

Public Environment Report
Tarkine Forest Drive
Tasmania

Reference: EPBC 2011/6210



Tasmania
Explore the possibilities

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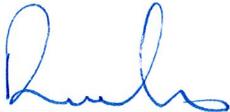
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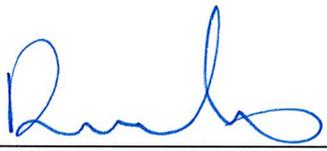
Date: 13 December 2012


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Date: 13 December 2012

Reviewed by: 
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Date: 13 December 2012

Authorised by: 
Dion Lester

Date: 13 December 2012

Report Revision History					
Rev No.	Description	Prepared by	Reviewed by	Authorised by	Date
A	Draft Public Environment Report Tarkine Forest Drive Tasmania Reference: EPBC 2011/6210	D. Lester C. Livesey A. North	I. Woodward	D. Lester	6/06/2012
B	Draft Public Environment Report Tarkine Forest Drive Tasmania Reference: EPBC 2011/6210	D. Lester C. Livesey A. North	I. Woodward	D. Lester	7/09/2012

Executive Summary

The development of the Tarkine Forest Drive on Tasmania's rugged North West Coast is an important infrastructure project for all Tasmanians and symbolises both the past and the future of this beautiful area that has captured the hearts of generations of miners, fishermen and foresters who have built a living from its natural resources.

Environmental imperatives, changing industries and the strong growth in eco-tourism have meant that a new future is emerging, and there is no greater symbol of that than the upgrade of this road and its tourism facilities.

The Tarkine Forest Drive has been identified in a number of previous studies and policy documents as an important strategic development. The project almost exclusively involves upgrade of existing infrastructure and will enable increased access and appreciation of the many attributes of the Tarkine Region without impacting detrimentally on these attributes.

The roads developed over many years by Forestry Tasmania will be improved so that they can support traditional activities but also be the catalyst for the new eco-tourism industries that are beginning to emerge. Tourist attractions, once only seen by knowledgeable locals or tourists prepared to head off the beaten track, will be accessible to everyone with just a normal suburban car.

The replacement of three important bridges along the route will once again connect communities and ensure that help will be on hand if ever the area is threatened by fire.

DIER believes that this road offers opportunities for bringing together the best minds to showcase innovative solutions as we all try to protect Tasmania's precious flora and fauna. Ultimately, these solutions will have more widespread benefits.

DIER is intent on improving the existing road in an iconic area and believes that its development will provide long term benefits to the north west community and valuable lessons on how construction can be managed sensitively.

This document contains detailed background information on many matters. For an outline of the EPBC Act listed threatened flora and fauna species previously recorded within a 5 km radius or considered to potentially occur refer to Table 4.3 and 4.4 respectively. For a description of the Matters potentially impacted by the proposed works refer to Tables 5.2 (flora) and 5.3 (fauna), and for an outline of the proposed safeguards refer to Tables 6.1 (construction phase) and 6.2 (operational phase).

For the Operational Roadkill Mitigation adaptive management framework please refer to Figure 6.12.

1. General information

For convenience, each major section of this document is prefaced in blue font with the relevant extract of the guideline requirements. A full copy of the final guidelines can be found at the end of Volume 2 of this PER, in Appendix E.

This must provide the background and context of the action including:

- *The title of the action*
- *The full name and postal address of the designated Proponent*
- *A clear outline of the objective of the action*
- *The location of the action (including maps of the locations of all supporting infrastructure such as quarries, access tracks and temporary storage facilities)*
- *The background to the development of the action*
- *How the action relates to any other actions (of which the Proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action, including current and anticipated linking road works or transport routes)*
- *The current status of the action*
- *The consequences of not proceeding with the action.*

1.1 Title of the action

The title of the proposed action is the **Tarkine Forest Drive**.

The Tarkine Forest Drive referral was received by the Department of Sustainability, Environment, Water, Populations and Communities on the 25th November 2011 and formally entered into their system (being allocated the reference number 2011/6210) on the 1st December 2011.

1.2 Proponent

The project proponent is:

Department of Infrastructure, Energy and Resources (DIER)
(Contact: Andrew Fowler, Senior Project Manager)
GPO Box 936
Hobart, TAS 7001

1.3 Objective

The fundamental objective of this project is to improved accessibility to the region for the general public and tourists. In fulfilling this objective, DIER intend to:

- Seal the existing Circular Head Council and DIER roads to provide three choices of self drive routes through the Tarkine
- Widen the road to cater for buses within the Arthur Pieman Conservation Area and semi-trailer tucks where the road abuts State Forest
- Provide a road which will have a good safety performance
- Upgrade tourist facilities, to the extent that it is possible within the project budget, at Kanunnah Bridge, Sumac Lookout Car Park, Julius River Reserve and Lake Chisholm.

1.4 Location

The location of the Tarkine Forest Drive is shown in Figure 1.1. The nearest townships are Arthur River in the west and Trowatta in the east. There are no major towns in the immediate vicinity. The nearest major towns are Smithton, approximately 30 km to the north of the area, and Wynyard, approximately 45 km to the northeast.



Figure 1.1 - Tarkine Forest Drive - project location

1.5 Background to the development of the proposed action

In 2009 the Tasmanian Government identified an opportunity to improve tourism access to the Tarkine area through the development of a sealed 131 km tourist road connecting Myalla Road with the Arthur River Township. That project, known as the Tarkine Road Project, was seeking to develop the tourist potential of the North West region by creating a self-drive experience for visitors and by facilitating the subsequent development of commercial tourist ventures. The Tarkine Road Project had a budget allocation of \$23 M.

An extensive series of background surveys and monitoring programs had been undertaken for that project, commensurate with the environmental and heritage values present. The project was referred to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and was deemed to be a controlled action (EPBC 2009/5169) requiring assessment through an Environmental Impact Statement.

In late 2010 the then Premier, the Hon David Bartlett MP, announced a \$6.7 M investment in infrastructure in the North West, to be sourced from the original \$23 M allocated for the Tarkine Road Project. This budget reallocation made it necessary to re-scope the proposal and the original Tarkine Road Project referral was withdrawn.

In early December 2010, the then Minister for Infrastructure, the Hon Lara Giddings MP, announced that Cabinet had approved a revised project. This decision was based on strong support from key stakeholders, such as the Cradle Coast Authority Tarkine Discussion Group, for a revised Project. The revised project is the Tarkine Forest Drive, the subject of this report.

This budget commitment was consolidated in the 2011/12 State Budget with the Project identified as a key project and funding allocated for the period 2011/12 to 2013/14.

A new referral for the Tarkine Forest Drive Project was submitted on 18 November 2011. On 3 January 2012, the Minister determined that the proposal was a controlled action (EPBC 2011/6210) and that the level of assessment was to be a Public Environment Report (PER).

The Minister issued final guidelines for the PER in March 2012. This PER has been prepared in response to those guidelines which are prefaced at the start of each chapter.

1.6 Outcomes and benefits of the proposed action

1.6.1 Outcomes

The intended outcomes from the proposed Tarkine Forest Drive are listed below.

Accessibility

Although much of it was originally constructed to support the forestry industry, the existing road network has been used by local people for recreation purposes for many years.

However, because significant sections of the route are unsealed it is not suitable for hire vehicles and this greatly restricts its accessibility to tourists. The roads were also constructed to forestry standards rather than public road standards, which presents a safety risk to users, notably tourists, who are unfamiliar with it.

The Tarkine Forest Drive project will rectify these deficiencies and provide improved access to the Tarkine Region for all Tasmanians and tourists, allowing visitors to experience the areas wilderness and heritage values of the region safely and conveniently.

Tourism development potential

The Tarkine Forest Drive will create an impetus for the development of the tourism industry in the region by leveraging the Tarkine brand to put the North West Region firmly on the tourist map. Improved accessibility fits with visitor preferences to explore destinations which have varied experiences in close proximity and the project has the potential to increase the stay of tourists in the region to a number of days.

The project will also support existing and proposed ecotourism ventures and experiences in the Tarkine Region, resulting in the creation of a unique tourism icon. This will be of great benefit to a region that has been hit hard by the downturn in the economy, particularly the forestry sector.

Sustainable infrastructure

The Department of Infrastructure, Energy and Resources (DIER) will construct the project in full compliance with regulatory requirements, ensuring minimal environmental impact and protection of the local flora, fauna and heritage values. The construction location has had a long history of mining, commercial forestry and recreational activities and no new roads will be required.

DIER will implement a structured and disciplined process which establishes best practice innovation in sustainable road design and construction where feasible. This process will define sustainability objectives, set strategies, and establish indicators and measurement methodologies to verify that best practice sustainability procedures relevant to the project have been applied.

The project will include a number of ongoing environmental monitoring programs, management regimes and mitigation actions as part of its design, development and operation to ensure the highest practicable environmental outcomes.

Informed stakeholders

As part of DIER's commitment to delivering this important project, communication with key stakeholders and the broader public have been and will continue to be open, transparent and thorough. This will ensure that the multiple benefits and development potential resulting from this project are presented to stakeholders, together with the potential environmental impacts and the proposed impact avoidance and mitigation measures.

1.6.2 Benefits

The benefits to be delivered through undertaking the proposed Tarkine Forest Drive include the following.

Tourism improvements

The Tarkine has been identified in a number of previous studies as providing potential opportunities upon which to anchor the future of tourism in the North West Region. A number of economic studies demonstrate the benefits to the North West. These benefits include:

- A significant increase in nature based tourism sector in Tasmania
- An increase in visitor numbers and new spending
- An increase in the number of tourism sector jobs in the region

- Extended visitor stays - most visitors are likely to stay extra night(s) to enjoy the forest wilderness and coastal attractions due to new opportunities to stop and enjoy/observe the environment
- The ability to travel in a circuit, avoiding the need to cover the same route twice
- The provision of a low risk travelling environment (i.e. a sealed, speed controlled road).

Other regions will also benefit from promoting new Tasmanian tourist icon - “The Tarkine” - through flow on effects.

Economic benefits

A Benefit Cost Analysis (BCA) has been developed for the Tarkine Forest Drive and is provided later in this document. As a minimum, the following benefits are expected from the development of the project:

- Construction activities will create jobs and boost the economy while under construction
- Most of the direct spending benefit will occur in the North West communities between Devonport and Arthur River, all of which will provide the accommodation, services and employees required at attractions in and around the Tarkine
- The increased tourist access and activity are expected to have a significant economic spin off.

Safety benefits

The road at present is predominantly used for forest harvesting operations and the road configuration has evolved to meet the needs of this industry. Aspects of the current road network, particularly signage and intersection configuration, are not appropriate for the anticipated increase in traffic volumes, especially where light and heavy vehicles interact.

A benefit of the project will be the installation of road signage and improved road surfaces. These measures will greatly improve safety.

The road will be designed to provide additional safety benefits, such as the provision of a consistent sealed pavement for the entire road length.

Facilitation of future ecotourism and other development

The project is a logical extension and major enhancement of Tasmania’s Great Nature Trail. DIER has been working with Tourism Tasmania, Forestry Tasmania (FT) and other key stakeholders to optimise the implementation of the project’s tourism potential.

Construction of the Tarkine Forest Drive will facilitate future development in the North West through:

- Opening up the area to organised tours
- Creating a loop road to encourage visitors to spend more time in the North West
- Promoting existing attractions
- Allowing visitors with hire cars to access areas previously off limits due to insurance restrictions or perceived issues on unsealed roads
- Developing and improving tourist facilities within the State Forest
- Creating potential for significant attractors to create ‘iconic’ Tarkine experiences.

Sustainability benefits

By adopting and extending relevant best practice for sustainable design and construction, this project will serve to influence behavioural change, as well as capacity building, in the civil design and construction industry. It will encourage and build sustainability into design and construction practice and will objectively demonstrate that sustainable infrastructure is achievable in Tasmania. The extensive investigations that have been undertaken to date will assist in developing an adaptive strategy for achieving the sustainability objectives, and establishing indicators and measurement methodologies.

1.7 Project justification

The Tarkine Forest Drive is supported by a substantial body of policy documents and specific studies. The comprehensive strategic support for the project is summarised below.

1.7.1 Links with Government objectives

The Tarkine Forest Drive has been identified in a number of previous studies and policy documents as an important strategic development and almost exclusively involves upgrade of existing infrastructure. This will enable increased access and appreciation of the many attributes of the Tarkine Region without impacting detrimentally on these attributes.

Tasmanian infrastructure strategy

The Tasmanian Infrastructure Strategy coordinates the Tasmanian Government's effort across the major economic sectors of transport, water, energy and information technology.

The Transport Vision is: Delivering connected communities and the efficient and safe movement of people and freight.

To achieve this vision a number of Strategic Directions are expressed across the themes of coordinated infrastructure planning, effective governance and decision making, viable and sustainable infrastructure, efficient infrastructure delivery and leveraging our natural advantage.

The Tarkine Forest Drive is listed as one of the Transport Infrastructure Projects.

The Tarkine Forest Drive aligns with the Tasmanian Infrastructure Strategy. It will create jobs during construction and when completed the project will provide vital and sustainable transport infrastructure to tourism development along the route and in the North West Region more generally.

Sustainable and environmentally responsible principles have been foremost in the planning and concept design phases of the Tarkine Forest Drive. These principles will continue to be a priority during the construction phase and longer term maintenance of the road and its immediate environment.

The project will deliver much more than a road - it will open up once largely inaccessible areas to Tasmanians and visitors to the state and will create new business and employment opportunities. The project will not only benefit the economy in the North West region but will have flow on effects for the entire state.

Tarkine tourism development strategy

In 2004, the Cradle Coast Authority conducted an assessment of potential visitor experiences that would benefit the Circular Head area. The market research identified nature and wilderness based tourism as priorities for future development and suggested that the development of the 'Tarkine Wilderness Experience' represented one of the best prospects for attracting new visitor interest.

The Authority began investigating the Tarkine as a visitor destination, seeking input in early 2006 from regional tourism bodies, local government leaders, public land managers and special interest groups, including the Tasmanian Aboriginal community, the Tarkine National Coalition and the Arthur Pieman Conservation Management Committee. This led to the development of the Tarkine Tourism Development Strategy in 2008.

The Tarkine Tourism Development Strategy (the Strategy) provides a guiding framework for managed development of tourism in the Tarkine. The tourism vision for the Tarkine is:

The Tarkine provides unique, intense and powerful nature-based experiences that are well managed and sustainable.

The Strategy arose from recognition that the area holds some very special values that can be transformed into a range of visitor experiences. The development of the Tarkine Forest Drive will provide significantly improved accessibility to this area, facilitating tourism development. The project will be undertaken within a disciplined process that establishes best practice and innovation in sustainable road design and construction.

The Strategy contains a Development Framework, which frames the strategic tourism development within a series of interconnected functional components. Importantly, the key to this framework is the principle of using existing entry points, corridors and service centres to:

- Strengthen the viability of infrastructure and experiences
- Provide a geographical focus for development
- Protect the core assets and values of the Tarkine.

The corridor principles of the Development Framework aptly describe the aims and objectives of the Tarkine Forest Drive. The outcomes sought from this project are consistent with the Development Framework, with the additional outcome of open communication - this will ensure that the positive benefits of the road and the process undertaken to achieve them, are communicated to all key stakeholders.

The Tarkine Tourism Development Strategy is broken into seven key elements:

1. Tarkine entry points
2. Corridors
3. Regional linkages and gateway
4. Tarkine management
5. Product development
6. Industry development
7. Marketing and promotion.

The Tarkine Forest Drive significantly aligns with the Corridors element. Corridors are defined as existing access routes extending throughout the Tarkine, each of which should be *“developed as a series of experiences linked together, rather than a ‘highway’ through the Tarkine”*.

The South Arthur Forest Drive is identified as one of the five corridors. The Development Framework notes a proposal to seal the existing gravel sections of the South Arthur Forest Drive through to Arthur River Township and to name it the “Tarkine Forest Drive”. Because the current project aligns precisely with the suggested corridor works, it is appropriate that this project assumes that name. Accordingly, the project is referred to as the Tarkine Forest Drive.

The merit of the project is recognised because:

- The main road corridor and visitor sites are already in use by travellers and commercial operators
- It would provide an enhanced tourist circuit, with consistent signage and visitor facilities
- It would establish the critical mass needed to launch this part of the Tarkine as a multi-day destination.

The Development Framework goes on to suggest some specific additional tourist infrastructure development, such as parking and day use areas, which could be developed as part of the South Arthur Forest Drive corridor.

Other studies

As part of the North West’s Regional Development Strategy, the Cradle Coast Authority and Tourism Tasmania established ‘The Great Nature Trail’ as a way of enhancing the attractiveness of the journey to a potential cluster centred on Stanley, Smithton and Dismal Swamp.

Since its establishment, a number of regional tourism studies, such as the Stanley Tourism Precinct Study and the Tasmanian Experience Strategy, have identified that the Great Nature Trail cluster has some serious issues in terms of branding:

- A lack of experience-rich products
- Poor conversion of day visits to overnight stays
- Exposure to downtrends in key market segments
- A heavy reliance on Stanley as the main drawcard.

Key findings of the research identified the opportunity to develop experiences based around the cluster’s potential strengths in wildlife, wilderness walks, the coast, food and beverage. The Tarkine Wilderness Experience was identified as a key development opportunity for the region.

According to Tourism Visitor Survey data, in the past four years there has been an 11% drop in visitor numbers on the Great Nature Trail. There is also a clear reduction in visitation rates with distance westwards from Burnie.

Both facts indicate that the Great Nature Trail has become less competitive due to a lack of attractions and the need to ‘back-track’ to Burnie to connect with other established touring routes such as the Wilderness Touring Route to the West Coast.

Considerable recent independent research and expert advice supports the view that the Tarkine offers Tasmania the opportunity to recapture its pre-eminent position in nature-based tourism in the national market.

For example:

- The Tarkine has been identified (Stanley Precinct Tourism Study 2006) as a potential opportunity upon which to anchor the future of tourism in the North West Region
- Independent tourism marketing research, commissioned by Forestry Tasmania and the Department of Economic Development, suggests that the proposed North West Road may well be the “most significant tourism development available to the state after the introduction of the “Spirits of Tasmania” (EMDA, Moore Consulting & SCA Marketing, 2008)
- The Transport and Tourism Section of the Southern Regional Background Report 2007 summarises the key road transport and visitor needs for self drive tourism in Tasmania (85% of visitors) as follows
- Opportunities to stop and enjoy/observe the environment
- A non-threatening travelling environment, particularly on unfamiliar roads (i.e. by providing a sealed, speed controlled road)
- The opportunity to travel in a circuit, avoiding the need to cover the same route twice.

1.8 Budget and costs

The allocation of the funding for the Tarkine Forest Drive is a significant State Government commitment to the North West. While DIER always seeks to achieve value for money outcomes, given the recent economic misfortune of this Region, it is even more important in the context of the current climate that this project achieve the best possible value for money outcome.

Innovative solutions that are low cost, but effective, will be implemented where appropriate to ensure the project is delivered within the budget.

1.8.1 Current budget

The Tasmanian Government funding for the project, inclusive of tourism infrastructure facilities, is outlined in detail in the Benefit Cost Analysis in Appendix D.

For costing purposes the route is divided into a number of segments each with similar design and construction elements for most of their length.

