the Traffic Management Plan (Appendix E) specifies that vehicle movement along the ROW will be ordinarily between the hours of 0600 and 1800. Furthermore, all traffic will be required to adhere to speed limits on public roads.

For the purpose of assessing the inherent risk (without controls), it is noted that only a small area of Carpentarian Antechinus is intersected by the Project footprint.

Inherent risk

There is a **LOW** risk that, without controls, that mortality of individuals due to fauna strike, would cause a significant impact to EPBC-listed threatened species. The likelihood and consequences of this impact occurring are discussed below.

Risk component	Ranking	Explanation
Consequence	Serious	Both threatened species are nocturnal, and so are unlikely to be involved in a vehicle strike given the restricted driving hours mandated in the Traffic Management Plan. Moreover, only a small area of Carpentarian Antechinus habitat is intersected by the construction footprint. Therefore, at worst vehicle strike may cause the mortality of a few individuals with negligible impact to the population.
Likelihood	Rare	It would be an exceptional circumstance in which the mortality of a few individuals due to vehicle strike would have an impact on either threatened species' population.

Controls

As per the Traffic Management Plan (Appendix E), Safe Work Method Statements (SWMS) will be implemented governing the safe use of vehicles within the Project site, including:

- appropriate speed limits when travelling to and from site and within camps
- minimised vehicle activity at night.

Assessment of effectiveness

Large projects such as the NGP have strictly enforced Workplace Health and Safety requirements and so it is expected that adherence to the abovementioned SWMS will be high.

Residual risk

Risks associated with fauna strike are inherently **LOW**, and implementation of standard procedures through the CEMP will further reduce the likelihood of impacts occurring over the construction phase of the Project.

12.5.3 TRENCH EXCAVATION

Context and assumptions

Loss of threatened species could occur due to trench excavation. The construction ROW will include a trench with a minimum width of 62.5 cm and an average depth of 125 cm. The progressive excavation of that trench using heavy machinery and, in rocky country, blasting could disturb and/or lead to the mortality of burrowing fauna.

Note: The risk associated with a noise and vibration impact from blasting is detailed in Section 12.5.10.

Assumptions

For the purpose of assessing the inherent risk (without controls), it is assumed that excavating a very narrow, linear trench may impact upon a few individual burrowing fauna, but at such a small scale that impact will be negligible impact at an ecosystem level.

In calculating an inherent risk for this potential impact, it is assumed that because Plains Death Adders often retreat into deep soil cracks during the Dry season and Carpentarian Antechinus roost in rock

crevices during the day, there is the possibility during that time that individuals may be injured or killed during trench excavation.

However, the area of Plains Death Adder habitat that will be excavated is a trench 0.6 m wide extending for 206 km – a total of 12.4 ha. Although the density of Plains Death Adder in suitable habitat is unknown, it seems unlikely that more than one or two individuals of this species will have the misfortune of occurring within the excavation corridor. Moreover, those individuals may not be injured if excavated.

Likewise, the area of rocky refugia habitat of the Carpentarian Antechinus that will be excavated is a of the rocky refugia habitat supporting this particular population (0.21 ha out of the estimated 4 369 ha). Only if an individual is hiding in a rock crevice within the trench line could it be impacted by trenching. It is unlikely that any individuals of this species will have the misfortune of occurring within the excavation corridor. Those that do may flee.

Inherent risk

There is a **LOW** risk that, without controls, that mortality of individuals caused by trenching activities, would cause a significant impact to the EPBC-listed threatened species. The likelihood and consequences of this impact occurring are discussed below.

Risk component	Ranking	Explanation
Consequence	Serious	As the trench footprint within both threatened species is small, at worst a few individuals may perish during trench excavation, with negligible impact to the population.
Likelihood	Rare	It would be an exceptional circumstance in which a few individuals perishing during trench excavation would have an impact on either threatened species' population.

Controls

Notwithstanding the low level of inherent risk, a range of routine clearing controls will be implemented. If any threatened species are encountered during trench excavation, this risk will be re-assessed and appropriate management measures implemented.

Assessment of effectiveness

Given the low inherent risk, and assessment of effectiveness is not relevant.

12.5.4 ENTRAPMENT IN TRENCH

Context and assumptions

Loss of threatened species could occur due to entrapment in the open trench and/or stored pipes. Trenching and pipe-laying operations include stringing pipe sections on site, welding sections together, and then installing the assembled pipeline into the trench. There is potential for fauna to enter pipe sections, the welded pipeline or fall into the trench; become trapped, and die.

In Daly Waters in the Northern Territory – about 400 km north of the Tennant Creek end of this Project – Woinarski et al. (2000) recorded along 74 km of trench, 349 individual vertebrates from 40 species, with 11 per cent mortality. Contemporary trench management has reduced fauna mortality to less than 1 per cent (see Swan and Wilson 2012).

For the purpose of assessing the inherent risk (without controls), it is assumed that:

- no controls are in place to rescue or manage fauna – i.e. mortality will be approximately 11 per cent as per Woinarski et al. (2000).
- the sides of the trench are vertical, except in rocky country where blasting is required, in which case the sides of the trench will be sloped.
- Plains Death Adders occur within the construction footprint. It is unknown how proficient the species would be at escaping from a trench; however, Phillips (pers. comm. 2016) suggests that the species may have an adversity to falling given his experience in failing to capture Plains Death Adders in pitfall trapping exercises.
- as snakes can generally survive for extended periods without food, trapped Plains Death Adders have a significant time-frame opportunity to escape from the trench.
- trapped Plains Death Adders would be able to defend themselves from predation.
- Carpentarian Antechinus are adept climbers (given their preference for rocky habitats) and could generally escape from a sloped trench (but perhaps not a vertically-walled trench).
- as small mammals typically have high metabolic rates, trapped Carpentarian Antechinus would likely perish from lack of food before managing to escape from a vertically-walled trench.
- trapped Carpentarian Antechinus would be highly vulnerable to predation.

Inherent risk

There is a **LOW** risk that, without controls, that mortality of individuals caused by entrapment in the trench, would cause a significant impact to EPBC-listed threatened species. The likelihood and consequences of this impact occurring are discussed below.

Risk component	Ranking	Explanation
Consequence	Serious	As both threatened species are assumed to either be averse to falling into a trench, or adept at climbing out, at worst vehicle a few individuals may become trapped in the trench and perish, with negligible impact to the population.
Likelihood	Rare	It would be an exceptional circumstance in which a few individuals becoming trapped in the trench and perishing would have an impact on either threatened species' population.

Controls

Notwithstanding the low level of inherent risk, a range of routine clearing controls from the *Code of Environmental Practice for Onshore Pipelines* (APIA 2013) will be implemented:

- the trench will be progressively backfilled after the pipe is installed.
- to aid fauna that may have fallen into the trench, earth plugs will be installed at a maximum of 5 km apart intervals. An earth plug is a temporary trench crossing point that facilitates movement across the trench for vehicles, people and animals. The sides of the earth plug within the trench are at an angle of < 45^{o} allowing any fauna fallen within the trench to escape.

Additional earth plugs will be installed at property owner requests where cattle are required to access across the trench to reach water sources.

- to give shelter while fauna are within the trench, fauna shelters will be installed at least every 1 km.
- a Trench Inspection Procedure will be developed prior to construction commencing. This will provide for the presence of qualified fauna spotter-catchers (FSC) who will inspect the length of open trench daily to recover and release any fauna that is fallen into the trench overnight.
- to ensure that fauna does not enter the pipe end caps will be fitted to welded pipe strings at the end of each day's construction.

For the Plains Death Adder, it is considered that the general trench procedures outlined above will be sufficient. A Trench Inspection Report will be completed daily. If any threatened species are extracted from the trench, this risk will be re-assessed and, if necessary, additional management measures implemented.

For the Carpentarian Antechinus – in addition to the above controls – for every 50 m of rocky habitat and every 100 m of intervening habitat in the section of the construction ROW between KP 609.5 and KP 622, hessian (or similar material) will be draped from the top of one side of the trench, down along the side and bottom of the trench, and up the other side to the top of the opposite side of the trench. This will allow trapped Carpentarian Antechinus to cross and/or escape the trench and also hide from predators should they enter the trench.

Assessment of effectiveness

The controls outlined above are now standard procedure for pipeline projects in accordance with the *Code of Environmental Practice for Onshore Pipelines* (APIA 2013) and have been shown to reduce to in-trench mortality to less than 1 per cent (see Swan and Wilson 2012). The Construction Contractor has Standard Operating Procedures for trench inspection and clearance, and experience implementing these procedures on other pipeline projects.

Residual risk

Risks associated with fauna mortality due to entrapment in the trench are inherently **LOW**, and implementation of standard procedures through the CEMP will further reduce the likelihood of impacts occurring over the construction phase of the Project.

12.5.5 EDGE EFFECTS

Context and assumptions

Reduction in the quality of threatened species' habitats (long term or permanent) could occur due to edge effects. An 'edge effect' occurs when intact vegetation is disturbed and the newly-created edges between the intact and disturbed areas become lower quality habitat for species occurring in that vegetation – see, e.g., Murcia (1995). Land clearing, especially for the construction ROW, will create such an edge.

