Wedge-tailed eagle (*Aquila audax* subsp. *fleayi*)
Endangered (EPBCA) Endangered (TSPA)

The Tasmanian subspecies of the wedge-tailed eagle (*Aquila audax* ssp. *fleayi*) is regarded as being larger than the mainland birds with a wingspan of 2m and a body weight up to 5.5 kg[108]. However, there is an overlap in size between the two populations. Tasmanian juvenile and immature birds also differ in plumage colour from mainland birds[109], they lack the rufous-brown markings on the nape, hind neck and wing coverts[110]. Debus[111] refers to DNA studies that are underway to resolve the uncertain taxonomic status of the Tasmanian subspecies. Adults are resident, highly territorial and have very large home ranges. Although considered to be widespread but uncommon at the time of European settlement, the breeding success has decreased to a point where it is now considered that fewer than 100 pairs are successful at breeding each year[112].

Wedge-tailed eagles nest in a range of old growth native forests and the species is dependent on forest for nesting. It nests almost exclusively in mature eucalypts capable of supporting their nests, which can develop after many years of use into massive structures over 2m in diameter. The eagles choose old growth trees in relatively sheltered sites for locating their nests. Territories can contain multiple nests and up to five alternate nests have been located. Nests within a territory are usually close to each other but may be up to 1 km apart where habitat is locally restricted. Wedge-tailed eagles prey and scavenge on a wide variety of fauna including fish, reptiles, birds and mammals.

The main threat to the species is the continuing decline in productivity as a result of disturbance of breeding birds and loss of nesting habitat[113]. High levels of unnatural mortality because of persecution (illegal shooting, trapping and poisoning), electrocution and collision (with powerlines, vehicles, fences and wind turbines) have lead to a reduction in the mean age of the population, resulting in a reduction in breeding success[114].

Two nests that were known from locations close to the existing Blackwater and Sumac Roads have long since disappeared[115]. There are several other known nests within the vicinity of the proposed road alignment that indicate there are other territories present.

An aerial survey of select sites undertaken by Forestry Tasmania in autumn 2009 failed to locate any new nests. This assessment used PI Inventory mapping to identify tall forest classes within 500m of the road. Consultation with DPIPWE[116] identified additional potential nest areas extending out to 1km from the road corridor along the then new road sections. Further survey was undertaken in 2010 to inspect these additional areas. On revision of the route most of these areas are located to the east outside the current project area.

Vegetation mapping (50m wide corridor) carried out during ground surveys along the proposed route have identified additional areas of potential nesting habitat in tall eucalypt forest. Potential wedge-tailed eagle nesting habitat is presented in Figure 11.

[108] Bryant and Jackson 1999

[109] Marchant and Higgins 1993

[110] Marchant and Higgins 1993

[111] Debus 2009

[112] B. Brown *pers. com.*

[113] Threatened Species Section 2006

[114] Threatened Species Section 2006

[115] B. Brown *pers. com.*

[116] B. Brown, Threatened Species Section

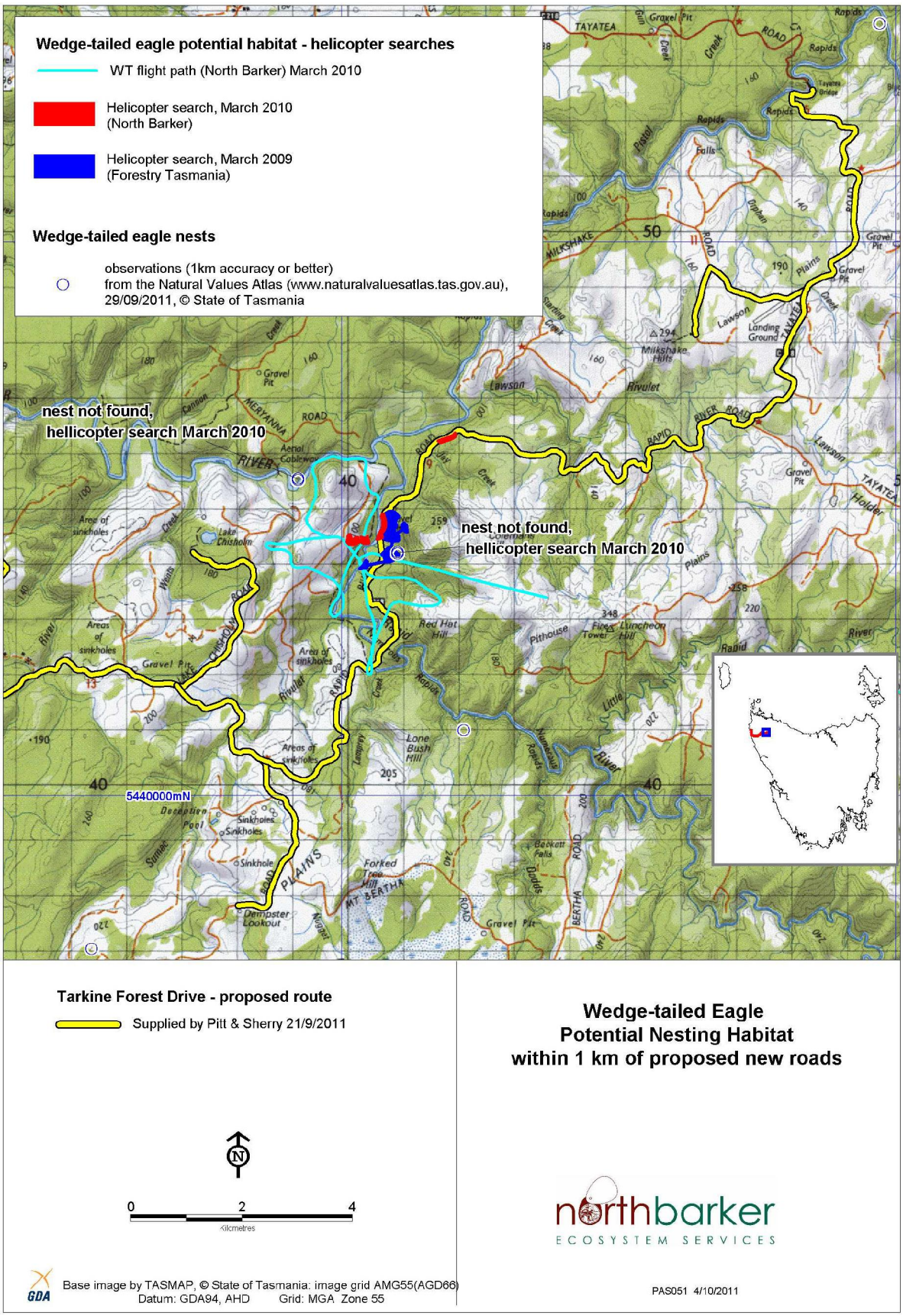


Figure 11: Wedge-tailed Eagle nests and search area

Grey goshawk (*Accipiter novaehollandiae*)
Rare (TSPA)

The Tasmanian morph of the grey goshawk (*Accipiter novaehollandiae*) is exclusively white in colour. It is typically associated with rainforest, wet forest and swamp forests with a preference for nesting in blackwoods, often in gullies and streamside situations. Nest sites are often, although not exclusively, reused in following seasons. There are only approximately 100 known nesting pairs in Tasmania.

Blackwood swamp forest and stream side blackwood forest in the north west has been identified as a key area for the grey goshawk[117]. There are substantial areas of forest supporting blackwood across the study area, although the potential for a nest site to coincide with **the new section of road** is small.

There are known nest sites to the north of the proposed road alignment and there is one known nest within 1km of the Segment G. There are also observations of goshawks around the road in the same area. However, non breeding juveniles and sub-adults are known to disperse to areas away from core breeding habitat so that observation of birds does not necessarily indicate a breeding territory.

Azure kingfisher (*Ceyx azureus* subsp. *diemenensis*)
Endangered (EPBCA) Endangered (TSPA)

The Tasmanian subspecies of the azure kingfisher (*Ceyx azureus* subsp. *diemenensis*) is distinctly larger than the mainland counterpart, with subtle variation in colour intensity[118]. It is confined to major river sites along the northwest, west and south coasts of Tasmania with only isolated occurrences elsewhere.

Resident birds are typically associated with heavily vegetated riparian areas along major rivers, favouring sites with overhanging trees touching or close to the water level. Nesting occurs in hollows in riverbanks. The Arthur River is well documented as supporting this species along its lower reaches (covered by regular sightseeing river boats)[119]. The Tasmanian Bird Atlas 1979[120] identifies a record of the azure kingfisher further up the catchment of the Arthur River near the confluence with the Lyons River. Bridge construction is reported as a potential threat to the species. The proposal to undertake such works across the Rapid River and Nelson Bay River presents a potential threat to any nesting bird utilising the banks in the immediate vicinity of these sites.

The Tasmanian azure kingfisher is listed as endangered on the Tasmanian *Threatened Species Protection Act 1995,* and recently it has been added to the *Commonwealth EPBC Act 1999.*

Green and gold frog (*Litoria raniformis*)
Vulnerable (EPBCA) Vulnerable (TSPA)

The green and gold frog is distributed across eastern and northern Tasmania including the north east and north west. The green and gold frog is most abundant north between Launceston and Devonport and south to the Longford and Hagley area. There is a break in the distribution to the west of Devonport with no records until Smithton. There is a scattering of records in the far north west from Smithton to Woolnorth and some older records in 1988 on the west coast at Temma south of the Tarkine Forest Drive project area. The distributional records are from Natural Values Atlas (an on-line database maintained by the Department of Primary industries, Parks, Water and Environment)

[117] Bryant & Jackson 1999

[118] Wapstra *et. al.* (unpublished)

[119] Wapstra *et. al.* (unpublished)

[120] Cited in Wapstra *et. al.* (unpublished)

and supplemented with additional observations from Simon Plowright in the north west of Tasmania.

Immature frogs will disperse some distance from breeding waterbodies and can be found in a range of wetland including ephemeral ponds. However, adult frogs require permanent still or slow flowing water with abundant floating or emergent vegetation for breeding. Breeding habitat includes swamps, dams and lagoons (e.g. Blackmans Lagoon).

The range of the green and gold frog does not extend to the button grass moorlands of western Tasmania (Figure 12). Potential habitat for the green and gold frog within and adjacent to the study area has been identified using existing geological mapping and is shown in Figure 13. All low lying soaks, creeks and pools extending up to 500m beyond the geological boundary of Mesoproterozoic quartzites and metamorphosed sediments are shown in Figure 13. These include some small vegetated pools on the immediate margin of the Temma Road on Segment B which appear potentially suitable. Based on this modelling, target surveys were undertaken in 2010. No evidence of green and gold frog was found. (Refer Appendix 8).

Australian grayling (*Prototroctes maraena*)
Vulnerable (EPBCA) Vulnerable (TSPA)

The Australian grayling has been recorded near the mouth of the Arthur River. It is also likely to utilise lower and middle reaches of other rivers and creeks which are not obstructed by barriers affecting fish passage.

Most of the smaller creeks where they are crossed by the Tarkine Forest Drive are unsuitable as they are too small and are obstructed by natural barriers. Figure 14 shows the rivers systems which have been modelled that include creek mouths and larger watercourses.

Habitat for the Australian Grayling crosses potential habitat at Nelson Bay River, Frankland River and Rapid River. Standard measures to minimise the risk of sedimentation runoff into creeks and rivers will ensure any potential impact is avoided. In the long term a sealed road will result in far less risk of sedimentation hazard.

Figure 12: Green and gold frog records NW Tasmania

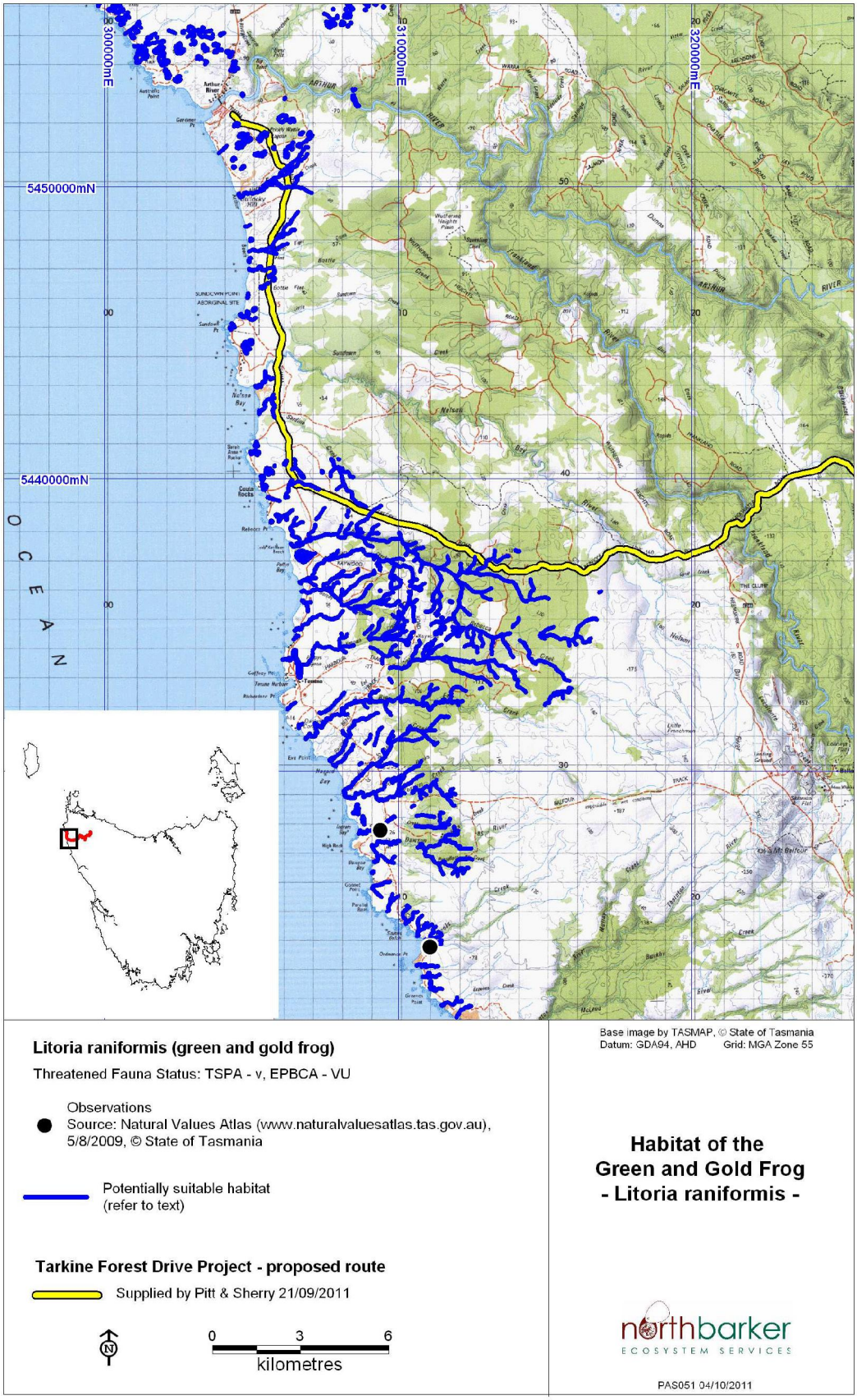


Figure 13: Potential green and gold frog habitat

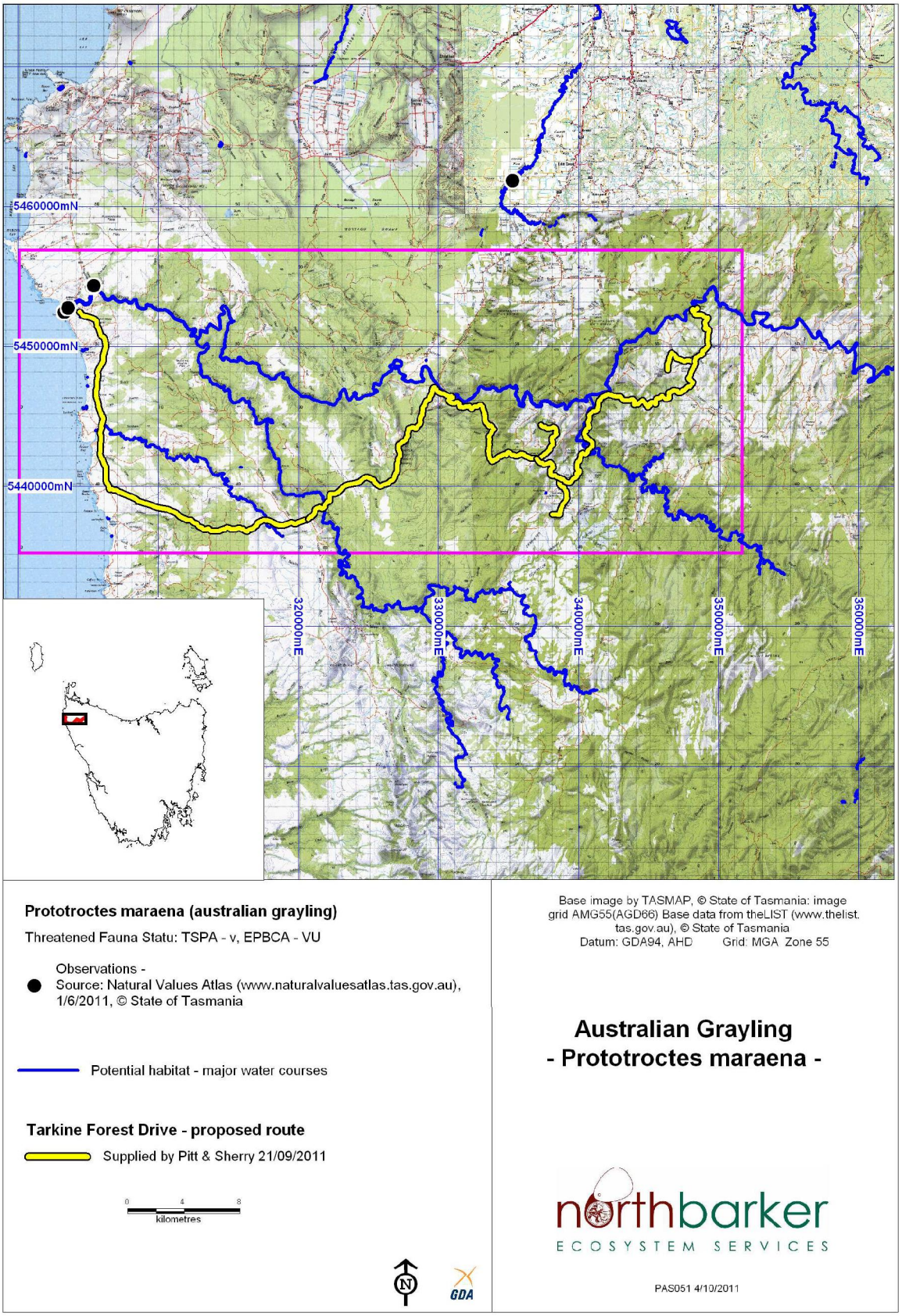


Figure 14: Australian grayling habitat

Giant freshwater lobster (*Astacopsis gouldi*)
Vulnerable (EPBCA) Vulnerable (TSPA)

The giant freshwater lobster (*Astacopsis gouldi*) is one of the largest freshwater crustaceans in the world and can reach 20 cm in length and weigh over 4kg. Individuals are very slow growing, females taking up to 14 years and males 9 years to reach sexual maturity[121]. The distribution of the giant freshwater lobster is confined to the Arthur River catchment and northern rivers that flow into Bass Strait, excluding the Tamar catchment[122].

Preferred habitat is associated with river systems that have significant sections with vegetated river banks[122]. Slow flowing creeks in the upper catchment with pools and snags are also important habitat. Adults shelter in deep pools beneath submerged logs and overhangs, juveniles tolerate slightly faster flowing creeks but also require submerged logs for shelter[122]. Individuals can show dispersal behaviour even leaving the water to walk across land but tend to return to a home site.

The main threats to the giant freshwater lobster are past legal and currently illegal fishing pressure and habitat disturbance[122]. The species has suffered significant decline in habitat and population (partly through over fishing) and has declined in several river systems.

Habitat modification such as disturbance to streamside vegetation leading to changes to water flows, sedimentation and channel clearing from agricultural and forestry activities continue to pose a threat to the giant freshwater lobster[122].

Stream barriers such as large weirs, dams and poor culvert design can lead to isolation and fragmentation. Concrete structures such as raised road culverts may act as a barrier to the freshwater lobster[123]. However this is likely to be dependent on culvert design and its impact on water flow.

Fishing has been banned since 1998; however, illegal fishing (poaching) continues to present a threat to the species[122]. The Tarkine Forest Drive will not however, change current levels of public access.