The cost estimate of the works has been based on historical rates for similar works delivered by DIER. Previous estimates prepared for the works have also been taken into account and appropriate contingencies are included to compensate for the uncertain scope in some areas and uncertain cost in others.

1.9 Other known actions in the region

Figure 1.2 illustrates the other activities (past, current and reasonably foreseeable) within the region. In summary it depicts:

- Current Mining Leases
- Mining Lease Applications
- Forestry Tasmania
- The Intergovernmental Agreement nominated reserve areas
- Land tenure.

Each of these will be discussed in more detail below.

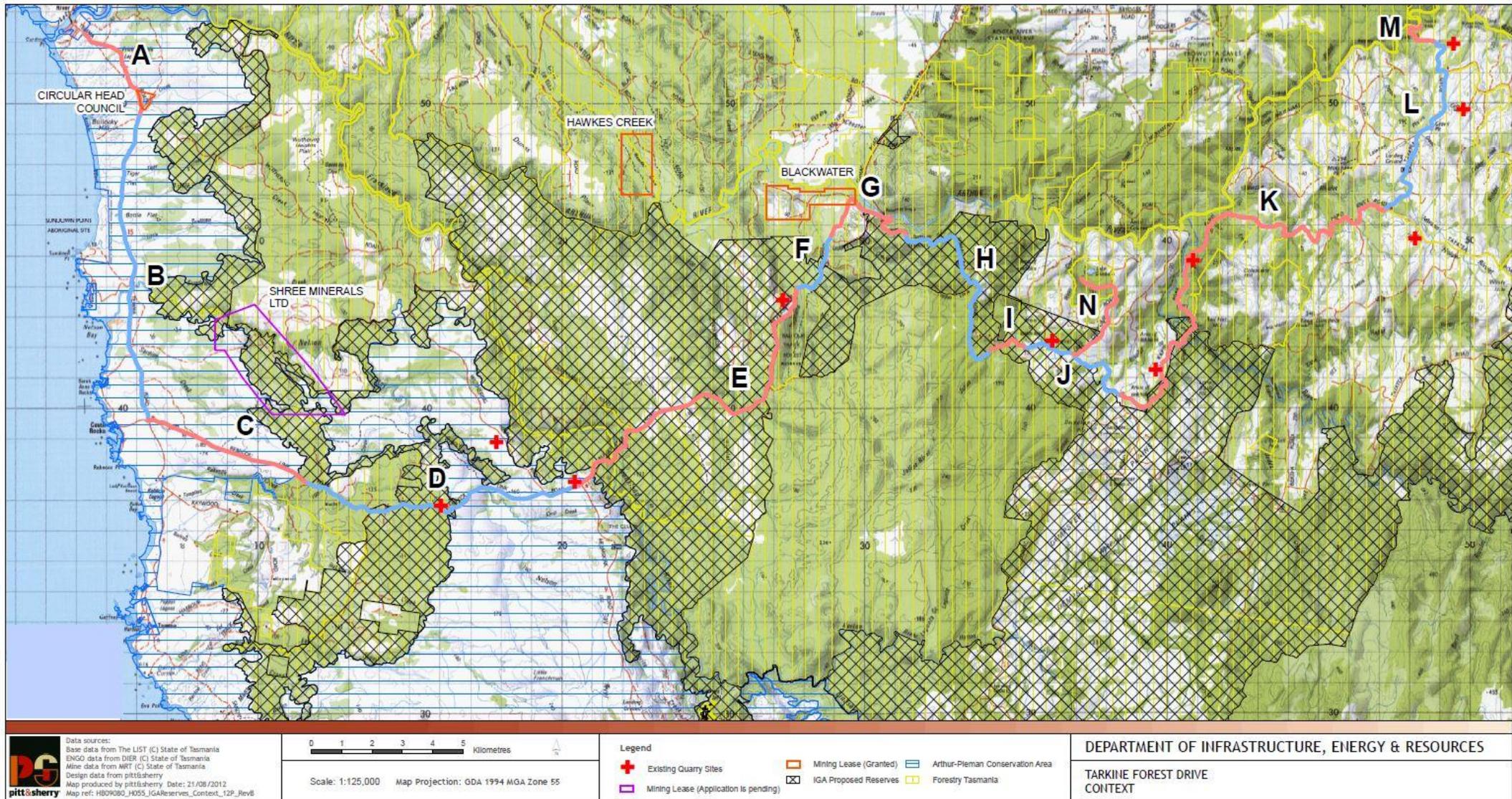


Figure 1.2 - Context Figure

Current mining leases

Tasmanian Advanced Minerals - Blackwater

Tasmania Advanced Minerals Pty Ltd (TAM) have been operating a silica flour extraction pit at Blackwater Road, near Kanunnah Bridge since early 2008.

The activity is regulated by the EPA Division of the Department of Primary Industries, Parks, Water and Environment as a level 2 activity as defined in Schedule 2 of the *Environmental Management and Pollution Control Act 1994*. The proposal was assessed by the then Board of the Tasmanian Environment Protection Authority (EPA) and Circular Head Council.

The operation produces up to 50,000 m³/year of silica flour, equivalent to 100,000 tonnes/year. The product is transported in 30 - 35 tonne trucks to an off-site processing facility located in Wynyard where it is refined for export. There is an average of approximately 12 truck loads/day of product leaving the site for processing at the Wynyard premises.

The mine site is directly adjacent to the proposed Tarkine Forest Drive route. In addition, the heavy vehicle access to the mine site uses a very small segment of the proposed route - from Kanunnah Bridge to Blackwater Road, approximately 3.5 km.

Tasmanian Advanced Minerals - Hawkes Creek

Tasmania Advanced Minerals Pty Ltd (TAM) have been operating a silica flour extraction pit at Chatlee Road in State Forest, approximately 35 km south west of Smithton since mid-2011.

The activity is regulated by the EPA Division of the Department of Primary Industries, Parks, Water and Environment as a level 2 activity as defined in Schedule 2 of the *Environmental Management and Pollution Control Act 1994*. The proposal was assessed by the Board of the Tasmanian Environment Protection Authority (EPA) and Circular Head Council.

The operation produces up to 50,000 m³/year of silica flour, equivalent to 100,000 tonnes/year. The proposal is to undertake the operation over approximately 7 years based on the anticipated production levels. The product is transported to an off-site processing facility located in Wynyard where it is refined for export. There is an average of approximately 12 truck loads/day of product leaving the site for processing at the Wynyard premises.

While the mine site is near the proposed Tarkine Forest Drive route, the heavy vehicle access to the mine site does not use any sections of the Tarkine Forest Drive. Trucks travel from Smithton via Irishtown Road, Grooms Cross Road, Trowutta Road, Roger River Road and Leensons Road, approximately 5 km west of Kanunnah Bridge.

Mining Lease applications

Shree Minerals propose to develop a magnetite/hematite mine near Nelson Bay River. The site is located east of Couta Rocks and approximately 7 km northeast of Temma. The transport of product will use Rebecca Road, Blackwater Road and Sumac Road, all part of the proposed Tarkine Forest Drive.

This development is currently subject to assessment under the *Environment Protection and Biodiversity Conservation Act 1999* and was approved by the Tasmanian Environment Protection Authority and Circular Head Council in late August 2012, under the Tasmanian *Environmental Management and Pollution Control Act 1994*.

Shree Minerals propose an additional 34 vehicle movements per day for years 2 to 10 of the mine, a 34% increase on the existing traffic movements on these roads (pitt&sherry 2011). Shree have committed to the following actions to mitigate against this increase in traffic and increase in risk of roadkill:

- No product transport will commence post civil twilight
- A daily worker transport bus will be provided to and from the site
- All employees will be educated on the known roadkill hotspots on the transport network and of the importance of reducing roadkill and of responding appropriately if it does occur. This will include encouragement of workers (and the worker bus) to reduce speed to below 50 kph during the dawn to dusk period (pitt&sherry 2011).

Forestry Tasmania

There is a large amount of uncertainty in relation to future forestry activities in the Tarkine region as a result of the Intergovernmental Agreement (see below). Once this process is resolved, Forestry Tasmania will be reviewing the areas available for harvesting and then develop the appropriate plans accordingly. In any event, all the activities will be Forestry Activities under the Regional Forest Agreement and therefore are exempt from the EPBC Act.

There are a number of historical and recently active Forestry Tasmania quarries along the proposed route. The majority of these sites are not licensed for activities other than Forestry operations regulated by the Forest Practices Code. Unless a mining lease application is granted and approval under the *Environmental Management and Pollution Control Act 1994* is gained, these quarries cannot be used for any other purpose. Given the uncertainty around the extent of resource extraction that will occur in this area (due to the current negotiations around the Intergovernmental Agreement) and the fact that the proposed Tarkine Forest Drive will now be managed by DIER, it is expected that most of these quarries will see very little extraction over the next 20 years.

Intergovernmental agreement

The Tasmanian Forests Intergovernmental Agreement was signed by the Prime Minister Julia Gillard and Tasmanian Premier Lara Giddings on 7 August 2011. As part of this agreement, an Independent Verification Group was established to provide advice to the Prime Minister and the Tasmanian Premier on sustainable timber supply requirements and areas and boundaries of reserves. The Environmental Non-Government Organisation's nominated reserve areas adjacent to the Tarkine Forest Drive are shown above in Figure 1.2. If agreement between the parties is reached, these areas will not be available for forestry operations and will be subject to statutory protection (via the Tasmanian Forest Agreement Bill 2012, currently before the Tasmanian Parliament). The extent to which these areas will be available for other forms of development will depend on the nature of the 'Protection Order' initiated for a particular area of land.

Other Land tenure

There are no private land parcels directly adjacent to the Tarkine Forest Drive route. There are 2 predominant land tenures, Forestry Tasmania reserves (which have previously been discussed) and the Arthur Pieman Conservation Area, managed by the Tasmanian Parks and Wildlife Service.

The Arthur-Pieman Conservation Area Management Plan 2002 applies to all use and development proposed for this Conservation Area. The Arthur-Pieman Conservation Area, a reserve of approximately 103,000 hectares, provides protection for significant areas of Aboriginal cultural heritage, coastal landscapes and wilderness, and ecosystems.

The objectives of conservation areas include encouraging appropriate tourism, recreational use and education based on the purposes of reservation and the natural or cultural values of the conservation area.

Prior to any development within this area a Reserve Activity Assessment must be approved by the Parks and Wildlife Service.

1.10 Consequences of not proceeding with the action

The Tarkine Forest Drive is a high priority community project. Community expectations are for the original funds allocated to be expended in the area to boost the economy and jobs. Delays in delivering the project will continue to compound construction costs and potentially attract public criticism.

The investment of public funds in upgrading the Tarkine Forest Drive to “Tourist Road” standard will result in a high return on investment to government and the community. The proposed Tarkine Forest Drive upgrade will generate a series of economic impacts in terms of employment and a stimulus to Gross State Product (GSP) and further impacts through increased tourism activity. If the project does not proceed, these multiple benefits (which are quantified in the Benefit Cost Analysis) will not be realised. Given the economic impact and unemployment due to recent closures of business such as PaperlinX, McCain’s and the Hampshire Mill, job creation is a high priority for the North West region.

In addition to the well documented socioeconomic benefits from the project, there are a number of environmental benefits, as follows.

The roadkill mitigating strategy associated with the project includes an extensive community education program, outlined in section 6 of this document. This education program will have benefits that will reach well beyond the project footprint and could go some way to reducing roadkill on other roads in Tasmania.

DIER has already invested significant resource in baseline and general research around roadkill - in particular, proving the success of audible rumble strips as a means of reducing roadkill. DIER is further committed to regularly monitor roadkill on the Tarkine Forest Drive and adapting the mitigation actions in a process of continual learning - please refer to section 6 for further information.

The continual roadkill data collection and further information on successful mitigation options adds significantly to the body of information on roadkill and roadkill mitigation. It is well documented that many studies of mitigation measures suffer from a lack of replication and statistical control groups (Taylor & Goldingay 2010). The work undertaken to date provides a statistically rigorous baseline to move forward with further research and offers lessons to be applied across the entire road network in Tasmania.

DIER is committed to sharing the results of the research undertaken to date and also any further results through the development and implementation of the roadkill mitigation plan. Other State government agencies and organisations (such as DPIPWE and the Save the Tasmanian Devil Program), local government in Tasmania and indeed other State’s road authorities will significantly benefit from the research to date and also the further monitoring and reporting once mitigation treatments are implemented. These benefits will be lost if the project does not proceed.

There are two areas outside the Tarkine Forest Drive (Roger River Road and a 12.8 km section of Arthur River Road, north of Arthur River) that are recognised as having existing elevated roadkill. As part of the mitigation strategy for the Tarkine Forest Drive the existing hot spots on these roads will have appropriate treatments (rumble strips) applied - the details are outlined in Section 6. These benefits will be lost if the project does not proceed.

The development of the Tarkine Forest Drive will improve the safety of the road. This will include sealing improved road surfaces and the installation of road signage and traffic calming devices. These benefits will be lost if the project does not proceed.

Given its prominence in the community since the announcement of the original project in 2008/09, the three years hiatus in making a start to this revised project means there is now a high expectation from the community that it be commenced and completed as soon as possible.

2. Description of the action

In relation to the requirement to describe all components of the action, all construction and operational components of the action, where known or able to be predicted, must be described in detail. This includes date or time period over which construction will take place, exact dimensions of structures to be built and materials, equipment and machinery to be used.

The components of the action addressed in the above information must include (but not be limited to) specifications or details of:

- Road dimensions and structure for all sections of the road, including details of sealed surface, verge, batters, embankment and road corridor clearance, along with specific design elements such as traffic speed controls, barriers, design features to minimise roadkill, etc*
- All watercourse crossings requiring additional infrastructure works, including bridge works, culverts, embankments, temporary in-stream barriers and flow diversion structures*
- Service facilities developed in conjunction with the road route such as parking bays, toilets, access tracks, viewing platforms, camping and picnic facilities*
- Water quality monitoring and management programs, including erosion, sediment and runoff controls, water quality testing and other measures to maintain or enhance aquatic habitats in the vicinity of the road route*
- Any proposed additional development sites or support facilities not addressed in the referral, such as quarry operations to support the construction and maintenance of the upgraded road, additional access tracks to adjoining recreational sites such as side tracks to Dempster Lookout and Milkshake Reserve*
- Indicative details of supporting infrastructure for construction and road operations, such as machinery storage areas, access tracks, work or office sheds, wash down facilities, additional water, sewage, drainage and electricity facilities and associated installation works*
- Waste management arrangements, including storage and disposal of fuels, chemicals and other waste products during construction and ongoing use of the road*
- Details of the induction provided to workers, particularly in relation to potential impacts on threatened species.*

The length of the Tarkine Forest Drive is 92.77 km (including the Lake Chisholm access road - Segment N) consisting of:

- Road works
- Bridge works
- Tourism infrastructure works
- Roadkill mitigation works.

Appendix A provides a map series depicting all known elements of the proposed action (the development footprint) in relation to matters of National Environmental Significance (NES).

The proposed works are split into segments A - M, with segment A starting south of the Arthur River Township at the western extent and segment M ending at the southern abutment of Tayatea Bridge at the eastern extent (see Figure 2.1).

2.1 Construction programming approach

It is expected that the Tarkine Forest Drive will be constructed over two consecutive summers. The precise construction staging will be determined by the contractor once a contract is awarded.

2.2 Construction environmental management plan

A Construction Environmental Management Plan (CEMP) will be prepared by the contractor in order to implement the safeguards and mitigation measures specified in this PER (Section 6). The CEMP will describe the minimum construction management measures that will be required to be implemented by construction contractors as a condition of contract with DIER.

A comprehensive set of Environmental Protection Guidelines (EPGs) (Appendix C) have been developed for the CEMP that will manage the following:

- Road works
- Road grading and sealing
- Construction camps and worksites
- Watercourse works and crossings
- Heritage
- Noise
- Dust and other air emissions
- Introduced plants
- Pests and diseases
- Bushfire prevention
- Drainage, erosion and sediment control
- Cofferdam construction
- Waste and hydrocarbon management.

2.3 Road works

The proposed road works are described in Table 2.1 (and depicted in Appendix A) and can be summarised into the following categories:

- 19.671 km of repairs to the existing sealed road
- 66.180 km of gravel pavement that requires sealing
- 6.870 km of gravel pavement that requires both widening and sealing.

Table 2.1 also defines the estimated amount of vegetation required to be cleared along the roadside for the purposes of road widening. This is further quantified based on native vegetation community in Section 4 of this PER.

No other roadworks (including temporary access tracks) are anticipated.

Table 2.1 - Proposed road works based on segment

Section		Length (km)	Proposed Pavement Works	Proposed Other Works	Vegetation Clearance (Hectares)
ID	Description				
A	Temma Road South end of seal at Arthur River to Alert Creek	3.71	Reshape, widen, strengthen and seal the existing road.	Excavation and embankment to allow for the pavement widening at approximately 16 locations. Stabilisation of batters in sandy soil using local provenance seeds. Modification to minor junctions to match the pavement works. Install rumble strip groups	0.73
B	Temma Road Alert Creek to Couta Rocks Road	10.41	Reshape, widen, and seal the existing road north of Sundown Creek. Reshape and seal the existing road south of Sundown Creek.	Excavation and embankment to allow for the pavement widening at approximately 15 locations. Stabilisation of batters in sandy soil using local provenance seeds. Modification to minor junctions to match the pavement works. Profile changes and sight benches. Light coloured seal over this section. Install rumble strip groups	0.95
C	Rebecca Road Couta Rocks Road to FT spur Rebecca 1	5.75	Reshape and seal the existing road.	Light coloured seal over end of this section.	No vegetation clearance required for proposed works.
D	Rebecca Road FT spur Rebecca 1 to Western Explorer	9.98	Reshape and strengthen. Along the middle third widen, and seal the existing road.	Excavation and embankment to allow for the pavement widening at one location. Modification to minor junctions to match the pavement works. Modification to junctions so that the priority of the junctions is along Tarkine Forest Drive and not aligned with forestry operations. Replace the deteriorated bridge over Nelson Bay River with a concrete bridge. Light coloured seal over part of section.	0.21
E	Blackwater Road sealed section east of Western Explorer	12.25	Repair minor pavement failures. Reseal the western 3.05 km of the road	Light coloured seal over part of section. Install rumble strip groups at some junctions and access.	No vegetation clearance required for proposed works.