For the purpose of assessing the inherent risk (without controls), it is assumed that reinstatement and rehabilitation will be effective. The risk associated with that not being the case is addressed in Section 12.5.15.

It is further assumed that the critical habitat of both threatened species is sparsely-vegetated (see Figure 12-2 for Plains Death Adder and Figure 12-5 for Carpentarian Antechinus), and so vegetation integrity is not an important ecological requirement for those species (as compared with, for instance, a forest-

dwelling species). Therefore, edge effects on both threatened species negligible and an inherent risk to threatened species for this potential impact has not been calculated.

12.5.6 HABITAT FRAGMENTATION

Context and assumptions

Reduction in the quality of threatened species' habitats (long term or permanent) could occur due to habitat fragmentation. Habitat fragmentation is considered in this context to be the permanent process by which habitat loss results in the division of large, continuous habitats into smaller, more isolated remnants. These remnants are then subject to the complex processes of habitat degradation and island biogeography, leading to loss of species diversity – initially locally, but ultimately at the landscape scale.

For the purpose of assessing the inherent risk (without controls), it is assumed that reinstatement and rehabilitation are effective. The risk associated with that not being the case is addressed in Section 12.5.15.

It is also assumed that Carpentarian Antechinus habitat is – by nature – already fragmented, and so minor, additional fragmentation will have a negligible effect on the species (apart from possible disruption to breeding, which is addressed in Section 12.5.7).

The following inherent risk is therefore for Plains Death Adder only – based on the assumption that it is extant in the Project area. Possible disruption to this species' breeding cycle is addressed in Section 12.5.7.

Inherent risk

There is a **LOW** risk that, without controls, that habitat fragmentation will cause a significant impact to the Plains Death Adder. The likelihood and consequences of this impact occurring are discussed below.

Risk component	Ranking	Explanation
Consequence	Minor	The Plains Death Adder is not described as a social species and so temporary fragmentation should not result in disrupted social dynamics. The Plains Death Adder has a vast and contiguous area of habitat available. A temporary division of that habitat is akin to a negligible loss of the population's critical habitat.
Likelihood	Rare	It would be an exceptional circumstance in which temporary division of the population's critical habitat would result in habitat fragmentation that has an impact on the Plains Death Adder population.

Controls

Due to the low level of inherent risk, additional controls are not deemed necessary.

Residual risk

The residual risk without any additional controls is assessed as **LOW**.

12.5.7 DISRUPTION TO BREEDING

Context and assumptions

This section examines disruption to breeding due to the installation of the trench. Impacts from noise and dust are discussed in sections 12.5.10 and 12.5.11 respectively.

For the purpose of assessing the inherent risk (without controls), it is assumed that:

- reinstatement and rehabilitation are effective, and therefore the impact would only be temporary. The risk associated with that not being the case is addressed in Section 12.5.15.
- the Plains Death Adder generally breeds in black soil country from October to November, and produces live young from February to March (TSSC 2012). Because black soil country is usually very boggy during those months it is likely that construction works will not be undertaken during that period. Moreover, the Plains Death Adder has a vast and contiguous area of habitat available, such that a temporary division of that habitat will likely have a negligible impact to the population breeding cycle and is not further discussed here.
- although Carpentarian Antechinus habitat is already fragmented, there is a single population within the Project footprint, and therefore gene flow and dispersal (see Section 12.2.3).

Inherent risk

The inherent risk for impacts to EPBC-listed threatened species from disruption to breeding is determined to be **SIGNIFICANT.** The likelihood and consequences of this impact occurring are discussed below.

Risk component	Ranking	Explanation
Consequence	Severe	The temporary presence of a trench through, and in between, small areas of critical habitat may disrupt a single breeding cycle of some individual Carpentarian Antechinus. Given the males of this species typically die after a single breeding season, such a disruption could result in a temporary diminishment of a population.
Likelihood	Possible	It is not unreasonable that, in the absence of controls, the presence of trench between Carpentarian Antechinus sub-populations could disrupt a single breeding cycle of some individuals resulting in a temporary diminishment of a population.

Controls

For the Carpentarian Antechinus, to give individuals the opportunity to cross from one side of the trench to the other, the controls outlined in Section 12.5.4 are also relevant here. Specifically, for every 50 m of rocky habitat and every 100 m of intervening habitat in the section of the construction ROW between KP 609.5 and KP 622, hessian (or similar material) will be draped from the top of one side of the trench, down along the side and bottom of the trench, and up the other side to the top of the opposite side of the trench.

Assessment of effectiveness

It is unknown if the Carpentarian Antechinus will use the structures that will be put in place to extricate themselves from the trench, but it seems a reasonable assumption that Carpentarian Antechinus are adept climbers (given their preference for rocky habitats) and could escape from a sloped trench without the presence of controls, and from a vertically-walled trench using the controls.

Residual risk

In calculating the residual risk for this potential impact, it is assumed that the above controls are put in place and are effective.

Risk component	Ranking	Explanation
Consequence	Minor	With the controls in place to minimise the trench presenting a barrier to breeding dispersal, there should be negligible impact to the Carpentarian Antechinus population's breeding cycle.
Likelihood	Rare	It would be an exceptional circumstance in the trench presented such a barrier to dispersal that the result was more than a negligible impact to the Carpentarian Antechinus population's breeding cycle.

12.5.8 WEEDS

Context and assumptions

Reduction in the quality of threatened species' habitats (long term or permanent) could occur due to weed introduction and/or proliferation. Impacts may also occur due to bushfire caused by the proliferation of weeds creating higher fuel loads and therefore more intense fires.

There are many weed species within the Project footprint (see Section 6.1.8.2), especially on pastoral properties around watercourses, tracks and previously-disturbed areas. Clearing of native vegetation has the potential to increase the risk of weed spread because the open, disturbed ground is readily colonised and dominated by the fast growing weed species. Movement of personnel and vehicles throughout the Project area also has the potential to increase the likelihood of weed species being introduced into areas previously not recorded. Proliferation of weed species has the potential to lead to displacement of native vegetation, a reduction in habitat quality, reduction in food sources for fauna, and increased frequency and intensity of bushfires. The latter can also negatively impact upon the pastoral productivity of the land.

For the purpose of assessing the inherent risk (without controls), it is assumed that weeds are common within the project footprint, are easily transported, and that no weed hygiene activities are undertaken prior to, and during, land access.

Weeds are not considered a threatening process for Plains Death Adder (TSSC 2012). For Carpentarian Antechinus, one invasive plant species (but not a declared weed listed under Queensland or Northern Territory legislation) is identified in the *Approved Conservation Advice for Carpentarian Antechinus* (TSSC 2015a) as a possible threat: Buffel Grass (*Cenchrus ciliaris*). An invasion of that species could significantly change the ecology of the central Queensland ridges where the Carpentarian Antechinus occurs (Lloyd et al. 2013), especially in relation to increasing fuel loads and therefore fire impacts. Buffel Grass is common in previously-disturbed flat areas and sandy soils near watercourses at the Mount Isa end of the ROW in the area – but is not present in rocky country that constitutes critical Carpentarian Antechinus habitat. This is possibly due to a combination of factors – cattle (which spread Buffel Grass) do not graze the scree slopes, and Buffel Grass is outcompeted by spinifex in the rockier soils. As such – and because only very small areas of critical Carpentarian Antechinus habitat will be disturbed during construction – the introduction or proliferation of weeds is not considered a significant threat to that species.

For these reasons, a risk assessment of the potential impact of weeds to threatened species has not been undertaken.

Controls

Notwithstanding the low inherent risk to threatened species posed by this potential impact, there are controls in place that would further reduce this risk. The Weed Management Plan (Appendix J) outlines strategies to limit the introduction of new weeds within the Project area and limit the spread of existing weeds during project activities.

- prior to entering the construction site, vehicles, machinery and equipment must undergo weed hygiene inspections carried out by a trained Weed Hygiene Inspector in compliance with the Queensland Government Biosecurity Queensland Checklists (this is in lieu of the Northern Territory Government having equivalent procedures). Transport must be via approved transport routes.
- the introduction of soil or fill material must be accompanied by a Weed Hygiene Declaration form.
- prior to construction, the Project footprint will be surveyed to map existing weeds within the Project footprint or immediate surrounds. The information from the weed survey, combined with the desktop search results, will be used to map and categorise weed management zones ('weed zones'). Weed zones will be determined based on:
    - weed species and density recorded during the weed survey
    - weed classes according to Northern Territory and Queensland legislation
    - location of state, territory and property boundaries
    - likely construction activities within each zone
    - proximity to watercourses.
- the weed zones will inform weed control and weed hygiene requirements. The weed zones will only apply to initial land clearing and topsoil removal works, and reinstatement and reinstatement works – i.e. those works undertaken in 'dirty' areas (see below). The method for determining weed zones, and specific controls required for each zone, will be confirmed with the Weeds Branch of DLRM following the weed survey, and this weed management plan will be updated with the additional information.