The Frankland and Rapid Rivers have been identified as providing good quality habitat with strong lobster populations that are worthy of conservation[124]. These are both crossed by the Tarkine Forest Drive. Refer Figure 15.

Marrawah skipper (*Oreisplanus munionga larana*)
Vulnerable (EPBCA) Endangered (TSPA)

This endemic subspecies is confined to northwest Tasmania between Marrawah and Temma with an outlying population at Penguin. It is associated with habitats that include the larval food plant *Carex tasmanica,* typically in association with sedgeland or swamp forest and scrub dominated by *Melaleuca ericifolia* or *Eucalyptus brookeriana*[125]. There are several observation records from suitable habitat close to the coast adjacent to Temma Road (Segment B). Potentially suitable habitat is to be found at several of the creek crossings along this section of road.

Figure 16 shows the distribution of these records from the vicinity.

[121] Bryant & Jackson 1999

[122] Threatened Species Section 2006a

[123] Bryant & Jackson 1999

[124] Walsh 2003, cited in Threatened Species Section 2006a

[125] Bell & Miller 2005

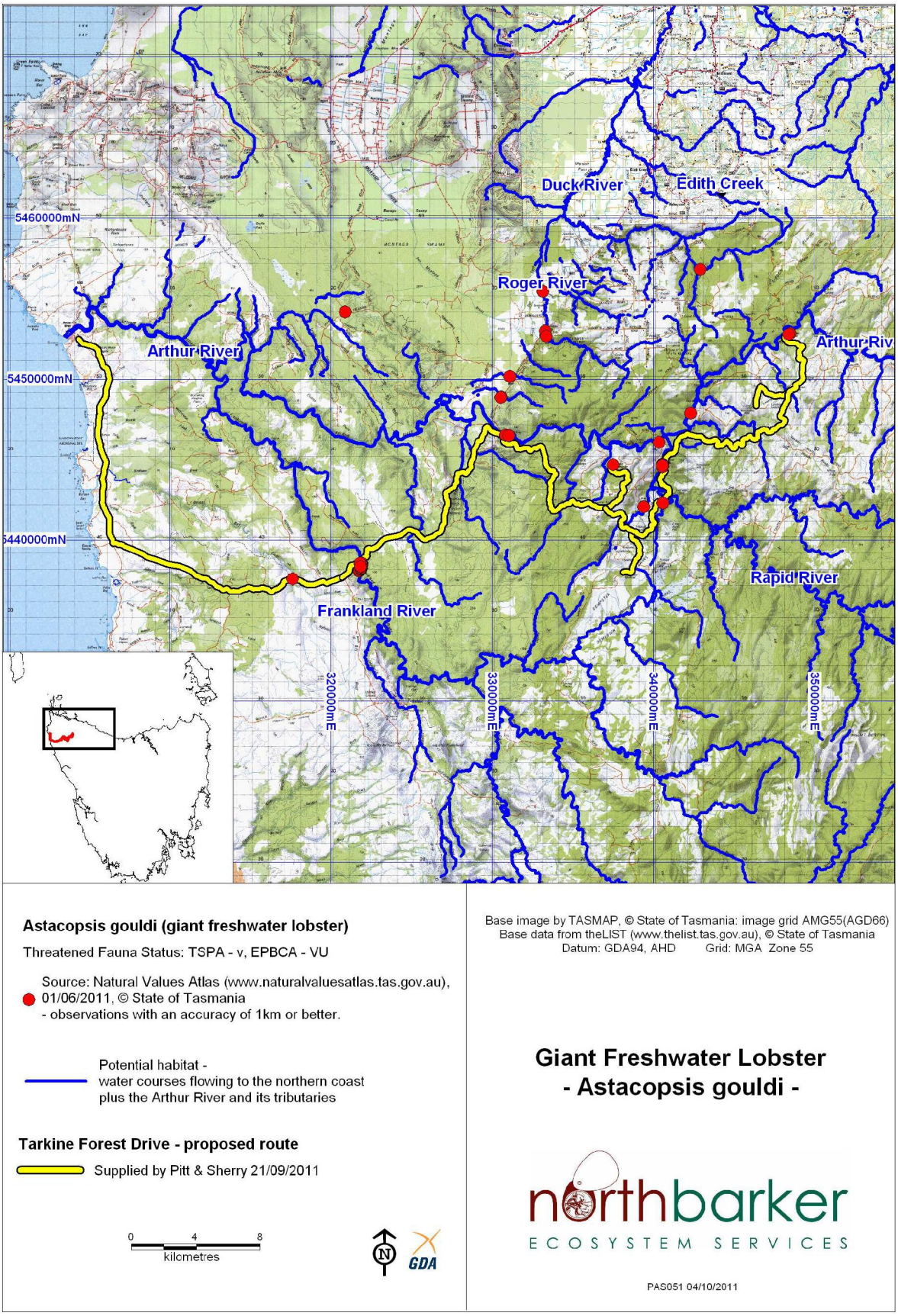


Figure 15: Giant freshwater lobster records from vicnity of study area

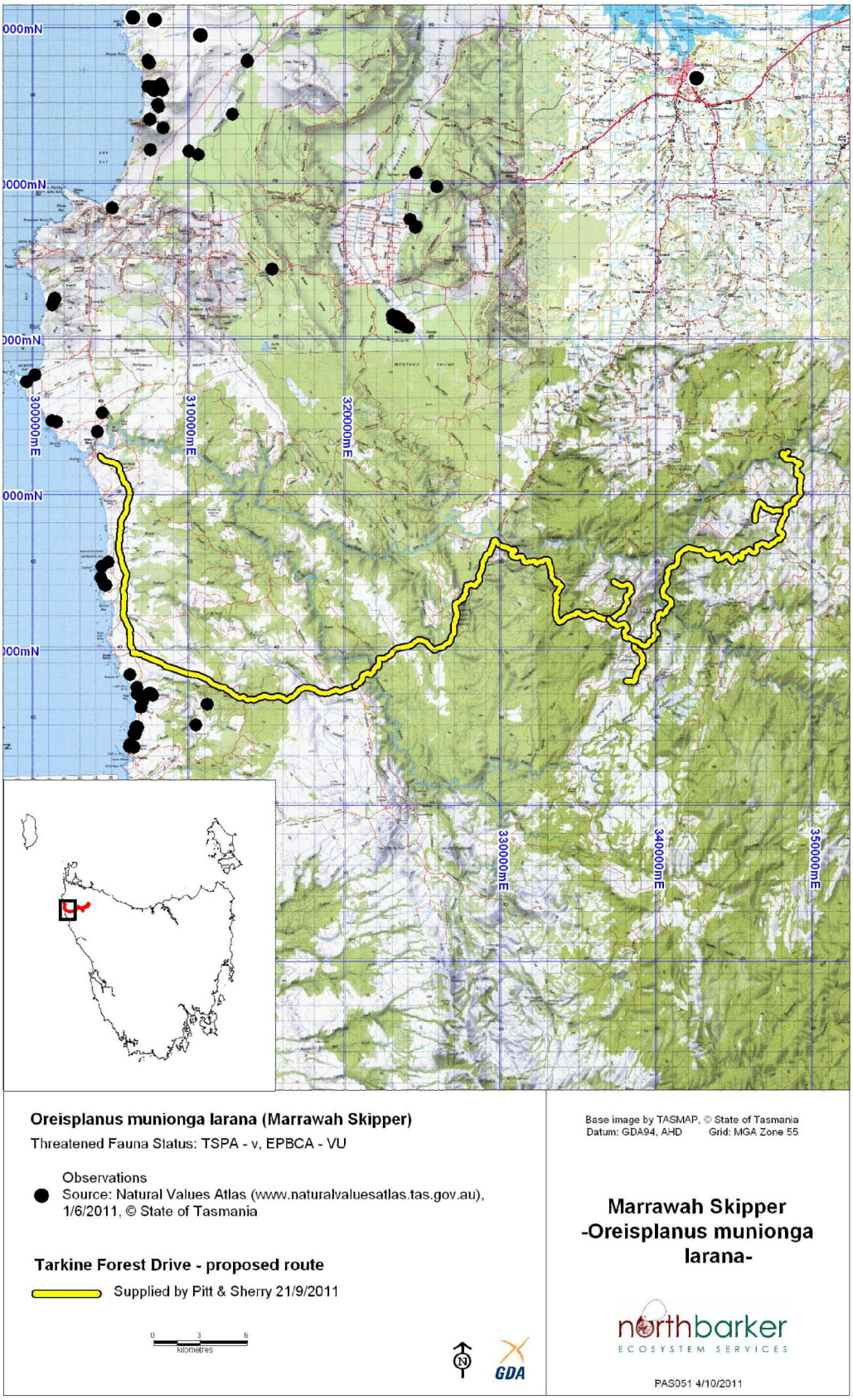


Figure 16: Marrawah skipper records from NW Tasmania

3.9 FERAL ANIMALS

The EPBC "Protected Matters Report"[126] identifies invasive feral animals that occur or invasive species habitat that is likely to occur. Feral goats, cats and rabbits are recorded as occurring or likely to occur due to suitable habitat being present.

Rabbits were recorded during headlight surveys in road Segments A & B which are both relatively grassy habitats. Outside of these two road sections habitat suitability is low. Currently rabbit numbers are relatively low but as the areas in which they were recorded correspond with hotspots for threatened orchids, the rabbit could represent a threatening process if the population were to increase suddenly. The population of the feral rabbit is very variable and would be expected to boom and bust over time. If the population is limited by predation then any impact to predators through increases in road kill or disease may trigger a rise in the rabbit population.

No sightings of domestic cats were made during the course of field survey, however, knowledge of the area and the distribution of feral cats in Tasmania suggest that cats are likely to be present throughout much of the study area. There is mounting opinion and concern that the decline of the Tasmanian devil provides an opportunity for the feral cat population to expand to exploit any niche gap created by the loss of native carnivores which may result from impacts of road kill or the arrival of DFTD[127].

Habitats on the western coastal plain appear the most suitable to goats, although there is no knowledge of goats being feral there[128].

[126] EPBC Protected Matters Report Protected Matters Report, 19 August 2009 (Commonwealth of Australia 2009) – Appendix 5

[127] N. Mooney in DFTD Senior Scientists Forum 2007 Consultation of Ranger at Arthur River

[128] Consultation of Ranger at Arthur River

4. ASSESSMENT OF IMPACT

The method of assessment undertaken for this project has varied across the study area. Existing roads (proposed for sealing) have been inspected by vehicle with intermittent sampling undertaken of representative examples of each vegetation community to confirm community classification. Detailed survey of the roadside vegetation was undertaken for the western section (Segments A, B, C, and part of D) where threatened flora was targeted. Specific habitats for frogs have also been investigated in this area.

The ecological impact of roads on ecosystems has been thoroughly documented to the point of being a specific scientific discipline, often referred to as 'road ecology'[129]. Roads cause direct impacts across the landscape through the removal of vegetation and the destruction of wildlife by vehicle collision or the creation of barriers to movement. They can also cause indirect change through the impacts of disturbance driving some animals away, or conversely through modification to the local environment attracting some species e.g. roadside grazing habitat or scavenging opportunities resulting in increased levels of mortality. They also may form corridors along which wildlife, weeds and disease may be spread. The increased levels of associated human activity created by opening up the landscape to access bring with them a potential range of additional impacts. The significance of these factors is considered below with respect to the Tarkine Forest Drive project.

4.1 NATIVE VEGETATION

Table 5 quantifies the extent of each community affected by the road. The footprint is determined by the length of road which passes through each vegetation type.

Five communities are listed as threatened in Tasmania. These are *Eucalyptus viminalis* coastal forest and woodland DVC, *Eucalyptus brookeriana* wet forest WBR, *Melaleuca ericifolia swamp forest* NME, Freshwater aquatic herbland (AHF) and Freshwater aquatic sedgeland and rushland ASF.

These are all localised. DVC is confined to the woodlands in Segment B south of Arthur River township. WBR is present at several locations along broad drainage lines where it forms a swamp forest but also occurs as regrowth forest near Julius River. NME is confined to slow flowing creek banks and locally poorly drained but moderately fertile sites. ASF and AHF are highly localised to a few small still ponds beside Temma Road (Segment B).

Generally the impact to vegetation is minor given the indirect effects of change brought about by the clearance of a road line through vegetation have already been created.

[129] Coffin 2007

Table 5 - Extent of Each Community within Footprint of Current Design

TASVEG Community[130]	Length of road km	Segments
Eucalyptus nitida dry forest and woodland **DNI**	8.0	A,B,C,D,E,K, L,M,O
Eucalyptus obliqua dry forest and woodland **DOB**	2.7	B,L,J,K,O
Eucalyptus viminalis coastal forest and woodland **DVC**	0.4	B
Eucalyptus brookeriana wet forest **WBR**	1.8	A,D,H,I,J
Eucalyptus nitida forest over *Leptospermum* **WNL**	6.9	A,E,J,K,L,N
Eucalyptus nitida forest over rainforest **WNR**	3.3	E,I,J,N
Eucalyptus nitida forest undifferentiated **WNU**[131]	0.3	P
Eucalyptus obliqua forest with broadleaf shrubs **WOB**	4.9	C,D,E,F,G,H
Eucalyptus obliqua forest over *Leptospermum* **WOL**	9.6	D,E,I,J,K,L,N
Eucalyptus obliqua forest over rainforest **WOR**	13.4	D,E,F,G,H,J,K,N
Eucalyptus obliqua undifferentiated **WOU**[132]	9.0	J,K,M,O,P
Acacia melanoxylon swamp forest **NAF**	0.3	G
Melaleuca ericifolia swamp forest **NME**	0.1	B
Nothofagus – Phyllocladus short rainforest **RMS**	1.8	E,G,I,K
Nothofagus – Atherosperma rainforest **RMT**	3.9	E,F,G,H,I
Rainforest (undifferentiated) **RMU**[133]	2.0	J,K
Freshwater aquatic sedgeland and rushland **ASF**	0.1	B
Freshwater aquatic herbland **AHF**	0.1	B
Coastal grass and herbfield	0.5	B

[130] Harris & Kitchener 2005

[131] From Tasveg mapping

[132] From Tasveg mapping

[133] From Tasveg mapping

TASVEG Community[130]	Length of road km	Segments
GHC		
Pure buttongrass moorland **MBP**	0.1	L
Buttongrass moorland with emergent scrub **MBS**	2.7	C,L,P
Buttongrass (undifferentiated) **MBU**[134]	2.7	M,O,P
Western lowland sedgeland **MSW**	5.3	D,E
Coastal heathland **SCH**	7.5	A,B,C
Lowland sedgy heathland **SHL**	0.3	B
Leptospermum scrub **SLW**	0.7	A,L,M
Melaleuca squarrosa scrub **SMR**	2.3	A,B
Riparian vegetation[135] **SRI**	0.5	M
Coastal scrub **SSC**	5.6	A,B
Western wet scrub **SWW**	0.3	E

Little or no vegetation clearance is anticipated along sections of gravel road proposed for sealing unless they are also expected to be widened. Preliminary assessments suggest approximately 20km of road will require widening. Assuming this will involve an average of 3m of clearance each side of the current formation then the total amount of area of vegetation clearance will be approximately 12 ha. Much of this vegetation is regenerating from earlier clearances.

[134] From Tasveg mapping

[135] From Tasveg mapping

4.2 Flora

4.2.1 Threatened Flora

Known and potential impacts to threatened flora have been determined and summarised in Table 6.

All threatened vascular plants considered to have a moderate to high potential of occurring on the roadside and thus potentially affected by the works occur in Segments A, B, C and D.

Table 6 - Threatened Flora Impacts

Species	Status TSPA/ EPBCA (upper case)	Assessment
Caladenia dienema Windswept spider orchid	Endangered/ ENDANGERED	Recorded several sites close to Segment B: South of Alert Creek – 30m offset. North of Sundown Creek – 50m offset. Couta Rocks Rd, edge of road (400m outside project area). Conclusion: Unlikely to be impacted if known sites are avoided.
Caladenia pusilla Tiny fingers	Rare/ -	Recorded several sites close to Segment B: No records within 100m of road. Conclusion: Unlikely to be impacted.
Carex gunniana Mountain sedge	Rare/ -	Single record 6km south of Arthur River (1999) close to road. Not able to be relocated. Conclusion: Unlikely to be impacted.
Corunastylis brachystachya Shortspike midge-orchid	Endangered/ ENDANGERED	Recorded in heathland near Couta Rocks (Segment B). One location is close to road (30m). Conclusion: Unlikely to be impacted if known sites are avoided.
Cotula vulgaris var. australasica Slender buttons	Rare/ -	Couta Rocks (Segment B). No records within 100m of road. Conclusion: Unlikely to be impacted.
Cullen microcephalum Dusky scurfpea	Rare/ -	Couta Rocks (Segment B). No records within 100m of road. Conclusion: Unlikely to be impacted.
Cyrtostylis robusta Large-gnat orchid	Rare/ -	Single record (150m off Segment A). Conclusion: Unlikely to be impacted.
Diuris lanceolata Large golden moths	Endangered/ ENDANGERED	Sundown Point and Rebecca Lagoon areas. No records within 100m of road. Conclusion: Unlikely to be impacted.
Diuris palustris Swamp doubletail	Endangered/ -	Tiger Flats (Segment B) Significant population in grassland on edge of road with up to 4 plants colonised the gravel shoulder. **Conclusion: Some impact anticipated but with careful management the impact will not be significant upon the population.**
Epacris curtisiae Northwest heath	Rare/ -	Occurs in heathland along Rebecca Road extending close to the road edge (Segments C & D). Also occurs a short distance up Blackwater Spur 8.1. **Conclusion: Some impact anticipated but with careful management the impact will not be significant upon the**

Species	Status TSPA/ EPBCA (upper case)	Assessment
		population.
Lotus australis Australian trefoil	Rare/ -	Couta Rocks (Segment B). No records within 100m of road. Conclusion: Unlikely to be impacted.
Microtidium atratum Yellow onion orchid	Rare/ -	Single record form Tiger Flats (Segment B) in company with other orchids close to road edge. **Conclusion: Potentially may be impacted**
Phyllangium divergens Wiry mitrewort	Vulnerable -	Couta Rocks and rocky outcrops off Temma Road (Segment B). No records within 100m of road, very little habitat. Conclusion: Unlikely to be impacted.
Prasophyllum favonium Western leek orchid	Endangered/ CRITICALLY ENDANGERED	Three previous records along Temma Rd (Segment B) are of low accuracy and old (1998 and 1988). Not recorded since despite targeted surveys. No records within 100m of road. Conclusion: Unlikely to be impacted.
Prasophyllum secutum Northern leek orchid	Endangered/ ENDANGERED	Single previous record along Temma Rd (Segment B) is of low accuracy and old (1990). Not recorded since despite targeted surveys. No records within 100m of road. Conclusion: Unlikely to be impacted.
Pterostylis cucullata Leafy greenhood	Endangered/ VULNERABLE	Two populations in vicinity at Gardiner Pt (Arthur River) and Possum Banks (south of Temma). No records within 100m of road. Conclusion: Unlikely to be impacted.
Pterostylis lustra Small sickle greenhood	Rare/ -	Three records from Tiger Flats, not relocated in recent surveys. No records within 100m of road. Conclusion: Unlikely to be impacted.
Pterostylis rubenachii Arthur River greenhood	Endangered/ ENDANGERED	Widespread along the coastal plain south of Arthur River to Bottle Flats (Segments A & B) with numerous populations including one at Tiger Flat very close to the roadside, including two plants observed in road shoulder 2009. **Conclusion: Some impact anticipated but with careful management the impact will not be significant upon the population**.
Spyridium vexilliferum var. vexilliferum Helicopter bush	Rare/ -	Two populations in vicinity at Gardiner Pt (Arthur River) and Couta Rocks. No records within 100m of road. Conclusion: Unlikely to be impacted.
Stylidium beaugleholei Fan triggerplant	Rare/ -	New recording for area in 2010 at Sarah Ann Rocks. No records within 100m of road. Conclusion: Unlikely to be impacted.
Stylidium perpusillum Tiny triggerplant	Rare/ -	Recorded form several sites in suitable habitat associated with soaks and shallow soils on rocky outcrops. Previous record form Tiger Flats. records within 100m of road. Conclusion: Unlikely to be impacted.

4.2. 2 Introduced Plants

Currently weed infestations are localised. Roads are conduits for the spread of generalist species capable of utilising the modified and disturbed environments of roadsides. Vehicles can spread seed along roads. Earthworks associated with road sealing will bring increased risk of weed species being introduced along its length. Long term, a sealed road requires less frequent grading along its shoulders. Consequently standard maintenance practise are less likely to cause the spread of weeds along a sealed road than an unsealed road.