Section		Length (km)	Proposed Pavement Works	Proposed Other Works	Vegetation Clearance (Hectares)
ID	Description				
F	Blackwater Road Gravel section south west of Kununnah Bridge	2.45	Reshape and seal the existing road.	Modification to accesses to match the pavement works. Light coloured seal over part of section. Install rumble strip groups at some junctions and access.	No vegetation clearance required for proposed works.
G	Blackwater and Sumac Roads Sealed section at Kununnah Bridge	4.47	Repair minor pavement failures.	Seal access to existing TAM operations. Install rumble strip groups at some junctions and access.	No vegetation clearance required for proposed works.
H	Sumac Road Kununnah Bridge seal to Julius River seal	7.2	Reshape, with localised widening, strengthen and seal the existing road.	Excavation and embankment to allow for the pavement widening at one location.	0.10
I	Sumac Road sealed section at Julius River	1.46	Repair minor pavement failures.	Seal access to camping area.	No vegetation clearance required for proposed works.
J	Sumac Road Julius River seal to Rapid River Road	4.51	Reshape, with localised widening, strengthen and seal the existing road.	Modification to junctions so that the priority of the junctions is along Tarkine Forest Drive and not aligned with forestry operations.	No vegetation clearance required for proposed works.
K	Rapid River Road Sumac Road to Tayatea Road	17.43	Reshape, widen, strengthen and seal the existing road.	Replace the deteriorated bridge over Rapid River with a concrete bridge. Replace deteriorated log culverts on two unnamed tributaries of Lawson Rivulet. Excavation and embankment to allow for the pavement widening at approximately 50 locations. Modification to junctions so that the priority of the junctions is along Tarkine Forest Drive and not aligned with forestry operations. Modification to accesses to match the pavement works. Extend culverts to allow for earthworks.	4.74
L	Tayatea Road Rapid River Road to sealed section at Tayatea Bridge	7.38	Reshape, widen, strengthen and seal the existing road.	Excavation and embankment to allow for the pavement widening at approximately 5 locations.	0.33

Section		Length (km)	Proposed Pavement Works	Proposed Other Works	Vegetation Clearance (Hectares)
ID	Description				
M	Tayatea Road sealed section at Tayatea bridge	1.52	Repair minor pavement failures.	Stabilise the high excavation batter immediately south of Tayatea Bridge.	No vegetation clearance required for proposed works.
N	Sumac Spur 4 and Lake Chisholm Road	4.25	Reshape, strengthen and seal the existing road.	Nil	No vegetation clearance required for proposed works.
TOTAL		92.77			

2.3.1 Construction method

Worker inductions

Worker inductions and regular toolbox meetings will be held in accordance with the safeguards and mitigation measures specified in Section 6 of this PER.

Road widening

Segment

A	B	C	D	E	F	G	H	I	J	K	L	M	N

Road widening to achieve design widths will take place along the Tarkine Forest Drive within the segments depicted above and in Appendix A. At these locations minor vegetation clearance will be required for the purposes of road widening and batter construction. In Segment D, H, J, K and L locations where road widening takes place will have road verges and batters free of vegetation. In Segment A and B (Arthur River Township as far south to Sundown Creek) rehabilitation of batters will take place because of the sandy soils at these locations. In Segment A and B the batters will be hydroseeded (using local provenance seeds) and hydromulched.

Spoil created by road widening activities will be disposed of at locations defined by the regulating authority for the land.

Culvert replacement and drainage works

Segment

A	B	C	D	E	F	G	H	I	J	K	L	M	N

The following culverts will be replaced along the Tarkine Forest Drive within segment K:

- Lawson Creek Tributary No.21: Replacement of the existing log culvert with twin 2100 mm diameter pipes
- Lawson Creek Tributary No.24: Replacement of the existing log culvert with twin 1800 mm diameter pipes.

Other lengthening and repairing of existing culverts may take place along the Tarkine Forest Drive.

2.3.2 Additional development sites or support facilities

Pavement material

All pavement materials will be transported to the site on an as-required basis. No onsite storage of pavement materials is anticipated.

It is anticipated that the Circular Head Council, Beacon Hill quarry (also known as the White Hill quarry) will be used to supply pavement material. This quarry is located approximately 1.5 km south of the Bass Highway and 4.5 km south east of Smithton. The GDA coordinates are E0345780 and N5475230.

The land use planning permit number is 3557. The permit limit is 28,000 m³ per annum. This premises has been approved as a Level 2 Activity under the *Environmental Management and Pollution Control Act 1994* (Tas) and the operation is primarily regulated by the Tasmanian Environment Protection Authority, Circular Head Council and Mineral Resources Tasmania.

No *Phytophthora cinnamomi* has been recorded at the Beacon Hill quarry.

Sealing aggregate

All sealing aggregate will be transported to the site and stored at the sealing aggregate storage sites (former quarries) depicted in Appendix A (also the location of the supporting infrastructure described below).

It is anticipated that the Hazell Bros - Long Hill quarry at Kimberley in northern Tasmania will be used for the supply of the sealing aggregate. This quarry is located approximately 3 km north east of Kimberley and 1.3 km west of the Bass Highway off Dan Road. The GDA coordinates are E459300 and N 541900.

The land use planning permit number is 7859. The permit limit is 100,000 m³ per annum. This premises has been approved as a Level 2 Activity under the *Environmental Management and Pollution Control Act 1994* (Tas) and the operation is primarily regulated by the Tasmanian Environment Protection Authority, Meander Valley Council and Mineral Resources Tasmania.

No *Phytophthora cinnamomi* has been recorded at the Long Hill quarry. It cannot be fully determined at this stage that the sealing aggregate storage sites depicted in Appendix A are free from *Phytophthora cinnamomi*. In order to safeguard against the risk of spreading *Phytophthora cinnamomi*, these sites will be capped with a suitable material before they are utilised to ensure that sealing aggregate and machinery do not come into contact with the existing substrate. Other provisions for the management of *Phytophthora cinnamomi* are discussed further in Section 6 of this PER.

The use of this quarry is subject to supply and a satisfactory commercial arrangement being negotiated. It may be that other commercial quarries are utilised. Any quarries that are used will have an appropriate mining lease, and land use permit. Only *Phytophthora cinnamomi* free facilities will be utilised.

Additional access tracks to adjoining recreational sites

All the recreational facilities close to the Tarkine Forest Drive (i.e. Milkshakes Forest Reserve and Dempster Lookout) are already serviced by roads managed by Forestry Tasmania. None of these roads will be modified as part of the proposed action.

Supporting infrastructure

The supporting infrastructure to be used for road works will only be known once the contract is awarded. However, it is likely that a demountable site office and associated compound will be established for the road works at any of the three sealing aggregate storage sites (former quarries) depicted in Appendix A. At these sites other supporting infrastructure will be provided, such as machinery storage areas and wash down facilities.

Potable water would be trucked in and stored in tanks on site. Sewage facilities will be in the form of portable toilets and waste would be trucked out and disposed of in an LGA sewerage system. Drainage of storm water from temporary buildings will be directed to a water course in such a manner that there is no movement of sediment. There will be no electricity supply connected for the construction of the works - all electrical power required will be generated on site using portable generators.

Equipment and machinery

The specific equipment and machinery to be used for road works will only be known once the contract is awarded. It is not expected that the road works will require the use of any special machinery. Normal machinery for the proposed works is expected to include the following:

- Bulldozers and excavators to undertake excavation of batters and widening
- Trucks to move excavated material and to import pavement material, sealing aggregate, asphalt and precast pipes and bridge components
- Graders and rollers to spread and compact pavement material respectively
- Bitumen spray trucks to apply the bitumen for the seal, trucks to place the sealing aggregate and rollers to compact the seal
- Asphalt paver to pave asphalt and rollers to compact the asphalt
- Excavators to excavate trenches for culverts
- Cranes to lift bridge components and to provide access to high batters for stabilisation works
- Concrete trucks to import ready mixed concrete
- Small trucks to move small (hand operated) pieces of plant and small quantities of material around the site
- Light vehicles.

2.4 Bridge works

Segment

A	B	C	D	E	F	G	H	I	J	K	L	M	N

2.4.1 Baseline water quality monitoring program

Prior to any bridge replacement works taking place a Baseline Water Quality Monitoring Program will be undertaken. Further information in relation to this program is provided in Section 6.

2.4.2 Nelson Bay River bridge replacement

The existing bridge across the Nelson Bay River (see Figure 2.2), located on segment D (see Appendix A), will be replaced with a bridge which is designed to Australian Standard AS5100.

The proposed replacement bridge design is depicted in Figure 2.3. It will have a 100 year design life span, SM1600 design loading and pass a Q100 flood below the bridge soffit. Design allowances have been made to account for adequate passage of wildlife under the bridge (while above 1 year Average Return Interval (ARI) storms) by extending the span to allow animals to follow the bank in normal water flows without needing to cross the road.



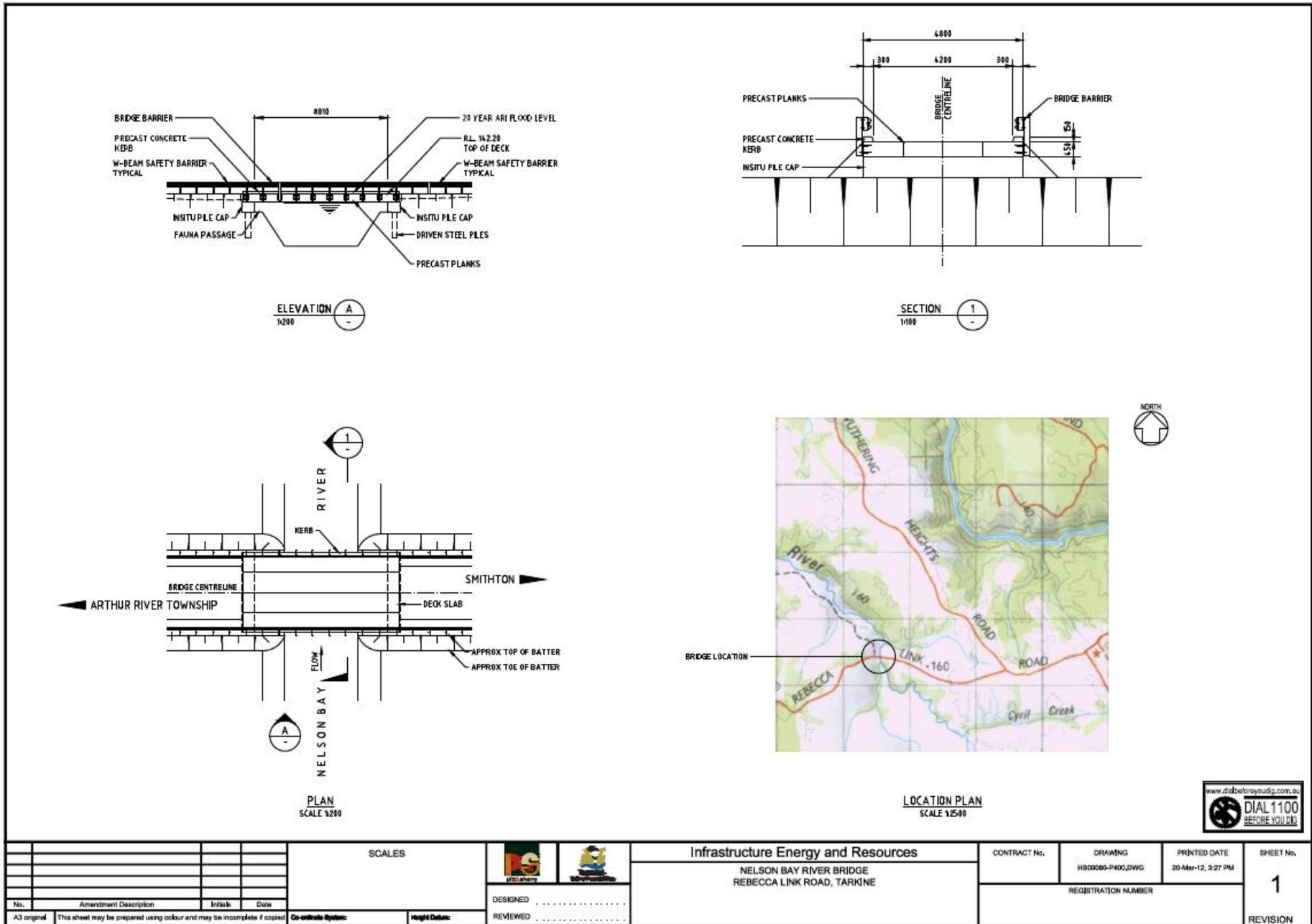
Figure 2.2 - Existing bridge across the Nelson Bay River

2.4.3 Construction method

The construction method proposed for the Nelson Bay River bridge replacement is as follows:

- Construction works will involve full road closure for approximately one week
- Site sheds will be located to the side of the existing road at locations not requiring any vegetation clearance
- Piles will be driven through the existing road embankment
- The existing timber bridge (see Figure 2.4) will be demolished and the timber removed from site
- New precast concrete abutments and beams will be transported to the site and then installed
- Steel traffic barriers will be installed on the sides of the bridge deck
- Approach road works will be completed to tie into the new bridge levels.

No work will be undertaken within the actual river for the Nelson Bay River bridge replacement. It is therefore anticipated that there will be no impact on stream flows. Site disturbance will be minimised by the use of precast concrete abutments and beams which will be fabricated offsite and transported to the site for installation. This will mean a reduction in temporary works installations.



<table border="1"> <tr><td>No.</td><td>Amendment Description</td><td>Initials</td><td>Date</td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </table>				No.	Amendment Description	Initials	Date					SCALES 		Infrastructure Energy and Resources NELSON BAY RIVER BRIDGE REBECCA LINK ROAD, TARKINE		CONTRACT No. HB09080-P400, DWG	DRAWING HB09080-P400, DWG	PRINTED DATE 20-Mar-12, 3:27 PM	SHEET No. 1
No.	Amendment Description	Initials	Date																
A3 original This sheet may be prepared using colour and may be incomplete if copied Co-ordinate System: Height Datum:				DESIGNED REVIEWED		REGISTRATION NUMBER			REVISION										

Figure 2.3 - Proposed bridge replacement design - Nelson Bay River

2.4.4 Rapid River Bridge replacement

The existing deteriorated timber bridge (currently closed) across the Rapid River (see Figure 2.4) located on segment K (see Appendix A) will be replaced with a bridge which is designed to Australian Standard AS5100. The proposed replacement bridge design is depicted in Figure 2.5. It will have a 100 year design life span, SM1600 design loading and pass a Q20 flood below the bridge soffit. Design allowances have been made to account for adequate passage of wildlife along the river banks under the bridge.



Figure 2.4 - Existing bridge across the Rapid River

2.4.5 Construction method

The construction method proposed for the Rapid River bridge replacement is as follows.

Construction works will involve full road closure for approximately 4 weeks. Site sheds will be located to the side of the existing road at locations not requiring any vegetation clearance.

The existing timber bridge (see Figure 2.4) will be demolished and the timber removed from site.

An existing ford, located downstream of the existing bridge will be used for limited construction traffic as required.

A coffer dam will be required to be constructed in the middle of the river to allow for construction of the middle pier (see design depicted in Figure 2.5).

This will be in place for approximately 3 weeks and will be constructed, used and decommissioned during the lowest estimated river flow period to minimise impact on river flow, bank erosion and scouring. At least half of the river will remain open to ensure sustained river flow. The coffer dam will be constructed out of fully salvageable materials (for example, precast concrete blocks or sand bags). If required, piles will be driven through the existing road embankment.

Precast concrete piers and abutments will be transported to the site and then installed. Precast concrete beams will be transported to the site and installed on the precast concrete piers and abutments.

Steel traffic barriers will be installed on the sides of the bridge deck.

Approach road works will be completed to tie the road into the new bridge levels.

The existing deteriorated timber bridge at Rapid River currently restricts some amount of river flow due to the two timber log piers located in the river bed (see Figure 2.4). The new bridge design should improve river flows and provide less constriction to debris under flood situations.

Site disturbance will be minimised by the use of precast concrete abutments and beams which will be fabricated offsite and transported to the site for installation. This will mean a reduction in temporary works installations.

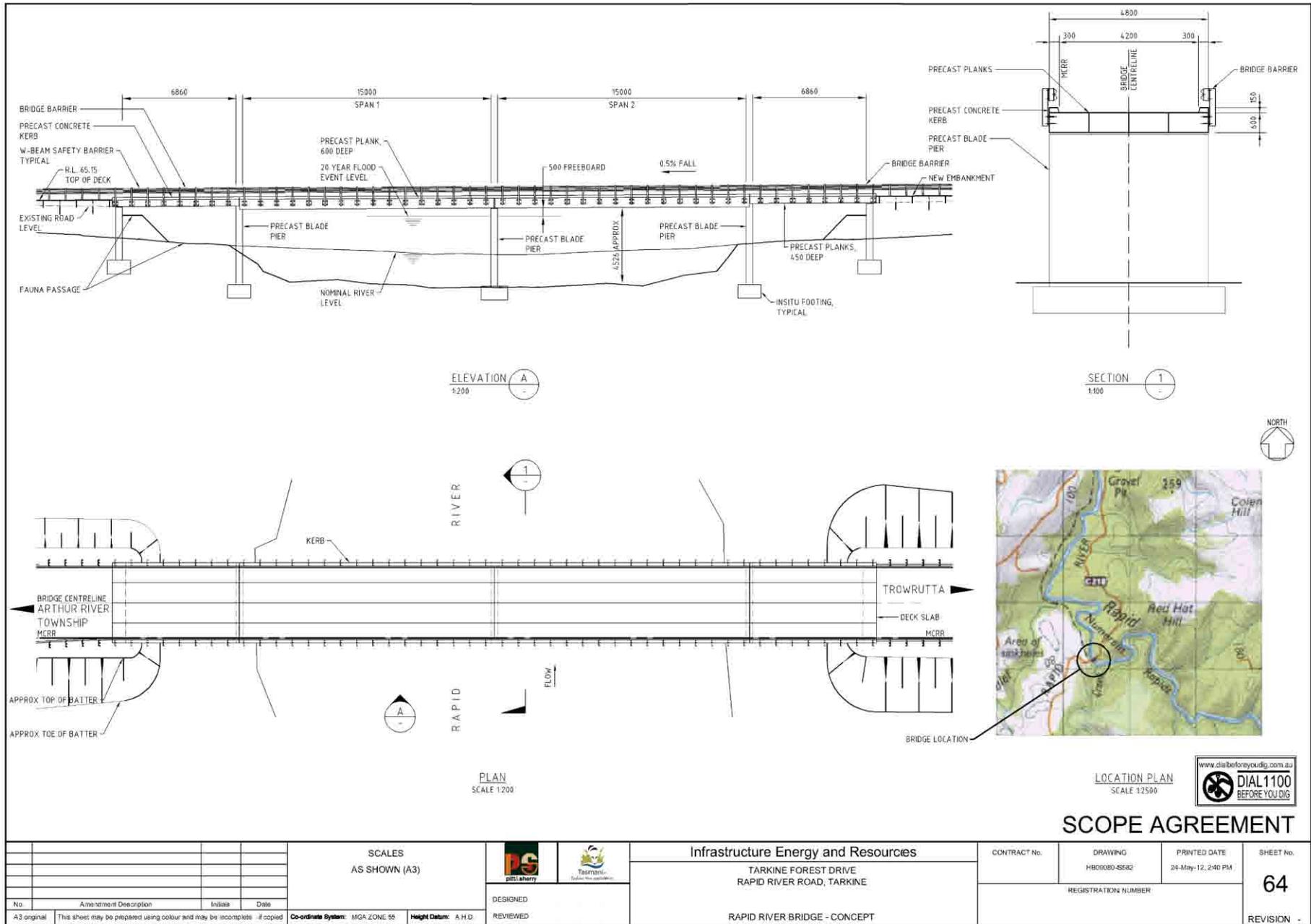


Figure 2.5 - Proposed bridge replacement design - Rapid River

2.5 Tourism infrastructure works

The proposed tourism infrastructure works are described in Table 2.2.

No vegetation clearance will take place for the proposed tourism infrastructure works. The location of the proposed tourism infrastructure works are depicted in Appendix A.