All vehicles and machinery working with topsoil or vegetation will be considered to be working in a 'dirty' area, in that there is the potential for these activities and vehicles to spread weed seed and/or vegetative material throughout the Project footprint. Vehicles and machinery with approval to operate in the 'dirty' area will include those involved in vegetation clearing, topsoil removal, weed control and those involved in backfilling and reinstatement activities. This will apply to vehicles and machinery establishing access tracks, clearing and establishing the construction ROW, clearing and establishing temporary construction infrastructure (camps and water storage dams), and establishing the compressor station sites. The vehicles and machinery working in 'dirty' areas will be required to use weed hygiene facilities, and operators will be required to undertake weed hygiene training. Weed hygiene inspections will be undertaken on these vehicles between weed zones.

During reinstatement of disturbed areas (i.e. filling in trench, replacing topsoil and spreading cleared vegetation) weed management will again be around weed zones.

Some Landholders may have specific weed hygiene requirements. These will be taken into consideration when identifying week risk zones.

The Weed Management Plan (Appendix J) outlines responsibilities, monitoring, performance indicators, corrective actions and reporting.

Assessment of effectiveness

The Weed Management Plan (Appendix J) includes best-practice measures to ensure appropriate hygiene of vehicles, education of personnel (e.g. cleaning boots and equipment between weed infested sites and other areas), active management protocols (e.g. hand pulling, spraying), and protocols for suitable storage of material likely to contain weed seed.

Prior to commencement of construction activities, the Project footprint will be subject to a complete weed survey; weed infestations will be mapped and location-specific weed controls developed where necessary. The approach to weed survey will be in accordance with DLRM Guidelines (Weed Management Branch 2015), which are considered best-practice.

12.5.9 FERAL FAUNA

Context and assumptions

Loss of threatened species could occur due to the introduction or proliferation of feral fauna species.

There are many vertebrate pest animal species extant within the Project area (Section 6.1.8.3), consistent with similar areas throughout Australia. It is therefore assumed that the region is already populated by the array of vertebrate pest animal species likely to occur in the semi-arid zone

Components of the construction phase have the potential to facilitate the proliferation of vertebrate pest animal species through, for instance, access to additional food resources during poorly-managed waste stream or the creation of breeding habitat (e.g. temporary dams for the Cane Toad).

For the purpose of assessing the inherent risk (without controls), it is assumed that no waste mitigation occurs. In addition, it is assumed that:

- for Carpentarian Antechinus, the two relevant feral animals are (as per TSSC 2015a):
    - Feral Cat, which probably predates this species, but the rocky habitat probably provides some protection (Curtis et al. 2012). Feral Cats are widespread across Australia and are likely to be well-established in the region.
    - Poisoning by ingestion of Cane Toads is a possible, but not demonstrated threat. However, as acknowledged by TSSC (2015a), there are many records of Carpentarian Antechinus that post-date Cane Toad invasion. Moreover, Cane Toads are likely established in the same area of the Project footprint within which Carpentarian Antechinus have been discovered (see below).
- according to TSSC (2012), the main identified threat to the Plains Death Adder is mortality by ingestion of the toxic Cane Toad. It is unclear to what extent Cane Toad occurs within the Project footprint. The most recent distribution modelling of Cane Toad includes the channel country to the eastern terminus of the pipeline, with modelling predicting potential distribution of the species westwards along the entire Project footprint. That region is considered marginal habitat for Cane Toad, with a maximum or 3 to 4 suitable breeding months.

  During field surveys for this EIS, ecologists recorded Cane Toads along the roadside near Camooweal – approximately 80 km north of the construction ROW. Camooweal is higher in the catchment than the Project footprint and so it could be assumed that Cane Toad would be presented downstream. However, there have been no observations of Cane Toad at either Avon Downs or Austral Downs, which are both located in black soil country (the latter only 4 km north of the construction ROW).

Two possible conclusions can be drawn from this:

a) Cane Toads have reached the limits of southerly expansion (as dictated by water availability) in the region, which does not include the construction ROW (except, perhaps, at the Mount Isa end). This seems the likeliest conclusion given the species is present in Camooweal, but not downstream at Austral Downs.

b) Cane Toads have yet to spread as far south as the construction ROW (except, perhaps, at the Mount Isa end), but suitable (albeit sub-optimal) habitat occurs, and so expansion into that region is inevitable. This is only possible if the species only recently made it to Camooweal and has not yet had the opportunity to travel downstream.

Therefore, the inherent likelihood of Cane Toad being introduced into area of the Project footprint within which it does not yet occur is either zero (because the species cannot occur there) or else possible, but largely inconsequential, because self-introduction was inevitable and likely to occur soon.

For these reasons, a risk assessment of the potential impact of feral fauna to threatened species has not been undertaken.

Controls

Notwithstanding the low inherent risk, there are controls in place that will ensure this risk is eliminated or remains low. Specifically, Chapter 13 outlines waste management controls that will be implemented across each Project phase.

12.5.10 NOISE AND VIBRATION

Context and assumptions

Reduction in the quality of threatened species' habitats (temporary) could occur due to noise and vibration. It is difficult to quantify and measure noise disturbance to native fauna given that different species have different tolerances and different capacities to move away from a noise disturbance.

For the purpose of assessing the inherent risk (without controls) – based on the Noise Assessment Report (Appendix T) – it is assumed that:

- the 65 dB(A) threshold screening criteria is only exceeded within 200 m of construction activities
- for species which may be more sensitive to noise and which have permanent nesting, roosting or colony areas (e.g. bats), the conservative assessment criteria of 12 dB(A) above existing LA_{eq} levels was applied meaning that construction activities have the potential to cause disturbance of noise-sensitive fauna up to 1 km from the construction ROW.
- blasting will only be undertaken for this Project in rocky areas. The intent of blasting is not to create a pit, but rather to fracture rock to be later removed by an excavator.
- sensitive fauna have the potential to be affected by vibration and overpressure within 400 m of the blasting.
- because construction will be progressive, any noise or blasting impacts will be short-lived.

In addition to the above, in assessing the inherent risk (without controls) to Carpentarian Antechinus it is assumed that the area of critical Carpentarian Antechinus habitat that will disturbed is small (a few hectares out of the estimated 4 369 ha).

This inherent risk assessment on the impact to Plains Death Adder assumes that the species has a vast and contiguous extent of occurrence within which to temporarily retreat (if necessary) and does not occur in areas where blasting will be required.

Inherent risk

There is a **LOW** risk that, without controls, noise emissions would cause a level of disturbance to EPBC-listed threatened species. The likelihood and consequences of this impact occurring are discussed below.

Risk component	Ranking	Explanation
Consequence	Minor	A short-lived, dust disturbance over a small area of critical habitat constitutes a temporary reduction in the quality of < 0.01 per cent of critical habitat.
Likelihood	Rare	It would be an exceptional circumstance in which such a temporary and localised noise disturbance had an impact on the population of Carpentarian Antechinus or Plains Death Adder.

Controls

Notwithstanding the low inherent risk to the environment posed by this potential impact, there are controls in place that would further reduce this risk. A Noise Management Plan (Appendix U) has been developed which will minimise the noise impacts on the environment.

The blasting subcontractor will be required to provide a Blasting Management Plan demonstrating compliance with all approval conditions prior to the commencement of blasting activities. Monitoring and recording of the air blast overpressure and ground borne vibration will be undertaken in accordance with regulatory requirements using the *Queensland Transport – Technical Note 3 April 1993 – Measurement of Ground Vibration and Air Blast*.

Assessment of effectiveness

The noise controls that will be implemented are best-practice in accordance with the *Code of Environmental Practice for Onshore Pipelines* (APIA 2013) and regulatory requirements included in the Environment Authority for the Project issued pursuant to the EP Act in Queensland. The Construction Contractor has Standard Operating Procedures for management of noise, and experience implementing these procedures on other pipeline projects.

Residual risk

The residual risk without any additional controls is assessed as **LOW**. The routine controls are expected to ensure that the risk remains low for the duration of the construction phase.

12.5.11 DUST

Context and assumptions

Reduction in the quality of threatened species' habitats (temporary) could occur due to dust. Construction will generate dust when vegetation is cleared – exposing soils to wind – and by vehicles travelling along

unsealed roads. The Air Quality Assessment Report (Appendix V) modelled the likely impacts of dust emissions of human sensitive receptors, but not on the environment.

Matsuki et al. (2016) studied the impacts of dust on plants in a semi-arid environment. For chemically-inert dust (i.e. that which comes from a disturbance of the existing environment), the study made the following observations:

- negative effects of dust on plants have primarily been reported in temperate and arctic environments
- arid and semi-arid environments are inherently dusty due to constant wind erosion and occasional dust storms, therefore plants in these environments are likely to be exposed to dust naturally and may be less likely to suffer short term impacts
- during the dry season, when dust is more likely, many arid and semi-arid plants naturally either die or reduce growth
- dust deposition could be high within 150 m of the source, but decreased rapidly with increasing distance and over time
- the influence of rainfall had a stronger effect on plants than dust.

The study reached a similar conclusion to similar studies – it seems likely that short-term dust generation in arid and semi-arid environments does not result in negative impacts on vegetation.

In assessing the inherent risk (without controls), it is assumed that the semi-arid environment within which the NGP Project is proposed to be undertaken is similar to the semi-arid environment within which the abovementioned study was undertaken.

In the absence of any indications otherwise, it is assumed that dust will have a negligible impact on Plains Death Adder. The species is not especially dependant on the health of the vegetation in its environment (especially if that health is only compromised for a short period of time), and has a vast and contiguous extent of occurrence within which to temporarily retreat (if necessary). Therefore, a risk assessment of the potential impact of dust to threatened species has not been undertaken.