4.3 Fauna

4.3.1 Habitat

The proposed Tarkine Forest Drive project will not involve the construction of any new sections of road through untracked bushland. It is estimated, therefore, that only limited areas of vegetation will be cleared, associated with minor upgrades at existing car parks and widening of some sections, notably Segments A, K and N. These will impact on approximately 12 ha of bushland.

This is not significant when compared with the extensive areas of forest and moorland surrounding the corridor.

4.3.2 Road kill

Roads are a well documented cause of wildlife mortality worldwide[136]. There is a relationship between traffic volume, speed, and wildlife mortality. Results indicate that traffic volumes of 10,000 average daily traffic (ADT) represent a complete barrier to animal movement for some species, and that many species suffer 50 percent mortality when crossing highways with volumes as low as 2,000 ADT[137]. It has been estimated that over 226,000 road kills are occurring per year across Tasmania[138].

No traffic modelling for the Tarkine Forest Drive has been completed. It is likely to be significantly lower than those volumes cited above, although the rates of road kill for some species may still be significant.

Shaw *et al* (undated) in a study of road kill and environmental and road design and construction factors along six stretches of road in eastern Tasmania, found that visibility, roadside barriers and escape routes were the most important predictors of the probability of finding a wildlife road kill on a stretch of road. The results and discussions from that report are summarised below.

Visibility

Visibility is related to the fact that most wildlife species in Tasmania are nocturnal and most animals are hit at night when driver vision is restricted to headlight range and animal vision is compromised by the contrast between oncoming headlights and the dark surrounds. Visibility is also influenced by the frequency of road corners and degree of undulation which suggested that drivers may not see wildlife in time to avoid them and that wildlife may not be sufficiently pre-warned of oncoming traffic. The combination of short visibility and a crest or a dip is particularly lethal.

[136] Coffin *et. al.* 2007

[137] Bank *et. al.* 2002

[138] Hobday and Minstrell 2008

Barriers

Solid metal barriers that are often associated with gullies and bridges are also linked with higher road kill. This may result from a combination of streams and rivers channelling wildlife movements in the landscape and the associated solid roadside barriers trapping animals on the road. The results of the study suggest that any restriction on either side of the road which inhibits the ability of wildlife to move off the road is likely to increase the risk of road kill particularly at night.

Table Drains and road clearance width

Roadside table drains and the roadside clearance width are important predictors of the likelihood of road kill. Deep drains adjacent to the road surface can act as barriers and impede animals from escaping from the path of oncoming vehicles, particularly if there are drains on both sides of the road.

The study also found that wide roads have low kill rates compared with all other roads. It is suggested that wide roads and clearance zones may have an inhibitory effect on wildlife crossing. These roads are also likely to be major highways, which may have long operated as population sinks and therefore population densities around these roads are low. A typical pattern for recently upgraded or completed roads is of a high kill rate in the first couple of years followed by a reduction in the number of road kills as the resident animals whose home ranges intersect the road are killed.

Hobday & Minstrell (2008) have published the most extensive analysis of road kill data in Tasmania which is drawn from a three year study of five major routes covering over 15,000km during which over 5,500 road kills were observed. The study is limited to eastern and central Tasmania. No similar study exists for western or northwest regions. The following observations come from this study.

- **Distribution.** There is both annual and seasonal variation in the density of road kill. Road kill is clumped; it was not distributed evenly along the roads. Overall, 70% of the road kill occurs in 20 to 45% of the road in each of the five routes that were included in the study. There are a number of road kill hotspots where high concentrations of road kill are observed.
- **Traffic speed**. Fifty percent of road kill is detected when vehicle speed is greater than 80km/h The study found that a 20% reduction in traffic speed would result in a decrease of road kill in the order of 50%.
- **Animal density**. Road kill was not related to the density of live animals at the scale that the study looked at [139].

Effect of road upgrade on devils and quolls

Jones (2000) reported that following the widening and sealing of the access road into the northern section of the Cradle Mountain – Lake St. Clair National Park the number of eastern quolls and Tasmanian devils killed on the road increased dramatically. Over a period of 17 months the resident population of 19 eastern quolls became extinct and the devil population of 39 individuals halved. The main cause of the increase in road kill was an increase in traffic speed. The increased road kill prompted the implementation of measures to slow traffic ('slow points') and efforts to increase driver awareness (signs and pamphlets). Traffic speed was reduced by 20km/h. Other measures included deterring wildlife from crossing the road in the path of approaching vehicles (wildlife reflectors) and encouraging escape off the road by installing ramps across gutters and

[139] The route boxes they used as to investigate the fine-scale spatial distribution of road kill were approximately 2.7 km by 2.1 km (Hobday and Minstrell 2008)

banks, and pipes for shelter. These measures resulted in the eastern quoll population re-establishing within six months, and after two years recovering to 50% of its previous level. There were also signs that the devil population was recovering.

Mooney and Thurstans (2004), quoted in the Landscape Impressions (2008) report on the review of road kill following the upgrade of the Arthur River Road (Marrawah to Arthur River section), estimated that there was at least 30 spotted-tailed quolls using the roadsides of the Arthur River and that around 10% of this population was being killed on the road each year. It is also reported that the authors concluded that the upgrade of the road did not appear to be affecting the spotted-tailed quoll population.

Landscape Impressions (2008) also found that there did not appear to be any significant relationship in Tasmanian devil road kill prior to the sealing of the road and after the road upgrade. However there is an upward trend. The four years leading up to and including 2003 reported 82 deaths, the five years subsequent to sealing 128 deaths. Road kill rates need to be measured against local background population abundance to assess whether they are having an impact. In the absence of population abundance data the significance of road sealing on road kill rates cannot be determined. However there are no control or reference sites for this study to enable an assessment of the impact. The road has included a suite of mitigation measures, the effectiveness of which cannot be properly assessed. The analysis by Landscape Impressions (2008) indicates a significant increase in road kill of all animals. If the population of devils has been in decline for this period then the change in road kill may be highly significant. To properly assess the impacts a Before-After/Control-Impact (BACI) type of study is required.

In the review of the potential impacts of road kill on fauna, the spotted-tailed quoll and Tasmanian devil have been identified at particular risk because they are a mid-sized mammal species that are either attracted to roads by the presence of road kill[140] or do not avoid roads, and they appear to have a low car avoidance[141].

In a review of papers on the effects of roads on animal abundance, species with large movement ranges, low reproductive rates and low natural densities were shown to be particularly at risk of being negatively affected by roads and traffic[142]. This would apply to both the spotted-tailed quoll and Tasmanian devil.

Of over 5,500 road kill analysed, Hobday and Minstrell (2008) reported that the estimated total road kill of Tasmanian devils is 3,392 devils per year. This is based on their research which included 49 Tasmanian devil individuals (1.5% of all identified road kill). Road kill accounts for 2 to 4% of the entire devil population annually[143]. Spotted-tailed quolls made up only 10 individuals (0.3% of all identified road kill). This suggests a road kill mortality rate that is five times lower, although the numbers are too few to be reliably extrapolated[144].

[140] Jones 2000

A study on the Freycinet Peninsula by Menna Jones found that in a 12 month period 20% of the devil population was removed due to road kill. The removal of road kill herbivores from the road eliminated the incidence of road kill (Jones unpublished data)

[141] Fahrig and Rytwinski 2009

[142] Fahrig and Rytwinski 2009

[143] *EPBC Nomination*

[144] A minimum of 50 samples is suggested as necessary to identify hotspot

Effect of Tarkine Forest Drive project on traffic

To make an assessment of the impact of the project on road kill some comparison should be undertaken between the traffic before and after the project. The route follows existing roads, although the traffic volumes are low. Table 7 summarises the nature of works by kilometres along the route. Refer to Figure 2 for the location of each section.

Table 7 – Summary of proposed roadworks by Segment

Works	Segments	Total Distance
Widen existing road and seal	A, K, N	23.9 km
Seal existing gravel roads	C, D, F, H, J, L, O,P	55.8km
Existing sealed roads	E, G, I, M	19.7 km
Total		**99.4 km**

The impact of the current project is limited to the sealing of existing unsealed roads with a full public access and existing but currently unmeasured current use. These activities will change the volume, character, timing and speed of traffic.

The project will also result in attracting traffic onto connector roads thus increasing traffic volumes. These effects will be most pronounced on the Arthur River Road between Arthur River and Marrawah. Traffic volumes have been measured in 2009/10 which will inform the impact of change brought about by the upgrades.

Existing traffic

Information has been sought from Forestry Tasmania on traffic volumes associated with projected forestry operations on the existing forestry road network (refer Appendix 7) along those parts of Tayatea Rd, Sumac Rd, and Blackwater Roads that will be used by the Tarkine Forest Drive. These suggest average movement of between five and nine vehicles per day[145]. These roads are also open to public use. Other users include other commercial operators such as beekeepers and existing tourists travelling on the Arthur Forest Drive[146]. The Fishermen, shack owners and holidaymakers use the Blackwater Road and Rebbecca Road as a shortcut to Corinna, Temma and Couta Rocks. Overall, numbers are likely to be small.

Traffic on the Temma Road south of Arthur River is higher (perhaps 50 vehicles per day)[147] tending to peak over weekends and public holidays.

Projected traffic

It can be expected that additional traffic volumes will include non tourist users. An improved road surface will attract more people wanting to access the west coast. Drivers may choose to travel via Kanunnah Bridge rather than Marrawah.

[145] Note this data was prepared prior to consideration of the impacts of the Tasmanian Forests Intergovernmental Agreement (7 August 2011).

[146] This is a tourist loop which links several destinations between the Kanunnah and Tayatea bridges. Since 2007 with the closure of the Tayatea Bridge, activity is likely to have reduced as tourists are required to back track

[147] This is an estimate based on traffic volumes at Marrawah of 100 per day in 2004 - Landscape Impressions(2008)

The character of traffic is important when considering what risk it presents to road kill. Most road kill events occur between dusk and dawn due to the nocturnal habits of most affected species. It is likely that a high proportion of tourists will limit their travelling to daylight hours and thus are not likely to contribute a significant road kill hazard.

Locals and commercial users are more likely to be travelling at night e.g. shack owners on a Friday night. Although their proportionate volumes are small, the timing and faster speeds expected by drivers familiar with the road and focussed on getting to a destination, rather than a driving experience, may result in a disproportionate threat to road kill[148]. Forestry operations in the south Arthur Forests are concentrated through the summer months, due to the wet winters[149]. Daylight hours are longer and consequently little associated traffic may occur after dark. However, any Tasmanian familiar with night time driving would be aware of some log truck traffic in the twilight hours.

Traffic speed

Traffic speeds have been shown to be significant when considering road kill. Tasmanian road kill data[150] suggests that a reduction in vehicle speed of 20% (e.g. reducing vehicle speed from 100km/h to 80km/h) would result in a decrease of overall road kill by up to 50%. M. Jones (pers. comm.) has suggested that maintaining a vehicle speed of less than 60km/h will reduce road kill to insignificant levels and is appropriate when designing a road to minimise road kill.

Many of the findings relating to road design and road kill minimisation relate to high speed roads such as highways. The Tarkine Forest Drive will include roads of widely differing construction standards. Some of the fastest sections will be associated with existing road formations which are wide and straight, to be found on the Temma Road north of Couta Rocks and the Rebecca Road. Other sections will be slower.

Overall, the sections of road west of Kanunnah Bridge (Segments A-G) present the greatest threat to road kill when considering traffic activity and road character. It is these sections that require most attention when designing the road to incorporate design features that minimise road kill. The opportunities for this work are limited though because this length of road already exists as a largely unsealed road and therefore road kill mitigation features would need to be retrofitted.

4.3.4 Riparian crossings

The project involves the replacement of two major bridge structures at Rapid River and Nelson Bay River. Elsewhere river crossings will remain unchanged whether currently serviced by bridges or culverts.

The investigations identified giant freshwater lobster (*Astacopsis gouldi*) and freshwater beddomid snails (*Beddomeia* spp.) as occurring in some of these habitats. There is also potential habitat for others such as the Australian grayling.

Management of road run off during construction of these bridges but also of all creek and river crossings is important to ensure no pollution occurs to waterways which could affect these and other riparian species. Sealing should not occur when there is an expectation of high rainfall events.

[148] Over five years of observing road kill on the Marrawah to Arthur River Road suggest that a high proportion of road kill is caused by a small proportion of drivers (Geoff King *pers. com.*)

[149] M. Peterson *pers. com.*

[150] Hobday and Minstrell 2008

4.3.5 Threatened Fauna

Wedge-tailed Eagle

The impact of disturbance to wedge-tailed eagles can be mitigated by identifying both active and inactive nests within 1km of the proposed road works and then implementing management prescriptions to minimise disturbance to the nest during the breeding season[151].

There are no known active eagle nests within 1km of the proposed Tarkine Forest Drive. Two previously recorded nests have both been lost. Helicopter searches of suitable nesting habitat has been extended to 1km, following advice from DPIPWE[152] that 500m (the original surveys) were insufficient. The reasoning for extending the search area to 1km rather than 500m is that current knowledge of active eagles is incomplete and therefore there is a moderate risk of inadvertently disturbing breeding birds if works are carried out in the breeding season from August to January inclusive. Any activity up to 1km when in line of site from an active eagle nest has the potential to disturb the breeding birds and possibly result in nest desertion[153].

The Rapid River bridge site is in the vicinity of an historic nest site. Although this nest no longer exists, the presence of a second nest, 1.3km to the north of the section justified further searching. No evidence of a nest could be found and consequently no impact to this species is anticipated.

Eastern barred bandicoot

The proposed works which are limited to the sealing of existing roads on the margins of the range of the eastern barred bandicoot is not likely to have any significant impact upon the species. Measures to mitigate the potential for increased bandicoot road kill could be implemented through a Road kill Mitigation Plan. The plan should outline measures to reduce road kill along the Tarkine Forest Drive including reducing traffic speeds, providing clear sightlines and modifying bridges and culverts to allow wildlife to pass under the road.

Spotted-tailed quoll

There are observation records of spotted–tailed quoll throughout the Arthur Forests area extending across the entire route. Spotlight surveys identified animals in virtually all segments covered by the surveys, although incidences of observations were far less frequent than for Tasmanian devils. This species potentially is vulnerable to increased levels of road kill as has been demonstrated in Cradle Valley and also demonstrated by investigations of the road kill north of Arthur River where road speed were increased following upgrades to the road.

The spotlight survey and road kill study undertaken for this project is being considered in a separate investigation.

Tasmanian devil

The Tasmanian devil may be susceptible to changes brought about by increases in road kill (see section 4.3.3 above). However the main cause of its listing as a threatened species has resulted from the rapid spread of Devil Facial Tumour Disease (DFTD) throughout a significant proportion of the population (see section 3.7). For the Tarkine

[151] Forest Practices Authority (version2 – July 2009)

[152] B. Brown email 21/8/09

[153] Forest Practices Authority (version2 – July 2009)

Forest Drive to be a factor in affecting the rate of spread of DFTD it would need to introduce an increased opportunity for the movement of animals either by the road providing a corridor for migration, or allowing access across existing landscape barriers. Alternatively if the upgrade of the road were to modify devil behaviour resulting in an increase in social interactions over road kill then this may increase the rate of disease spread.

The impacts of anthropogenic processes on the transmission of DFTD are mostly conjecture, with many of the hypotheses not properly tested. For example the role, if any of exposure to toxins has been proposed but is not being currently researched[154]. Impacts of agriculture and forestry, the concentration of animals around prey attracted to modified environments (eg new plantations, road kill, poisoned baiting etc) is also largely untested. Much of the route of the Tarkine Forest Drive passes through a landscape where commercial forestry is the main activity. Given the uncertainties of what impact these major land use activities may be having on the Tasmanian devil with respect to DFTD transmission, it is difficult to conclude that the Tarkine Forest Drive will significantly increase the rate of spread of DFTD.

Where absolute certainty is not forthcoming, the use of the 'precautionary principle' can be applied, and this is recognised under The Commonwealth EPBC Act. However it is considered that isolated exclusion of this project in the absence of broad scale limitation on all land uses in the region of the northern Tarkine area would have little benefit in safeguarding the species.

Green and gold frog (*Litoria raniformis*)

Based on current knowledge the potential of the Tarkine Forest Drive project to impact on green and gold frog habitat is low. There will be minimal vegetation disturbance through potential habitat areas. The potential habitat in the form of roadside wetlands along Segment B has been assessed and no evidence of green and gold frog was found. Indeed many of the wetlands that appeared potentially suitable in winter proved to be ephemeral and unsuitable in summer.

Segment B is already a constructed road with well defined table drains. Standard measures to minimise the risk of sediment runoff into these wetlands and creeks needs to be implemented to avoid potential impacts. These could include the installation of silt traps. In the long term a sealed road will result in lower levels of sediment.

Australian grayling (*Prototroctes maraena*)

Habitat for the Australian grayling crosses potential habitat for the Australian grayling at Nelson Bay River, Frankland River and Rapid River. Standard measures to minimise the risk of sedimentation runoff into creeks and rivers will ensure any potential impact is avoided. In the long term a sealed road will result in far less risk of sedimentation hazard.

Giant freshwater lobster (*Astacopsis gouldi*)

Habitat for the giant freshwater lobster is widespread throughout much of the route from east of the Frankland River. The river and creek crossing for the route are already in place and so sealing will not in itself make any change as long as the risk of sedimentation and other pollutants are controlled. Some of the creek crossing along the existing road are thought to be inadequate to support safe lobster passage[155]. In these situations lobsters are forced to leave the creek and cross the road. Increased traffic volumes may result in an increased risk of road kill of giant freshwater lobster. However

[154] McGlashan *et. al.* 2006, Obendorf and McGlashan 2008, Piecroft in DFTD Senior Scientists Forum 2007

[155] T. Walsh pers com

this incidence is likely to be low as no lobster were observed during the course of the spotlight surveys.

Marrawah skipper (*Oreisplanus munionga larana*)

Any works which result in clearance of vegetation along Segments A and B may impact on this species, particularly in the vicinity of creek crossings and drainage lines where plants of cutty sedge (*Carex appressa*) the larval foodplant occur.

4.3.6 Pests and diseases

Chytrid Fungus

Chytrid fungi include numerous species, most of which are free-living saprophytes, with a few species capable of infecting invertebrates and vascular plants. In 1999 a new species - *Batrachochytrium dendrobatidis* - was described. This fungus infects amphibians and causes the often fatal disease, chytridiomycosis. It has since been found to have infected populations of amphibians throughout the world. There has been a global decline in many species of amphibians which is thought to be linked to the spread of this disease. Chytridiomycosis has been a greater causal factor in loss of biodiversity than any other single known disease[156]. Half of documented declines and extinctions in frog species throughout the world cannot be attributed to habitat loss (the most common threatening process). The case for chytridiomycosis being the cause is compelling[157].

Retrospective studies have shown that chytrid fungus has been infecting Australian frogs since as early as the 1970s[158] and it is postulated to be a major causal factor in the decline of the green and gold frog *Litoria raniformis* throughout Australia[159]. It has been shown to be widespread across northern and eastern Tasmania, associated with townships but also found in more remote sites in central and western areas[160].

Chytrid fungus has been shown to be highly toxic to the green and gold frog and to burrows tree frog (*Litoria burrowsae*) endemic to western Tasmania, and is considered to present a 'high' risk to the decline of both species[161]. The core distribution of *L. burrowsae* is further to the south of the study area, although the absence of records within the Tarkine area may be more a reflection of the absence of searching in the region.

Obendorf (2005) suggests that live contact between frogs may be the means by which disease transmission occurs[162]. A survey for chytrid fungus across the Tasmanian Wilderness World Heritage Area suggests that the disease is associated with wetlands accessed by gravel roads. The authors of that study[163] conclude that 'human facilitated movement' is the likely cause of its spread. It is inconclusive as to whether this has been brought about by the deliberate introduction of frogs (probably inadvertently infected) or by some other means such as water or soil. However it is postulated that the use of water in maintaining gravel roads may facilitate the spreading of infected water from one location to another[164]. There is also a possibility that wildfire suppression could result in

[156] Skerratt *et. al.* 2007

[157] Skerratt *et. al.* 2007

[158] Johnson & Spear 2003 cited in Obendorf and Dalton 2006

[159] Threatened Species Unit 2001

[160] Obendorf 2005

[161] Obendorf 2005

[162] Obendorf 2005

[163] Pauza and Driessen 2008

[164] Pauza and Driessen cite studies undertaken elsewhere that come to a similar conclusion

the spread of infected water from one location to another due to the activities of water trucks.

The proposed Tarkine Forest Drive will not present any increased hazard other than during the construction phase when construction works may present a risk of introducing chytrid fungus into wetland systems.

Feral Animals

Increased access and land use change may accelerate the expansion of some feral animals into the region. Increases in road kill may attract feral cats. Rabbits are unsuited to most of the vegetation types outside of their current range on the west coast.