Table 2.2 - Proposed tourism infrastructure works

Segment	Location	Proposed Works
G	Kanunnah Bridge	Construct and seal a car park for 1 bus and up to 10 cars on the southern side of the Arthur River. Install an interpretation sign.
G	Sumac Lookout Car Park	Reseal the existing car park.
I	Julius River Reserve	Seal the existing car park. Construct and seal bus bays on Sumac Road adjacent to the toilet. Improve the path from the bus bays to the toilet Replace the existing toilet with double composting toilet. Construct a path from the existing car park to the toilets Construct an additional shelter 3m by 3m including concrete base. Convert all wood BBQs to gas burning BBQ Install an interpretation sign.
J	Lake Chisholm	Construct and seal car park 1100 m ² for 2 buses and 10 cars. Construct paths from the car park and bus bays to the toilet Construct a double composting toilet Install an interpretation sign.

2.6 Roadkill mitigation works

The Tarkine Forest Drive includes substantial roadkill mitigation works - these are described further in Section 6 of this PER.

2.7 Construction program

The construction season on the west coast is very short and timing is important to complete the project within the specified time periods.

Work is expected to begin during 2013, with the total project completed after the second year of construction.

2.8 Ongoing maintenance

DIER Roads and Traffic Division will assume the maintenance of the new road upon completion. Regular monitoring (as a minimum on a weekly basis) by maintenance crews will improve surveillance and identify issues as early as possible.

3. Feasible alternatives

Any feasible alternatives to the action to the extent reasonably practicable, including:

- *If relevant, the alternative of taking no action*
- *A comparative description of the impacts of each alternative on the NES matters protected by controlling provisions of Part 3 of the EPBC Act for the action, including alternative road design options for areas of known risk to listed threatened species*
- *Sufficient detail to make clear why any alternative is preferred to another.*

Short, medium and long-term advantages and disadvantages of the options must be discussed.

There are no feasible technical alternatives to the current proposal. The proposal involves sealing of existing roads. There are no other alternative existing routes possible to achieve the project objectives and a new greenfield road development would be unacceptable from an environment and also economic perspective.

The Tasmanian Government has previously described an opportunity to improve tourism access to the Tarkine area through the development of a sealed 131 km tourist road connecting Myalla Road with the Arthur River Township (EPBC 2009/5169). However, that project was abandoned due to a number of circumstances and is not a feasible alternative. The original proposal is briefly discussed below for background purposes only.

3.1 Original proposal - Tarkine Road

The Tasmanian government previously proposed this as an action.

The project sought to develop the tourist potential of the North West region by creating a self-drive experience for visitors and facilitating the subsequent development of commercial tourist ventures.

An extensive series of background surveys and monitoring programs had been undertaken commensurate with the environmental and heritage values present. The project was referred to the Commonwealth under the EPBC Act and was deemed a “Controlled Action” requiring full assessment via an Environmental Impact Statement.

When the then Premier, the Hon David Bartlett MP, announced a \$6.7 M investment in infrastructure in the North West from the original \$23 M allocated for the Tarkine Road Project, it was necessary to re-scope the project.

In early December 2010, the then Minister for Infrastructure, the Hon Lara Giddings MP, announced that Cabinet had approved a revised project. This decision was based on strong support from key stakeholders, such as the Cradle Coast Authority Tarkine Discussion Group. The revised project is the Tarkine Forest Drive, which is the subject of this PER.

An overview of potential impacts on Matters of NES associated with the original Tarkine Road proposal is provided in Table 3.1.

Table 3.1 - Overview of potential impacts on matters of NES in relation to the original proposal - Tarkine Road

Matters of National Environmental Significance	EPBC Act Status	Potential Impacts on Matters of NES
Eastern-barred bandicoot <i>Perameles gunnii gunnii</i>	Vulnerable	Elevated risk of roadkill on Mawbanna Road.
Spotted-tail quoll <i>Dasyurus maculatus</i> subsp. <i>maculatus</i>	Vulnerable	Elevated risk of roadkill.
Tasmanian devil <i>Sarcophilus harrisii</i>	Endangered	Elevated risk of roadkill. Minor risk of disturbance to den sites in the vicinity of new (currently un-roaded) sections in the east. A new crossing of the Arthur River might have increased movement of the species from the east, facilitating the rate of Devil Facial Tumour Disease (DFTD).
Tasmanian azure kingfisher <i>Ceyx azureus diemenensis</i>	Endangered	Minor impacts of disturbance to nesting birds in the vicinity of bridge crossings of Rapid River, Lyons River and Arthur River.
Giant freshwater crayfish <i>Astacopsis gouldi</i>	Vulnerable	River disturbance for construction of new crossings, provision of public access facilitating poaching into areas currently restricted to the public, increased potential risk in roadkill at crossings not suited to crayfish passage.
Arthur River greenhood <i>Pterostylis rubenachii</i>	Endangered	Minor losses to outlying plants in a roadside population (Segment B).
Shortspike midge orchid <i>Corunastylis brachystachya</i>	Endangered	Minor impacts to potential habitat in immediate vicinity of Segments A and B.
Windswept spider orchid <i>Caladenia dienema</i>	Endangered	Minor impacts to potential habitat in immediate vicinity of Segments A and B.

3.2 Taking no action

Taking no action would:

- Not satisfy the significant community expectation that the allocated funds would be spent in the region
- Not achieve any of the previously demonstrated benefits of proceeding with the proposal such as increased employment in the region and expected growth in tourism numbers
- Result in the loss of valuable planning and design works already completed to prepare the original project, which can be readily used to support a re-scoped Tarkine Project
- Be seen by the public as a waste of the significant investment in planning and design works.

For these reasons, this option is not favoured.

4. Description of the environment and matters of National Environmental Significance

A description of the environment of the proposed road upgrade route and the surrounding areas that may be affected by the action, including listed threatened species and ecological communities that are likely to be present in the vicinity of the road route, including but not limited to:

- *Sarcophilus harrisii* - Tasmanian Devil (Endangered)
- *Dasyurus maculatus maculatus* - Spotted-tail Quoll (Vulnerable)
- *Caladenia dienema* - Windswept Spider-orchid (Critically Endangered)
- *Corunastylis brachystachya* (also known as *Genoplesium brachystachyum*) - Shortspike Midge-orchid (Endangered)
- *Diuris lanceolata* - Snake Orchid also known as Large Golden Moths (Endangered)
- *Prasophyllum favonium* - Western Leek-orchid (Critically Endangered)
- *Prasophyllum secutum* - Northern Leek-orchid (Endangered)
- *Pterostylis rubenachii* - Arthur River Greenhood (Endangered)
- *Pterostylis cucullata* subsp. *Cucullata* Leafy Greenhood (vulnerable)
- *Aquila audax fleayi* Wedge-tailed Eagle (Tasmanian) (Endangered)
- *Astacopsis gouldi* Giant Freshwater Crayfish (Vulnerable)
- *Ceyx azureus* subsp. *Diemenensis* - Tasmanian Azure Kingfisher (Endangered)
- *Oreisplanus munionga larana* - Marrawah Skipper (Vulnerable).

In relation to these species the following must be addressed:

- a) Information on the abundance, distribution, ecology and habitat preferences of the species or communities*
- b) Discussion of the known threats to the species or community, with reference to threats posed by the proposed action*
- c) Maps identifying all known occurrences of the species or community and potential habitat for the species*
- d) Details of surveys for these species and their habitat in the vicinity of the proposed action, including details of survey effort, timing, location and methodologies for studies and surveys undertaken and the regional status, population size and distribution within the area surrounding the proposed action identified for these species*
- e) For all species that are considered unlikely to be impacted by the proposed action, but for which apparently suitable habitat is present and could be impacted by the proposed action, detailed information to demonstrate that impacts on the species are unlikely to occur*
- f) Discussion of the potential impacts on the above species of pest species, disease and fire outbreaks generated by the proposed action.*

Consideration of each species must have regard to any recovery plan prepared by the Commonwealth, Tasmanian or other state government, in relation to the species, and any publicly available policy statement prepared by the department in relation to the species.

4.1 Altitude

The Tarkine Forest Drive is at a low altitude following a line roughly parallel to the Arthur River, with the highest point being at the Dempster Lookout at 250 m above sea level.

4.2 Rainfall

Average annual rainfall in the area is generally high and ranges from approximately 1200 mm on the coast to more than 1500 mm inland.¹

4.3 Hydrology including water flows

The area through which the Tarkine Forest Drive extends has a very extensive drainage network, the orientation of which is northwest and then west to the Southern Ocean on the west coast. The orientation of these drainage lines reflects the local geology, particularly structural features.

Most of the project is located within the Arthur River catchment, a major drainage line on the west coast of Tasmania. Most of the drainage in the catchment is drawn from the southern side of the Arthur River.

The Arthur River flows north, and then northwest, with the entire Tarkine Forest Drive project area located on the southern side of the river.

The Arthur River is joined by numerous small creeks and rivers and several larger drainage lines, in particular the Frankland and Rapid Rivers, all of which have numerous tributaries.

The Frankland River flows northwest, joining the Arthur River at a point approximately 10 km due east of its mouth at Gardiner Point. The Rapid River also flows northwest, joining the Arthur River approximately due east of the coast and approximately 25 km due east of the Frankland/Arthur junction.

Drainage in the coastal area, Segments A and B, is direct to the Southern Ocean. The major stream in this section is the Nelson Bay River, which parallels the Frankland River, reaches the Southern Ocean at Nelson Bay. Several small, short streams, including Rebecca Creek, Sardine Creek and Sundown Creek, flow due west to the coast.

4.4 Land systems

The following seven land systems, as mapped by Richley (1978), occur in the vicinity of the Tarkine Forest Drive:

593161 Temma

Sand soils have developed on Quaternary coastal sand flats, dunes and beaches. The soils in the undulating hinterlands are light grey, have an organic sand pan, a peaty sand surface texture and an average depth of 1.3 m. In the swales they are dark grey, uniform soils with a peaty sand surface texture and an average depth of 1.1 m.

The soils in the stable dunes are weakly differentiated pale calcareous uniform soils with a loamy sand surface texture and an average depth >2.0 m. In the beach and active dunes the soils are undifferentiated pale calcareous uniform soils with a sand surface texture and an average depth >2.0 m. All soils in this land system have high permeability and are susceptible to high wind and rill erosion.

¹ Data from nearby weather stations indicate 1300mm at Temma, 1900mm at Balfour, 1540mm at Tewkesbury, 2180mm at Waratah and 1950mm at Savage River (Australian Bureau of Meteorology Website - www.bom.gov.au)

613111 Thornton River

This land system has developed on gently undulating plains on Precambrian sandstone-mudstone sequences. The soils on the plain are black sandy organic soils, becoming gravelly, with a peat surface texture. They have high permeability, an average depth of 0.6 m and have a low susceptibility to sheet erosion.

Stony, strong brown duplex soils with a loam surface texture have developed on slight rises. These soils have a moderate permeability, an average depth of 1.6 m and a low susceptibility to sheet erosion.

In the drainage lines the soils are black sandy organic soils with a sandy peat surface texture, high permeability and an average depth of 0.3 m. These soils have a high susceptibility to rill and gully erosion.

614131 Kellys Knob

Gradational soils have developed on low hills on Precambrian mudstones, quartzites. In the drainage lines they are light olive brown, have a peaty loam surface texture and an average depth >2.0 m. In the swales and gentle lower slopes they are gravelly, greyish brown, have a peaty loam surface texture and an average depth of 1.0 m.

On the crests and gentle upper slopes they are gravelly light brownish grey, with an average depth of 0.6 m. On the steeper side slopes they are gravelly brownish yellow to yellowish brown, with an average depth of 1.0 m. The soils in both these areas have a clay loam surface texture.

All the soils in this land system have a moderate permeability and a low susceptibility to sheet erosion.

714121 Neasey Plains

This land system has developed on mainly undulating plains on Precambrian slates and quartzite. On the crests and steeper upper slopes the soils are gravelly, black organic clay loams with a gravelly peat surface texture, high permeability, an average depth of 0.3 m and a high susceptibility to gully erosion.

On the lower slopes the soils are dark grey gradational soils with an average depth of 0.4 m. On the foot slopes, swales and flats they are gravelly, grey gradational soils with an average depth of 1.9 m. The soils in both these areas have a loamy peat surface texture, moderate permeability and are susceptible to low sheet erosion.

In the forested areas the soils are gravelly, yellow gradational soils with a peaty loam surface texture, moderate permeability and an average depth of 0.6 m. These soils are susceptible to moderate waterlogging.

714131 Milkshake Hills

This land system has developed on low hills on Precambrian slaty mudstones and dolomite. On the extensive dolomite areas the soil is black to very dark brown peat that becomes very gravelly with depth. This peat has a high permeability, an average depth of 0.5 m and is susceptible to high sheet and rill erosion.

Gradational soils have developed on the mudstone. On the crests and upper slopes they are gravelly, greyish brown, have a peat surface texture, an average depth of 0.4 m and are susceptible to moderate sheet erosion. On the side slopes the soils are brownish yellow to yellowish brown, have a loam surface texture, a moderate permeability, an average depth of 0.8 m and a moderate susceptibility to gully and sheet erosion.

In the swales they are gravelly, mottled light brownish grey, brownish yellow, have a peat surface texture, an average depth of 1.6 m and are susceptible to low sheet erosion.

722131 Trowutta

This land system has developed on mainly low hills on Cambrian basic-intermediate volcanics and greywacke turbidite sequences. The soils in this land system are gradational, with a clay loam surface texture and a moderate permeability.

On the crests they are gravelly, yellowish red and have an average depth of 1.0 m and on the undulating lower slopes they are yellowish brown and have an average depth of 2.0 m. These soils are susceptible to low sheet and rill erosion.

On the steeper valley slopes the soils are gravelly yellowish red to strong brown, have an average depth of >1.8 m and are susceptible to moderate sheet and rill erosion. In the flowlines they are brownish yellow, have an average depth of >2.0 m and are subject to moderate siltation.

782131 K-Wood

This land system has developed on low hills on Tertiary basalt. Strong brown uniform clay soils have developed on the crests and gentle upper slopes and yellowish red gradational soils on the steeper side slopes. Both these soils have a clay loam surface texture. In the drainage lines the soils are dark brown uniform soils with a medium clay surface texture.

All the soils in this land system have a moderate permeability, an average depth >1.8 m and a low susceptibility to sheet erosion.

4.5 Geoconservation

The area is considered to have a number of outstanding natural features, many of which have been identified as geo conservation sites. There are a number of geoconservation sites located in the vicinity of the Tarkine Forest Drive. These are listed by significance and sensitivity in Table 4.1. Site sensitivity is defined in Table 4.2. No direct impact on these sites is anticipated as a result of the proposed action.

Table 4.1 - Geoconservation sites in the vicinity of the Tarkine Forest Drive

Code	Site Name	Significance	Sensitivity
NSB08	Balfour Warm Spring	World	2
NSB25	Balfour 'String of Beads' Fossil Locality	World	3
ART14	Trowutta - Sumac Karst Systems	Australia	4
NSB21	Prickly Wattle Palaeosols	Tasmania	1
NSB17	Mawson Bay-Gardner Point Precambrian Sedimentary Structures	Tasmania	3
ART01	Arthur River Stromatolite Localities	Tasmania	3
ART13	Trowutta Arch	Tasmania	6
NSB04	Spongolite/Limestone Association	Tasmania	7
ART04	Rapid River Linear Feature	Tasmania	9
NSB01	Arthur River Estuary	Tasmania	9
NSB06	Smithton Basin Plain Karst	Tasmania	9
ART08	Julius River Stromatolite Locality	Regional	3
HUN26	Welcome Swamp/Salmon/Blackwater Karst Systems	Regional	4
NSB22	Rebecca Lagoon Dune-barred Drainage	Regional	4
NSB24	Tarkine High-level Cobble Beaches	Regional	5
NSB02	Oxbow Lakes	Regional	6

Code	Site Name	Significance	Sensitivity
NSB03	Arthur River Togari Group Typical Section	Regional	8
NSB09	Australia Point Ladder Ripples	Local	3
NSB05	Roger River - Ekberg Karst Systems	Unknown	4

Table 4.2 - Geoconservation site sensitivity index

Sensitivity	Definition
1	Values sensitive to inadvertent damage simply by diffuse, free ranging human pedestrian passage, even with care (e.g. fragile surfaces that may be crushed underfoot).
2	Values sensitive to effects of more focussed human pedestrian access even without deliberate disturbance (e.g. entrenchment by pedestrian tracks; coastal dune disturbance).
3	Values sensitive to damage by scientific or hobby collecting or sampling, or by deliberate vandalism or theft (e.g. some fossil and mineral sites; speleothems).
4	Values sensitive to damage by remote processes (e.g. hydrological or water quality changes; blasting impact; changes to subsurface seepage water routes).
5	Values sensitive to damage by higher intensity shallow linear impacts, depending upon their precise position (e.g. vehicle tracks; minor road construction; excavation of ditches or trenches).
6	Values sensitive to higher intensity but shallow generalised disturbance on site. (This might involve either the removal or addition of material) (E.g. light tracks and associated drainage changes; soil erosion; site rehabilitation in quarries or road cuttings).
7	Values sensitive to deliberate linear or generalised shallow excavation (simple road construction; shallow borrow pits).
8	Values sensitive to major removal of geo-material, or large scale excavation or construction (e.g. quarries).
9	Values sensitive only to very large scale contour change (e.g. very large quarries).
10	Special cases. Large regions whose geoconservation values reside essentially in their large scale form.

4.6 Historic heritage values

No listed historic heritage sites of either state or national significance were identified by the historic heritage investigations.

4.7 Indigenous heritage values

The background research and field investigations found no new Aboriginal heritage sites. The investigation did confirm a number of known Aboriginal Heritage Sites (as listed on the Tasmanian Aboriginal Site Index) adjacent to the proposed road development on Segment D.

Because the proposed works predominantly involve sealing existing roads only they are not expected to impact on any known Aboriginal heritage sites.

4.8 Other important or unique values of the environment

The route of the proposed Tarkine Forest Drive skirts the northern boundaries of the area known as the Tarkine which is made up of a series of dedicated formal reserves and multiple use State Forest between the Arthur River and the Pieman River.

All State Forest in this region has been assessed under the Tasmanian Regional Forest Agreement (1997), two subsequent 5 year reviews of the RFA and again during the Tasmanian Community Forest Agreement (2005).

The road predominantly passes through registered multiple use forest that has a 40-year history of management for wood production, recreation and conservation.

The Tarkine has been nominated for National Heritage Listing.

Forest reserves along the Tarkine Forest Drive (or close to) include:

- Lake Chisholm Forest Reserve
- Julius River Forest Reserve
- Trowutta Forest Reserve
- Balfour Track Forest Reserve
- Sumac Forest Reserve
- Rebecca Creek Forest Reserve.

Conservation areas include:

- Arthur-Pieman Conservation Area (a very large area encompassing much of the area between the Arthur and Pieman Rivers).

Public reserves:

- There is a small Public Reserve at the Arthur River where the proposed road (Segment A) reaches the Arthur River.

4.9 Flora and Fauna assessment methodology

The assessment for matters of NES has been undertaken in accordance with the *Guidelines for Natural Values Assessment*.² The flora and fauna report prepared by NBES Ecosystem Services is provided in Appendix B. It is referred to often throughout this PER in relation to matters of NES and is cited as NBES 2011.