The situation is likely similar for the Carpentarian Antechinus; however, for the purpose of assessing the inherent risk (without controls), a precautionary approach has been undertaken in assuming that dust has a negative effect on Carpentarian Antechinus – although how this is manifest is unknown.

Inherent risk

Risk component	Ranking	Explanation
Consequence	Minor	A short-lived, dust disturbance over a small area of critical habitat constitutes a temporary reduction in the quality of < 0.01 per cent of critical habitat.
Likelihood	Rare	It would be an exceptional circumstance in which such a temporary and localised dust disturbance had an impact on the population of Carpentarian Antechinus or Plains Death Adder.

Controls

Notwithstanding the low inherent risk to threatened species posed by this potential impact, there are controls in place that would further reduce this risk. General controls including dust suppression from water carts, and reinstatement and rehabilitation are outlined in the Air Quality Management Plan (Appendix W).

12.5.12 WATER QUALITY

Context and assumptions

Reduction in the quality of threatened species' habitats (both either long term or permanent) may occur due to reduced water quality caused by:

- chemical spill
- sedimentation from erosion
- uncontrolled release of contaminated water.

Changes in the quality of surface and/or groundwater can lead to enduring impacts on ecosystems that depend on that water. For this Project, such changes to water quality may potentially occur during the transportation and storage of chemicals, during camp waste water treatment, from disposal of water used for hydrostatic testing, by exposure of problematic soils, and by sedimentation entering watercourses from the erosion of disturbed soils.

For the purpose of assessing the inherent risk (without controls), it is assumed that:

- impact is localised and temporary due to the low volumes of potential contaminants and there being no permanent water in the construction footprint.
- works are undertaken during times when there is no flow or low flow in the watercourses.

Neither Carpentarian Antechinus nor Plains Death Adder live within, or depend upon, waterbodies, and so changes in water quality will not affect these species. Therefore, a risk assessment of the potential impact from reduced water quality to threatened species has not been undertaken.

12.5.13 WATER AVAILABILITY

Context and assumptions

Reduction in the quality of threatened species' habitats may occur due to reduced water availability because of extraction of water for construction activities from natural sources and/or because of altered surface water flows due to construction activities. The wetlands and watercourses in the region are ephemeral, thus environmental water from surface water sources is only temporarily available. Seasonal groundwater levels may influence the duration that the region's swamps and wetlands retain water.

Changes in the quantity and/or availability of surface and/or groundwater can lead to enduring impacts on ecosystems that depend on that water. For this Project, such changes may potentially occur due to water extraction for construction and/or hydrostatic testing purposes, and/or from construction activities alter surface water flows as a result of the installation of the pipeline across watercourses.

For the purpose of assessing the inherent risk (without controls), it is assumed that:

- at any one site, volumes extracted will be relatively small one-off events

- works are undertaken during times when there is no flow or low flow in the watercourses.

Neither Carpentarian Antechinus nor Plains Death Adder live or depend on waterbodies, and so changes in water availability will not affect these species. Therefore, a risk assessment of the potential impact from changes in water availability to threatened species has not been undertaken.

12.5.14 BUSHFIRE

Context and assumptions

Loss of threatened species and reduction in the quality of threatened species' habitats (temporary) could occur due to bushfire. Construction works – particularly welding – could generate sparks and cause bushfires. Bushfire has the potential to cause direct mortality to fauna, displacement of fauna, and/or reduction in habitat quality. Bushfire, however, is a common occurrence in some vegetation communities in the region.

Fire mapping indicates that approximately half of the Project footprint has burnt two to three times between 2003 and 2015. This is on the higher scale of burning frequency for central Australia. The black soil country between KP 353 and KP 561 generally experienced no fires between 2003 and 2015 – likely due to cattle grazing (fuel-load reduction) and perhaps the lack of spinifex-dominated grasslands.

Given the above context, for the purpose of assessing the inherent risk (without controls), it is assumed that that any bushfires generated by Project activities serve to increase the frequency of bushfires that occur in the region.

It is also assumed that no attempts are made to control bushfires generated by Project activities.

With respect to the threatened species, it is assumed that:

- the rocky country which comprises critical Carpentarian Antechinus habitat has a low susceptibility to bushfire and is not heavily impacted by the few bushfires which do occur. This assumption is based on field observations of that habitat being sparsely vegetated, free from Buffel Grass (which greatly increases fuel loads), exhibiting little evidence of historic burning.
- the black soil country which comprises critical Plains Death Adder habitat also has a low susceptibility to bushfire and is not heavily impacted by the few bushfires which do occur. This assumption is based on field observations of that habitat being sparsely vegetated (tussocks of grass occurring in small, discrete patches – see Figure 12-2) and exhibiting little evidence of historic burning (confirmed by the fire mapping mentioned above).

For these reasons, the risk is determined to be **LOW** and no further assessment has been undertaken.

Controls

All construction activities, including establishment and operation of temporary camps, will occur within cleared Project footprints to minimise the risk of ignition sources coming into contact with flammable material (such as cleared vegetation). Any works involving potential ignition sources will have fire prevention and control requirements included in relevant procedures. All vehicles and equipment will be equipped with fire extinguishers and water carts will be located in the proximity of high fire risk activities on high fire danger days. There will be dedicated places for smoking and butt collection bins. Fire ratings and warnings in the area will be monitored and Jemena and the Construction Contractor will liaise with Bushfires NT and Rural Fire Service Queensland as required.

Assessment of effectiveness

The above controls all represent industry best-practice and are expected to be effective in reducing the probability and extent of bushfire.

Residual risk

Risks associated with bushfire are inherently **LOW**, and implementation of standard procedures through the CEMP will further reduce the likelihood of impacts occurring over the construction phase of the Project.

12.5.15 FAILURE OF REHABILITATION

Context and assumptions

Reduction in the quality of threatened species' habitats (long term or permanent) could occur due to inadequate reinstatement contributing to a failure of rehabilitation. During the construction phase, reinstatement of all disturbed areas will be undertaken progressively (apart from tracks required for access to permanent facilities or requested to be retained by the landholder or manager). Reinstatement will involve replacing all sub-soils where excavated, re-spreading all top soils, re-contouring of the disturbed area to match the surrounding landscape, installation of flow diversion banks as required by the Primary ESCP and re-spreading cleared vegetation over the reinstated soils. The topsoil will contain seed stock which will aid in natural revegetation of the area. Rehabilitation success will depend, to varying degrees, on the adequacy of the reinstatement – particularly because inadequate reinstatement may lead to loss of topsoil due to erosion.

The majority of the land clearing is narrow and linear, and the vegetation communities within the Project footprint are regionally common and widespread (see Section 6.1.3).

For the purpose of assessing the inherent risk (without controls), it is assumed that:

- inadequate reinstatement only occurs in discrete locations (i.e. it is not systemic)
- there is a low risk of an impact at an ecosystem level from habitat fragmentation and edge effects (as assessed in Sections 12.5.5 and 12.5.6)

It is further assumed that the critical habitat of both threatened species is sparsely-vegetated (see Figure 12-2 for Plains Death Adder and Figure 12-5 for Carpentarian Antechinus), and so vegetation integrity is not an important ecological requirement for those species (as compared with, for instance, a woodland species). The reinstatement of rocky habitats will involve the return of any side-lined rocks and scree, therefore quickly re-creating functionally-similar habitat for the Carpentarian Antechinus to that disturbed. Therefore, localised rehabilitation failure due to inadequate reinstatement would have a negligible impact on the habitat quality of both threatened species, and the risk is assessed as **LOW**.

Controls

Notwithstanding the low inherent risk to threatened species posed by this potential impact, there are controls in place that would further reduce this risk. The reinstatement and rehabilitation plan for the construction footprint and associated acceptance criteria are detailed in the Environmental Management Plan (Chapter 13). Reinstatement will follow the construction contractor's Reinstatement Management Procedure. It details how land will be cleared, vegetation stored, and land reinstated in the optimal way to give reinstatement the best chance of being successful.

Reinstatement will be audited against strict acceptance criteria. Reinstatement works and weed control will be undertaken as required.

To mitigate the potential of this risk being realised, rehabilitation success and erosion will be monitored. If initial reinstatement activities do not facilitate regrowth in some areas, then active revegetation (e.g. hand seeding) will be undertaken, if required. This is most likely to occur in watercourse crossings (approaches and banks). Seeding will also be considered for areas where erosion risk is high; grass seed will be spread to establish a ground cover in those areas.

As mentioned above, the reinstatement of rocky habitats will involve the return of any side-lined rocks and scree, therefore quickly re-creating functionally-similar habitat for the Carpentarian Antechinus to that disturbed.

Assessment of effectiveness

The reinstatement and rehabilitation procedures for the construction footprint and associated acceptance criteria are detailed in the Environmental Management Plan (Chapter 13). Reinstatement will follow the Construction Contractor's Reinstatement Management Procedure. It details how land will be cleared, vegetation stored, and land reinstated in the optimal way to give reinstatement the best chance of being successful. Reinstatement will be audited against strict acceptance criteria.