4.4 Summary of Management Issues by Road Segment

The following observations are based on a preliminary survey, some from a moving vehicle and some Segments on foot. Field records are supplemented with referral to database information of natural values. Threatened flora issues are primarily concentrated in the coastal and most westerly section of the Tarkine Forest Drive.

General

The existing road gravels vary from light to dark, reflecting the available gravel resource. The sealed sections are all dark grey. Headlight surveys suggest that wildlife are more quickly and easily observed with a lighter background providing drivers with advanced warning to slow down and reduce risk of collision[165].

The section from Kanunnah Bridge to the west coast (Segments A-G) is likely to be used at night when locals travel to the west coast to shacks because the inland route is perceived to be faster[166]. However this may not represent an increased risk to quolls or devils if it only diverts existing traffic from the Marrawah route.

There are limited records for declared weeds throughout the entire study area. It would be a worthwhile aim to eradicate all declared weeds as they all occur as small isolated occurrences which are outliers of populations elsewhere in the municipalities.

Segment A – Temma Road – south of Arthur River

The current features of the road are naturally traffic calming. The road follows contours, is often winding and relatively narrow although moderately long straight sections do occur. There are grassy sections adjacent to the road where marsupials graze in the mornings and evenings. These sections create road kill hotspots.

This section had the highest frequency of wallabies seen during headlight surveys. Several road kill were recorded during field survey and a live Tasmanian devil was recorded. Most of the road kill removed from the road had been eaten. The road kill attract both the spotted tailed quoll and devil onto the road exposing them to the risk of vehicle strike.

There is a minor occurrence of a vulnerable community of *Eucalyptus brookeriana* wet forest. This vegetation type may be impacted in road widening and associated road works.

Segment A - Unfenced cattle grazing.

Segment A – Temma Road narrow and winding

[165] Magnus 2006

[166] Vehicles towing boats were seen travelling the roads several times during the evening in the first week of July – *pers. obs.*

Segment A

Segment A

Segment B – Temma Road

The southern portion of this section is flanked by heath associated with poorer soils and less grass with a corresponding drop in grazing wallaby although wombats were seen on several evenings. Wombats seem able to survive in generally less fertile sites.

In the north the road section contains large expansive grassy areas that support grazing animals - both native and introduced. Wallaby, rabbit, cows and native hens are common. The road is straighter and wider here encouraging faster driving speeds and hence increasing the risk of road kill and associated scavenging of carcasses by quoll and Tasmanian devil.

The sealing of the pavement in this section creates an environment on which cattle may camp on the warm road surface especially at night. This presents a novel road accident hazard as the road is unfenced. The use of a pale pavement may mitigate this risk as this will not absorb as much heat as would the more typical dark road surface.

There is also a hotspot for threatened orchid species in the area in the vicinity of Tiger Flats. Any works in this area will potentially impact on threatened species and restrictive measures will need to be imposed to limit disturbance.

This section traverses through coastal *E. viminalis* forest which is listed as vulnerable. There are minor occurrences of a vulnerable wetland community, freshwater aquatic sedgeland and rushland adjacent to the road. The road has possibly altered drainage in a way to create the small wetlands. These frog friendly habitats are particularly susceptible to introductions of chytrid fungus.

PC sensitive vegetation occurs in this area and symptomatic evidence is present hence standard soil hygiene practices need to be applied.

Wetland on immediate edge of road (Segment B).

Segment B – heath on the poorer soils in the south of the section.

Sundown Creek bridge (Segment B).

Marsupial grazed pasture on edge of road (Segment B).

Segment C – Rebecca Road

The gravel road in this section is generally wide with long straight sections and should not in general require any further disturbance of adjacent vegetation. Although this road is a fast section, it does not support many grazing marsupials and has long sight distances, so inheritably has a lower chance of road kill.

This area also has threatened orchid records in the moorland vegetation and therefore the results of spring surveys may impact on possible disturbance to adjacent vegetation if threatened orchids are located.

PC sensitive vegetation occurs in this area and symptomatic evidence is present hence standard soil hygiene practices need to be applied.

Rebecca Road – Segment C.

Rebecca Road – Segment C.

Segment D – Rebecca Road

This section of road has a minor occurrence of a vulnerable community *Eucalyptus brookeriana* wet forest.

The listed rare shrub – *Epacris curtisiae* occurs within moorland along this section. A detailed assessment of this low shrub has been undertaken during its peak flowering period showing it to be widespread and at times very close to the roadside.

PC sensitive vegetation occurs in this area and evidence is widespread. There are occasional declared weeds in this section including spanish heath and gorse. Soil hygiene and weed control prescriptions would apply when working in this area.

Segment D There are extensive moorlands adjacent to this road section.

Segment D – adjacent to the Rebecca Creek Forest Reserve.

Segment E – Blackwater Road – sealed section

This is a sealed section with relatively high travel speeds (> 60km/h) and therefore increased risk of road kill.

There are occasional declared weeds in this section including spanish heath and gorse. Soil hygiene and weed control prescriptions would apply when working in this area.

A work area which has been rehabilitated has symptomatic evidence of PC. This has implications on whether the area is used as a storage depot again. If it is, the area would have to be sealed to stop the movement of infected soil. There is also a population of the listed rare shrub *Epacris curtisiae* in the vicinity. This species also occurs a short distance along Blackwater Spur. Any parking or storage of material in this road could impact on this species.

Footprints of Tasmanian devils were recorded near the junction of the Heemskirk Road and Rebecca Road.

The Balfour Track Forest Reserve southern access is located along this section.

Segment E – Blackwater Road

Segment E – Blackwater Road

Segment F – Blackwater Road

This is a short section of gravel road between two sections of sealed road that has relatively high travel speeds due to flatness and straightness. On this wide section of road it is unlikely the surrounding vegetation need be disturbed significantly while the road is being sealed.

Segment F

Segment F

Segment G – Sumac Road-Blackwater Road

This is a sealed section of road. An area of open grazing on the southern side of the Kanunnah Bridge is a hotspot for rufus wallaby to graze and therefore a road kill risk and potential scavenger attraction. Vertebrate animals may well use the bridge for access between the southern and northern sides of the Arthur River.

There are occasional declared weeds in this section including spanish heath and blackberry. Soil hygiene and weed control would apply when working in this area.

There is old growth mixed forest between the bridge and the Sumac lookout.

Segment G – Blackwater Road adjacent to the Arthur River.

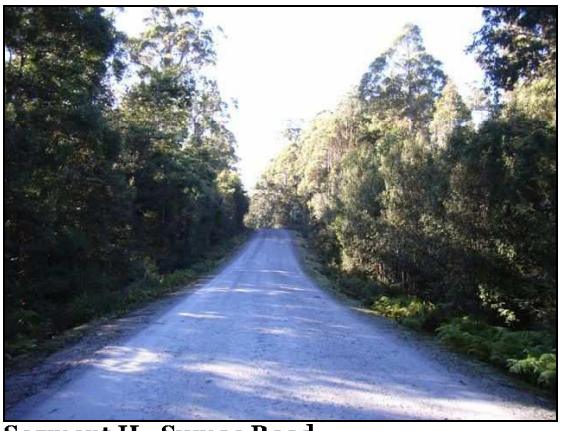
Segment G on the approach to the Kanunnah Bridge.

Segment H – Sumac Road – Kanunnah Bridge to Julius River

This wide gravel road has alternating straight and winding sections. There is not much potential for grazing mammals to feed on the roadside and, combined with long driver sight distances, creates a low risk for road kill of both grazing and scavenging mammals.

There are occasional occurrences of the declared weed, spanish heath. Soil hygiene and weed control would apply when working in this area.

Segment H - Sumac Road



Segment H - Sumac Road

Segment I – Julius River FR

This is a sealed section of Sumac Road on the approaches to Julius River Forest Reserve and includes the link between the picnic area and the campervan site. A spotted-tailed quoll was observed patrolling along the Julius River in the middle of the day at the picnic area, which apparently forms part of its home range[167] – perhaps the animal has been habituated to scavenging there. There is consequently a heightened risk of road kill at the Julius River bridge.

Non local Tasmanian eucalypts have been planted in this area. They may naturalise in the area in the long term. Foxglove, an environmental weed, is widespread along the roadside.

The existing sealed section through the Julius River Forest Reserve

The approach to the campervan camping area

Segment J – Sumac Road – Julius River to Rapid River Rd

This sound gravel road with alternating straight and winding sections is used regularly by both forestry and tourist traffic. Not much potential for grazing mammals to feed on roadside combined with long driver sight distances create a low risk for road kill of both grazing and scavenging mammals.

The existing quarry in this section will need to be managed for standard soil and weed hygiene issues. There were some exotic plantings adjacent to the road here.

Spanish heath, a declared weed, is scattered along the roadsides south of Lake Chisholm junction. Soil hygiene and weed control would apply when working in this area.

[167] G. King *pers. com.*

Gravel quarry adjacent to Sumac Rd (Segment J)

Rapid River bridge (Segment K)

Segment K – Rapid River Road

This section of sound gravel road is significantly narrower and in places windier than the Sumac Road. It travels through wet and mixed tall forest west of Rapid River and then predominantly through moorland towards Tayatea Road. The moorland vegetation type supports low densities of grazing mammals and is therefore likely to be a low road kill hazard. The forest containing myrtles near the Rapid River is potentially susceptible to myrtle wilt.

PC sensitive vegetation occurs in this area, hence standard soil hygiene practices need to be applied.

Rapid River Rd (Segment K)

Rapid River Rd - eastern end (Segment K)

Segment L – Tayatea Road

Much of this road segment is naturally traffic calming because the road is relatively narrow and undulating and so reducing risk of road kill. Minimal works will be required prior to sealing.

There is abundant evidence of Tasmanian devil activity in this area (latrine on road).

PC sensitive vegetation occurs in this area hence standard soil hygiene practices need to be applied.

Segment L.

Segment L – the overburden at the side of the road creates a microhabitat that supports trees adjacent to the moorland.

Segment L –junction with the Milkshakes Forest Reserve Road (Segment P).

Segment L where it meets the existing sealed section that continues down to the Tayatea Bridge.

Segment M – Tayatea Road - sealed section

This section descends past steep batters to the Tayatea Bridge. Some potential for wildlife to be trapped on the road and at risk to road kill. Foxglove, an environmental weed, is common in the roadside. Soil hygiene and weed control would apply when working in this area.

The junction of Sumac Road and Lake Chisholm Rd.

Lake Chisholm Forest Reserve carpark.

Segment N – Sumac Spur 4-1 and Lake Chisholm Road

This is a detour section of Lake Chisholm Road leading to the Forest Reserve of the same name. Up to the edge of the forest reserve the surrounding vegetation is predominantly

regrowth eucalypt forest. Vegetation adjacent to the existing car park and adjacent to the road includes wet *Eucalyptus brookeriana* forest which is of high conservation value.

Segment O - Sumac Rd – Rapid River Road to Dempster Lookout

Not investigated.

This crosses areas of open moorland (Dempster Plains). The listed rare shrub – *Epacris curtisiae* occurs within moorland along this section. A detailed assessment of this low shrub would need to be undertaken if works are proposed outside the shoulder.

PC sensitive vegetation occurs in this area.

Segment P - Milkshake Reserve Access Road

Not investigated.

PC sensitive vegetation occurs in this area.

5. MITIGATION

5.1 VEGETATION MANAGEMENT

Some of the construction works may impact on important flora and fauna habitats. However the risk of unnecessary and indirect impacts outside the 'footprint' of the developments could be minimised by following certain protocols:

1. Clearly define the extent of clearance required for the project;
2. Identify the boundary of all areas of sensitive native vegetation to be retained in the vicinity of works;
3. Implement a vegetation management plan tackling key environmental weeds in the vicinity of earthworks. This should concentrate on threatened flora and significant vegetation habitat and seek management that encourages natural recruitment;
4. Reduce the risk of spread of declared and environmental weeds, during and after works, by implementing a weed management and spread prevention plan.
5. Include a plant and animal pathogen prevention plan. This will aim to minimise the introduction of feral pathogens such as root rot fungus (*Phytophthora cinnamomi*) and chytrid fungus; as well as introduce measures that minimise the risk of spread of the native chalara fungus which causes myrtle wilt.

5.2 ROAD KILL

The guiding principles developed for Austroads that aim to achieve fauna sensitive road design[168] are appropriate to this project. These outline a process for incorporating management practices and a monitoring and reporting regime to manage the issue of road kill.

Bank *et al* (2002) state that mitigation measures for road kill should aim to keep wildlife off the road. Presently the most commonly used and effective method is fencing; however fences lead to fragmentation of the landscape. Fencing needs to be used in conjunction with measures to provide connectivity. Underpasses (culverts, box-culverts), overpasses and viaducts are used in Europe on major roads. Of these the underpass using a culvert/box culvert is probably the most viable for the Tarkine Forest Drive.

Hobday and Minstrell (2008) found that there were localised high-density road kill areas or 'hotspots' on the Tasmanian roads that they studied. They suggest that mitigation can be targeted at these 'hotspots' to change animal or human behaviour to reduce road kill. They suggest that the most effective mitigation strategy is to change human behaviour, particularly reducing driving speed at those locations where road kill is high ('hotspots') at particular times of the day and the year.

Shaw *et al* (2003) used predictive regression procedures to identify road kill hotspots using local-scale information. They suggest that the logistic regression model they developed could be used to identify hotspots on a road design prior to construction to identify where mitigation measures could be implemented prior to the construction or alteration of a road.

Shaw *et al* (2003) report that there are limitations to the model:

[168] Jungalwalla 2003

- they apply only to macropods and possums; other models may need to be developed for other species with different movement patterns and modes of behaviour when faced with traffic;
- they only apply to non-urban roads with posted speed limits ≥ 80km/h; and
- their surveys did not attempt to quantify the role of landscape-scale features, such as habitat quality. Shaw *et al* (2003) note that these are likely to be of direct consequence to managers in the planning phase of new routes.

Management measures to mitigate road kill

Shaw *et al.* (2003) report that some features of roads are more amenable to management intervention than others and that the real strength of the predictive modelling approach based on local features is that it can be used to identify and match sites, which have a high probability of road kill, for adaptive management-type interventions. For example, it is easier to provide escape routes or manage roadside grass than it is to manipulate banks and road curviness in hilly country.

Magnus (2006) identified that there are two main mechanisms to mitigate road kill:

- Changing driver behaviour by:
  - Changing driver attitude by increasing awareness of road kill.
  - Making people aware that they are entering a road kill hotspot by the use of signs, rumble strips and/or lighting.
  - Slowing traffic through road design (more corners, less straight roads) or installing traffic calming devices.
- Changing animal behaviour by:
  - Discouraging wildlife from lingering on roads and roadsides by reducing food (removing grass cover, removing other road kill) or by making road surfaces lighter which may make animals feel more conspicuous and exposed.
  - Providing safe crossings (overpasses, underpasses) and escape routes.

Magnus *et. al.* (2006) documents good practice for road design including:

- Minimise the factors of road designs that increase danger to wildlife by avoiding the creation of roadside barriers:
  - Reduce slopes of batters or build "escape ramps" that allow animals to get off the road in the face of oncoming traffic.
  - Where guard rails are installed ensure that they are designed to not act as barriers.
  - Reduce the incidence of sharp corners to increase visibility for both driver and animal.
  - Reduce road speed through use of road design (traffic calming) and speed advisory signage for night time driving.
  - When installing culverts at creek crossings ensure that they allow for the passage of wildlife (including platypus). Consider the use of box culverts with ledges for dry crossings, consider installing bio-baffles in round culverts (devices bolted to the floor of the culvert to reduce water flow and assist with fish and platypus passage).

Road design opportunities are limited on the Tarkine Forest Drive project. The entire route is already predetermined by existing roads.

Reducing traffic speed

There is a general consensus[169] that 60km/h is a preferred maximum for traffic speed to ensure that road kill is minimised.

Much of the Tarkine Forest Drive is of a high standard which even in its unsealed state is providing relatively high road speeds (>80km/h). These sections may warrant mitigation measures which can be retrofitted to the road to reduce road kill.

Identifying black spots

The Shaw *et al.* (2003) model could be applied through the faster and likely busier sections from Kanunnah Bridge to Arthur River to help to identify black spots.

The vegetation character, soil fertility and biological productivity along the route are variable. This is noticeable along the west coast (Segments A and B). North of Bottle Flat there is higher fertility, as indicated by grassy paddocks and openings within shrubby forest, than is found to the south. Saggs (*Lomandra longifolia*) are a prominent component of the ground layer.

Observational evidence[170] is that the abundance of wildlife in this area is much higher, suggesting road kill rates may be higher also. Although studies elsewhere suggest no relationship between density and road kill rates this is contrary to anecdotal observations[171]. This road section therefore may require mitigation measures to reduce road kill if it does, as suggested, support the greatest risk to Tasmanian devils and spotted tailed quolls along the route because it passes through the most suitable habitat for these species. The coastal heathland and buttongrass moorland vegetation south of Bottle Flat, extending along the western half of Segment C, is less productive. There is no grass to attract significant numbers of grazing herbivores, although wombats and Bennett's wallabies are present. Road kill is likely to be less in this section of the road therefore requiring fewer mitigation measures.

Monitoring is perhaps the most reliable way of identifying road kill hotspots although data collection must be sufficiently comprehensive to provide reliable indicators.

Road kill mitigation should consider the nature of the risk. As described by Magnus *et. al.* (2006) it should first tackle driver behaviour but also consider management of animal behaviour where appropriate. Driver behaviour can be modified to reduce road kill risk.

The following measures are recommended to address driver behaviour.

1. Tourists should be encouraged to plan for the completion of driving in daylight hours. This could be promoted to tourists at each end of the Tarkine Forest Drive and in associated tourist literature. Nocturnal wildlife observation should be promoted at sites outside the Tarkine Forest Drive section such as Marrawah.

2. Log truck and other forestry operations could be restricted to daylight hours. Some control may be able to be exerted through Forestry Tasmania arrangements with contractors. No winter harvesting and no vehicle twilight activity would be of benefit.

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[169] Jones *pers. com.*, Hobday *pers. com.*

[170] A, North, K Ziegler *pers. obs.*. This is being further tested by a road kill and wildlife activity monitoring study being currently undertaken – refer Monitoring in this report

[171] G. King *pers. com.*

3. Identify obvious hotpots where high rates of road kill are known. See Monitoring below.

4. Incorporate road design features near road kill hotspots, such as warning signs, riffle strips, fencing and underpasses.

The following road design and management measures are recommended to address animal behaviour.

1. Ensure vegetation management of verges along sections where the design speed exceeds 80km/h allow for early driver / wildlife sighting. Dense vegetation could be cleared back from the pavement edge to a predetermined width. Dense shrubs along Bottle Flat should be sufficiently cleared back to improve sight distances.

2. Minimise the growth of grassy verges, which attract grazing herbivores, especially in forest. Grass specific herbicides (e.g. Fusilade©) can be applied. There are localised patches of grassy verges along Blackwater and Sumac Roads. It is acknowledged that clearing of dense scrub from roadsides may encourage the establishment of grassy vegetation.

3. Prescribe table drain profiles that do not act as barriers to animals.

4. In steep terrain where there may be a steep bank on one side and barriers on the drop-off on the other side, consideration needs to given to the provision of escape routes. The number and spacing of escape routes will depend on traffic speed and the barrier effect of the road. The design of the barrier fencing should allow animals to pass easily under the fence. Where there is a steep drop then some benching may be needed to provide an escape route.

5. Evaluate creek crossings to determine whether culverts and bridges meet minimum design standards to facilitate animal passage. For example, space each side of the river beneath bridges, ledges in box culverts, bio baffles in round culverts, secondary pipe culverts above water level for devils and quolls. Consider these in light of road kill monitoring to determine whether retrofitting may be necessary in the future.

The Outline Framework for Fauna Sensitive Road Design and Management[172] states that a monitoring regime should address all success criteria and management objectives, be achievable with available resources, prescribe sufficient time to measure impacts, and prescribe specific instructions as to how the monitoring is to take place.

Monitoring for road kill prior to and after, if the road is constructed, provides an opportunity for adaptive management measures. These may include some retrofitting of structures to tackle any problems that arise that were not identified in the assessment phase.

Monitoring of an existing road, before and after sealing, allows for some assessment of the impact of these changes. However, the design of the monitoring study and the quality of the data is critical to enhance the probability of detecting any changes due to the road construction.

The study will need to consider issues such as the seasonality of road kill. Road kill also varies from year to year, depending on broader environmental factors such as variation

[172] Jungalwalla 2003

in climatic conditions (more road kill may occur during drought periods as animals are attracted to the road for food), variation in fauna abundance, traffic volumes and timing.