4.9.1 Background research

The following sources were used for biological records from the region (NBES 2011):

- Natural Values Report³ - all threatened plant and animal records within 5 km of the study area plus potential suitability for other threatened fauna
- EPBC Act Protected Matters Report⁴ - all matters of NES that may occur in the area or relate to the area in some way
- ECOtas (2009) - for information regarding threatened flora: *Caladenia dienema* (windswept spider-orchid) and *Prasophyllum favonium* (western leek orchid) in the Arthur-Pieman Conservation Area and miscellaneous findings of other threatened species and species of biogeographical interest
- A literature review of research relevant to the Tasmanian devil, the Devil Facial Tumour Disease (DFTD) and roadkill.

² [http://www.dpiw.tas.gov.au/inter/nsf/Attachments/SSKA-7UM3YC/\\$FILE/Guidelines%20for%20Natural%20Values%20Assessments.pdf](http://www.dpiw.tas.gov.au/inter/nsf/Attachments/SSKA-7UM3YC/$FILE/Guidelines%20for%20Natural%20Values%20Assessments.pdf)

³ Natural Values Atlas, 5 October 2011 (DPIPWE)

⁴ EPBC Act Protected Matters Report , 5 October 2011 (Commonwealth of Australia)

4.9.2 Flora assessment

Most of the existing road corridors have been inspected from a moving vehicle. Sufficient information has been collected to be able to map the vegetation communities along the route. Validation sampling has been undertaken of representative examples of each vegetation community to confirm community classification (NBES 2011).

Vegetation communities have been extrapolated to a corridor of 50 m either side of the existing road from field data and interpretation of aerial photography. Vegetation communities have been determined according to TASVEG (Harris and Kitchener 2005 cited in NBES 2011).

Environmental and ‘declared⁵’ weed locations have been mapped (NBES 2011).

Plant pathogens, including *Phytophthora cinnamomi* which causes dieback and *Chalara australis* fungus which causes myrtle wilt, have been considered. Symptomatic evidence of either infection has been recorded (NBES 2011).

Natural Values Atlas and EPBC Act Protected Matters Report records of threatened species with moderate to high accuracy within 500 m of the road corridor have been considered in greater detail in respect to the probability of the species having populations that may be impacted by the proposed action (NBES 2011). Field surveys have been undertaken, guided by the database records.

Preliminary surveys were undertaken in winter (July) 2009. These surveys and desktop studies identified areas with a high probability of supporting threatened flora warranting targeted survey during appropriate flowering or vegetative periods (NBES 2011).

Targeted surveys were undertaken for northwest heath (September 2009) and for orchids and other threatened flora on the coastal heaths (November 2009) (NBES 2011).

Botanical nomenclature follows the census of Tasmanian plants (Buchanan 2009 cited in NBES 2011).

Northwest heath survey

A survey was undertaken in September 2009 along the Rebecca Road between the Frankland River bridge and Temma Road to map and define the populations of northwest heath (*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 north west heath and to take place before other white flowering shrubs had commenced full flowering (NBES 2011).

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 (<50 km/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* (NBES 2011).

Orchid and spring ephemeral survey

A targeted survey was undertaken between 3 and 5 November 2009. The survey involved a single pass on foot along each side of the road between Arthur River and the boundary of State Forest at Rebecca Creek.

⁵ Under the *Weed Management Act 1999* (Tas)

All potential habitats were inspected for several threatened orchid species that have been previously recorded from the vicinity. The timing was chosen to maximise opportunity for identifying the species to coincide with their flowering period. Locations of previous records of threatened orchids were targeted (NBES 2011). All threatened species identified were documented. Detailed information on numbers of plants and the distribution in relation to the existing road were measured and recorded. At one location known as Tiger Flats (northern end of Segment B - Figure 4.1), intensive searching was undertaken in the area immediately surrounding any observed plants to ensure all plants present were recorded. This involved passes on foot at 2 m intervals by three ecologists. This area was subsequently reinspected by members of Threatened Plants Tasmania in 2010 (Threatened Species Section 2010).

4.9.3 Fauna assessment

Fauna habitats were reviewed and assessed for their potential to provide habitats for threatened fauna identified from the desktop study as occurring or potentially occurring within the study area. The mapped vegetation communities were used as a basis for identifying fauna habitats (NBES 2011).

Fauna observations were recorded on all road sections, although sections that were walked enabled considerably more observations of scats and footprints of the Tasmanian devil and spotted-tailed quoll to be recorded. Opportunistic observations of mammal fauna throughout the survey were recorded, including roadkill (NBES 2011).

A subsequent survey of the entire route was undertaken over 2 days in March 2012. Attention was given to identifying location of carnivore scats as a means of identifying potential roadkill hot spots for vertebrate carnivore such as Tasmanian devil and spotted-tailed quoll. Inspections were also made of all creek crossings with consideration of suitability for passage by giant freshwater crayfish. The purpose of this investigation was to identify potential locations where animals may be forced to leave the creek to cross the road.

The potential for the project to introduce or expand the range of feral animals and animal diseases (notably Chytrid fungus) was also considered (NBES 2011).

Vertebrate carnivores

The northwest of Tasmania is an important area for two threatened species of vertebrate carnivore, the Tasmanian devil and the spotted-tailed quoll (Jones and Rose 1996 cited in NBES 2011). Therefore, the fauna survey has focused on these species. The Tasmanian devil has been subject to intensive study and research in recent years because of the threat posed by DFTD to the long-term survival of the largest marsupial carnivore in Australia (NBES 2011).

The potential impact of the proposed Tarkine Forest Drive has been the subject of significant media interest, provoked by an open letter sent by a group of concerned scientists to Peter Garrett, the then Minister of DEWHA and to Mr David Llewellyn the former Minister of DPIW. The concerns that have been expressed are based on the notion that the area provides an important refuge for the Tasmanian devil. The area is understood to support relatively high densities of devils that are not yet infected by DFTD (Hawkins et al. 2006, MacCallum et al. 2007 cited in NBES 2011).

There is a view that the development of the Tarkine Forest Drive will allow the movement of DFTD into an uninfected area as well as resulting in a significant increase in roadkill which would provide additional pressure on an already threatened species.

An aim of the fauna survey was to examine and test these assumptions or provide recommendations as to how they could be further tested (NBES 2011).

The fauna assessment sought to collate the most recent information and knowledge of the Tasmanian devil and DFTD. It considers the dispersal patterns of the Tasmanian devil and the impact roads might have on the species.

It also considered the current distribution and population density of the Tasmanian devil in the region and the most recent information about the distribution of DFTD (NBES 2011).

Previous studies on the relationship between traffic, road type and roadkill elsewhere in Tasmania were reviewed. The potential impacts of roadkill from the Tarkine Forest Drive development were assessed. The road alignment was reviewed to identify likely hotspots for devil and quoll activity (NBES 2011).

The fauna assessment also investigates the possible impacts of the project on the potential spread of DFTD. The assessment considers whether the project is likely to (NBES 2011):

- Increase the rate and distance of movement of devils
- Facilitate the movement of animals from areas of infection to areas currently free of the disease
- Significantly change existing (if they exist) natural barriers to devil movement in northwest Tasmania.

A forum was held in late July 2009, attended by scientists with knowledge of the Tasmanian devil and/or spotted-tailed quoll along with staff from State and Federal Government agencies and project engineers and consultants. The forum provided an opportunity to communicate the details of the project to the scientists and to obtain feedback on what are the key issues associated with the project in relation to impacts on Tasmanian devils and spotted tailed quolls. Discussions were had on the issues relating to roadkill and DFTD. The outcomes from the forum have been used to inform the fauna assessments.

At the time of the forum, it was the original project plan being discussed. This included a new link east of Tayatea Road through to Myalla Road. Consequently, much of the discussion revolved around considerations that are no longer relevant (NBES 2011).

Roadkill and headlight survey

A headlight survey was undertaken for four consecutive evenings in early July (2009), covering sections A-L. The purpose of this survey was to provide some indicative information on presence of species and their distribution (NBES 2011).

A 12 month monitoring project has been undertaken covering the western half of the route where existing roads are in place (Segments A-J)⁶.

The monitoring was linked to the use of traffic counters (for three 3 week periods) which recorded numbers, classification (axle set up) and speed of vehicles. Roadkill monitoring included daily surveys of 100 km of study road made up of 60 km of the Tarkine Forest Drive, plus two 20 km reference roads. Weekly roadkill data was collected for the remaining 43 weeks of the year to detect variations caused by seasonal changes such as weather and post weaning wildlife. Headlight surveys were also undertaken to attempt to inform hot spots of activity and to check for any correlation between these and roadkill hotspots.

The purpose of the monitoring was:

- To compare the roadkill rate before and after development of the Tarkine Forest Drive
- To identify hotspots of roadkill before construction to inform mitigation measures
- To test the effectiveness of headlight surveys for identifying roadkill hot spots
- To provide ongoing data to inform adaptive management response to pre determined triggers.

⁶ undertaken by Wildspot Consulting (Sept 2009-2010)

Eagle nest habitat

Forestry Tasmania (FT) has provided map data identifying areas that were aerially searched for eagle nests. Although no metadata was included, the maps indicate areas identified as potential nest habitat and the search route flown by helicopter. The search area covered approximately 500 m either side of the road, presumably based on the assumption that limited sighting is likely beyond that distance.

Habitat areas appear to follow standard nest site characteristics described in the Forest Practices Authority *Fauna Technical Note No. 1: Eagle Nest Searching, Activity Checking and Nest Management*⁷. That is, the habitat areas have been derived from Photographic Interpretation (PI) types that distinguish mature eucalypts as emergent trees in the canopy that are greater than 27 m in height (Forest Practices Authority 2009 cited in NBES 2011). More recent PI mapping identifies several other areas of potential eagle nesting habitat that were not identified in the FT mapping. A potential eagle nest habitat map for a 1 km corridor has been provided by DPIPW. This considers PI type and slope and aspect. Information from the ground survey, particularly the height of the eucalypt communities in the vicinity of the proposed route has been included in the development of the eagle nest habitat model (NBES 2011).

A prospective eagle nest habitat map was developed which identified those areas requiring further searching. The additional areas were searched by helicopter using a Ecureuil AS350 B2 which is well suited to this task as it is able to carry three passengers and capable of hovering, thus maximising the searching efficiency. The aerial survey was undertaken on 23rd February 2010. Surveyors included two staff from NBES and Nick Mooney⁸. The flight course was programmed into the helicopter GPS to provide the pilot with the road alignment. The survey then ventured into perceivable habitat that was identified as supporting mature eucalypt forest. Other prospective habitat identified during the survey that fell outside the modelled areas was also inspected (NBES 2011).

Frog survey

Potential habitat along the coastal sections was the subject of a separate study⁹ to assess the presence of the *Litoria raniformis* (green and gold frog) (NBES 2011).

4.9.4 Analysis

Data collected included remapping of vegetation communities, weeds, plant disease, threatened species locations, and evidence of Tasmanian devil or spotted tailed quoll activity. The findings have been collated using a Geographical Information Systems (GIS). This information has been analysed at a mapping scale of 1:17,500. Maps to this scale have been set up on GIS for printing to inform management decisions, further survey, planning etc. Calculations have been made to determine the extent of vegetation that will be cleared to construct the road. This uses vegetation mapping based on TASVEG with updates to areas that were covered by surveys (NBES 2011).

Concept design has been used where available¹⁰(NBES 2011).

4.9.5 Limitations

The vegetation assessment has not identified all vascular flora due to the limitations of the sampling technique. Sampling has been undertaken to a level that assists with vegetation community identification. Threatened flora habitat has been identified applying current knowledge of the species (NBES 2011).

⁷ <http://www.fpa.tas.gov.au> accessed 5/10/2009

⁸ recently retired from DPIPW, Nick Mooney is a wildlife biologist with vast experience of research of the wedge-tailed eagle

⁹ undertaken by Wildpsot Consulting 2010

¹⁰ Limited to footprints of car parks to be sealed

Targeted surveys have been undertaken only at selected sites identified in the earlier assessment ¹¹(NBES 2011).

All threatened plant species known from the Natural Values Atlas and the EPBC Act Protected Matters Report are considered in the light of habitat suitability (NBES 2011).

The fauna assessment was informed by the identification of habitat of significant fauna species known from the area, based on the interpretation of database records for threatened fauna. Headlight surveys for fauna were undertaken on four nights and tracks and other signs that indicated fauna presence (e.g. scats and footprints) were opportunistically noted. A separate headlight and roadkill study, commissioned on the back of recommendations of earlier investigations, was reviewed (NBES 2011).

4.10 Threatened flora species

Table 4.3 provides a summary of the survey results for EPBC Act listed threatened flora species previously recorded on the Natural Values Atlas (within a 5 km radius of the study area) or listed on the EPBC Act Protected Matters Report (NBES 2011).

¹¹ undertaken by NBES in 2009 for the original Tarkine Road proposal

Table 4.3 - Summary of the survey results for EPBC Act listed threatened flora species previously recorded on the Natural Values Atlas (within a 5 km radius of the study area) or listed on the EPBC Act Protected Matters Report

To be *likely*, it is not necessary for an impact to have a greater than 50% chance of happening; it is sufficient if an impact on the environment is a real or not remote chance or possibility.¹²

In this table *impact* is without safeguards and mitigation measures and may include direct, indirect, facilitated or cumulative impacts. Section 5 of the PER specifies type and significance of impact.

PER Reference	Matter of NES	Results of surveys and assessment of likelihood of occurrence/habitat suitability	Applicable segment along the Tarkine Forest Drive	Is the proposed action <i>likely</i> to have an <i>impact</i> on the matter of NES and why?	Section 5 reference where <i>impact</i> is further assessed																												
4.10.1	Arthur River greenhood (<i>Pterostylis rubenachii</i>) EPBC Act status: Endangered	Recorded within 100m of the road. Widespread along the coastal plain south of Arthur River to Bottle Flats (Segments A & B) with numerous populations including one at Tiger Creek.	<table border="1"> <tr> <td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td> </tr> <tr> <td style="background-color: #f08080;"></td><td style="background-color: #f08080;"></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	A	B	C	D	E	F	G	H	I	J	K	L	M	N															The proposed action is likely to have an impact on this matter of NES.	5.5.1
A	B	C	D	E	F	G	H	I	J	K	L	M	N																				
No further analysis in PER	Grassland greenhood (<i>Pterostylis ziegeleri</i>) EPBC Act status: Vulnerable	No records within 100m of the road. Recorded at Gardiner Point, Arthur River in 2009 in grassland on dune swales. Limited potential habitat along road. Targeted surveys during flowering season in 2009 failed to identify any plants within the road corridor. Most suitable habitat (Tiger Flats) has been subject to regular investigations but this species has never been recorded.	<table border="1"> <tr> <td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td> </tr> <tr> <td style="background-color: #f08080;"></td><td style="background-color: #f08080;"></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	A	B	C	D	E	F	G	H	I	J	K	L	M	N															The proposed action is unlikely to have any impact on this matter of NES. Justification: There is no impact to known habitat and no facilitated impacts can be envisaged.	No further analysis in the PER
A	B	C	D	E	F	G	H	I	J	K	L	M	N																				
4.10.2	Large golden moths - also known as snake orchid (<i>Diuris lanceolata</i>) EPBC Act status: Endangered	No records within 100m of the road. Recorded within 500m. Moderate potential to occur. Targeted surveys during the flowering season in 2008 and 2009 failed to identify any plants within the road corridor.	<table border="1"> <tr> <td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td> </tr> <tr> <td></td><td style="background-color: #f08080;"></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	A	B	C	D	E	F	G	H	I	J	K	L	M	N															The proposed action is unlikely to have any impact on this matter of NES. Justification: There is no impact to known habitat and no facilitated impacts can be envisaged.	No further analysis in the PER
A	B	C	D	E	F	G	H	I	J	K	L	M	N																				

¹² Australian Government (2009)

PER Reference	Matter of NES	Results of surveys and assessment of likelihood of occurrence/habitat suitability	Applicable segment along the Tarkine Forest Drive	Is the proposed action <i>likely</i> to have an <i>impact</i> on the matter of NES and why?	Section 5 reference where <i>impact</i> is further assessed																												
4.10.3	Leafy greenhood (<i>Pterostylis cucullata</i> subsp. <i>cucullata</i>) EPBC Act status: Vulnerable	No records within 100m of the road. Recorded within 500m. Low potential to occur. Two populations in the vicinity at Gardiner Pt (Arthur River) and Possum Banks (south of Temma). Targeted surveys during flowering season in 2009 failed to identify any plants within the road corridor.	<table border="1"> <tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>	A	B	C	D	E	F	G	H	I	J	K	L	M	N															<p>The proposed action is unlikely to have any impact on this matter of NES.</p> <p>Justification: There is no impact to known habitat and no facilitated impacts can be envisaged.</p>	No further analysis in the PER
A	B	C	D	E	F	G	H	I	J	K	L	M	N																				
No further analysis in PER	Native wintercress (<i>Barbarea australis</i>) EPBC Act status: Critically Endangered	No records within 100m of the road. There are no records from north west Tasmania at all. Low potential to occur. A herb of riparian systems that drain to the south and north of the Central Highlands.	Not applicable	<p>The proposed action is unlikely to have any impact on this matter of NES.</p> <p>Justification: The Tarkine Rd is outside the known range of this species.</p>	No further analysis in the PER																												
4.10.4	Northern leek orchid (<i>Prasophyllum secutum</i>) EPBC Act status: Endangered	No records within 100m of the road. Recorded within 500m. Low potential to occur. Single previous record along Temma Rd (Segment B) is of low accuracy and old (1990). Targeted surveys during flowering season in 2008 and 2009 failed to identify any plants within the road corridor. Much of Segment B was burnt in 2009 providing ideal conditions for flowering in 2009.	<table border="1"> <tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>	A	B	C	D	E	F	G	H	I	J	K	L	M	N															<p>The proposed action is unlikely to have any impact on this matter of NES.</p> <p>Justification: There is no impact to known habitat and no facilitated impacts can be envisaged.</p>	No further analysis in the PER
A	B	C	D	E	F	G	H	I	J	K	L	M	N																				
4.10.5	Pretty leek orchid (<i>Prasophyllum Pulchellum</i>) EPBC Act status: Critically Endangered	No records within 100m of the road. Recent record from 200m east of Temma Rd. Moderate potential to occur. Also known to occur near Bluff Point Rd turnoff, 4km north of study area and at Rebecca Creek 2km south.	<table border="1"> <tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>	A	B	C	D	E	F	G	H	I	J	K	L	M	N															<p>The proposed action is unlikely to have any impact on this matter of NES.</p> <p>Justification: There is no impact to known habitat and no facilitated impacts can be envisaged.</p>	No further analysis in the PER
A	B	C	D	E	F	G	H	I	J	K	L	M	N																				