12.6 OPERATIONAL PHASE RISKS

The Project's Operational Phase will have a small team of field staff responsible for the operation and maintenance activities in Mount Isa and Tennant Creek. There will be ongoing weed control and rehabilitation monitoring. There is a risk of pipeline failure leading to bushfire.

12.6.1 WEEDS

Context and assumptions

Reduction in the quality of threatened species' habitats (long term or permanent) could occur due to weed introduction and/or proliferation caused by operational usage of vehicles. During the Project's construction phase, weeds will be managed according to the Weed Management Plan (Appendix J). That plan allows for hygiene and weed management as required. However, the effectiveness of the Weed Management Plan cannot be determined during the short term construction phase, consequently ongoing surveillance and, if necessary weed management, is required.

During the operations phase, opportunities for weed spread due to Project activities are substantially reduced. The only traffic along the reinstated ROW will be that associated with weed surveillance and control.

For the purpose of assessing the inherent risk (without controls), it is assumed that construction phase weed management has been largely successful, but that there is still the occasional new outbreak of weeds.

Weeds are not considered a threatening process for Plains Death Adder (TSSC 2012). For Carpentarian Antechinus, one invasive plant species (but not a declared weed listed under Queensland or Northern Territory legislation) is identified in the *Approved Conservation Advice for Carpentarian Antechinus* (TSSC 2015a) as a possible threat: Buffel Grass (*Cenchrus ciliaris*). An invasion of that species could significantly change the ecology of the central Queensland ridges where the Carpentarian Antechinus occurs (Lloyd et al. 2013), especially in relation to increasing fuel loads and therefore fire impacts. Buffel Grass is common in previously-disturbed flat areas and sandy soils near watercourses at the Mount Isa end of the ROW in the area – but is not present in rocky country that constitutes critical Carpentarian Antechinus habitat. This is possibly due to a combination of factors – cattle (which spread Buffel Grass) do not graze the scree slopes, and Buffel Grass is outcompeted by spinifex in the rockier soils. As such – and because only very

small areas of critical Carpentarian Antechinus habitat will be traversed during the operations phase – the introduction or proliferation of weeds is not considered a significant threat to that species. Consequently, the risk has been assessed as **LOW**.

Controls

Notwithstanding the low inherent risk to threatened species posed by this potential impact, there is a control in place that would further reduce this risk. This involves ongoing surveillance and management which will be outlined in the Operations Weed Management Plan. This plan will outline the surveillance strategy which will be supported by the pre-construction weed mapping.

Assessment of effectiveness

The effectiveness is dependent on implementation of the Operations Weed Management Plan. If the plan is implemented fully – including strategic surveillance and control for the period that is required to assess weeds – then it should be effective.

12.6.2 NOISE

Context and assumptions

Reduction in the quality of ecosystems and threatened species' habitats (both temporary) may occur due to noise from the compressor stations. During operations, gas flaring and venting will occur at the compressor stations. This will occur during emergency release of gas and during maintenance periods. The venting duration is expected to be 15 minutes once every 6 months.

The Noise Assessment Report (Appendix T) states that during venting noise levels have the potential to exceed the LA_{eq} short term criteria at a distance of up to 1.5 km. Therefore, a potential impact on noise-sensitive ecological receptors is predicted up to 1 km from the compressor stations (using the criteria of 12 dB(A) above background).

For the purpose of assessing the inherent risk (without controls), it is assumed that there are no threatened species envelope (as indicated by the Threatened Species Survey Report – Appendix G). Therefore, the risk has been assessed as **LOW** and no further analysis has been undertaken.

12.6.3 FAILURE OF REHABILITATION

Context and assumptions

Reduction in the quality of threatened species' habitats (long term or permanent) could occur due to the failure of rehabilitation (because of insufficient natural revegetation). During the construction phase all disturbed areas not required for operations or not requested by landholders to be retained (for example dams and access tracks) will be reinstated. Rehabilitation will be from natural growth of grasses and shrubs. The success of rehabilitation will not be known for some years after reinstatement.

For the purpose of assessing the inherent risk (without controls), it is assumed that unsuccessful rehabilitation only occurs in discrete locations (i.e. it is not systemic).

It is further assumed that the critical habitat of both threatened species is sparsely-vegetated (see Figure 12-2 for Plains Death Adder and Figure 12-5 for Carpentarian Antechinus), and so vegetation integrity is not an important ecological requirement for those species (as compared with, for instance, a woodland species). Therefore, localised rehabilitation failure due to unsuccessful rehabilitation would have a negligible impact on the habitat quality of both threatened species; consequently the risk has been assessed as **LOW**.

Controls

Notwithstanding the low inherent risk to threatened species posed by this potential impact, there are controls in place that would further reduce this risk. The reinstatement and rehabilitation plan for the construction footprint and associated acceptance criteria are detailed in the Environmental Management Plan (Chapter 13). Reinstatement will follow the construction contractor's Reinstatement Management Procedure. It details how land will be cleared, vegetation stored, and land reinstated in the optimal way to give reinstatement the best chance of being successful. Reinstatement will be audited against strict acceptance criteria.

To mitigate the potential of this risk being realised, rehabilitation will be monitored for lack of vegetation and ongoing erosion. If initial reinstatement activities do not facilitate regrowth in some areas, then active revegetation (e.g. hand seeding) will be undertaken, if required. This is most likely to occur in watercourse crossings (approaches and banks). Seeding will also be considered for areas where erosion risk is high; grass seed will be spread to establish a ground cover in those areas.

Assessment of effectiveness

The process for reinstatement and rehabilitation detailed in the Environmental Management Plan (Chapter 13) is derived from the *APIA Code of Environmental Practice for Onshore Pipelines (2013).*

The reinstatement and rehabilitation acceptance criteria for the NGP are prescribed in the Environmental Authority for the Queensland component of the NGP Project issued by the Department of Environment and Heritage Protection (DEHP); these acceptance criteria will be used across the Project area These acceptance criteria are applied routinely to similar Projects in Queensland and therefore are considered effective for long-term mitigation of biodiversity impacts. As the acceptance criteria apply to the life of the Project they are expected to be effective in ensuring that any failure of rehabilitation is detected and rectified.

The extent to which the Project has the potential to cause a significant impact to the environment because of unsuccessful rehabilitation will largely depend on the effectiveness of the weed control measures implemented through the Weed Management Plan (Construction), and during operational phase weed surveillance and control (see Section 12.6.1).

12.6.4 PIPELINE FAILURE

Context and assumptions

Reduction in the quality of threatened species habitats (temporary) could occur due to a bushfire caused by pipeline failure and ignition. The pipeline will be designed, constructed, tested, operated and maintained in accordance with *Australian Standard 2885 Pipelines – Gas and Liquid Petroleum (AS 2885)* and other applicable standards and regulations or industry Codes of Practice. This industry is mature and such incidents are rare and the risk has been assessed as **LOW**.

12.7 MITIGATION AND MANAGEMENT

This section provides additional detail in relation to Jemena's approach to mitigation and management of threatened species risks. Through implementation of the risk controls discussed in the sections above, within the management framework described below, residual risks are expected to be reduced to levels that Jemena considers will be tolerable to Project stakeholders.

Jemena's approach to mitigation and management of risks to threatened species across each Project phase is detailed in the Environmental Management Plan (Chapter 13 – Section 13.3). As requested in Section 5.4.3 of the EIS ToR, a Biodiversity Management Plan (BMP) (Appendix H) has been prepared to provide clear and concise methods to mitigate impacts on biodiversity and threatened species. This plan was prepared by Environmental Consultants with demonstrated experience in the mitigation and monitoring of adverse impacts to biodiversity, and incorporates advice received from various advisors with specific expertise in relation to the threatened species – Carpentarian Antechinus and Plains Death Adder – which are respectively known to occur and likely to occur within the Project footprint. Details of personnel involved in the preparation of the BMP are provided in Appendix D of this EIS.

As the most significant potential impacts to threatened species are associated with the Project construction phase, the BMP has been prepared specifically to provide the Construction Contractor with clear guidance in relation to appropriate risk controls and monitoring requirements. In addition to the BMP, the following EIS documents provide for mitigation and management of impacts to threatened species:

- Weed Management Plan – Appendix J
- Noise Management Plan – Appendix U
- Air Quality Management Plan – Appendix W
- Traffic Management Plan (Construction) – Appendix E
- Water Management Plan – Appendix O
- Primary Erosion and Sediment Control Plan – Appendix P.

The Construction Contractor will incorporate all controls into the CEMP and associated procedures, which will be finalised prior to the commencement of construction activities.

Operational risks are less significant and do not require a stand-alone management plan. Threatened species mitigation and management requirements applicable to the Project operational phase are detailed in the Environmental Management Plan (Chapter 13). Jemena will incorporate these controls into the Operational Environmental Management Plan (OEMP), which will be finalised prior to commencement of operations.

This management framework is consistent with the *Code of Environmental Practice for Onshore Pipelines* (APIA 2013) and is proven to be effective in managing risks associated with the various phases of pipeline projects.

12.8 SUMMARY OF RESIDUAL RISK

The NGP Project will involve activities which do have potential to impact on important populations of two threatened species. Each identified risk has been reduced to 'as low as reasonably practicable' through the application of management and mitigation measures, many of which are standard practice for onshore pipeline projects. The mitigation measures prescribed in this chapter are expected to reduce all risks to EPBC-listed threatened species to low.