The effectiveness of any mitigation measures is generally difficult to measure. For example the effectiveness of the features incorporated along the Marrawah to Arthur River Road cannot be demonstrated. Although some lessons for the design of the crossings can be taken which may improve their effectiveness e.g. longer fences larger pipes, placement of pipes so they do not fill with water when it rains.

Any attempt to monitor for changes in the impact of road kill on a particular species will also require an assessment of population densities in the area. In addition, any attempt to monitor for impact of roadwork to road kill requires the use of a reference site where no works are undertaken. The reference site should match the study site as closely as possible.

The potential risk of road kill of giant freshwater lobster has been raised in recognition of the substandard design of some culverts at creek crossings (section 4.3.5). A formal review of all crossings could be made in light of this to identify potential black spots and considered retrofitting of features to encourage lobster passage, where future monitoring identifies elevated incidences of road kill.

Monitoring

A 12 month Monitoring Project has been undertaken of the western half of the route (Segments A-L & O). The assessment and reporting of this work falls outside the scope of this report.

Following completion of each stage of the Tarkine Forest Drive project, regular monitoring for road kill should be undertaken. To make useful comparison with the baseline data, repeat surveys of the control sections will be necessary.

6. LEGISLATIVE IMPLICATIONS

6.1 COMMONWEALTH *ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999*

A copy of the EPBC Act Protected Matters report is included in Appendix 5. This identifies 49 threatened species (38 fauna, 11 flora) plus 24 migratory bird species. Those with potential habitat in the area are considered in section 3.8. Those which have been confirmed or considered to potentially occur have been highlighted.

Referral under the EPBC Act is necessary if, as the Act states:

'An action has, will have, or is likely to have a significant impact on a vulnerable / endangered species if it does, will or is likely to (amongst other things):

- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- adversely affect habitat critical to the survival of a species.'

Referral is made to Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC).

The western section (Segments A, B, C) pass through an area of western Tasmania which supports as many as nine nationally listed orchid species. Only one is likely to be at risk of impact from the project.

Two nationally listed fauna species may be impacted by the proposals.

6.1.1 Arthur River Greenhood

This occurs as several populations in the area but at one location (Tiger Flats – Segment B) the population is located on the very edge of the Temma Road. Two plants were observed in 2009 that had colonised the gravel road shoulder. Therefore any works in this are is likely to have a direct impact on some plants. Detailed assessment of this population suggests that the impact need be relatively minor. A similar impact is equally likely from standard road maintenance procedures. Indeed in the long term a sealed road is likely to have less impact than a gravel road, which requires regular grading. However it is critical that the core of the population is protected from inadvertent damage during the construction period as the location would be deemed suitable for storage of materials and machinery.

6.1.2 Tasmanian devil

The EPBC Tasmanian Devil Policy states that "new roads or upgrades in sensitive locations that may substantially increase the risk of Tasmanian devils being killed are likely to require referral and consideration under the EPBC Act."[173]

An increase in traffic volume and speed is likely to increase road kill, not only within the Tarkine Forest Drive but within connecting roads. This impact may be significant, especially if the Devil Facial Tumour Disease were to spread to the far Northwest.

The potential impacts on the Tasmanian devil from the proposed action to construct the Tarkine Forest Drive are likely to constitute a 'controlled action' by the Minister for the Environment.

[173] DEH 2006

Design features, which manage driver and wildlife behaviour, and a monitoring program, which includes an adaptive management response to any significant increases in road kill, will mitigate potential impacts on the Tasmanian devil.

6.1.3 Spotted-tailed quoll

An increase in traffic volume and speed along the Tarkine Forest Drive and connecting roads may lead to an increase in road kill of spotted-tailed quolls.

6.2 Tasmanian *Threatened Species Protection Act 1995*

Although over 30 species of listed flora have been recorded within the vicinity of the road, consideration of all species and targeted surveys indicates that the number of species likely to be impacted by the works is perhaps four species:

- **Swamp doubletail (*Diuris palustris*) (Endangered)**
- **Northwest heath (*Epacris curtisiae*) (Rare)**
- **Yellow onion-orchid (*Microtidium atratum*) (Rare)**
- **Arthur River greenhood (*Pterostylis rubenachii*) (Endangered)**

Impacts to all four species are likely to be minor and significant areas of habitat can be avoided with appropriate controls.

A permit is likely to be required under this legislation for the project for direct impacts to these flora species. Further survey for flora, may be necessary to fully quantify impacts once detailed deign has been undertaken.

No direct impacts to any threatened fauna species are anticipated.

6.3 Tasmanian *Weed Management Act 1999*

Table 8 summarises the status of declared weeds in the municipality of Circular Head according to relevant Weed Management Plans prepared under the Act. Weeds of National Significance (WONs) are identified.

It should be noted that the level of survey undertaken for this project is of insufficient resolution to pick up all weed infestations.

Table 8 – Status of Declared Weeds

Weed	WONs	Status In Circular Head
Blackberry (*Rubus fruticosus* agg.)	WONs	B, widespread
Gorse (*Ulex europaeus*)	WONs	B, localised
Spanish heath (*Erica lusitanica*)	-	A, localised
Creeping thistle (*Cirsium arvense*)	-	B, localised

According to the provisions of the *Weed Management Act 1999,* Zone A municipalities include those which are either free of the weed or host small isolated infestations which are considered eradicable. The principal management objective should be to implement an integrated control program for eradication and prevent future occurrences.

Zone B municipalities are those which host large, widespread infestations of the declared weed that are not deemed eradicable because the feasibility of effective management is low at this time, therefore the objective is containment of infestations. The objective includes preventing spread of the declared weeds from the municipality and preventing spread to properties currently free of them. There is a requirement to prevent spread of the weeds to properties containing sites for significant flora, fauna and vegetation communities such as those present here.

6.3.1 Spanish heath

Under this Act Circular Head is classed as a Zone A municipality for infestations of Spanish heath (*Erica lusitanica*).

The eradication of Spanish heath should be given particular attention as currently the infestations are limited. There are moderately low numbers of individual plants on the verges of the road on Rebecca Road and Sumac Road. The two plants at the edge of the Rebecca Road were hand pulled and bagged and later burnt. The infestations on the verges of Sumac Road and Backwater Road are between 50 and 100 sqm in area. These infestations should be treated prior to commencement of works. Annual follow up of weed treatment is critical to effectively eradicate this weed at a local level. Prescribed actions that result in the eradication and prevention of spread should be prepared. Because the infestations are all on the sides of roads, the greatest risk to spreading the Spanish heath comes from road maintenance activities such as grading or slashing the road verges.

6.3.2 Gorse

Circular Head Council is a Zone B municipality under the Act which has a management aim of containment, the localised nature of the single gorse plant recorded on the Blackwater Road and another on Rebecca Road makes it feasible to aim for eradication.

6.3.3 Blackberry

Circular Head Council is classed as Zone B municipality for infestations of blackberry. While the principal management objective under legislation is containment of infestations and to prevent spread of the declared weed from the municipality, the minor isolated infestations are outliers in areas otherwise free of blackberry so it would be feasible to apply the management aim of eradication.

A weed management plan for the Tarkine Forest Drive should be prepared that considers measures to reduce the risk of spreading or introducing weeds. The extensive nature of the road works associated with this project will require strategic planning to minimise the risk of weed translocation. Containment sites which may otherwise act as infection sites should be identified and known sites treated prior to works starting.

The locations of known weed populations should be marked to ensure road works do not involve the movement of seed infected road gravels. Future roadside maintenance in this area should respond to the presence of these infestations to ensure it does not inadvertently spread the weed

6.4 Tasmanian *Land Use and Planning Approvals Act 1993*

The study area is entirely confined to Circular Head Council.

LUPAA states that 'in determining an application for a permit, a planning authority must (amongst other things) seek out the objectives set out in Schedule 1'.

Schedule 1 includes 'The objectives of the Resource Management and Planning System of Tasmania' which are (amongst other things):

'To promote sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity'.

Sustainable development includes 'avoiding, remedying or mitigating any adverse effects of activities on the environment'.

Threatened species issues are adequately dealt with through other legislation. There is very limited vegetation clearance required for this project.

6.5 TASMANIAN *FOREST PRACTICES ACT 1985*

Public roads are exempt from this act, but activities within State Forest may require a Forest Practices Plan.

If the entire road is to become a public road then it may be entirely exempt.

The *Forest Practices Act (FPA)* requires a Forest Practices Plan (FPP) where the clearing of forest is in excess of 1 hectare or 100 tonnes of timber or involves 'vulnerable land' where the thresholds become less. An amendment to the *Forest Practices Act* (April 2007) precludes the approval for the clearance of threatened forest communities and extends to the regulation of clearance of listed threatened non forest communities.

The approval of a FPP will be subject to advice from the Development and Conservation Assessment Branch, DPIPWE with respect to threatened species. It may also consider other values unless they are assessed through the planning approval process.

7. CONCLUSION

The Tarkine Forest Drive project is entirely confined to the sealing of existing roads and car parks with some minor infrastructure provisions. The project is located in an area near the northern fringes of a region popularly termed The Tarkine of which the Australian Government Department of Sustainability, Environment, Water, Population and Communities is currently considering a nomination for listing as the Tarkine Wilderness Area on the National Heritage List under the EPBC Act.

The aim of the project is to facilitate tourist access in the northwest Arthur River Forests area of Tasmania, resulting in an increase in the numbers of people and vehicles in the region and widening the range of user groups. It will provide improved public access through the sealing of existing roads, which will encourage hire car access.

An increase in human activity and access to isolated natural areas will bring with it environmental impacts. This assessment specifically considers the impact of the project on the natural biological values of the area.

The existing road infrastructure within the study area is extensive. This, combined with the extent of other land use activities throughout much of the corridor, is relevant to and provides context for this assessment. Much of the landscape crossed by the Tarkine Forest Drive is subject to forestry and mining. In addition, the western half of the road is already used as an alternate transport link to that part of the west coast between Arthur River and Temma.

The extent of direct impact to native vegetation systems is minor when compared to existing impacts on the vegetation in the area from activities such as forestry and mining.

There are a number of threatened flora species which may be impacted by the project. The project is unlikely to have a significant impact on the conservation status of any of the species that are known from the area, although some impacts are likely.

There are several threatened fauna species which may be impacted by the project. The most significant issue is the potential for the project to impact on the status of the Tasmanian devil which is under significant threat from DFTD. As knowledge about DFTD and its impact on the Tasmanian devil is rapidly evolving, it is difficult to conclude with confidence what the impact of the project is likely to be.

The impact of the Tarkine Forest Drive on the Tasmanian devil, and to the spotted-tailed quoll, can be minimised if mitigation measures are adopted; including design features and measures to reduce the incidence of road kill supplemented by a monitoring program which incorporates triggers for management actions when levels of impacts are exceeded.

8. SUMMARY OF RECOMMENDATIONS

Further surveys

The following specific investigations are required to assist with the impact assessment and referral review.

- **Unsurveyed sections and additional infrastructure**

Several sections not yet surveyed may require further investigation. These include new sections , not previously considered: Sumac Road, south of Spur 4.1 (part of Segment J),; Rapid River Road form Sumac Rd to just past Rapid River bridge (part of Segment K); Tayatea Rd approaching Tayatea Bridge (Segment M), Sumac Rd form Rapid River Rd to Dempster Lookout (Segment O) and Milkshake Hills access road (Segment P). In total these unsurveyed sections extend over 18.3 km.

There may also be additional sites associated with the project that have not been assessed such as quarry sites or extensions to existing car parks.

- **Orchids**

Orchid habitat extends onto the road shoulder at one location on Segment B (Tiger Flats). Full quantification of the impact at this section would be dependent on further detailed design of works. This may be necessary to inform a permit application under the Tasmanian *Threatened Species Protection Act 1995*.

- ***Epacris curtisiae* – northwest heath**

This shrub is known from the roadside within the Arthur-Pieman Conservation Area along Rebecca Road. Any earthworks in this vicinity would need to be defined to enable quantification of losses. A new record of this species (2011) from Sumac Spur 8A, extending within 30m of the existing Blackwater Road suggest that the moorland section of road should be surveyed if any earthworks are planned in this area. Given this section of road is already sealed this may not be an issue. The inclusion of Dempster Lookout also incorporates new habitat for this species. Any earthworks on Dempster Plains should be assessed for impacts to this species.

- **PC survey**

Phytophthora cinnamomi is present and potentially could occur throughout sections of heathland and moorland. Although opportunistically recorded from previous work, detailed survey of all potential habitats is recommended. Select sampling of plant material exhibiting symptomatic evidence should be collected for confirmation testing. The findings from the survey can inform the best strategies for the Weed and Disease Management Plan.

- **Creek crossing assessment**

Some creek crossings are serviced by culverts that are inadequate at allowing giant freshwater lobster passage. Larger bridge crossings don't always allow for large animal passage. In both cases animals are forced to cross above the road and are at risk to road kill.

Detailed assessment of existing culverts and bridges could be undertaken to categorise all crossing for suitability. This information could be used to direct monitoring of road kill and also to consider options for retrofitting features to encourage animal passage. The design of the two new bridges are particularly relevant to this consideration.

Addendum

The results from the further surveys should be reported as an addendum to this document. Information will be used to inform planning and design. It is unlikely any of these findings will affect the outcome of any approvals but they may suggest modifications to the design or require specific management actions.

Management plans

It is recommended that the following plans are prepared prior to construction to minimise impacts on threatened flora and fauna:

- **Bridge Crossing**

This plan should investigate options for design features to permit animal passage along the riverbanks at the base of bridges.

- **Road kill Monitoring**

A 12 month road kill monitoring study was undertaken in 2009-2010. This project will provide baseline data against which monitoring post construction can be compared. Outcomes from the monitoring should help to:

  - identify locations where high levels of road kill already exist (blackspots)
  - inform requirements for road design changes to reduce the road kill hazard

- **Road kill Mitigation**

A road kill mitigation plan should be developed to minimise the risk of road kill resulting from the implementation of the Tarkine Forest Drive. This should include modelling of the road kill hazard presented by the road layout. The plan should identify areas where mitigation measures should be implemented and should also recommend what management measures should be implemented to reduce the risk of road kill. The existing road sections should be assessed for features that are associated with road kill including barriers, culverts, and embankments.

- **Flora and Fauna Management Plan**

This plan should consider all threatened species identified in this report and addendum that may be impacted by the construction and ongoing use of the Tarkine Forest Drive. It should prescribe measures to protect species and habitats and quantify any impacts to threatened species that may require permits.

- **Weed and Disease Management Plan**

This will consider measures to minimise the risk of introducing weeds and diseases into the area. It will also prescribe measures to control or secure existing infestations.

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APPENDIX 1 – CONSERVATION VALUES OF PLANT AND ANIMAL SPECIES

SPECIES OF NATIONAL SIGNIFICANCE

Listed in Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The *EPBC* Act has six categories of threat status for species:

1. **Extinct -** If at a particular time there is no reasonable doubt that the last member of the species has died.
2. **Extinct in the wild -** If it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or If it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
3. **Critically endangered** - If at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
4. **Endangered** - If it is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
5. **Vulnerable** - If at a particular time it is not critically endangered or endangered; and it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
6. **Conservation dependent -** If, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

SPECIES OF STATE SIGNIFICANCE

Listed in Tasmanian *Threatened Species Protection Act 1995* (TSP Act)

Threatened flora and fauna species in Tasmania are listed in Schedules 3 (extinct or endangered), 4 (vulnerable) or 5 (rare). These three categories are defined in Section 15 of the Act.

1. **Extinct** - If no occurrence of the taxon in the wild can be confirmed during the past 50 years.
2. **Endangered -** If it is in danger of extinction because long-term survival is unlikely while the factors causing it to be endangered continue operating.
3. **Vulnerable** - If it is likely to become an endangered taxon while the factors causing it to be vulnerable continue operating.
4. **Rare** - If it has a small population in Tasmania that is not endangered or vulnerable but is at risk."

Species that have been nominated and approved by the Scientific Advisory Committee for listing in the Act.

SPECIES OF REGIONAL OR GENERAL SIGNIFICANCE

The following definitions are from three publications: Flora Advisory Committee 1994, Vertebrate Advisory Committee 1994, Invertebrate Advisory Committee 1994.

Flora only - Species listed as rare but not necessarily 'at risk' (**r3**).

Fauna only – Species requiring monitoring (**m**).

Both – Species of unknown risk status (**k**) in Tasmania, or thought to be uncommon within region, or a species having a declining range or populations within the area.

Species considered being outside its normal range or of an unusual form as determined and justified in the body of the report.

Species identified in regional studies as being of conservation significance that are not listed in current legislation.

Species that have been recognised, but have not been formally described in a published journal, that are thought to be significant as determined and justified in the body of the report.

Plant species that are not known to be reserved. To be so it must be known to exist in at least one secure Reserve. Secure reserves include reserves and parks requiring the approval of both Houses of Parliament for their revocation. They include: National Parks, Aboriginal Sites, Historic Sites, Nature Reserves, State Reserves, Game Reserves, Forest Reserves, Wellington Park, and insecure reserves in the World Heritage Area which is protected by international agreement under the World Heritage Convention.

APPENDIX 2 – LEGISLATIVE IMPLICATIONS OF THREATENED SPECIES

TASMANIAN STATE LEGISLATION AFFECTING THREATENED SPECIES

Threatened Species Protection Act 1995

Threatened flora and fauna species in Tasmania are listed in Schedules 3 (endangered) and 4 (vulnerable) of the Threatened Species Protection Act, 1995. Rare species that are considered to be 'at risk' are listed in Schedule 5 of the Act. These three categories are defined in Section 15 of the Act.

1. "An extant taxon of native flora or fauna may be listed as **endangered** if it is in danger of extinction because long-term survival is unlikely while the factors causing it to be endangered continue operating.
2. A taxon of native flora or fauna may be listed as **vulnerable** if it is likely to become an endangered taxon while the factors causing it to be vulnerable continue operating.
3. A taxon of native flora or fauna may be listed as **rare** if it has a small population in Tasmania that is not endangered or vulnerable but is at risk."

The Act provides mechanisms for protecting these species from threatening processes the implementation of 'recovery plans', 'threat abatement plans', 'land management plans', public authority agreements', and 'interim protection orders'.

Section 51 (a) of the TSPA states that: "A person must not knowingly, without a permit - take, trade in, keep or process any listed flora or fauna". The Act defines 'take' as including: "kill, injure, catch, damage, destroy and collect. A land manager is therefore required to obtain a permit from the Tasmanian Department of Primary Industries, Water and Environment (DPIWE) to carry out management that may adversely affect any of the species listed in the Act.

Commonwealth of Australia Legislation Affecting Threatened Species

Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act establishes a process for assessing actions that are likely to have impacts of *national environmental significance.* Such impacts include World Heritage Areas, RAMSAR Wetland sites of international importance, migratory species protected under international agreements, nuclear actions, the Commonwealth marine environment and **nationally threatened species and communities.**

Threatened species are defined in several categories:

1. Extinct

- If at a particular time there is no reasonable doubt that the last member of the species has died.

2. Extinct in the wild

- If it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or
- If it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.

3. Critically endangered

- If at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.

4. Endangered

- If it is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

5. Vulnerable

- If at a particular time it is not critically endangered or endangered; and it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

6. Conservation dependent

- If, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

An action that is likely to affect species that are listed in any of the above categories may require ministerial approval unless the Commonwealth Environment Minister has granted an exemption. The Act establishes a **referral process** to Environment Australia to determine whether an action requires a formal **approval** and thus would be required to proceed through the **assessment and approval process**.

A referral must provide sufficient information to allow the Minister to make a decision. The Minister is then required to make a decision within 20 business days of the referral. The Minister may decide an approval is not necessary if the action is taken in a specified manner. The action may not require approval but may require a **permit** if undertaken on Commonwealth land. If an approval is required then an **environmental assessment** must be carried out. In such instances the environmental assessment approach will be determined by the Minister and may vary from preliminary documentation to a full public inquiry depending on the scale and complexity of the impact.