PER Reference	Matter of NES	Results of surveys and assessment of likelihood of occurrence/habitat suitability	Applicable segment along the Tarkine Forest Drive	Is the proposed action <i>likely</i> to have an <i>impact</i> on the matter of NES and why?	Section 5 reference where <i>impact</i> is further assessed																												
		Targeted surveys during flowering season in 2008 and 2009 failed to identify any plants within the road corridor.																															
No further analysis in PER	Scrambling ground fern (<i>Hypolepis distans</i>) EPBC Act status: Endangered	No records within 100m of the road. Very low potential to occur. Only known in the vicinity from a site close to Henry Ryan Creek 7km northwest of Tayatea Bridge. This is one of only four known populations on mainland Tasmania.	Not applicable	The proposed action is unlikely to have any impact on this matter of NES. Justification: Outside known range, likelihood of occurrence is remote	No further analysis in the PER																												
4.10.6	Shortspike midge orchid (<i>Corunastylis brachystachya</i>) EPBC Act status: Endangered	Recorded within 100m of the road. Recorded in segment B in heathland near Couta Rocks. One location is 30 m from the edge of the road.	<table border="1"> <tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>	A	B	C	D	E	F	G	H	I	J	K	L	M	N															The proposed action is likely to have an impact on this matter of NES.	5.5.2
A	B	C	D	E	F	G	H	I	J	K	L	M	N																				
No further analysis in PER	Tailed spider-orchid (<i>Caladenia caudata</i>) EPBC Act status: Vulnerable	No records within 100m of the road. No records from region.. Very low potential to occur (heathland). No records from far NW Tasmania, although known from Rocky Cape National Park where there is similar habitat.	Not applicable	The proposed action is unlikely to have any impact on this matter of NES. Justification: The Tarkine Rd is outside the known range of this species.	No further analysis in the PER																												
4.10.7	Western leek orchid (<i>Prasophyllum favonium</i>) EPBC Act status: Critically Endangered	No records within 100m of the road. Recorded within 500m. Low potential to occur. Three previous records along Temma Rd (Segment B) are of low accuracy and old (1998 and 1988). Targeted surveys during flowering season in 2008 and 2009 failed to identify any plants within the road corridor.	<table border="1"> <tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>	A	B	C	D	E	F	G	H	I	J	K	L	M	N															The proposed action is likely to have an impact on this matter of NES.	5.5.3
A	B	C	D	E	F	G	H	I	J	K	L	M	N																				

PER Reference	Matter of NES	Results of surveys and assessment of likelihood of occurrence/habitat suitability	Applicable segment along the Tarkine Forest Drive	Is the proposed action <i>likely</i> to have an <i>impact</i> on the matter of NES and why?	Section 5 reference where <i>impact</i> is further assessed																												
4.10.8	<p>Windswept spider orchid (<i>Caladenia dienema</i>)</p> <p>EPBC Act status: Endangered</p>	<p>Recorded within 100m of the road. Recorded at several sites close to Segment B including:</p> <ul style="list-style-type: none"> • South of Alert Creek: 30m from the edge of the road • North of Sundown Creek: 50m from the edge of the road • Couta Rocks Rd: On edge of road 400m outside project area. 	<table border="1" data-bbox="1003 443 1438 512"> <tr> <td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td>K</td><td>L</td><td>M</td><td>N</td> </tr> <tr> <td style="background-color: #f08080;"></td><td style="background-color: #f08080;"></td><td style="background-color: #f08080;"></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>	A	B	C	D	E	F	G	H	I	J	K	L	M	N															<p>The proposed action is likely to have an impact on this matter of NES.</p>	5.5.4
A	B	C	D	E	F	G	H	I	J	K	L	M	N																				

Eight EPBC Act listed threatened flora species have been recorded from within 500 m of the proposed Tarkine Forest Drive. This is based on the following:

- A review of the Natural Values Atlas records of moderate or high accuracy
- Targeted surveys undertaken by ECOtas (2009) on behalf of DPIPW as part of extension surveys for threatened orchids
- Targeted survey of Segments A, B and C undertaken for the proposed action by NBES (2011)
- Targeted survey for habitat of one species by Threatened Plants Tasmania (cited in NBES 2011).

These species are all orchids and include:

1. Arthur River greenhood (*Pterostylis rubenachii*)
2. Large golden moths - also known as snake orchid (*Diuris lanceolata*)
3. Leafy greenhood (*Pterostylis cucullata* subsp. *cucullata*)
4. Northern leek orchid (*Prasophyllum secutum*)
5. Pretty leek orchid (*Prasophyllum pulchellum*)
6. Shortspike midge orchid (*Corunastylis brachystachya*)
7. Western leek-orchid (*Prasophyllum favonium*)
8. Windswept spider orchid (*Caladenia dienema*).

Locations of these orchids in relation to the development footprint are depicted in Appendix A. Further information in relation to abundance, distribution, ecology, habitat preferences, known threats and detailed survey results is provided below.

4.10.1 Arthur River Greenhood (*Pterostylis rubenachii*)



Figure 4.1 - Arthur River greenhood (Tiger Flats)

Abundance

The estimated total population of Arthur River greenhood (Figure 4.1) is less than 900 plants. There are 4 known populations. The largest population estimated to support 800 plants in 1999 occurs over an area of 2.5 x 0.5 km (Bullocky Hill to Bottle Creek)¹³.

Distribution, ecology and habitat preference

Arthur River greenhood is endemic to Tasmania and is only found in the Arthur River area, where it extends over an area of 8 square kilometres occupying 3 hectares in total (Figure 4.2). The species occurred on the northwest coast at Western Plains and at Cowrie Point but is now believed to be extinct at these locations. The species is known from dry, sandy slopes of sparsely vegetated stabilised sand dunes, and also in permanently wet to moist scrubby and sedgy coastal heath converted to semi-improved pasture by annual slashing (Threatened Species Unit 2000).

Habitat occurs in the vicinity of Segments A and B. Observation records are shown in Appendix A Maps 1-4.

This species potentially flowers from October to November (Wapstra et al. 2010).

Known threats

The entire distribution of Arthur River greenhood is associated with modified environments maintained by slashing and winter agistment. The principal threats to the species are associated with a change of land management regimes. In summary, the threats to the species include the following (Threatened Species Unit 2000):

- Habitat loss (agricultural and urban development)
- Cattle grazing (localised erosion)
- Agricultural improvement (use of fertilisers)
- Revegetation (coast wattle planting)
- Inappropriate fire regime (reduced burning could lead to scrub invasion modifying habitat).

The impacts of the proposed action are discussed in Section 5. In summary they will result in no direct loss of habitat other than some small amounts of marginal habitat in grassland on segments A & B. The only potential losses are of plants that have colonised a gravelled swale adjacent to the road shoulder near an existing population (Figure 4.3). None of the other known threats will be affected by the proposed action. No changes to cattle grazing or other agricultural activities are anticipated. No coastal wattle planting will occur. No expectation for reduction in fire regime is anticipated.

There are no known pests or diseases that impact on this species. Neither the preferred grassy habitat nor the species is susceptible to *Phytophthora cinnamomi*. Fire outbreaks are not likely to adversely affect this species as the habitat is unlikely to be flammable during the spring flowering period. Orchids are adapted to fire and typically benefit from periodic burns. Fire is used as a tool for habitat management (Threatened Species Section 2010).

There is some potential risk that habitat at Tiger Creek is impacted if machinery is allowed to park or materials are stored in the grassy areas.

¹³ Tas DPIPWE unpublished report 2010 cited in the *Pterostylis rubenachii* – Arthur River Greenhood Species Profile and Threats Database (SPRAT Profile) <http://www.environment.gov.au>

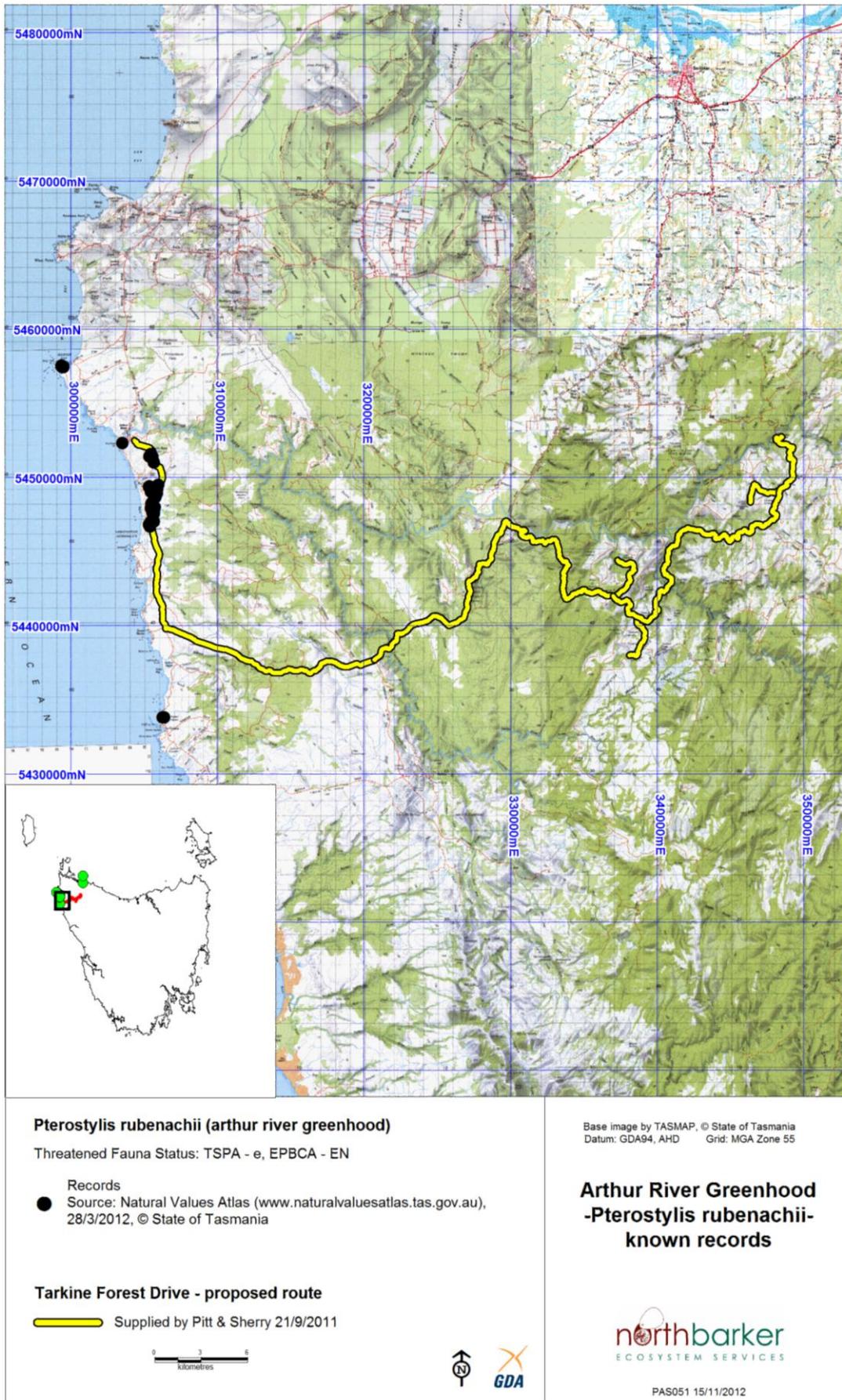


Figure 4.2 - Distribution of Arthur River greenhood (Source: Natural Values Atlas March 2012)

Survey

There was considered to be the potential for finding further populations of this orchid species in similar habitat in the vicinity of Segments A and B of the road and around Couta Rocks (NBES 2011). These areas were targeted for survey (as outlined in Section 4.9.2).

One population is located in close vicinity to the Tarkine Drive at a site known as Tiger Creek (Figure 4.3) which is located east of Temma Road in discrete areas north of Bottle Creek and roughly opposite the cattle yards.



Figure 4.3 - Grassland at Tiger Flats - significant orchid habitat (Segment B) (Source: NBES 2011)

As part of this project targeted searches were undertaken in November 2009 (4.9.2 Orchid and Spring Ephemeral Survey). No new populations were identified. One population at Tiger Creek was carefully inspected.

All known populations were separately investigated in 1999 and 2009 with the roadside populations near Tiger Creek reinspected in 2010 and 2012 (Threatened Species Section 2010, Threatened Plants Tasmania 2012).

The results from the targeted surveys at Tiger Creek revealed fluctuations in numbers with a dramatic decline observed in 2012 (219 in 1999, 160 in 2009, 211 in 2010 and only 43 in 2012).

The majority of plants are located in stable grassland habitat over 10 m from the road and not under direct threat from works. However, in 2009 it was observed that two plants were located much closer to the road shoulder. These plants are at risk to any road works including standard grading works (Figure 4.4).

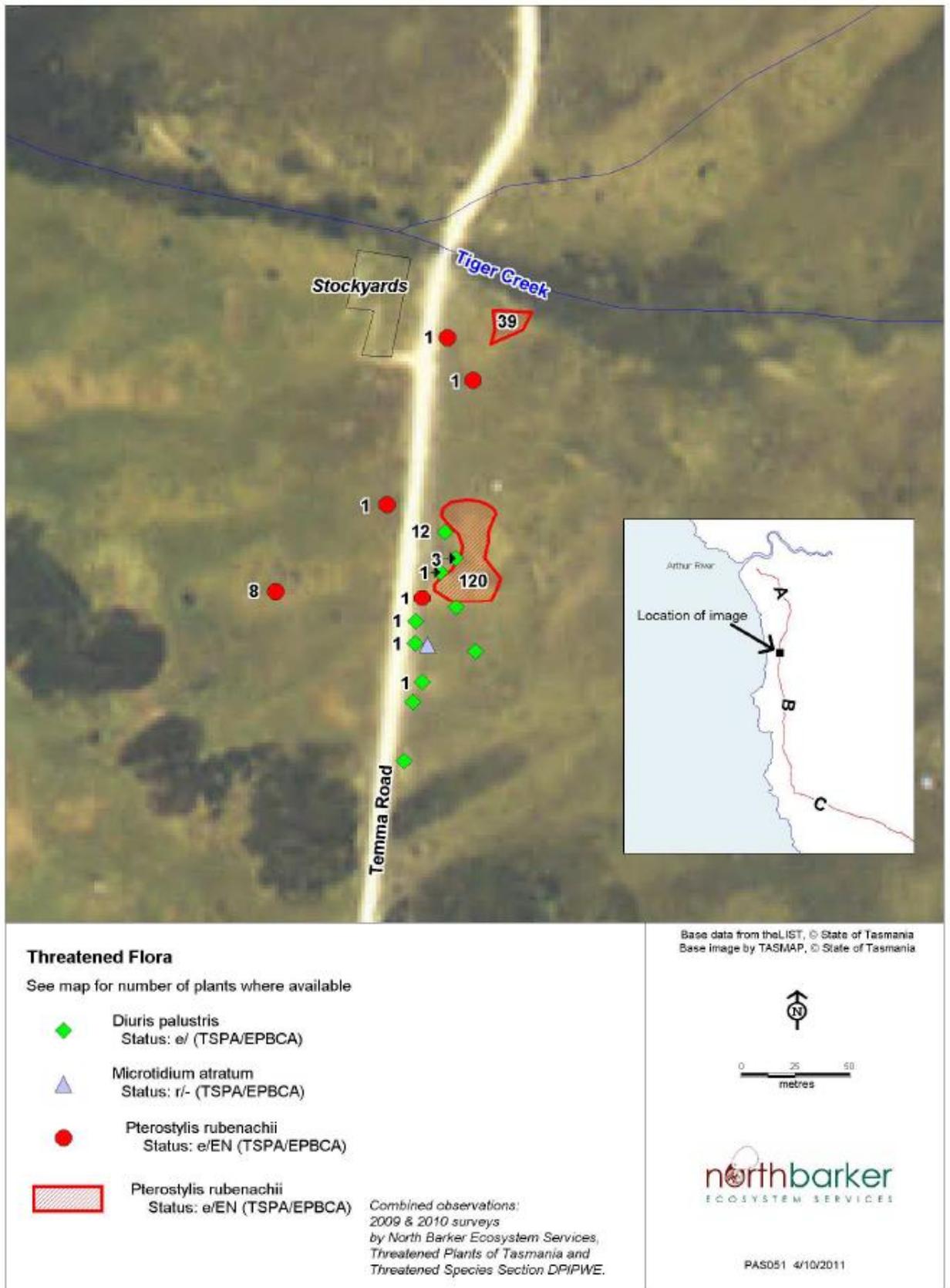


Figure 4.4 - Threatened flora from Tiger Flats (Segment B) (Source: NBES 2011)

One of the benefits of the 2012 survey is that the plants close to the roadside were relocated. These were able to be inspected to confirm that with the exception of one location containing two plants the areas supporting these plants can be avoided from any direct impact.

4.10.2 Large Golden Moths (*Diuris lanceolata*)

Abundance

The estimated total population of large golden moths (in a good flowering year) is between 500 and 800 plants with 200 to 250 in each of the two largest populations at Anthony Beach and Rebecca Lagoon. There are six known populations. However, due to agricultural activities the populations at Woolnorth and Marcus River Road are now considered extinct. Because of the restricted area of suitable habitat, the populations at Sundown Point and Nelson Bay are small (Threatened Species Unit 2000a).

Distribution, ecology and habitat preference

Large golden moths are endemic to Tasmania and confined to a 1,220 square kilometre area in the northwest corner of the State. Its distribution is localised in the Arthur River region and between Stanley and Smithton (Figure 4.5).

The species is known from windswept coastal grassland and coastal scrub and heathland among dwarfed shrubs and sedges on moist to well drained sandy and clay loam, sometimes on rocky outcrops (Threatened Species Unit 2000a).

Habitat occurs in the vicinity of Segment B. Observation records are shown in Appendix A Maps 5 & 6.

Flowering may occur from November to January (Wapstra et al. 2010).

Known threats

The key threats to large golden moths are clearing, draining and pasture development, which is believed to have eliminated the species from much of its historical distribution. The sites at Sundown Point and Nelson Bay are not subject to any known threats (Threatened Species Unit 2000a).

No threats to this species will be derived from this action as no populations occur in the immediate vicinity of the road to be affected by any clearing or drainage works. No pasture development is facilitated by this action.

None of the other known threats will be affected by the proposed action. No clearance of vegetation or draining is anticipated in potential habitat. No pasture development will result from this action.

There are no known pests or diseases that impact on this species. Neither the preferred grassy habitat nor the species is susceptible to *Phytophthora cinnamomi*. Fire outbreaks are not likely to adversely affect this species as the habitat is unlikely to be flammable during the spring flowering period. Orchids are adapted to fire and typically benefit from periodic burns. Fire is used as a tool for habitat management (Threatened Species Section 2010).

Survey

Three of the four Natural Values Atlas records are located between Sundown Creek and Nelson River and out toward Sundown Point. Targeted surveys by ECOTas (2009) in the summer of 2008/2009 located extant populations near Sundown Point and near Rebecca Lagoon. The records from ECOTas (2009) include numerous individual plants and localised patches that infill the known extent of this species (NBES 2011).

The roadsides in the vicinity of these populations were targeted for survey (as outlined in section 4.9.2).