12.9 THREATENED SPECIES SIGNIFICANT IMPACT ASSESSMENT

As detailed in Section 12.2, a detailed and thorough assessment process led to the conclusion that important populations of two threatened species are known to occur, or likely to occur, within the Project footprint:

- Plains Death Adder (*Acanthophis hawkei*) in the black soil country between KP 355 and KP 561
- Carpentarian Antechinus (*Pseudantechinus mimulus*) in the rocky country between KP 609.5 and KP 620.5.

The potential risks of Project activities impacting on these two species are assessed above. Using that information, in this section the risk assessment process for determining whether a Project will have a 'significant impact' on a threatened species (as defined in *EPBC Significant Impact Guidelines 1.1*) is been undertaken for the two relevant species. That process ensures that all activities that present a significant inherent risk of impacting the two threatened species have been considered.

Note: The tables below refer to 'inherent likelihood'. This is considered the likelihood – in the absence of any mitigation measures – that a significant impact for that particular criterion occurs.

12.9.1 CARPENTARIAN ANTECHINUS (*PSEUDANTECHINUS MIMULUS*)

Summary of existing environment

This species is listed under both the TPWC Act and the EPBC Act as Vulnerable.

Field surveys identified Carpentarian Antechinus in rocky ridges north and south of Mica Creek (KP 617), and in a granite boulder outcrop to the west of those ridges (KP 610) (see Figure 12-8). Based on this evidence – and the ecology of the species – it is likely that Carpentarian Antechinus occupy any suitable rocky outcrops, boulder piles and rocky ridges/hills occurring with some regularity between KP 606 and KP 620 of the construction ROW. Within this stretch, there are scattered granitic boulder piles and linear metamorphic ridges with varying levels of outcropping. It is expected that this rocky habitat – referred to henceforth as 'rocky refugia habitat' – provides daytime refuge, as well as night-time foraging habitat, and is critical habitat for the species.

The construction ROW intersects rocky refugia habitat on three occasions (see Table 12-7). The largest (and most significant) intersection occurs on a metamorphic ridgeline between KP 616 and KP 616.3 (1.01 ha), of which Carpentarian Antechinus was identified during field surveys. The remaining two intersections of rocky refugia habitat are small and the construction ROW only traverses the edge of these areas (cumulative total area of 0.03 ha).

Table 12-7. Rocky refugia habitat intersected by the construction ROW – Carpentarian Antechinus

KP	Area (ha)
610.2	0.01
610.6	0.02
617.0	1.01
Total	**1.04**

To maintain gene flow between rocky refugia habitat, it is likely that the species uses the large areas of flatter lowlands (sandy loams) surrounding the rocky habitat for dispersion habitat during the breeding

season. These flatter areas have been termed ‘dispersive habitat’, and are more likely to be used during the breeding season (which is thought to occur between August and October, Curtis et al. 2012). Such movement would occur at night; however, there is no information regarding the distance to which the species can travel during dispersal periods.

As noted in Section 12.2.3, it is not clear the degree to which occurrences of Carpentarian Antechinus are connected in this part of its distribution – i.e. whether there is a population extending north-south in the main range of rocky hills together with isolated populations in clusters of rocky outcrops to the west, or some level of dispersal and genetic flow between all these occurrences, and therefore one population within the construction footprint. Given how small and apparently isolated the area of habitat within which a Carpentarian Antechinus recorded in a camera trap was, the latter situation seems more likely in order for such habitat patches to remain populated.

Significant impact assessment

The likelihood of that population of Carpentarian Antechinus being significantly impacted by this Project is assessed in Table 12-8 against the criteria contained within the *EPBC Significant Impact Guidelines*. A conservative area of occupancy of that population is estimated to be 4,369 ha.

Conclusion

There is an estimated 4 369 ha of critical habitat – rocky outcrops, boulder piles or rocky hills – available to support the Carpentarian Antechinus population that overlaps the construction footprint. A negligible proportion (1.04 ha or 0.02 per cent) of this habitat will be disturbed (temporarily) during construction works. A few individuals may be impacted upon directly or indirectly during construction activities, or all potentially-impacted upon individuals may temporarily re-locate to adjacent suitable habitat. None of these consequences constitute a significant impact to this species.

Table 12-8. Significant impact assessment for Carpentarian Antechinus

Criterion	Inherent likelihood	Summary of mitigation measures and significant impact assessment	Residual likelihood
Lead to a long-term decrease in the size of an important population	**LOW**	Construction works will disturb suitable habitat for Carpentarian Antechinus. Broadly, this could lead to a long-term decrease in the population through loss of habitat and direct mortality. Carpentarian Antechinus is nocturnal and is thought to hide in rock crevices during the day. Construction activities will only occur during the day and so the primary potential impact of construction on this species would be associated with land-clearing, trenching, blasting and pipe-laying. • **Land-clearing.** The Carpentarian Antechinus habitat that will be cleared is a negligible proportion of the rocky refugia habitat supporting this particular population (1.04 ha out of the estimated 4 369 ha). Indeed, the preference – from a construction perspective – is to avoid rocky habitat. Land-clearing will occur during the day when this species will be hiding in rock crevices, and so should not directly impact upon any individuals. Once construction is complete, all disturbed habitat will be rehabilitated. • **Trench excavation.** The Carpentarian Antechinus habitat that will be excavated is a negligible proportion of the rocky refugia habitat supporting this particular population (0.21 ha out of the estimated 4 369 ha). Only if an individual is hiding in a rock crevice within the trench line could it be impacted by trenching. It is unlikely that any individuals of this species will have the misfortune of occurring within the excavation corridor. Those that do may flee. • **Blasting** will be required to assist in the excavation of the trench in the rocky habitat that also supports Carpentarian Antechinus. However, the blasting used to facilitate trench excavation is controlled such that there is no over-blast (i.e. projected debris). Instead, the blasting fractures the rock *in situ* for subsequent removal by an excavator. Therefore, there should not be any direct impact to Carpentarian Antechinus from blasting. It is unlikely that any individuals of this species will have the misfortune of occurring within the area being blasted. Those that do may flee. • **Pipe-laying.** Carpentarian Antechinus could fall into the open trench. It is assumed that the species are adept climbers (given their preference for rocky habitats) and could generally escape from the sloped trenches that will be used in rocky habitats. Nevertheless, in accordance with the *Code of Environmental Practice for Onshore Pipelines* (APIA 2013), a Trench Inspection Procedure will be developed prior to construction commencing. This will provide for the presence of qualified fauna spotter-catchers (FSC) who will inspect the length of open trench daily to recover and release any fauna that is fallen into the trench overnight. In addition, in the section of the construction ROW proximate to Carpentarian Antechinus habitat (KP 609.5 and KP 622), for every 50 m of rocky habitat and every 100 m of intervening habitat, hessian (or similar material) will be draped from the top of one side of the trench, down along the side and bottom of the trench, and up the other side to the top of the opposite side of the trench. This will allow Carpentarian Antechinus to cross and/or escape the trench. • **Disturbance from noise.** Construction activities will occur at daytime, and Carpentarian Antechinus is nocturnal	**LOW**

Criterion	Inherent likelihood	Summary of mitigation measures and significant impact assessment	Residual likelihood
		species. Construction will be progressive and so any impact will be short-lived. Nevertheless, it is acknowledged that when construction is taking place, a small number of individual Carpentarian Antechinus may be killed. However, the region comprises a significant area of suitable habitat. Therefore, it is expected that, if present, the species will occur broadly within that habitat. Because construction activities are disturbing a tiny proportion of that habitat, the effect on the local population of a few individuals possibly perishing is likely to be minimal. For these reasons, the Project will not lead to a long-term decrease in the size of an important population.	
Reduce the area of occupancy of an important population	**LOW**	The construction of the NGP will temporarily disturb a negligible proportion of the rocky refugia habitat supporting this particular Carpentarian Antechinus population (1.04 ha out of the estimated 4 369 ha).	**LOW**
Fragment an existing important population	**MEDIUM**	Temporary population fragmentation by a linear development such as this could occur if construction works (especially the excavated trench) create a physical barrier to the movement of Carpentarian Antechinus, resulting in a division of this population. In the section of the construction ROW proximate to Carpentarian Antechinus habitat (KP 609.5 and KP 622), for every 50 m of rocky habitat and every 100 m of intervening habitat, hessian (or similar material) will be draped from the top of one side of the trench, down along the side and bottom of the trench, and up the other side to the top of the opposite side of the trench. This will allow Carpentarian Antechinus to cross and/or escape the trench. Once construction is complete, the ROW will be reinstated and rehabilitated, and will no longer present a physical barrier for the movement and dispersal of this Carpentarian Antechinus population. No fragmentation will occur post-construction.	**LOW**
Adversely affect critical habitat	**MEDIUM**	Woinarski et al. (2014) note that Carpentarian Antechinus has been recorded from a range of vegetation types, but always at rocky sites. Apart from that, there is no literature that identifies critical habitat features for this species within the Mount Isa region. The construction of the NGP will temporarily disturb a negligible proportion of the rocky refugia habitat supporting this particular Carpentarian Antechinus population (1.04 ha out of the estimated 4 369 ha). Therefore, the construction of the Project will temporarily adversely affect a negligible amount of the species' critical habitat.	**LOW**
Disrupt the breeding cycle of an important population	**MEDIUM**	Carpentarian Antechinus is thought to breed between August and October (Curtis et al. 2012). Within this genus, males typically die after their first breeding season, although Curtis et al. (2012) consider it likely that some males survive to breed in a second year. Construction works could disrupt some breeding opportunities for pairs in the immediate vicinity (assuming they have not moved away). As this Carpentarian Antechinus population is likely to occur in an estimated 4 369 ha of	**LOW**