APPENDIX 3 – PLANT COMMUNITIES

Community: DNI

Trees:	*Allocasuarina monilifera, Eucalyptus nitida*
Tall Shrubs:	*Banksia marginata, Leptospermum lanigerum, Leptospermum nitidum, Leptospermum scoparium, Melaleuca squarrosa*
Shrubs:	*Bauera rubioides, Dillwynia glaberrima, Epacris impressa, Epacris lanuginosa, Melaleuca squamea, Persoonia juniperina var. brevifolia, Philotheca virgata, Pultenaea juniperina, Sprengelia incarnata*
Low Shrubs:	*Aotus ericoides*
Herbs:	*Stylidium graminifolium*
Graminoids:	*Empodisma minus, Eurychorda complanata, Gahnia grandis, Gymnoschoenus sphaerocephalus, Lepidosperma filiforme, Patersonia fragilis, Schoenus lepidosperma subsp. lepidosperma*
Ferns:	*Gleichenia dicarpa, Lycopodium deuterodensum, Selaginella uliginosa*

Community: GHC

Low Shrubs:	*Hibbertia sericea var. sericea*
Graminoids:	*Ficinia nodosa, Juncus kraussii subsp. australiensis, Lomandra longifolia*
Grasses:	*Austrodanthonia sp., Themeda triandra*

Community: MBW

Tall Shrubs:	*Banksia marginata, Leptospermum glaucescens, Leptospermum nitidum*
Shrubs:	*Baeckea leptocaulis, Bauera rubioides, Boronia citriodora, Dillwynia glaberrima, Epacris impressa, Melaleuca squamea, Monotoca submutica, Philotheca virgata, Sprengelia incarnata*
Graminoids:	*Chordifex hookeri, Empodisma minus, Eurychorda complanata, Gymnoschoenus sphaerocephalus, Lepidosperma filiforme, Leptocarpus tenax, Patersonia fragilis, Schoenus lepidosperma subsp. lepidosperma, Xyris operculata*
Ferns:	*Selaginella uliginosa*

Community: MSW

Tall Shrubs:	*Leptospermum lanigerum, Leptospermum nitidum*
Shrubs:	*Allocasuarina zephyrea, Melaleuca gibbosa, Melaleuca squamea, Philotheca virgata, Sprengelia incarnata*
Graminoids:	*Chordifex hookeri, Empodisma minus, Gymnoschoenus sphaerocephalus, Hypolaena fastigiata, Lepidosperma filiforme, Leptocarpus tenax, Sporadanthus tasmanicus, Xyris sp.*

Community: RMS

Trees:	*Acacia melanoxylon, Atherosperma moschatum subsp. moschatum, Eucryphia lucida, Nothofagus cunninghamii*
Tall Shrubs:	*Anodopetalum biglandulosum, Anopterus glandulosus, Leptospermum lanigerum, Melaleuca squarrosa*
Shrubs:	*Cenarrhenes nitida, Trochocarpa cunninghamii*
Graminoids:	*Juncus pauciflorus, Uncinia riparia*
Ferns:	*Histiopteris incisa, Hymenophyllum rarum, Hypolepis rugosula*

Community: RMT

Trees:	*Atherosperma moschatum subsp. moschatum, Eucalyptus nitida, Eucryphia lucida, Nothofagus cunninghamii, Phyllocladus aspleniifolius*
Tall Shrubs:	*Anodopetalum biglandulosum, Anopterus glandulosus*
Shrubs:	*Aristotelia peduncularis, Cenarrhenes nitida, Pimelea drupacea, Tasmannia lanceolata*
Ferns:	*Asplenium appendiculatum subsp. appendiculatum, Blechnum wattsii, Dicksonia antarctica, Grammitis magellanica subsp. nothofageti, Hymenophyllum peltatum, Rumohra adiantiformis*

Community: SMR

Trees:	*Eucalyptus brookeriana*
Tall Shrubs:	*Banksia marginata, Leptospermum lanigerum, Leptospermum scoparium, Melaleuca squarrosa, Nematolepis squamea*
Shrubs:	*Bauera rubioides, Epacris impressa, Euryomyrtus ramosissima, Leucopogon collinus, Melaleuca squamea, Persoonia juniperina, Philotheca virgata, Sprengelia incarnata, Tasmannia lanceolata*
Low Shrubs:	*Aotus ericoides*
Herbs:	*Abrotanella forsteroides, Xanthosia tasmanica*
Graminoids:	*Baloskion tetraphyllum subsp. tetraphyllum, Chordifex hookeri, Eurychorda complanata, Gahnia grandis, Gymnoschoenus sphaerocephalus, Hypolaena fastigiata, Lepidosperma concavum, Leptocarpus tenax, Patersonia fragilis, Xyris operculata*
Grasses:	*Ehrharta distichophylla*
Ferns:	*Blechnum wattsii, Selaginella uliginosa*
Climbers:	*Cassytha glabella*

Community: SWW

Tall Shrubs:	*Leptospermum glaucescens, Leptospermum scoparium, Melaleuca squarrosa*
Shrubs:	*Bauera rubioides, Bossiaea cinerea, Epacris impressa, Monotoca submutica, Persoonia juniperina, Sprengelia incarnata*
Low Shrubs:	*Aotus ericoides*

Community: WBR

Trees:	*Acacia melanoxylon, Atherosperma moschatum subsp. moschatum, Eucalyptus brookeriana, Eucalyptus obliqua, Eucryphia lucida, Nothofagus cunninghamii, Phyllocladus aspleniifolius*
Tall Shrubs:	*Anopterus glandulosus, Leptospermum lanigerum, Leptospermum scoparium, Monotoca glauca, Nematolepis squamea, Zieria arborescens*
Graminoids:	*Gahnia grandis*
Ferns:	*Blechnum nudum, Blechnum wattsii, Dicksonia antarctica, Gleichenia dicarpa, Pteridium esculentum*

Community: WNL

Trees:	*Eucalyptus nitida, Eucalyptus obliqua, Nothofagus cunninghamii, Phyllocladus aspleniifolius*
Tall Shrubs:	*Acacia mucronata, Acacia mucronata subsp. dependens, Acacia verticillata, Banksia marginata, Leptospermum glaucescens, Leptospermum lanigerum,*

	Leptospermum nitidum, Leptospermum scoparium, Melaleuca squarrosa, Monotoca glauca, Nematolepis squamea, Oxylobium arborescens
Shrubs:	*Bauera rubioides, Cenarrhenes nitida, Leptecophylla juniperina, Melaleuca squamea, Tasmannia lanceolata*
Herbs:	*Dianella tasmanica, Drymophila cyanocarpa*
Graminoids:	*Baloskion tetraphyllum subsp. tetraphyllum, Gahnia grandis*
Ferns:	*Blechnum wattsii, Gleichenia dicarpa, Gleichenia microphylla*

Community: WNR

Trees:	*Eucalyptus nitida, Nothofagus cunninghamii, Phyllocladus aspleniifolius*
Tall Shrubs:	*Acacia mucronata, Anodopetalum biglandulosum, Anopterus glandulosus, Leptospermum nitidum, Leptospermum scoparium, Melaleuca squarrosa, Monotoca glauca, Nematolepis squamea*
Shrubs:	*Bauera rubioides, Cenarrhenes nitida, Leptecophylla juniperina, Sprengelia incarnata*
Graminoids:	*Gahnia grandis*
Ferns:	*Gleichenia dicarpa*

Community: WOB

Trees:	*Acacia melanoxylon, Eucalyptus obliqua*
Tall Shrubs:	*Acacia mucronata, Acacia verticillata, Leptospermum lanigerum, Leptospermum scoparium, Melaleuca squarrosa, Nematolepis squamea, Pomaderris apetala, Zieria arborescens*
Shrubs:	*Acacia longifolia, Olearia lirata*
Graminoids:	*Gahnia grandis, Juncus bassianus*
Ferns:	*Dicksonia antarctica*

Community: WOR

Trees:	*Acacia melanoxylon, Eucalyptus obliqua, Eucryphia lucida, Nothofagus cunninghamii, Phyllocladus aspleniifolius*
Tall Shrubs:	*Acacia verticillata, Anodopetalum biglandulosum, Anopterus glandulosus, Melaleuca squarrosa, Monotoca glauca, Olearia argophylla, Pomaderris apetala*
Shrubs:	*Cenarrhenes nitida, Coprosma quadrifida, Olearia lirata*
Herbs:	*Correa lawrenceana var. lawrenceana*
Graminoids:	*Gahnia grandis*
Ferns:	*Blechnum nudum, Dicksonia antarctica, Histiopteris incisa, Hypolepis rugosula*

APPENDIX 4 – SURVEY FROM WESTERN SECTION (SEGMENTS A, B & C).

SSC - coastal scrub SEGMENT A

Grid Reference:	306212E, 5450183N
Accuracy:	within 1 kilometre
Recorder:	Karen Ziegler
Date of Survey:	4 Nov 2009
Trees:	*Eucalyptus nitida, Eucalyptus viminalis subsp. viminalis*
Tall Shrubs:	*Banksia marginata, Leptospermum laevigatum*
Shrubs:	*Acacia longifolia subsp. sophorae, Leucopogon parviflorus, Persoonia juniperina*
Low Shrubs:	*Hibbertia sericea var. sericea*
Herbs:	*Acaena novae-zelandiae, Caladenia carnea, Comesperma vulgaris, Hydrocotyle hirta, Microtis arenaria, Pterostylis pedunculata*
Graminoids:	*Ficinia nodosa, Lepidosperma concavum, Lomandra longifolia*
Ferns:	*Pteridium esculentum*

WBR SEGMENT A

Grid Reference:	305553E, 5451872N
Accuracy:	within 50 metres
Recorder:	Karen Ziegler
Date of Survey:	4 Nov 2009
Trees:	*Eucalyptus brookeriana*
Tall Shrubs:	*Acacia verticillata, Leptospermum lanigerum, Melaleuca ericifolia, Monotoca glauca, Pomaderris apetala*
Shrubs:	*Coprosma quadrifida, Leucopogon parviflorus*
Ferns:	*Dicksonia antarctica, Pteridium esculentum*

DVC SEGMENT B

Grid Reference:	306012E, 5448933N
Accuracy:	within 50 metres
Recorder:	Karen Ziegler
Date of Survey:	4 Nov 2009
Trees:	*Eucalyptus viminalis subsp. viminalis*
Tall Shrubs:	*Banksia marginata, Leptospermum laevigatum*
Shrubs:	*Acacia longifolia subsp. sophorae, Leucopogon parviflorus*
Low Shrubs:	*Hibbertia sericea var. sericea*
Herbs:	*Ajuga australis, Dichondra repens, Geranium potentilloides*
Graminoids:	*Ficinia nodosa, Lomandra longifolia*

SCH coastal heathland influenced by microhabitat along rd SEGMENT B

Grid Reference:	305862E, 5443183N
Accuracy:	within 1 kilometre
Recorder:	Karen Ziegler
Date of Survey:	4 Nov 2009
Trees:	*Allocasuarina monilifera, Eucalyptus nitida*
Tall Shrubs:	*Acacia mucronata, Acacia verticillata, Acacia verticillata subsp. ovoidea, Banksia marginata, Leptospermum laevigatum, Leptospermum lanigerum, Leptospermum scoparium, Melaleuca ericifolia, Melaleuca squarrosa, Pultenaea daphnoides var. obcordata*
Shrubs:	*Acacia longifolia subsp. sophorae, Amperea xiphoclada var. xiphoclada, Bauera rubioides, Bossiaea cordigera, Daviesia ulicifolia, Epacris impressa, Leucopogon collinus, Leucopogon ericoides, Leucopogon parviflorus, Melaleuca gibbosa, Persoonia juniperina, Pomaderris elliptica*
Low Shrubs:	*Acacia myrtifolia, Aotus ericoides, Astroloma humifusum, Hibbertia sericea var. sericea*
Herbs:	*Acaena novae-zelandiae, Caladenia carnea, Calochilus paludosus, Comesperma*

	vulgaris, Kennedia prostrata, Microtis arenaria, Mitrasacme pilosa var. pilosa, Rhytidosporum procumbens, Sphaerolobium sp., Thelymitra juncifolia, Thelymitra rubra
Graminoids:	*Diplarrena latifolia, Gahnia grandis, Lepidosperma sp., Leptocarpus tenax, Lomandra longifolia, Patersonia fragilis*
Grasses:	*Ehrharta distichophylla*
Ferns:	*Gleichenia microphylla, Pteridium esculentum*
Climbers:	*Comesperma volubile*
Weeds:	*Hypochoeris radicata, Ulex europaeus*

Orchids along Temma Road SEGMENT B

Grid Reference:	306212E, 5441183N
Accuracy:	within 5 kilometre
Recorder:	Karen Ziegler
Date of Survey:	5 Nov 2009
Herbs:	*Caladenia carnea, Calochilus herbaceus, Calochilus paludosus, Calochilus platychila, Microtis arenaria, Prasophyllum rostratum, Pterostylis tasmanica, Thelymitra aristata, Thelymitra exigua, Thelymitra juncifolia, Thelymitra nuda, Thelymitra pauciflora, Thelymitra rubra*

Orchid sp. along Rebbecca Rd. SEGMENT C

Grid Reference:	307612E, 5439483N
Accuracy:	within 1 kilometre
Recorder:	Karen Ziegler
Date of Survey:	5 Nov 2009
Herbs:	*Caladenia dienema, Calochilus paludosus, Calochilus platychila, Microtis arenaria, Prasophyllum rostratum, Thelymitra juncifolia, Thelymitra rubra*

GHC - Tiger Flat SEGMENT B

Grid Reference:	305650E, 5447600N
Accuracy:	within 50 metres
Recorder:	Andrew J. North
Date of Survey:	4 Nov 2009
Tall Shrubs:	*Acacia verticillata subsp. ovoidea, Leptospermum scoparium*
Shrubs:	*Melaleuca gibbosa*
Low Shrubs:	*Acrotriche serrulata, Astroloma humifusum*
Herbs:	*Acaena echinata, Diuris palustris, Drosera pygmaea, Hypoxis hygrometrica, Microtis sp., Oxalis perennans, Plantago coronopus, Pterostylis rubenachii, Thelymitra sp., Wurmbea dioica subsp. dioica*
Graminoids:	*Baumea juncea, Ficinia nodosa, Isolepis levynsiana, Juncus astreptus, Lomandra longifolia*
Grasses:	*Austrodanthonia sp.*
Ferns:	*Pteridium esculentum*
Weeds:	*Acetosella vulgaris, Anthoxanthum odoratum, Briza minor, Centaurium erythraea, Hypochoeris radicata, Lotus sp., Prunella vulgaris, Trifolium dubium*

AHF - creek - SEGMENT B

Grid Reference:	305700E, 5447950N
Accuracy:	within 50 metres
Recorder:	Andrew J. North
Date of Survey:	4 Nov 2009
Tall Shrubs:	*Leptospermum lanigerum*
Shrubs:	*Epacris lanuginosa*
Herbs:	*Crassula helmsii, Hydrocotyle sibthorpioides, Hypericum japonicum, Lythrum hyssopifolia, Nymphoides exigua, Ranunculus glabrifolius, Villarsia reniformis*
Graminoids:	*Juncus planifolius, Lepidosperma filiforme, Schoenus nitens*
Ferns:	*Gleichenia microphylla*
Weeds:	*Parentucellia viscosa, Plantago major*

Grassy swale on sand - SEGMENT B

Grid Reference:	305637E, 5448133N
Accuracy:	GPS (within 10 metres)
Recorder:	Andrew J. North
Date of Survey:	4 Nov 2009
Herbs:	*Craspedia aff. glauca "Tunbridge"*
Grasses:	*Themeda triandra*
Weeds:	*Potentilla anserina*

SCH - SEGMENT B

Grid Reference:	305560E, 5446530N
Accuracy:	within 50 metres
Recorder:	Andrew J. North
Date of Survey:	5 Nov 2009
Trees:	*Allocasuarina monilifera*
Tall Shrubs:	*Acacia verticillata subsp. ovoidea, Banksia marginata, Leptospermum laevigatum, Leptospermum scoparium*
Shrubs:	*Bossiaea cordigera, Epacris impressa, Leucopogon collinus, Leucopogon ericoides, Phyllota diffusa*
Low Shrubs:	*Aotus ericoides, Astroloma humifusum, Hibbertia prostrata, Hibbertia sericea var. sericea, Leucopogon virgatus*
Herbs:	*Comesperma retusum, Coronidium scorpioides, Gonocarpus tetragynus, Kennedia prostrata, Opercularia varia, Sphaerolobium sp., Thelymitra aggericola, Thelymitra exigua*
Graminoids:	*Ficinia nodosa, Hypolaena fastigiata, Lepidosperma concavum, Leptocarpus tenax, Lomandra longifolia, Patersoniafragilis*
Ferns:	*Pteridium esculentum*
Climbers:	*Cassytha pubescens, Comesperma volubile*

SMR - SEGMENT B

Grid Reference:	305720E, 5445890N
Accuracy:	within 50 metres
Recorder:	Andrew J. North
Date of Survey:	5 Nov 2009
Shrubs:	*Amperea xiphoclada var. xiphoclada, Bauera rubioides, Boronia nana var. hyssopifolia, Dillwynia glaberrima, Euryomyrtus ramosissima, Melaleuca squamea, Philotheca virgata, Pimelea linifolia subsp. linifolia, Sprengelia incarnata*
Low Shrubs:	*Acacia myrtifolia*
Herbs:	*Caesia parviflora, Caladenia carnea, Calochilus herbaceus, Gastrodia sesamoides, Poranthera microphylla, Pterostylis tasmanica, Thelymitra aristata, Thelymitra erosa, Thelymitra nuda, Thelymitra rubra, Viola hederacea*
Graminoids:	*Chordifex hookeri, Eurychorda complanata*
Grasses:	*Ehrharta distichophylla*
Ferns:	*Blechnum nudum, Blechnum wattsii, Lindsaea linearis*

SRI - Little Sundown Creek - SEGMENT B

Grid Reference:	305770E, 5445600N
Accuracy:	within 50 metres
Recorder:	Andrew J. North
Date of Survey:	5 Nov 2009
Tall Shrubs:	*Acacia mucronata subsp. mucronata, Acacia verticillata subsp. verticillata, Melaleuca ericifolia, Pomaderris apetala, Pultenaea daphnoides var. obcordata*
Shrubs:	*Leucopogon parviflorus, Persoonia juniperina, Pomaderris pilifera*
Low Shrubs:	*Styphelia adscendens*
Herbs:	*Calochilus paludosus, Calochilus platychila, Dianella tasmanica, Drosera binata, Gonocarpus micranthus subsp. micranthus, Gratiola nana, Lobelia alata, Selliera radicans*
Graminoids:	*Baumea acuta, Calorophus elongatus, Juncus procerus*
Weeds:	*Vellereophyton dealbatum*

APPENDIX 5 – EPBC PROTECTED MATTERS

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report: Coordinates

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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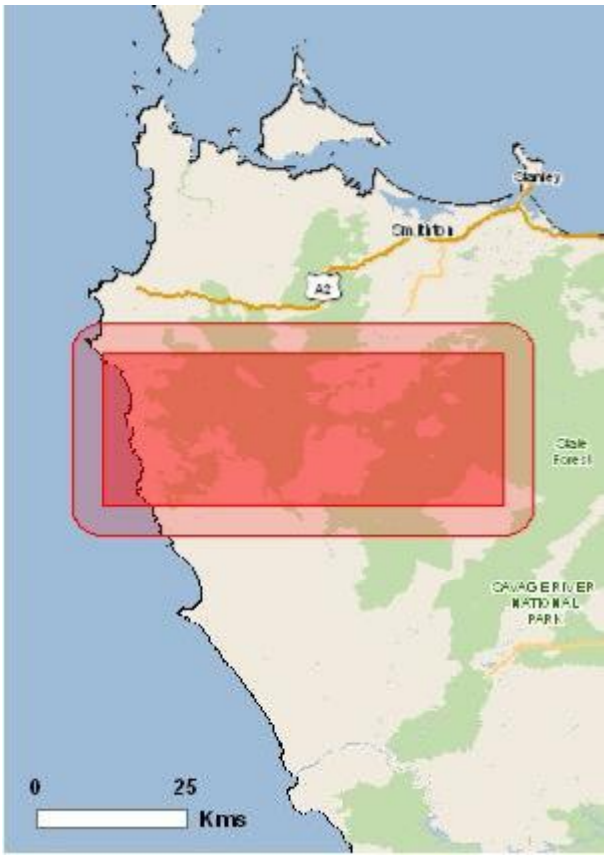

Coordinates
Buffer: 5.0Km

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Significance (Ramsar Wetlands):	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	Relevant
Threatened Ecological Communitites:	1
Threatened Species:	46
Migratory Species:	32

Other Matters Protected by the EPBC Act

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

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

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

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

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	44
Whales and Other Cetaceans:	11

Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

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

Place on the RNE:	31
State and Territory Reserves:	25
Regional Forest Agreements:	1
Invasive Species:	7
Nationally Important Wetlands:	2

Details

Matters of National Environmental Significance

National Heritage Places [Resource Information]

Name	Status
Natural	
The Tarkine TAS	Nominated place

Commonwealth Marine Areas [Resource Information]

Approval may be required for a proposed activity that is likely to have a significant impact on the environment in a Commonwealth Marine Area, when the action is outside the Commonwealth Marine Area, or the environment anywhere when the action is taken within the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