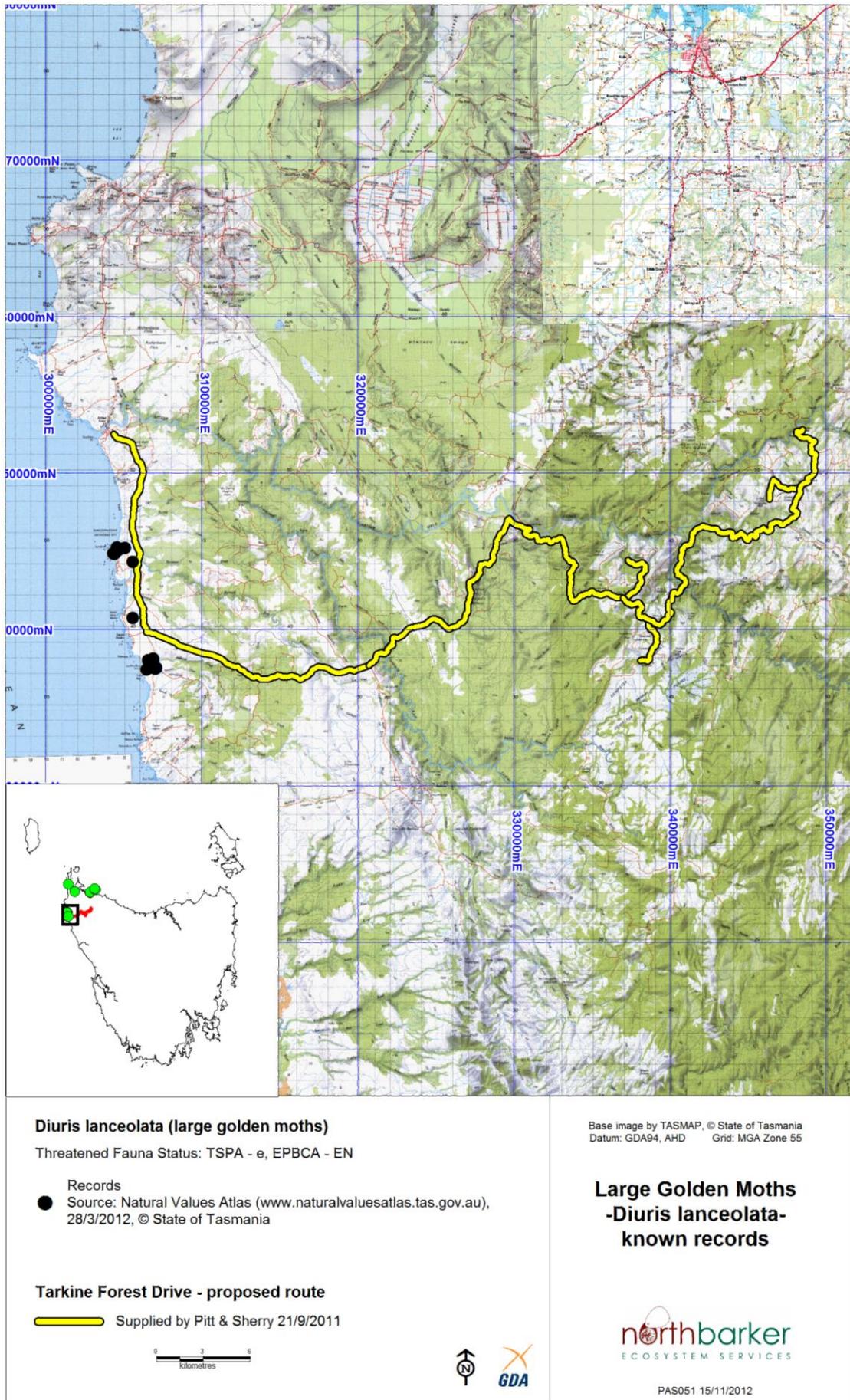


Figure 4.5 - Distribution of large golden moths (Source: Natural values Atlas March 2012)

There have been no records of this species from the section of road impacted by the proposed action. With such a conspicuous flower it is unlikely to have been overlooked, given the intensity of surveys in this area during the peak flowering period (NBES 2011).

4.10.3 Leafy Greenhood (*Pterostylis cucullata* subsp. *cucullata*)

Abundance

The estimated total population of leafy greenhood in Tasmania is 10,000 to 11,000 plants (Threatened Species Section 2010a). The Australian population is estimated to include 50,000 Duncan (2010). There are sixteen subpopulations in Tasmania. Locally, there are two populations at Gardiner Point near Arthur River (23 plants) and Possum Banks south of Temma (2000-3000) (Threatened Species Section 2010a).

Distribution, ecology and habitat preference

In Tasmania this robust terrestrial orchid species is known only from the coast from the far north west including offshore islands and from one population on Flinders Island on calcarenite soils (Figure 4.6). The habitat in northwest Tasmania is tea-tree or paperbark scrub on stabilised dunes in well drained locations. On Flinders Island it is on the edge of a vegetation change between Flinders island scrub and tussock grassland.

The niche is sheltered south to south east facing sites protected from prevailing winds and in seasonally damp soils. It has a linear range of 350 km and an area of occupancy of 80 ha (Threatened Species Section 2010a).

Habitat occurs in the vicinity of Segment A. There are no observation records shown in Appendix A, although there is a record at Gardiner Point just off Map 1.

The potential flowering period for this species is October to November with a peak in late October to early November (Wapstra et al. 2010).

Known threats

The key threats to leafy greenhood include land clearance, cattle grazing and inappropriate fire regimes. In summary, the threats to the species include the following (Threatened Species Section 2010b):

- Habitat loss (dune destabilisation, marram grass planting and spread, agricultural and urban development)
- Cattle grazing (trampling, nutrient enrichment)
- Inappropriate fire regimes (reduced burning could lead to scrub invasion modifying habitat)
- Predation (browsing by garden snails)
- Weeds (pasture grasses)
- Climate change (unknown influence, possible changes to rainfall)
- Stochastic risks.

No threats to this species will be derived from this action. No habitat is in the vicinity. No changes to cattle grazing are anticipated. No expectation for reduction in fire regime resulting from this action. No likelihood of garden snails being introduced to sites, not least because the works are not anticipated to occur in the vicinity of known habitat and no plant material is proposed to be transported. Likewise, there is no significant likelihood of weeds being introduced to known habitat as the action is spatially removed (>1 km) from habitat. The action will have no impact on climate change.

The potential for stochastic risk, i.e. one off impact associated with construction or other changes derived from the action, is highly remote because of the distance between known habitat and the proposed action.

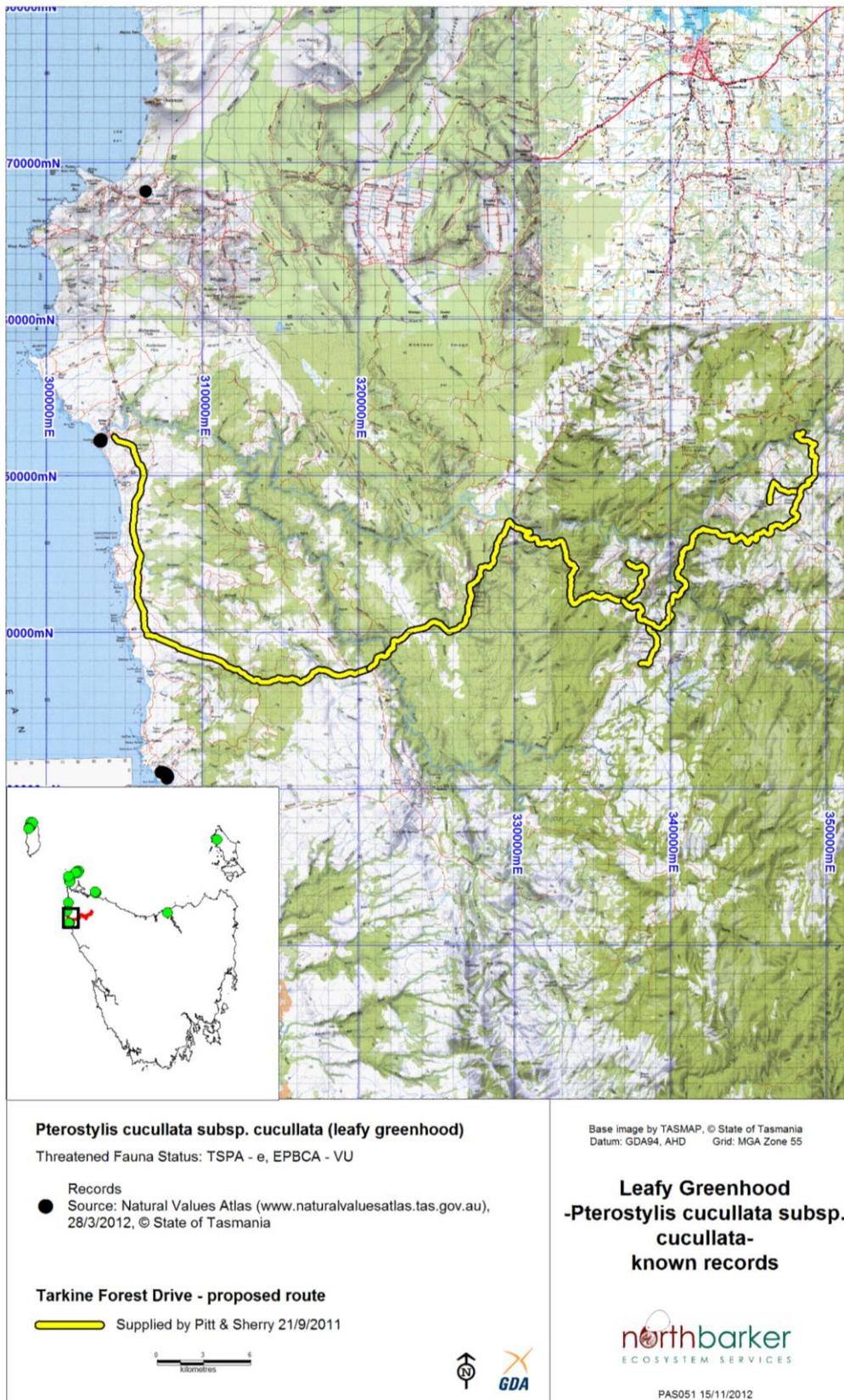


Figure 4.6 - Distribution of leafy greenhood (Source: Natural Values Atlas March 2012)

There are no known pests or diseases that impact on this species. Neither the preferred grassy habitat nor the species is susceptible to *Phytophthora cinnamomi*. Fire outbreaks are not likely to adversely affect this species as the habitat is unlikely to be flammable during the spring flowering period. Orchids are adapted to fire and typically benefit from periodic burns. Fire is used as a tool for habitat management (Threatened Species Section 2010).

Survey

Two populations are known from the vicinity at Gardiner Pt (Arthur River) and Possum Banks (south of Temma).

The roadsides along Segments A & B between the two known populations were targeted for survey (as outlined in section 4.9.2).

The surveys undertaken during flowering season in 2009 failed to identify any plants within the road corridor (NBES 2011).

4.10.4 Northern Leek-orchid (*Prasophyllum secutum*)

Abundance

The estimated total population of northern leek-orchid is less than 500 plants. There are thirteen documented populations, many of which have not been recorded in recent years due to the highly ephemeral habitat of the species. Most populations support 10-30 plants with two larger populations on the north coast (Threatened Species Section 2008).

Distribution, ecology and habitat preference

Northern leek-orchid is endemic to Tasmania and is confined to the north and northwest coasts with outliers on Flinders Island and the west coast (Figure 4.7). The area of occupancy is 10 ha (Threatened Species Section 2008).

The species is known from among shrubs in the swales of stabilised dunes (Threatened Species Section 2008).

Habitat occurs in the vicinity of Segment B. A single observation record is shown in Appendix A Map 4.

The species potentially flowers from early October to early December (Wapstra et al. 2008) but only following fire. Consequently many populations remain unobserved for many years.

Known threats

The key threats to northern leek orchard are conversion of suitable habitat to agricultural uses. The species may have had a widespread distribution in the coastal heathlands of the northern West Coast of the State. However, most of the suitable habitat in the area has been converted to agricultural use. The difficulty in identifying populations outside of the season post fire means many populations may have been destroyed, and continue to be threatened by clearance (Threatened Species Section 2008).

Other localised threats to some populations include damage from 4WD, sand digging, rubbish dumping, cattle grazing and enrichment (Threatened Species Section 2008). Within the Arthur-Pieman Conservation Area, cattle agistment potentially poses a threat.

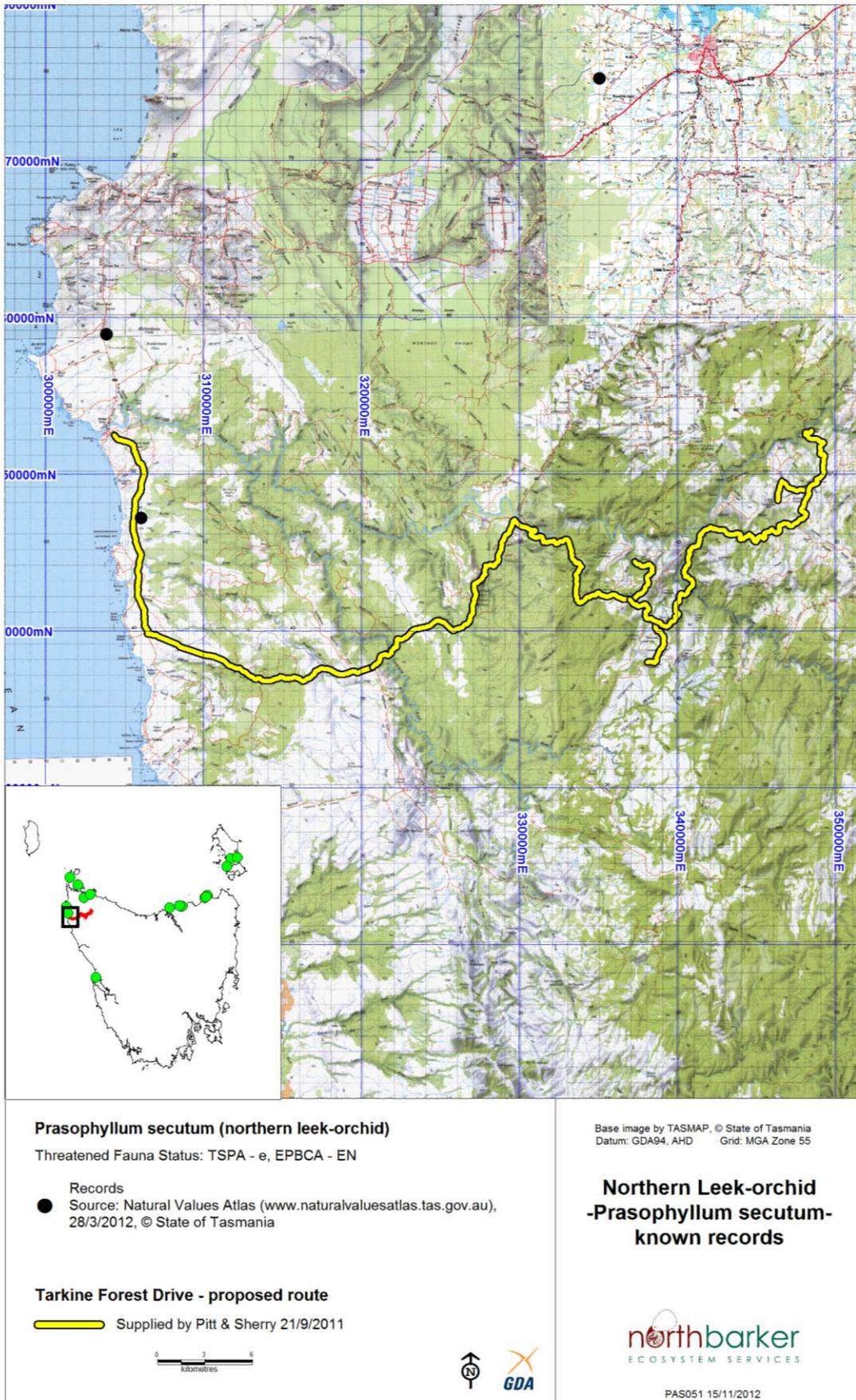


Figure 4.7 - Distribution of northern leek orchid (Source: Natural Values Atlas March 2012)

No threats to this species will be derived from this action. None of the activities listed above are likely to be changed by the proposed action.

There are no known pests or diseases that impact on this species. Neither the preferred grassy habitat nor the species is susceptible to *Phytophthora cinnamomi*. Fire outbreaks are not likely to adversely affect this species as the habitat is unlikely to be flammable during the spring flowering period. Orchids are adapted to fire and typically benefit from periodic burns. Fire is used as a tool for habitat management (Threatened Species Section 2010).

Survey

The record from Arthur Pieman Conservation Area is described as Tiger Flats (Segment B), an area renowned for several other threatened orchid species. It has not been recorded since 1990 and location information is uncertain (NBES 2011).

The roadside in the vicinity of potential habitat were targeted for survey (as outlined in section 4.9.2).

Fire promotes flowering in this species. The area burnt in autumn 2009 between the access tracks to Sarah Ann Rocks and Couta Rocks had the greatest potential to have flowering plants of this species evident in the spring of 2009. Targeted searches undertaken in November 2009 (during the peak flowering period) did not record this species, although the Tiger Flats area had not been subject to fire (NBES 2011).

4.10.5 Pretty Leek-orchid (*Prasophyllum pulchellum*)

Abundance

The estimated total population of pretty leek-orchid was 130 plants in 2000 (Threatened Species Unit 2000c). There were five populations with one in the northwest in the vicinity of Arthur River Road / Bluff Hill Point Road junction approximately 2km north of Arthur River township. Since that time it has been found to be more widespread in the region being recorded from three separated roadside sites on the Western Explorer (9-20km south of the Tarkine Forest Drive), plus two sites off Temma Road. One of these is approximately 2km south of the Couta Rocks Rd junction, but the latest observation (from spring 2011) located a patch of 6 plants less than 200m east of the Temma Road adjacent to Segment B. Total numbers in the north west, based on Natural Values Atlas data, appear to be as many as 150 individuals suggesting the overall population is significantly elevated above that known in 2000 and reported in the Listing Statement at the time.

Recent observations are well dispersed, in contrast to some of the other localised orchids. It is likely that there are other currently unrecorded populations in more remote sites that are less easily accessed. The habitat of these new records is extensive in the area, unlike some of the other orchids described in this section.

Distribution, ecology and habitat preference

Pretty leek-orchid is endemic to Tasmania, but is widespread, with records from the central north, the Tasman Peninsula and the far south east (Figure 4.8). The area of occupancy has not been quantified, but was considered to be <10 ha in 2000. (Threatened Species Unit 2000c).

The species is described as occupying dense low sedgy heath in association with paperbark and tea tree. This habitat is widespread in the Arthur Pieman Conservation Area.

Habitat occurs in the vicinity of Segments B, and C.

The species potentially flowers from late October to December with peak flowering in November (Wapstra et al. 2010), but only following fire. Consequently many populations remain unobserved for many years.