Criterion	Inherent likelihood	Summary of mitigation measures and significant impact assessment	Residual likelihood
		the rocky refugia habitat, the possible disruption to a few pairs of breeding Carpentarian Antechinus would not constitute a significant impact.	
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent the species is likely to decline	**LOW**	Construction will only impact a small area of the local range of the species. Once construction is complete, the entire ROW will be progressively reinstated and rehabilitated. For this species, the reinstatement of rocky habitats will involve the return of any side-lined rocks and scree, therefore quickly re-creating functionally-similar habitat for the Carpentarian Antechinus to that which was disturbed. The short period and negligible area of disturbance make it unlikely that Project activities will decrease the availability or quality of habitat to the extent the species is likely to decline.	**LOW**
Result in invasive species, that are harmful to the species, becoming established in the species' habitat	**LOW**	Three invasive species are identified in the *Approved Conservation Advice for Carpentarian Antechinus* (TSSC 2015a) as possible threats to Carpentarian Antechinus: • Feral Cat probably predates this species, but the rocky habitat probably provides some protection (Curtis et al. 2012). Feral Cats are widespread across Australia and are likely to be well-established in the region. • Buffel Grass (*Cenchrus ciliaris*) invasion could significantly change the ecology of the central Queensland ridges where the species occurs (Lloyd et al. 2013), especially in relation to increasing fuel loads and therefore fire impacts. Buffel Grass is common in previously-disturbed flat areas and sandy soils near watercourses at the Mount Isa end of the ROW in the area – but is not present in rocky country that constitutes critical Carpentarian Antechinus habitat. This is possibly due to a combination of factors; cattle (which spread Buffel Grass) do not graze the scree slopes, and Buffel Grass is outcompeted by spinifex in the rockier soils of the scree slopes. • Poisoning by ingestion of Cane Toads is considered a possible, but not demonstrated threat. However, as acknowledged by TSSC (2015a), there are many records of Carpentarian Antechinus that post-date Cane Toad invasion. Moreover, Cane Toads are likely established in the same area of the Project footprint within which Carpentarian Antechinus have been discovered. For these reasons, Project activities will not increase the extent or intensity of these threatening processes.	**LOW**
Introduce disease that may cause the species to decline	**LOW**	There is no literature linking a disease to the decline of Carpentarian Antechinus.	**LOW**

12.9.2 PLAINS DEATH ADDER (*ACANTHOPHIS HAWKEI*)

Summary of existing environment

This species is listed under both the TWPC Act and the EPBC Act as Vulnerable.

Although there are no records of Plains Death Adder within the Project footprint, field surveys confirmed that there are 206 km of Plains Death Adder potential habitat (black soil plains) within the Project footprint between KP 355 and KP 561. Habitat mapping conducted at a scale of 1:10,000 indicates that the Project footprint intersects approximately 820.1 ha of suitable habitat for Plains Death Adder (see Table 12-4 and Table 12-5) for breakdown of habitat types specific to Plains Death Adder in the Northern Territory and Queensland, respectively).

The presence – within the Project footprint – of suitable habitat to that known to support Plains Death Adder indicates a reasonable likelihood that the species occurs within the Project footprint. It seems reasonable to infer that such an occurrence would be part of the same population as that containing the record proximate to the construction footprint. What is unclear is whether that population is contiguous with the population that hosts the occurrence records from 100+ km further north in a different land system. Applying the precautionary principle, it is assumed that, if extant, occurrences of Plains Death Adder within the construction footprint would constitute a separate population (i.e. no gene flow) to that containing the multiple records of the species 100+ km to the north.

Significant impact assessment

The likelihood of that population of Plains Death Adder being significantly impacted by this Project is assessed against the criteria contained within the *EPBC Significant Impact Guidelines* in Table 12-9. The area of occupancy of that population is estimated to be 1.6 million ha.

Conclusion

Plains Death Adder has not been recorded within the Project footprint and may not occur that far south, in which case all of the above content is a moot exercise. If it does, then the ecology of Plains Death Adder, the Project's narrow disturbance footprint, and short duration of disturbance all limit the inherent (and therefore residual) risk of construction activities significantly impacting upon this species to 'low'. The only possible impact could be if Project activities introduce Cane Toads into areas of suitable within the Project footprint that are not yet occupied by that species. Whilst that would impact negatively upon Plains Death Adder, such an event would be inconsequential, because self-introduction is inevitable and likely to occur soon.

Table 12-9. Significant impact assessment for Plains Death Adder

Criterion	Inherent likelihood	Summary of mitigation measures and significant impact assessment	Residual likelihood
Lead to a long-term decrease in the size of an important population	**LOW**	Construction works will disturb potentially suitable habitat for Plains Death Adder. Broadly, this could lead to a long-term decrease in the population through loss of habitat and direct mortality. Plains Death Adder is nocturnal and construction activities will only occur during the day, and so the primary potential impact of construction on this species would be associated with land-clearing, trenching, blasting and pipe-laying. • **Land-clearing.** The area of Plains Death Adder habitat that will be cleared is a 30 m ROW corridor extending for 206 km, as well as access tracks and other infrastructure – a total of 820.1 ha (see Table 12-4 and Table 12-5). In contrast, this population of Plains Death Adder has an estimated contiguous area of occupancy of 1.6 million ha. Hence, the Plains Death Adder habitat that will be cleared is a negligible proportion of the total habitat supporting this particular population. According to Ward and Phillips (2012), Plains Death Adder movement is less frequent during the dry season, and they often retreat into deep soil cracks. It is likely, then, that there will be very few Plains Death Adder above the ground during the time when most land-clearing will be undertaken. • **Trench excavation.** When the bulk of construction works in Plains Death Adder habitat is undertaken may coincide with when the species has retreated into deep soil cracks, and so there is a risk that buried individuals may be injured or killed during excavation. However, the area of Plains Death Adder habitat that will be excavated is a trench 0.6 m wide extending for 206 km – a total of 12.4 ha. Although the density of Plains Death Adder in suitable habitat is unknown, it seems unlikely that more than one or two individuals of this species will have the misfortune of occurring within the excavation corridor. Moreover, those individuals may not be injured if excavated. • **Pipe-laying.** Plains Death Adder could fall into the open trench, although Phillips (pers. comm. 2016) suggests that the species may have an adversity to falling given the failure of previous pitfall trapping exercises for Plains Death Adder. Nevertheless, in accordance with the *Code of Environmental Practice for Onshore Pipelines* (APIA 2013), a Trench Inspection Procedure will be developed prior to construction commencing. This will provide for the presence of qualified fauna spotter-catchers (FSC) who will inspect the length of open trench daily to recover and release any fauna that is fallen into the trench overnight. The region comprises a vast area of contiguous suitable habitat with a high degree of homogeneity. Therefore, it is expected that, if present, the species will occur broadly within that habitat. Because construction activities are disturbing a tiny proportion of that habitat, the effect on the local population of a few individuals possibly perishing is likely to be minimal. For these reasons, the Project will not lead to a long-term decrease in the size of an important population.	**LOW**
Reduce the area of occupancy of an important population	**LOW**	The construction of the NGP will temporarily disturb a negligible proportion of the rocky refugia habitat supporting this particular Plains Death Adder population (820.1 ha out of the estimated 1.6 million ha).	**LOW**
Fragment an existing	**LOW**	Temporary population fragmentation in a linear development such as this could occur if construction works (especially the	**LOW**