EEZ and Territorial Sea

Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Lowland Native Grasslands of Tasmania	Critically Endangered	Community likely to occur within area

Threatened Species [Resource Information]

Name	Status	Type of Presence
BIRDS		
Aquila audax fleayi		
Wedge-tailed Eagle (Tasmanian) [64435]	Endangered	Breeding likely to occur within area
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Ceyx azureus diemenensis		
Tasmanian Azure Kingfisher	Endangered	Breeding known to occur within area

[25977]		
Diomedea epomophora epomophora		
Southern Royal Albatross [25996]	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora sanfordi		
Northern Royal Albatross [82331]	Endangered	Species or species habitat may occur within area
Diomedea exulans amsterdamensis		
Amsterdam Albatross [82330]	Endangered	Species or species habitat may occur within area
Diomedea exulans exulans		
Tristan Albatross [82337]	Endangered	Foraging, feeding or related behaviour may occur within area
Diomedea exulans gibsoni		
Gibson's Albatross [82271]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Fregetta grallaria grallaria		
White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea		
Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster		
Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat known to occur within area
Pterodroma mollis		
Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis		
Fairy Tern (Australian) [82950]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche bulleri		
Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta		
Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta salvini		
Salvin's Albatross [82343]	Vulnerable	Species or species habitat may occur within area
Thalassarche chrysostoma		
Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida		
Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
Tyto novaehollandiae castanops		
Masked Owl (Tasmanian)	Vulnerable	Breeding known to occur within area

[67051]		
CRUSTACEANS		
Astacopsis gouldi		
Tasmanian Giant Freshwater Lobster, Giant Lobster, Giant Freshwater Crayfish [64415]	Vulnerable	Species or species habitat known to occur within area
FISH		
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area
FROGS		
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat likely to occur within area
INSECTS		
Oreisplanus munionga larana		
Marrawah Skipper, Alpine Sedge Skipper, Alpine Skipper [77747]	Vulnerable	Species or species habitat known to occur within area
MAMMALS		
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (Tasmanian population)		
Spotted-tail Quoll, Spot-tailed Quoll, Tiger Quoll (Tasmanian population) [75183]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Perameles gunnii gunnii		
Eastern Barred Bandicoot (Tasmania) [66651]	Vulnerable	Species or species habitat likely to occur within area
Sarcophilus harrisii		
Tasmanian Devil [299]	Endangered	Species or species habitat likely to occur within area
PLANTS		
Barbarea australis		
Native Wintercress, Riverbed Wintercress [12540]	Critically Endangered	Species or species habitat likely to occur within area
Caladenia caudata		
Tailed Spider-orchid [17067]	Vulnerable	Species or species habitat likely to occur within area
Caladenia dienema		
Windswept Spider-orchid [64858]	Endangered	Species or species habitat known to occur within area
Diuris lanceolata		
Snake Orchid [10231]	Endangered	Species or species habitat likely to occur within area

Genoplesium brachystachyum Short-spiked Midge-orchid [32155]	Endangered	Species or species habitat likely to occur within area
Hypolepis distans Scrambling Ground-fern [2148]	Endangered	Species or species habitat likely to occur within area
Prasophyllum favonium Western Leek-orchid [64949]	Critically Endangered	Species or species habitat likely to occur within area
Prasophyllum pulchellum Pretty Leek-orchid [64953]	Critically Endangered	Species or species habitat likely to occur within area
Prasophyllum secutum Northern Leek-orchid [64954]	Endangered	Species or species habitat likely to occur within area
Pterostylis rubenachii Arthur River Greenhood [64536]	Endangered	Species or species habitat likely to occur within area
Pterostylis ziegeleri Grassland Greenhood, Cape Portland Greenhood [64971]	Vulnerable	Species or species habitat may occur within area
SHARKS		
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area

Migratory Species [Resource Information]

Name	Status	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered*	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Foraging, feeding or related behaviour may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered*	Species or species habitat may occur within area
Macronectes giganteus		

Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri		
Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche chrysostoma		
Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable*	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata		
Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias		
Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Breeding likely to occur within area
Neophema chrysogaster		
Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat known to occur within area
Migratory Wetlands Species		
Ardea alba		
Great Egret, White Egret		Species or species habitat may occur within area

[59541]
Ardea ibis
Cattle Egret [59542] Species or species habitat may occur within area
Gallinago hardwickii
Latham's Snipe, Japanese Snipe [863] Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land -

Listed Marine Species [Resource Information]

Name	Status	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Catharacta skua		
Great Skua [59472]		Species or species habitat may occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered*	Species or species habitat may occur within area
Diomedea dabbenena		
Tristan Albatross [66471]	Endangered*	Foraging, feeding or related behaviour may occur within area
Diomedea epomophora (sensu stricto)		
Southern Royal Albatross [1072]	Vulnerable*	Species or species habitat may occur within area
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered*	Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Halobaena caerulea		
Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat may occur within area
Lathamus discolor		

Swift Parrot [744]	Endangered	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Breeding likely to occur within area
Neophema chrysogaster		
Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat known to occur within area
Pterodroma mollis		
Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri		
Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche chrysostoma		
Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable*	Species or species habitat may occur within area
Thinornis rubricollis rubricollis		
Hooded Plover (eastern) [66726]		Species or species habitat likely to occur within area

Fish

Heraldia nocturna		
Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis		
Bigbelly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Histiogamphelus briggsii		
Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Hypselognathus rostratus		
Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Maroubra perserrata		
Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus		
Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Notiocampus ruber		
Red Pipefish [66265]		Species or species habitat may occur within area

Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area

Whales and Other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area

Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	Status
Natural	
Arthur River Fauna Type locality TAS	Indicative Place
Bond Tier - Dismal Swamp Area TAS	Indicative Place
Duck River Forest Reserve TAS	Indicative Place
Julius River Forest Reserve and Adjacent Area TAS	Indicative Place
Leensons Road Area TAS	Indicative Place
Lerunna Road Fauna Type Locality North TAS	Indicative Place
Lerunna Road Fauna Type Locality South TAS	Indicative Place
Lovells Creek Area TAS	Indicative Place
Luncheon Hill Forest Reserve and Adjacent Area TAS	Indicative Place
Mawson Bay Area TAS	Indicative Place
Montagu Swamp Forest Reserve TAS	Indicative Place
Tarkine TAS	Indicative Place
Trowutta Plateau TAS	Indicative Place
Wes Beckett Forest Reserve TAS	Indicative Place
Arthur River Geological Monument TAS	Registered
Dismal Swamp Area TAS	Registered
Lake Chisholm Forest Reserve TAS	Registered
Norfolk Range Area TAS	Registered
Roger River State Reserve TAS	Registered
Savage River Region TAS	Registered
Sumac Rivulet Region TAS	Registered
Tarkine Wilderness Area TAS	Registered
Trowutta Caves State Reserve TAS	Registered
Indigenous	
Rebecca Creek Spongolite Quarry Complex TAS	Indicative Place
Bluff Hill Point TAS	Registered
Nelson Bay Area TAS	Registered
Sundown Point Aboriginal Site TAS	Registered
Temma Coastal Area TAS	Registered
Historic	
E.H.Fentons Salmon River Sawmill TAS	Indicative Place
Milkshake Hills Forest Reserve Area TAS	Indicative Place
Balfour Track TAS	Registered

State and Territory Reserves [Resource Information]

Nabageena, TAS
Julius River, TAS

Sumac, TAS
Temma, TAS
Whitewater Smithton, TAS
Montagu River, TAS
Wes Beckett, TAS
Luncheon Hill, TAS
Lovells Creek, TAS
Duck River, TAS
Arthur-Pieman, TAS
Balfour Track, TAS
Warra Creek, TAS
Rebecca Creek, TAS
Trowutta Caves, TAS
Montagu Swamp, TAS
Milkshake Hills, TAS
Kings Run, TAS
Sundown Point, TAS
Trowatta, TAS
Donaldson River, TAS
Trowutta, TAS
Savage River Pipeline, TAS
Roger River, TAS
Lake Chisholm, TAS

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.
Tasmania RFA, Tasmania

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Plants		
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtiji		

Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]	Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]	Species or species habitat likely to occur within area

Nationally Important Wetlands **[Resource Information]**

Unnamed Wetland, TAS
Lake Chisholm, TAS

Caveat

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

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

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

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

Only selected species covered by the following provisions of the EPBC Act have been mapped:
- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:
- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:
- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

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

Coordinates

-41.02843 144.6335,-41.02843 145.23788,-41.25685 145.23788,-41.25685 144.6335,-41.02843 144.6335

Acknowledgements

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

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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APPENDIX 6 – VERTEBRATE CARNIVORE ASSESSMENT FORUM

Event: Tarkine Forest Drive - Carnivore Assessment Forum

Date/time: 22 July 2009, 0900-1230

Attendees

- Randy Rose (retired academic from the School of Zoology at the University of Tasmania)
- Barrie Wells (Veterinarian)
- Chloe Lucas (Road kill Network)
- Clare Hawkins (Threatened Species Zoologist, DPIPWE)
- Nick Mooney (Section Head, Wildlife Monitoring and Management, DPIPWE)
- David Pemberton (Threatened Species Section, DPIPWE)
- Andrew Sharman (Program Manager, Devil Disease Project Team, DPIPWE)
- Rodrigo Hamede (PhD student, "Contact Networks in Wild Tasmanian Devils: Social Behaviour & Devil Facial Tumour Disease")
- Shannon Troy (PhD student "Landscape Ecology of the Tasmanian Spotted-Tailed Quoll")
- Phil Cantillon (Tarkine Forest Drive Project Director, DIER)
- Andrew North (Ecologist, North Barker, for P&S)
- Karen Ziegler (Ecologist, North Barker, for P&S))
- Menna Jones (Researcher, Devil Disease Project Team)
- Andrew Harvey (Senior Natural Values Assessment Officer, Development and Conservation Assessment Section, DPIPWE)
- Gar Foong (Tarkine Forest Drive Project Manager, DIER)
- Raymond Brereton (Senior Ecologist, Hydro Consulting, for P&S)
- Gavan Banks - Senior Project Engineer - Roads (Pitt & Sherry)
- Brian Williams - Principal Engineer Road Design (Pitt & Sherry)

Apologies: Dion Lester (Pitt & Sherry)

Facilitator: Timothy Phillips (Resonance Sustainability Services, for P&S)

NB: The following are summary notes of key discussion points from the Forum. They are not intended to be a verbatim record of discussions. They have been prepared based on the notes taken by the facilitator and members of the fauna/flora assessment project team. Furthermore, the views expressed in these notes are not necessarily those of the Tasmanian Government.

Background and welcome

Group was welcomed by the facilitator, who also explained his role, i.e. keeping group on track, following agenda, ensuring all attendees were given opportunity to speak etc.

It was noted that this is a controversial project with many divergent views and that attendance at this forum does not necessarily imply support for the project.

The forum objectives were presented and discussed.

- Provide attendees a briefing on the status of the Tarkine Forest Drive assessment project, with particular reference to the assessment of impacts on vertebrate carnivores
- Provide update on preliminary field work undertaken by North Barker within study area
- Identify and discuss information/ data requirements and sources for the assessment
- Identify and discuss potential issues and impacts regarding road kill - priority areas, methodology, designs and treatments
- Identify and discuss potential issues and impacts regarding devil facial tumour disease

The program was revisited. There were no major questions or comments regarding the workshop objectives or program.

Introductions

All attendees were asked to introduce themselves and identify a specific issue they would like discussed at the forum. Issues raised included:

- Additional information about the project
- Role of the Tasmanian Devil program in this process and identify the existing relevant information as well as information gaps
- How animals use the landscape and roads
- The need for a facts and evidence based assessment
- Impact of vehicle speed
- Increase understanding of the traffic information, both existing and proposed
- Fauna assessment
- Just here to listen and learn
- Identify the potential increased risk regarding Devil Facial Tumour Disease (DFTD)
- What is the existing road network?
- Impact of road on quoll
- What is unique or different regarding NW devils
- Strong informative process
- Conflict between user expectations and mitigation
- DFTD
- Traffic information and road kill
- Mitigation strategies
- Transferable outcomes, i.e. improved road kill mitigation across road network

Project overview – Phil Cantillon (DIER)

Road will be built in three stages

- Stage 1. West Coast
- Stage 2. Middle section

- Stage 3. Wynyard section

The West Coast section of the road will have a 6 m pavement width with a 0.5 m verge on either side of the road.

The Wynyard section will have a 4 m pavement width with a 0.75 m verge on either side of the road.

Of the $23 million budget for the road, $2.5 million is allocated to tourism infrastructure.

An understanding of the existing road use is critical to the assessment, including:

- Amount of use
- Nature of the use (e.g. forestry contractors, mining contractors, tourists)

Route and design as described is just a starting point, there is the possibility that it may change as new information comes in.

It is intended to seal the entire route.

Q. Why the Southern Spur?

A. There is access to a trig station with significant views, as well as a starting point for a walk into Tarkine Falls.

Q. What are the actual traffic volumes?

A. We are gathering that information and have a report in preparation.

Andy North – The current status of the assessment process

The three handouts (maps) were mentioned and discussed (see attached).

North Barker are using TASVEG to describe the habitats within the study area along with Forestry Tasmanian PI typing, other API and ground truthing.

Land use within the study area will also be described, existing and potential.

The study area covers 500 m either side of the road.

The difficulty of obtaining abundance data on devils and quolls was then discussed. In one study, 2 months of trapping had captured 15 spotted-tailed quolls and 137 Tasmanian devils, another study had trapped 22 spotted-tailed quolls over a year.

It was noted that quolls inhabit a range of habitats and that the highest densities had been found in coastal scrub.

It was suggested that walking the road verges to look for signs (scats, tracks) of devils and quolls would give some indication of presence/absence, which may help to identify areas of activity along the road.

Other sources of data included the RFA report "*Preliminary assessment of distribution and habitat associations of the spotted-tailed quoll and eastern quoll in Tasmania*" Jones, M.E., and Rose R. (1997).

Road kill –facilitated discussion

There was discussion about the value of having traffic data prior to construction. The projection for traffic volumes after construction, when all components of the road have been completed including tourist infrastructure, is in the order of 100,000 vehicles per year. It was noted that this was an estimate at the higher end.

It was noted that it is not only the volume of traffic that is important but also the type of traffic and it was necessary to measure the different types of traffic and when the use the road (e.g. forestry workers compared with tourist traffic).

Traffic variables to measure before and after construction of the road:

- type of traffic (e.g. forestry workers, tourists, locals, mining workers)
- time of day of vehicle movements
- traffic volume
- vehicle speed

The main risk periods for road kill are dawn and dusk. The main risk factors for road kill are where the traffic is local and commercial as evidenced by the Cradle Mountain road upgrade (Jones, M.E. 2000. Road upgrade, road mortality and remedial measures: impacts on a population of eastern quolls and Tasmanian devils. *Wildlife Research* 27:289-296) and the Arthur River road upgrade (Landscape impressions. 2008. *Assessment Report: Arthur River Road EPBC Decision 2003/90.* Report to Circular Head Council).

The "Warren Report" that DIER has had prepared has some data on current traffic use of roads within the study area.

Monitoring of road kill impacts post upgrade / construction of the Tarkine Forest Drive will be required to mitigate potential road kill hotspots.

Q.Is this the final route?

A. More or less +/- 150 metres (depending on site specific conditions)

Discussion on EPBC Assessment

The EPBC assessment of the proposed action will be about the change in use of the existing roads and new sections and the impact of the consequential impacts resulting from the change in use, i.e. the change in the risk profile of the road resulting from the:

- the increase in traffic volumes
- the increase in road use from other activities (e.g. forestry and mining)
- increase in traffic speed

The assessment will require a description of the baseline traffic profile and a description of the change to the projected traffic profile following the construction of the road.

Road kill continued

A risk profile of factors contributing to road kill are identified in Hobday, A. J. and Minstrell, M.L. 2008. Distribution and abundance of road kill on Tasmanian highways: human management options. *Wildlife Research* 35: 712-716.

M. Jones (unpublished data from a study on Class C roads on the east coast of Tasmania) has identified predictors of road kill:

visibility (poor straight line visibility resulted in increased road kill)

roadside barriers (e.g. fences and cuttings); (the presence of roadside barriers which prevented animals from getting off the road increased road kill)

escape routes (runways);

increased traffic speed

A combination of features can increase the risk of road kill. It was noted that a higher incidence of road kill was observed in the inside of corners especially when associated with grassy habitats that attract herbivores.

Devil Facial Tumour Disease (DFTD)

Extent of DFTD

The western most occurrence of DFTD is at Upper Natone and Surrey Hills, however this is not a definitive boundary and this data is 12 months old.

The Program will be undertaking a new round of monitoring on the "front" in September and October.

The identification of DFTD relies on gross pathology. Disease front monitoring is based on clinical testing. There is no pre-clinical test available yet. The development of a pre-clinical test is currently underway and trials are happening however, it is unlikely to be available until September or October at the earliest if it proves to be viable.

The disease front is not a straight line and "fingers" of the disease can occur following particular landscape features, for example as it moves up valleys. The disease could be further west of the current known localities.

On average, the current rate of DFTD spread is estimated to be 7 km/year. Although, there have been instances of spread at higher rates in some local areas of up to 50 km/year.

There have been no local extinctions as a result of the disease. However, in the north east the devil population is at a very low level. It has declined significantly and the age structure of the population has changed. There are no animals over two years old. It is thought that in the northeast the disease has been 100% fatal. There is evidence that animals are breeding much earlier due to a combination of reasons including greater availability of food, denning habitat and lack of sexual suppression of young females that normally would have been living with their mothers for longer. When a population is very low stochastic events may impact severely on remaining animals.

It is inevitable that the disease will get into the north west, it is just a matter of when.

DFTD and Road kill

Road kill then becomes a much greater threat because of declining population levels. Road kill could have a significant impact in the north west after the disease arrives.

If there is road kill monitoring it is essential that it is related to local devil or quoll population densities to assess the impact on these populations. The background populations may be slowly decreasing while road kill remains at static levels for a period.

The paper by "McCallum, H., D. M. Tompkins, M. Jones, S. Lachish, S. Marvanek, B. Lazenby, G. Hocking, J. Wiersma, and C. Hawkins. (2007) Distribution and impacts of Tasmanian devil facial tumor disease. *EcoHealth* 4(3): 318-325" has the most up to date published information on the distribution and impact of the disease.

Different genetic provenance

There is evidence that the north west devil population is a different genetic provenance. Therefore DFTD may have a different impact on this population, mortality rates may be lower.

The pinch point for the genetic separation is at Mawbanna. The devil genetic provenance starts to change at about Devonport. There is a grey zone in the genetic provenance from Devonport to Stanley.

General discussion

The rate of the spread of DFTD will affect the nature of the response from the Devil Task Force. If there is an opportunity for DFTD to leap frog into new areas this would have a major impact on the Devil Disease Program.

Need a landscape context for the road as adjoining landuse could also impact devil movement. Therefore it is necessary to know forestry three and ten year plans.

There was a discussion about the use of roads by devils. Devils are forest and woodland animals that do not necessarily use roads to move around the landscape. They use runways in forests.

A landscape with many roads does not necessarily increase the home range of devils. There is published data on devil movements.

An increase in road killed herbivores does not necessarily lead to an increase in devil road kill

Quolls and road kill

Spotted-tailed quolls will sometimes use roads but to a lesser degree. Quolls prefer vegetation with an implicate structure (e.g. wet forest, but also occur in coastal scrub).

There is a predictive model for spotted-tailed quoll occurrence across Tasmania in the RFA report "*Preliminary assessment of distribution and habitat associations of the spotted-tailed quoll and eastern quoll in Tasmania*" Jones, M.E., and Rose R. (1997). However, further work is needed to define high quality habitat for quolls and devils.

There is little information on how quolls use the landscape (information gap). Questions include:

- How do they move in the landscape?
- Do they use roads?
- Do they use forests?
- Do they use coastal scrubs?

General discussion

The change in the rate of spread of DFTD is related to home range. The Devil Program is investigating the fencing of a disease free population in north west as a secure population. The implementation of this project requires information on how devils use the landscape. A study is planned for the north west at Woolnorth.

The new section of road at the eastern end may promote movement across a possible genetic barrier comprised of the rainforest in this area. Though this doesn't seems likely for the high frequency of devil scats seems on section 9 between the Lyons River and Wynsmith Track.

Is the opening up of the new section of road creating access to a landscape that would normally be a barrier/potential barrier to devils and will that change the rate spread of DFTD and allow access to a population that is not yet exposed to the disease.

Mitigation of movement of devils along the new section of road - can the road be fenced to keep devils out?

Road kill revisited

Need information on traffic and the potential risk of road kill to design mitigation measures. Some mitigation features e.g. straighter roads, decrease the value of road for tourist traffic.

The road should be designed for a traffic speed of 60 kmh or less to reduce the incidence of road kill.

Road ecology is a large field and there is a range of available information on mitigation measures to reduce road kill out there.

Adaptive management will come out of monitoring post construction.

Removal of road kill herbivores on the Tasman Peninsula has shown to decrease devil road kill.

Devil dens

Maternity dens are an important resource for devils because they may only have one breeding attempt in a diseased population. Therefore any impacts on maternity dens from road construction and operation should be avoided. The location of dens is related to suitable denning habitat including rock outcrops, rock shelters, fallen large logs, and large tree root bowls.

A den survey is recommended for the new road construction. The survey area should be 30-50 m?? either side of the road. (There did not appear to be consensus on the survey area and we may need to go back to the Threatened Species Section and the Development and Conservation Assessment Section of DPIPWE for advice).

Roadside walks are recommended to identify hotspots for devil and quoll activity.

General discussion

The impacts on devil and quoll populations of road kill can/could lead to local extinction in some circumstances where the population is already impacted by road kill.

A study on the Freycinet Peninsula (Jones unpublished data) found that in a 12 month period 20% of the devil population was removed due to road kill. The removal of road kill herbivores from the road reduced the incidence of road kill.

The Freycinet devil population was able to sustain this 20% loss without significant impact on the overall population. However, in the presence of DFTD this loss is unlikely to be sustainable.

It was recommended that a snapshot of the current incidence of road kill is obtained based on the current levels of vehicle use. This information may be available from DIER and Forestry Tasmania.

It was suggested that overall best practice would be to mitigate the level of road kill across the landscape within the study area by addressing the issue of traffic movements at night. This approach would require the involvement of Forestry Tasmania and other road users.

This landscape scale approach to mitigating road kill may result in lowering the incidence of road kill below current levels. This approach is unlikely to be considered an offset for the action in the EPBC assessment.

Other threatened species within the study area that need to be addressed in the impact assessment included the grey goshawk and the wedge-tailed eagle.

The induction of contractors with regard to road kill should be included in the environmental management plans for the construction and operation of the road. Construction /Maintenance of the road could stipulate travel in daylight hours.

The road design should consider the road design speed, visibility and the different classes of use. The road should be designed for low speeds, however, there is limited information on designing low speed roads as existing standards and guidelines focus on performance issues associated with the road, and road safety.

There is some evidence that road pavement colour can influence the incidence of road kill. Pale road surfaces may reduce road kill because animals are more visible on a lighter surface compared to a dark surface where they tend to blend in particularly at night.

Conclusion

The road designers, scientific team and project sponsors were asked for some concluding comments:

- Speed is obviously an issue, as well as the types of use
- There are limited design guidelines for lower speed roads, a real gap
- Impact of colour will be looked at further
- We need to know who will be driving this at night.

Attendees were advised that notes of the forum would be written up and distributed in the next few weeks. Members of the assessment team are likely to contact attendees for clarifications and/or additional information.

Attendees were thanked for coming along and invited to stay for a light lunch.

END NOTES

APPENDIX 7 – PREDICTED FORESTRY OPERATIONS [174]

Projected wood volume flow in South Arthur Forests 2009-2023 and consequential vehicle movements

Harvest zone and principal cart network roads	Tarkine Drive sections used	Average tonnes per year (x1000 tonnes)	Total loads/year (ave.= 35t/load)	Average loads/day	Truck movements /day	Contractor & misc vehicle movements /day	FT mgt, misc & service movements /day
Holder & Tayetea Rds (crossing Tayetea Bridge)	Parts of 17 & 18	15.21	435	1.7	3.4	1.7	0.85
Mt Berth & Balfour blocks via Sumac Road (crossing Kannunah)	22 & existing sealed sections of Sumac Rd	12.24	350	1.4	2.8	1.4	0.7
Wuthering Heights and Rebecca via Blackwater Road (crossing Kannunah) bridge)	23, 24 & existing sealed sections of Blackwater Rd	22.31	637	2.6	5.2	2.6	1.3
Totals		**49.76**	**1422**	**5.7**	**11.4**	**5.7**	**2.9**

Notes:

- Activity/movements based on operations on 250 days/year
- Contractor movements are projected to be 50% of truck movements (generally one crew cab vehicle only)
- FT supervisors,mgt & service movements are projected to be 25% of truck movements (generally one crew cab vehicle only)
- Timber cart is directed to nearest bridge over the Arthur River
- Forestry Tasmania controls routes that log trucks MUST use.
- Log cartage, contractor and other vehicle movements generally occur in daylight hours, particularly in summer.
- The sealing of forest roads will not significantly increase traffic speeds.
- FT will endeavour to schedule cart routes and harvest operations to minimise interaction with tourist traffic.
- Relatively low carts (average of 5.7 loads per day) indicate tourists will be unlikely to encounter log trucks

[174] Supplied by Forestry Tasmania, by email form Mike Peterson 24 08 2009

APPENDIX 8 – ROAD KILL MONITORING PLAN

MEMO

To: Various

From: Dion Lester

Date: 29 September 2009

RE: Tarkine Forest Drive Project - Road kill

The Tasmanian Government has identified an opportunity to improve tourism access to the Northwest of Tasmania through the development of a tourist road. If completed, the project will provide a sealed tourism road totalling some 134.0 km and will take visitors from the Wynyard area, through forest, accessing the Tarkine's attractions and connecting with the end of the Great Nature Trail at Arthur River, to complete a tourist loop through to Smithton and Stanley.

An extensive program of environmental investigations is underway as part of the design development for the Tarkine Road, including the following:

- A Botanical Survey and Fauna Habitat Assessment has been undertaken for the majority of the route, when complete the field survey will provide a description of the flora and fauna species and vegetation communities that are present along the route and any contextual information of any significant values identified within the study area. This will establish whether any threatened flora and fauna species, habitats or significant vegetation communities are present. The survey will also determine the distribution of Phytophthora and any weeds.

In addition to the typical Botanical Survey and Fauna Habitat Assessment, some further more specific investigations are underway.

Northwest Tasmania is considered to support relatively high densities of devils that are not infected by the Devil Facial Tumour Disease (DFTD). As a result additional studies are being implemented to investigate the potential impacts on vertebrate carnivores. The aims of the studies are to assess the current rate of road kill and investigate the possible impacts of the project on the potential spread of DFTD.

1) Road kill

This study will consider the current rate of road kill in the area and will review previous studies on the relationship between traffic and road kill elsewhere in Tasmania. A number of scenarios will be investigated to determine the potential scale of the impact from road kill.

2) Devil Facial Tumour Disease (DFTD)

Investigate the possible impacts of the project on the potential spread of DFTD, including an assessment of whether the construction of the road:

- Is likely to increase the rate and distance of movement of devils;
- Will facilitate the migration of animals from areas of infection to areas currently free of the disease

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- Is likely to significantly change existing (if any) natural barriers to devil movement in northwest Tasmania.

A Carnivore Assessment Forum was held in late July. This forum consisted of scientists and professionals with recent and relevant expertise and experience in road kill, vertebrate carnivores and DFTD, a veterinarian, and State and Federal Government regulators.

Two of the key recommendations emerging from this forum were for the project team to gain an understanding of both the current incidence of road kill and traffic data prior to the detailed environmental assessment and construction of the route. This will provide some baseline information of current road kill rates to compare against the future impacts. Any observable increases that reach a predetermined threshold, could be used to trigger adaptive management responses to minimise road kill.

Accordingly the following work is proposed:

1. Road kill Monitoring

- The proposed route of the Tarkine Forest Drive between Sections 21-27. Sumac Spur 4 to Arthur River township - following Sumac Rd, Blackwater Rd, Rebecca Rd, Temma Rd, will be monitored once per week for 12 months beginning in October 2009
- The proposed route between Couta Rocks and Arthur River will be monitored daily because this section is of greatest concern
- Road kill monitoring will be done daily during the period that the traffic counters are installed in October 2009, January and April 2010
- The data that will be recorded is the GPS location of the road kill, the species, evidence of scavenging will be also be recorded. The observer where possible will distinguish between feeding by devils, quolls or crows
- After the road kill has been initially recorded, the animals will not to be moved. This will ensure the monitoring program does not skew the road kill data, e.g. if the road kill is removed it may prevent the target species from scavenging road kill and therefore prevent the typical road kill of these species during the pre-construction period.

2. Headlight survey

- The aim of the headlight survey is to provide abundance data on animals to compare with the road kill observations.
- Surveys will be undertaken at dusk daily.
- The headlight survey will be done over a period of three weeks at three different times during the year. The survey will be done at the same time as the traffic counts (October 2009, January and April 2010) to assist with monitoring and basic maintenance of counters.
- The data that will be recorded is the GPS location, time of sighting and species.
- The method of the headlight survey is:
  - The survey will be done at a speed of between 50-60 km/h,
  - Commencing at last light, approx 30 mins after sunset,

- Two people will be required to do the headlight surveys, one to drive and one to record the observations.

The location / study area for both the road kill monitoring and headlight survey will encompasses the "busier" sections of the proposed route where existing impacts are likely to be measurable, e.g. from the Sumac Road (Section 21 of the proposed route) to Arthur River township (Section 27). There are also two reference sections where no modifications to traffic conditions are proposed. These are approx 15km along Roger River Road from Roger River to Kanunnah Bridge and 15km south from Sumac Spur 4 along Sumac Road.

3. Traffic counts

- Most of the existing road is very lightly trafficked and has no reliable traffic data.
- There is a requirement to understand the existing traffic flows and speed to provide baseline data for a number of the assessments.
- Eight sites for traffic counts have been identified and three of the sites are on gravel roads.
- Because of the low and highly variable traffic flows the traffic counters will be in place for three weeks.
- Traffic counts will occur in October 2009, January and April 2010 because of the seasonal nature of recreational uses on the northern part of the west coast and the variation in timber harvesting.

APPENDIX 9 – NORTHWEST HEATH (*EPACRIS CURTISIAE*) SURVEY

northbarker
ECOSYSTEM SERVICES

Tarkine Forest Drive

North West Tasmania

Epacris curtisiae Survey

4 October 2011
PAS051

Andrew North anorth@northbarker.com.au **Philip Barker** pbarker@northbarker.com.au
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Introduction

The Flora and Fauna Impact assessment of the Tarkine Drive project[175] identified a list of threatened flora that potentially could occur within the immediate vicinity of the road.

One of these is the north west heath - *Epacris curtisiae*, listed as rare on the Tasmanian *Threatened Species Protection Act 1995*. This is a Tasmanian endemic which occurs in heathland and moorland in a localised area mainly confined to the the Dempster Plains, Frankland River catchment and western slopes of the Norfolk Range between the Arthur and Pieman Rivers. The Rebecca Road section of Tarkine Forest Drive bisects the range. There are numerous records on the Natural Values Atlas along the road between the Norfolk Rd junction and Nelson Bay River.

Survey

The survey[176] was undertaken in September 2009 along the Rebecca Road between the Frankland River bridge and Temma Rd to map and define the populations of *Epacris curtisiae*. Additional opportunistic observations were also collated during the course of other work in November 2009. The main survey was timed to coincide with peak flowering of *Epacris curtisiae* and to take place before other white flowering shrubs had commenced full flowering.

The survey involved targeted inspection of all records on Natural Values Atlas. A reconnaissance of the road for the remainder of the study area was undertaken by a slow drive past (<50km /hr). Where plants or likely habitat were identified, on ground survey was undertaken to determine the extent and size of the population. Hand held GPS was used to plot locations and site data collected to determine the population scale and to identify evidence of *Phytophthora cinnamomi*.

Where large or extensive populations were encountered survey was limited to mapping the boundary close to the road. The full extent of distribution away from the road was not able to be determined in all instances.

Results

Figure 1 presents the mapped extent of *Epacris curtisiae* plus records on the Natural Values Atlas that could not be verified. Some of these are of low accuracy suggesting that additional mapping occurs.

Most previous recorded populations could be verified, although two were not. Minor extension range was recorded along the Rebecca Rd with an outlier 5km west of the core population which is associated with the moorland east of Nelson Bay River.

The size of some patches was found to be large and estimated to number 10s of thousands with others much smaller. Populations extend to the road verge in some places, being located immediately outside the very deep table drains.

Phytophthora cinnamomi symptoms were evident at a number of sites. This evidence mainly took the form of dying *Sprengelia incarnata* plants, at one site there was also dying *Banksia marginata*. At two sites *Epacris curtisiae* plants showed symptomatic evidence of *Phytophthora cinnamomi*.

[175] North Barker Ecosystem Services, Tarkine Drive Vegetation Survey And Fauna Habitat Assessment 15 October 2009

[176] Survey and Photos were undertaken by Anthea Fergusson of Natural Values Consulting as a sub consultancy to NBES

Epacris curtisiae plant A. Fergusson

Epacris curtisiae flower A. Fergusson

Habitat of *E. curtisiae.* Photo A Fergusson

E. curtisiae plant part healthy, part dying. Photo: A. Fergusson

Impacts

The risk of impacts to *Epacris curtisiae* is dependent on the extent of works outside the existing road alignment for Segments C and D. The road is well formed and mainly requires sealing and, with vegetation clearance estimated to not exceed 2m[177].
Some minor impacts are anticipated. Given the extent and size of the population these are considered to be insignificant.

It is understood that the area of hard standing located at the western end of the seal on Segment E may be preferred site for parking machinery and storing materials. The surrounding vegetation supports a population of *Epacris curtisiae*. This was partially impacted by a management burn undertaken in Spring 2009.

Evidence of *Phytophthora cinnamomi* was observed at some of the locations. The heathlands through this area include several susceptible species and localised deaths of banksia and other heath species were observed. The use of machinery undertaking works through this area brings with it a heightened risk of spreading and relocating current infestation of *Phytophthora cinnamomi*.

Conclusion

Populations of *Epacris curtisiae* are known to occur in close proximity to the Rebecca Road. With appropriate management and controls impacts can be limited to some plants of which core populations will be unaffected but small numbers of outlying plants will be impacted. It should be noted that many of the plants impacted would be similarly impacted by periodic drain clearance works.

The long term effect of having the road being sealed will reduce the risk to *Epacris curtisiae* growing close to the road by eliminating the impacts of regular gravelling and grading and associated run off.

The plant pathogen management plan should be prepared that specifically addressed impact to this species.

A threatened species permit under the Tasmanian *Threatened Species Protection Act* will be required once detailed design of works are developed.

[177] Advice from B Williams Pitt and Sherry

APPENDIX 10 – FROG SURVEY COASTAL SECTION

Green and Gold Bell frog Survey Arthur River to Couta rocks

Wildspot Consulting Pty Ltd was commissioned by Pitt and Sherry to conduct a survey of Green and Gold Bell frog *Litoria raniforms* on the Northwest coast region of Tasmania from Arthur River to Couta rocks. The purpose of the survey was to try and ascertain the presence of the Green and Gold Bell frog in the wetlands near the proposed road development. A small area of habitat had been previously identified by North Barker Consultants as being potentially suitable for the Green and Gold Bell frog.

All potential habitats were surveyed for *L. raniformis* between January 7th 2010, and March 12th 2010.

The previously identified wetlands, though having potential for the presence of the species are of poor quality and are all ephemeral water bodies with most drying up in late spring which inhibits the breeding cycle of this frog species. In the Northwest where this species occurs in ephemeral swamps they are most active in early October and this is considered the optimum time for locating the species as they are more vocal at this time. This is especially important in ephemeral habitat. However, successful surveys can sometimes be undertaken once an area has dried up. If there are frogs in the area they can usually be found basking on warm sunny days in areas of bare ground amongst the wetland vegetation. This method of surveying is usually particularly useful for locating juveniles from the current breeding season.

The suitable habitat identified previously by North Barker along the proposed road development was visited on eight occasions. There were six visits during the day when the conditions were considered ideal and twice at night. No *L. raniformis* were observed or heard in any of the areas surveyed and there have been no records of this species occurring in the past decade.

A series of other potentially suitable sites were identified from aerial images of the area. Sites were chosen for either being near the proposed road development or on the downstream side of the development. Fourteen locations were identified (Figure 1). This included the Rebecca Lagoon (site 6) which although well south of the development, and out of the disturbance zone, was considered a good example of permanent water which would be most likely contain *L. raniformis* if they existed in the area. Several visits to the lagoon failed to show any evidence of the species. Most of the other 13 sites were dry and no *L. raniformis* could be found.

The species has declined considerably over its former range in the Northwest and it seems possible they no longer occur in this area; however, *L. raniformis* was rediscovered in some areas in the far Northwest after an apparent absence of fifteen years. This highlights the importance of continued vigilance when working in areas which have potential for this species.

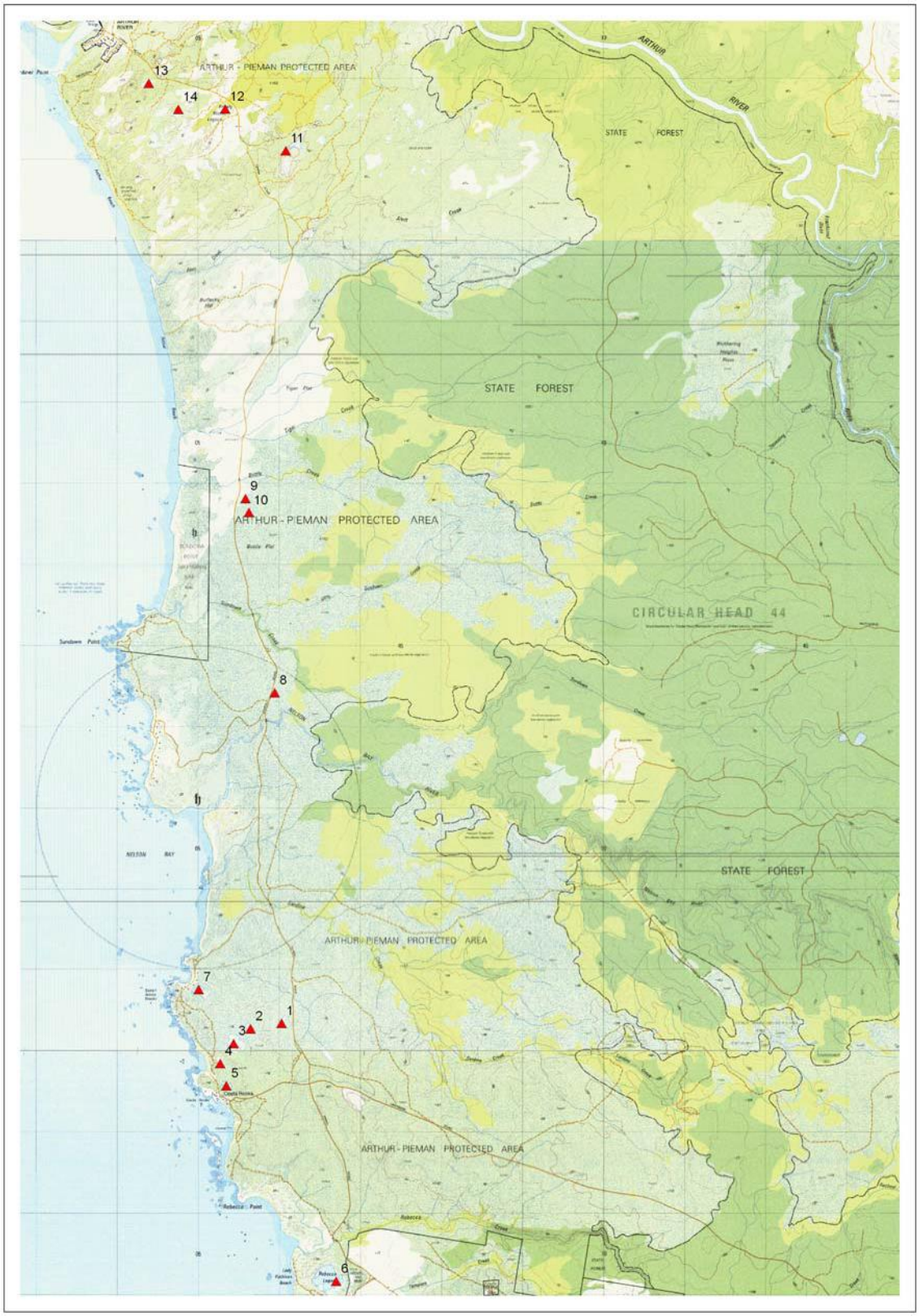

Figure 1. Map showing the 14 locations checked for L. raniformis

Rebecca Lagoon

The only permanent water in the study area

Coastal lagoon at Couta Rocks

Ephemeral lagoons identical in composition to this are known to contain breeding populations of L.raniformis in the far northwest; however none were found here.

Coastal lagoon at Sarah Anne Rocks

Note: Photo was taken in late March after rainfall. This lagoon had been dry most of the summer