Criterion	Inherent likelihood	Summary of mitigation measures and significant impact assessment	Residual likelihood
important population		cleared ROW and/or excavated trench) create a physical barrier to the movement of Plains Death Adder, resulting in a division of the local population. If the species is present it is unlikely that the temporary 30 m wide construction ROW will form a physical barrier to the species. The trench may form a temporary barrier. Construction activities will be temporary with the disturbed areas being progressively rehabilitated. No fragmentation will occur post-construction. Moreover, Plains Death Adder is not described as a social species and so temporary fragmentation should not result in disrupted social dynamics or breeding.	
Adversely affect critical habitat	**LOW**	Plains Death Adder habitat is considered to be floodplains and cracking soil plains (Webb et al. 2002). There is no literature that identifies critical habitat features within that broad habitat. In the region of this Project, these habitats have a large degree of homogeneity with respect to vegetation and other features.	**LOW**
Disrupt the breeding cycle of an important population	**LOW**	Plains Death Adder generally breeds from October to November, and produces live young from February to March (TSSC 2012). In the area of the construction footprint containing potentially-suitable Plains Death Adder habitat, construction works will likely be focussed in the dry season. If the species is present, a temporary disturbance is not expected to impact the species.	**LOW**
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent the species is likely to decline	**LOW**	Disturbance to Plains Death Adder habitat will be temporary. Once construction is complete, the entire ROW will be reinstated and rehabilitated. For this species, that narrow strip of land will functionally be quickly reintegrated into the surrounding territory (i.e. some degree of disturbance whilst rehabilitation takes place will not be detrimental to the ecological requirements of Plains Death Adder). The short period and negligible area of disturbance make it unlikely that Project activities will decrease the availability or quality of habitat to the extent the species is likely to decline.	**LOW**
Result in invasive species, that are harmful to the species, becoming established in the species' habitat	**LOW**	According to TSSC (2012), the main identified threat to the Plains Death Adder is mortality by ingestion of the toxic Cane Toad (*Rhinella marina*). Cane Toads are slowly encompassing the geographic distribution of the Plains Death Adder, and it has been predicted that by 2030 Cane Toads will have encompassed almost all of the Plains Death Adder known range (Phillips et al. 2003). It is unclear to what extent Cane Toad occurs within the Project footprint. The most recent distribution modelling of Cane Toad (see Figure 12-9) derived from Kearney et al. 2008) includes the channel country to the eastern terminus of the pipeline, with modelling predicting potential distribution of the species westwards along the entire Project footprint. That region is considered marginal habitat for Cane Toad, with a maximum or 3 to 4 suitable breeding months. During field surveys for this EIS, ecologists recorded Cane Toads along the roadside near Camooweal – approximately 80 km north of the construction ROW. Camooweal is higher in the catchment than the Project footprint and so it could be assumed that Cane Toad would be presented downstream. However, there have been no observations of Cane Toad at	**LOW**

Criterion	Inherent likelihood	Summary of mitigation measures and significant impact assessment	Residual likelihood
		either Avon Downs or Austral Downs, which are both located in black soil country (the latter only 4 km north of the construction ROW). Two possible conclusions can be drawn from this: • Cane Toads have reached the limits of southerly expansion (as dictated by water availability) in the region, which does not include the construction ROW (except, perhaps, at the Mount Isa end). This seems the likeliest conclusion given the species is present in Camooweal, but not downstream at Austral Downs. • Cane Toads have yet to spread as far south as the construction ROW (except, perhaps, at the Mount Isa end), but suitable (albeit sub-optimal) habitat occurs, and so expansion into that region is inevitable. This is only possible if the species only recently made it to Camooweal and has not yet had the opportunity to travel downstream. Therefore, the inherent likelihood of Cane Toad being introduced into area of the Project footprint within which it does not yet occur is either zero (because the species cannot occur there) or else possible, but largely inconsequential, because self-introduction was inevitable and likely to occur soon.	
Introduce disease that may cause the species to decline	**LOW**	There is no literature linking a disease to the decline of Plains Death Adder.	**LOW**
Interfere with the recovery of a species	**LOW**	The *Commonwealth Listing Advice on Plains Death Adder* (TSSC 2012) identifies priority recovery and threat abatement actions to support the recovery of the Plains Death Adder. None of these will be interfered with, or hindered by, the development. In fact, two of the actions may be aided as a consequence of this Project: • More precisely assess population size, distribution, ecological requirements and the relative impacts of threatening processes. • Undertake survey work in suitable habitat and potential habitat to locate any additional populations/occurrences/remnants. Whilst this species usually limits its movements during the dry season (i.e. when the bulk of construction works are being undertaken), the excavation of trench through potential Plains Death Adder habitat will ostensibly create an enormous pitfall trap for this species – one that will be inspected daily by trained fauna spotter-catchers. This situation may lead to confirmation that a population of this species occurs this far south, and also aid in more precisely assessing distribution, ecological requirements – as per the objectives of the two priority recovery and threat abatement actions mentioned above.	**LOW**

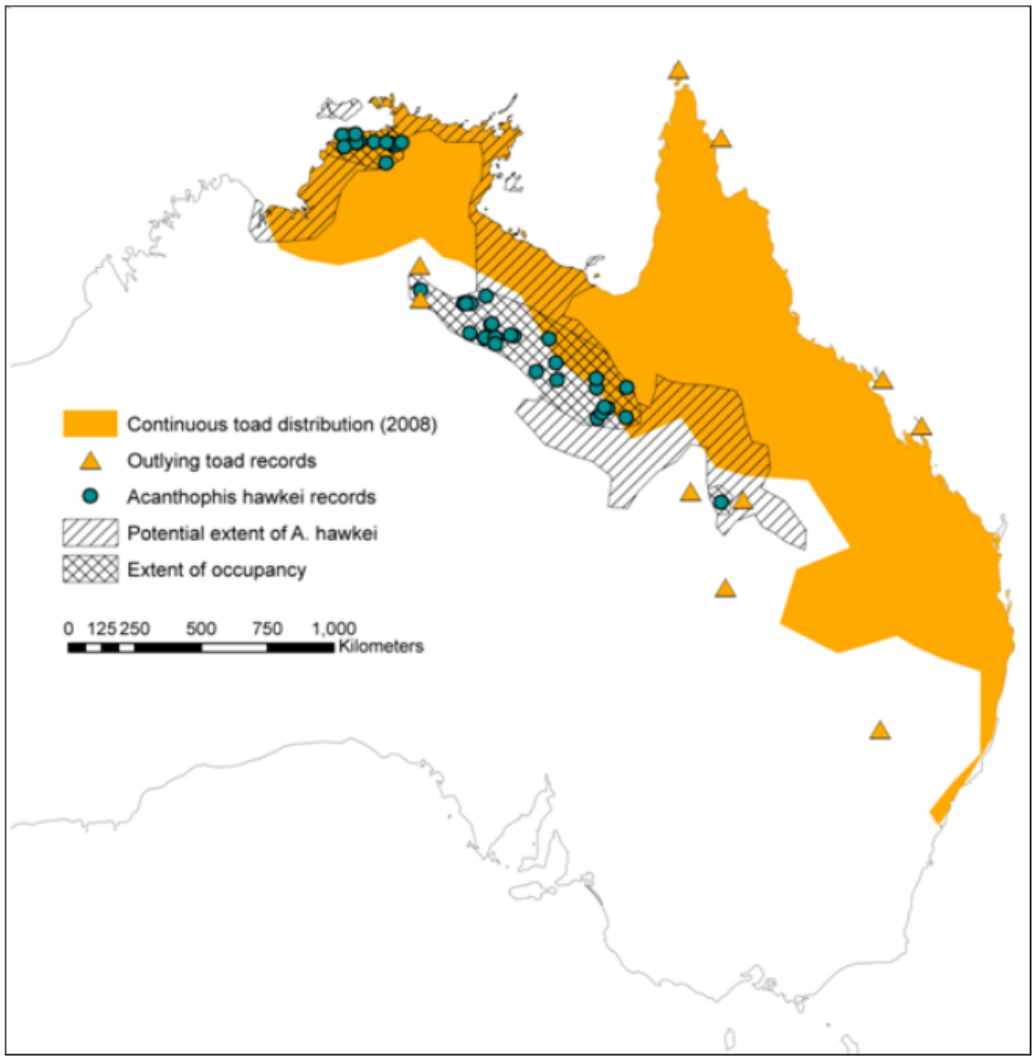

Figure 12-9. Map of Plains Death Adder and Cane Toad distribution (from TSSC 2012)

12.10 CONCLUSION

The Commonwealth Department of the Environment has decided that the NGP Project is a controlled action requiring assessment and approval under the EPBC Act before it can proceed. The relevant controlling provision was listed threatened species.

The analysis of species distribution and ecology presented in this Chapter concluded that there are two threatened species that are known or likely to occur within the Project footprint. The Carpentarian Antechinus was trapped within the pipeline ROW. The Plains Death Adder, whilst not surveyed, may occur in within the Project footprint in areas of suitable habitat.

Further analysis of the potential impact of Project activities on the Carpentarian Antechinus and Plains Death Adder, concluded that there would be no significant impact on these species. This conclusion indicates that the Project is consistent with the principles of Ecologically Sustainable Development; the Precautionary Principle has been applied through engaging field surveys and adopting mitigation measures that will minimise potential impacts on threatened species (and biodiversity values more broadly), inter-generational equity is achieved through no residual impacts to threatened species, and the biodiversity principle is upheld as the diversity and ecological integrity threatened species populations is not expected to be impacted.

Part of the rationale for the no impact conclusion was that even without mitigation actions it is unlikely that these species would be impacted by this development; this is due to the small proportion of habitat being disturbed and the short-duration of the construction phase impacts. Suitable habitats for these threatened species do not occur within the Project operational footprint. After mitigation actions have been applied in accordance with the Precautionary Principle the risk to the two threatened species considered here was further reduced.

Mitigation actions proposed are commonly applied to projects of this type and have found to be effective. The majority of the biodiversity measures are specified in the *Code of Environmental Practice – Onshore Pipelines* (APIA 2013), which is the industry best-practice standard for environmental management. In addition, all measures have been reviewed and agreed by the pipeline Construction Contractor, who has substantial experience in effective implementation of the measures specified on other pipeline Projects across Australia.

12.10.1 OFFSETS

There are no residual significant impacts for any EPBC-listed threatened species. Consequently, no offsets are required or proposed.


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