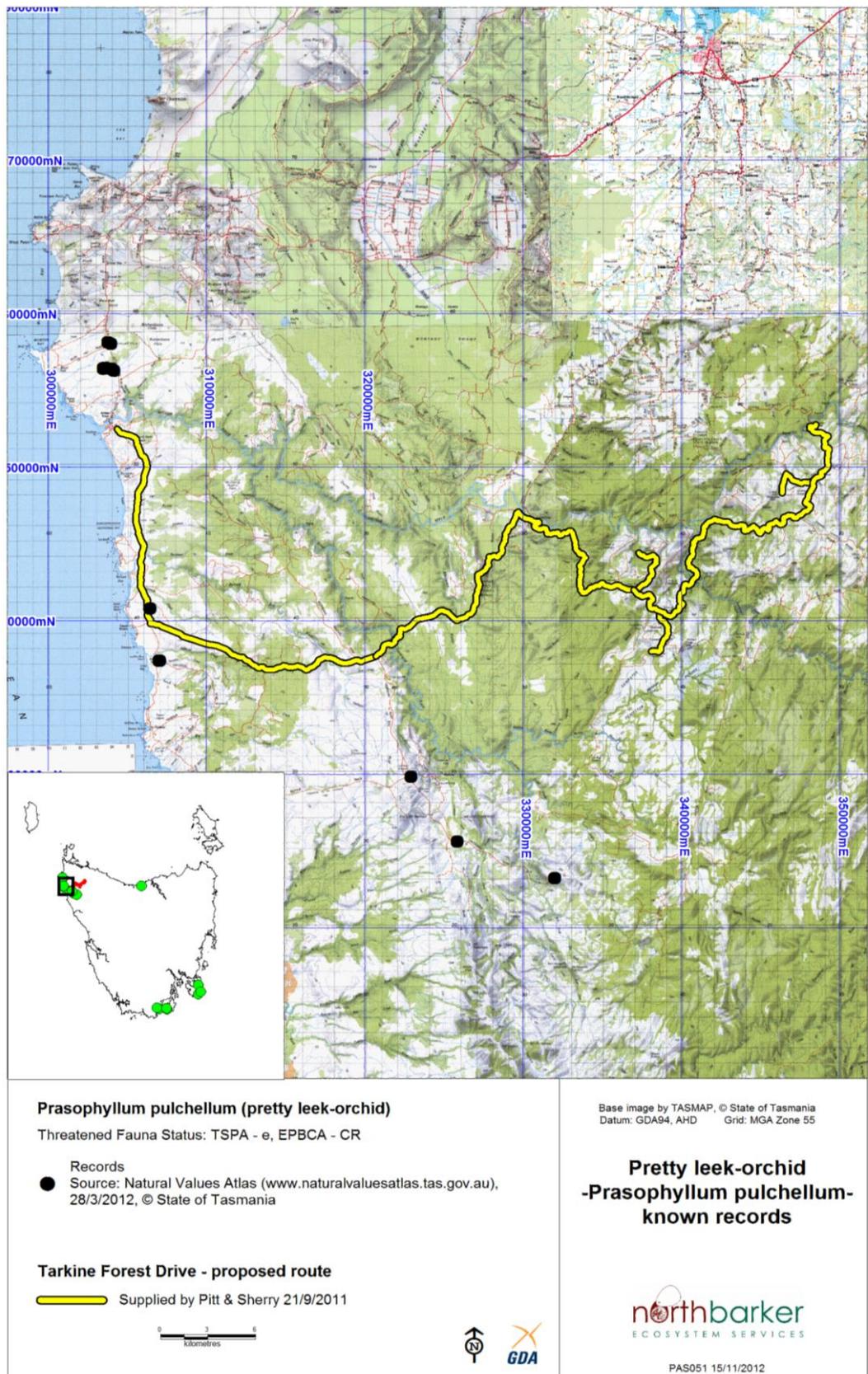


Figure 4.8 - Distribution of pretty leek orchid (Source: Natural Values Atlas March 2012)

Known threats

The key threats to pretty leek orchid are habitat loss, including residential development at one site and inappropriate fire regimes affecting habitat suitability. The localised patch size of most populations and the long absences of observation between fire events means that inadvertent impacts may occur (Threatened Species Unit 2000c).

No direct threats to this species will be derived from this action. None of the activities listed above are likely to be changed in a way that would impact on the species by the proposed action.

No land clearance is planned for the area of most likely habitat associated with the heathland sections of Segments B and C (road widening is limited to Appendix A maps 1-4 further to the north of likely habitat). There is no expectation for modification to the fire regime resulting from this action. Inappropriate disturbance may potentially occur in the vicinity of known records, although this should be able to be managed by regulation of construction activities. The action will have no impact on climate change.

Although no native orchid species are directly susceptible to *Phytophthora cinnamomi*, the plant pathogen can alter the composition of the heathy habitat by displacing heathy species with tolerant graminoids. This could affect the habitat suitability for the orchid. Fire outbreaks may impact on flowering plants (this being a summer flowering species). However, orchids are adapted to fire and typically benefit from periodic burns. Fire is used as a tool for habitat management (Threatened Species Section 2011).

Survey

The roadside in the vicinity of potential habitat were targeted for survey (as outlined in section 4.9.2).

Fire promotes flowering in this species. The area burnt in autumn 2009 between the access tracks to Sarah Ann Rocks and Couta Rocks had the greatest potential to have flowering plants of this species evident in the spring of 2009. Targeted searches undertaken in November 2009 (during the peak flowering period) did not record this species (NBES 2011). The recent observation record is from a site on the opposite side of the road.

4.10.6 Shortspike Midge Orchid (*Corunastylis brachystachya*)

Abundance

The estimated total population of shortspike midge orchid is likely to be less than 100 mature individuals across 5 subpopulations, although data is deficient for two sites. Locations are widely dispersed between northern and western Tasmania. The species has a linear range of 82 km dispersed over 1700 km² (Threatened Species Section 2011).

Distribution, ecology and habitat preference

Short spike midge-orchid is known from Rocky Cape National Park, the Arthur Pieman area and near Stanley in the north-west of Tasmania (Figure 4.9).

The species is known from heathland and heathy eucalypt woodland on well-drained rocky sites (Jones et al. 1999) which is extensively represented in the study area in the vicinity of Segment B, around Couta Rocks and the most westerly section of Segment C on Rebecca Road (NBES 2011).

- One Natural Values Atlas record from junction of Couta Rocks Rd and Temma Rd in 1999 (NBES 2011)

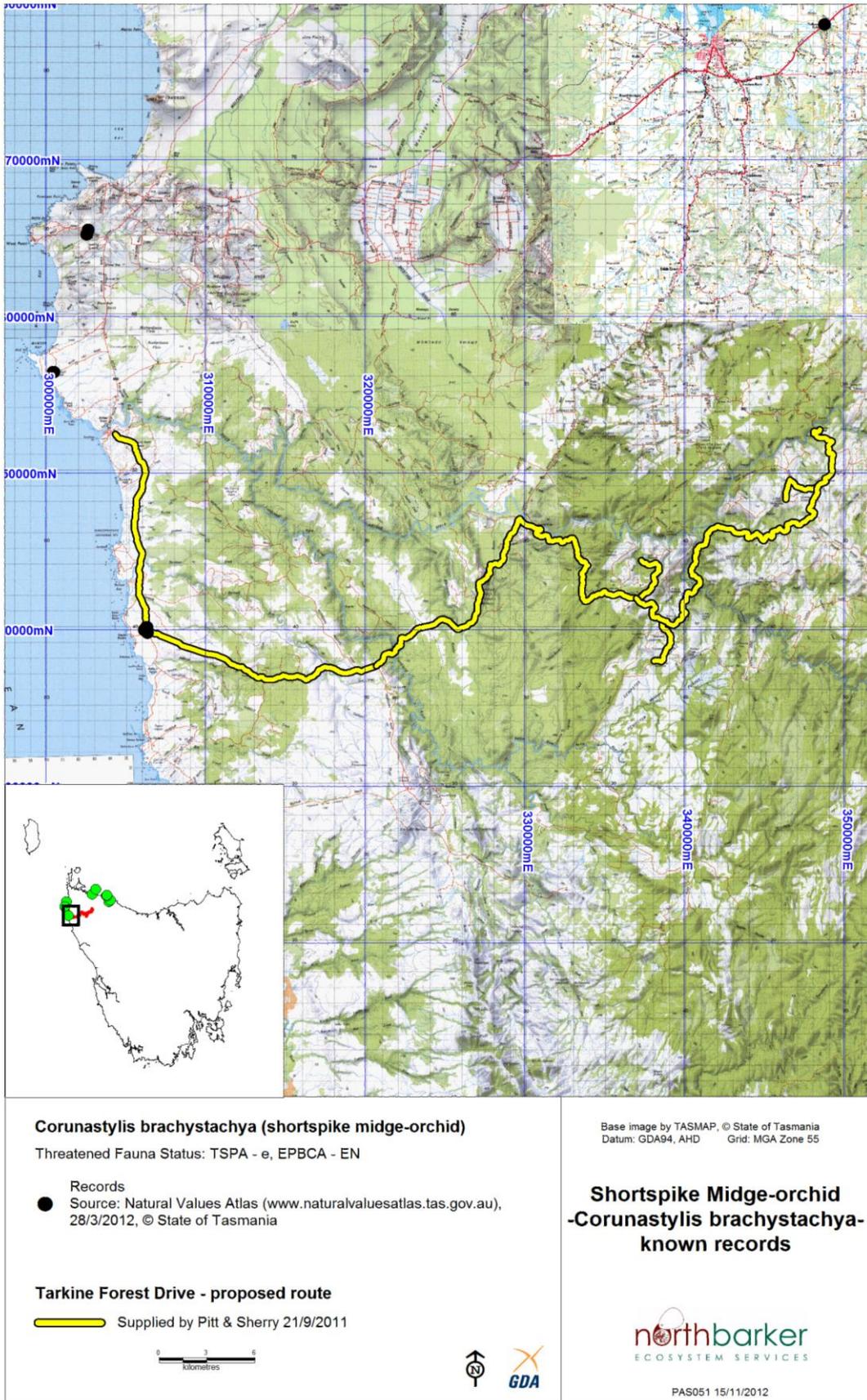


Figure 4.9 - Distribution of short spike midge- orchid (Source: Natural Values Atlas March 2012)

- Recent record in March 2009 is from edge of old track 50m west of Temma Rd 300m north of Couta Rocks Rd.

Habitat occurs in the vicinity of Segments B & C. Observation records are shown in Appendix A Map 8.

The few records of this species suggest a potential to flower from February to April with a peak in March (Threatened Species Section 2011).

Known threats

The key threats to short spike midge-orchid are stochastic risks due to the highly localised distribution and lack of accurate knowledge of some population locations limiting appropriate management planning. In summary, the threats to the species include the following (Threatened Species Section 2011):

- Land clearance (albeit inadvertently given uncertainty of population locations)
- Inappropriate fire regime (management tendency away from preferred high intensity fires)
- Inappropriate disturbance regime (intense soil disturbance, slashing during flowering, roadworks)
- Climate change (unknown influence).

The impacts of the proposed action are discussed in Section 5. No land clearance is planned for the area of most likely habitat associated with the heathland sections of Segments B and C (road widening is limited to Appendix A maps 1-4 further to the north of likely habitat). There is no expectation for modification to the fire regime resulting from this action. Inappropriate disturbance may potentially occur in the vicinity of known records, although this should be able to be managed by regulation of construction activities. The action will have no impact on climate change.

Although no native orchid species are directly susceptible to *Phytophthora cinnamomi*, the plant pathogen can alter the composition of the heathy habitat by displacing heathy species with tolerant graminoids. This could affect the habitat suitability for the orchid. Fire outbreaks may impact on flowering plants (this being a summer flowering species). However, orchids are adapted to fire and typically benefit from periodic burns. Fire is used as a tool for habitat management (Threatened Species Section 2011).

Survey

This species was the subject of a targeted search by members of Threatened Plants Tasmania in autumn 2010. The species was confirmed to occur at various locations in heathland between Temma Rd and Couta Rocks including one site 30 m off the Temma Road (NBES 2011).

4.10.7 Western Leek-orchid (*Prasophyllum favonium*)

Abundance

The estimated total population of western leek-orchid is less than 40 plants. There are five known localities of the species, each with a single population (except for Couta Rocks which has two). Populations are usually very small, with 1 or 2 colonies each consisting of 3 to 5 plants occupying an area of 5-10 metres (Threatened Species Unit 2000b).

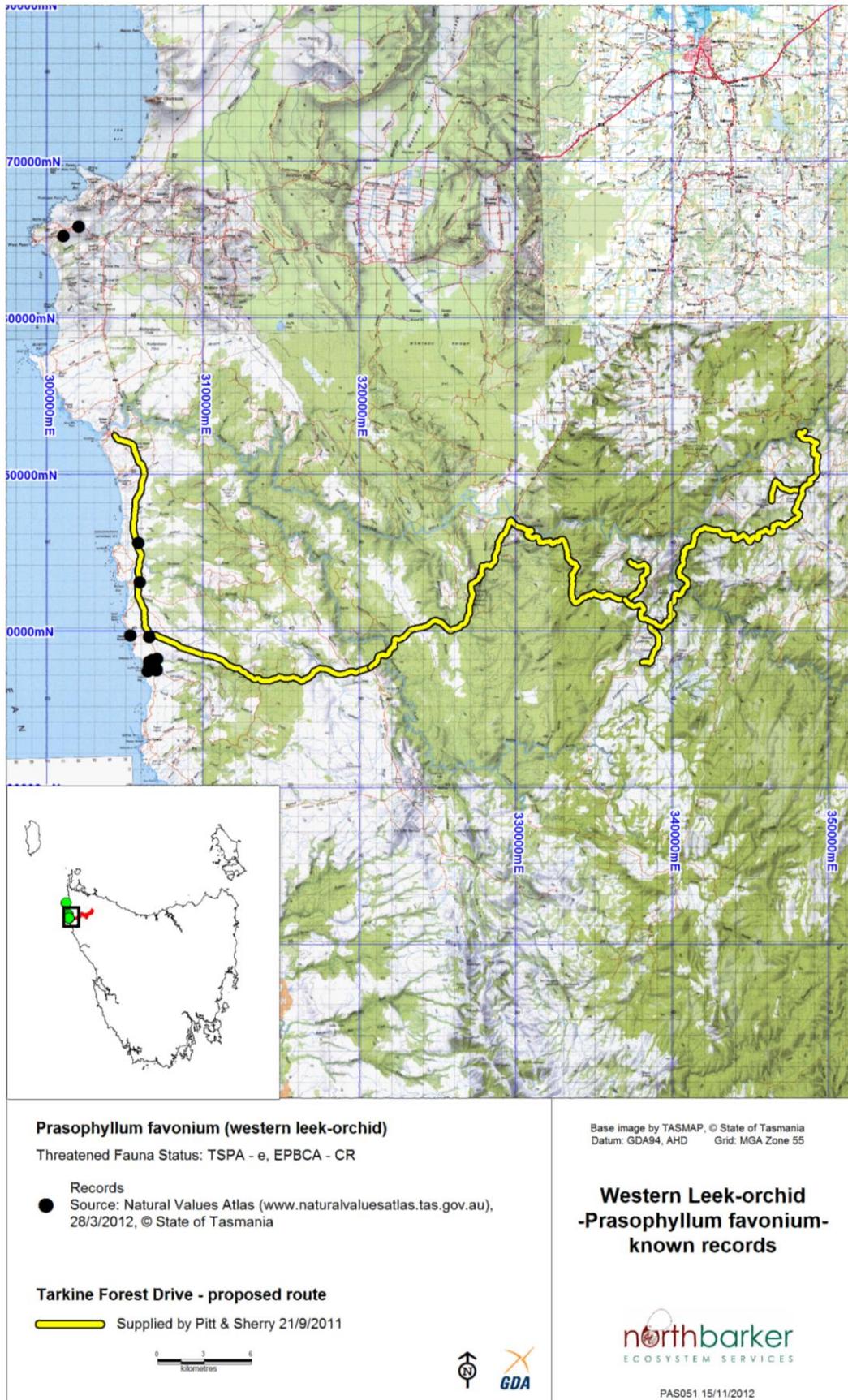


Figure 4.10 - Distribution of western leek orchid (Source: Natural Values Atlas March 2012)

Distribution, ecology and habitat preference

Western leek-orchid is endemic to Tasmania and is confined to a narrow 30 km stretch between West Point and Sandy Cape in the far north west of the State (Figure 4.10). The species is known from among shrubs in windswept, dense low heathland on moderately drained grey to black sandy peaty loam (Threatened Species Unit 2000b).

Habitat occurs in the vicinity of Segment B. Observation records are shown in Appendix A Maps 5 & 6.

It potentially flowers from early October to early December (Wapstra et al. 2010).

Known threats

The key threats to western leek-orchid are conversion of suitable habitat to agricultural uses. The species may have had a widespread distribution in the coastal heathlands of the northern West Coast of the State. However, most of the suitable habitat in the area has been converted to agricultural use (Threatened Species Unit 2000b).

The key concern with this species is the small number and size of known colonies. These small populations could easily be destroyed by prolonged droughts and other localised disturbance events. Within the Arthur-Pieman Conservation Area heathland cattle agistment poses a threat (Threatened Species Unit 2000b).

The impacts of the proposed action are discussed in Section 5. No direct threats to this species will be derived from this action as clearance is minimal within the vicinity of Segment B and will not take place in potential habitat (low heathland). No changes to cattle grazing are anticipated.

There are no known pests or diseases that impact on this species. Although the species is not directly susceptible to *Phytophthora cinnamomi*, the plant pathogen can alter the composition of the heathy habitat by displacing heathy species with tolerant graminoids. This could affect the habitat suitability for the orchid. Fire outbreaks are not likely to adversely affect this species as the habitat is unlikely to be readily flammable during the spring flowering period. Orchids are adapted to fire and typically benefit from periodic burns. Fire is used as a tool for habitat management for heathland orchids (Threatened Species Section 2010).

Survey

The species was not recorded from 2008 extensions surveys (Wapstra et al. 2010) targeting this species amongst several others, although the study makes reference to a separate record for late 2008 from Heemskirk Road. Consultation with the recorders¹⁴ indicates that this record is incorrect and that their observation was actually along Bluff Hill Point Track north of Arthur River and outside the study area. They also confirm that none of the Natural Values Atlas records could be relocated in their own 2008 searches (NBES 2011).

The roadsides along Segments B & C in the vicinity of potential habitat were targeted for survey (as outlined in section 4.9.2).

Fire promotes flowering in this species. The area burnt in autumn 2009 between the access tracks to Sarah Ann Rocks and Couta Rocks had the greatest potential to have flowering plants of this species evident in the spring of 2009. Road Segment B has the greatest potential of revealing new records for this species but the more coastal end of Segment C also supports potential habitat. Targeted searches undertaken in November 2009 (during the peak flowering period) did not record this species (NBES 2011).

¹⁴ M. Wells and P. Fehre

4.10.8 Windswept Spider Orchid (*Caladenia dienema*)

Abundance

The estimated total population of windswept spider orchid is less than 250 mature individuals with most subpopulations comprising less than 20 mature individuals usually occurring as scattered plants over a relatively small area. The species has a patchy distribution along the west coast, comprising 16 subpopulations spread over approximately 90 km (Threatened Species Section 2010).



Figure 4.11 - Windswept spider orchid (Source: NBES 2011)

Distribution, ecology and habitat preference

Windswept spider orchid is endemic to western and northwest Tasmania with the core part of its range in the Temma to Marrawah region. A historical recording from the north coast indicates a potentially much wider distribution including the whole northwest corner of the State (Figure 4.12).

The potential habitat for the species is widespread on the west coast and is identified as coastal heathland within 1 km of the coastline. The species is known from coastal scrub and windswept coastal grassland and heaths amongst stunted shrubs and sedges on moist to well-drained sand and clay loams (Threatened Species Section 2010). Many occurrences are associated with rock outcrops and rocky open heathy eucalypt woodland and heathland (ECOtas 2009 cited in NBES 2011).

Habitat occurs in the vicinity of Segments A, B & C. Observation records are shown in Appendix A Maps 2, 4, 5, 7, 8, 9, 10 & 11.

Potential flowering is all of October and November (Wapstra et al. 2010).

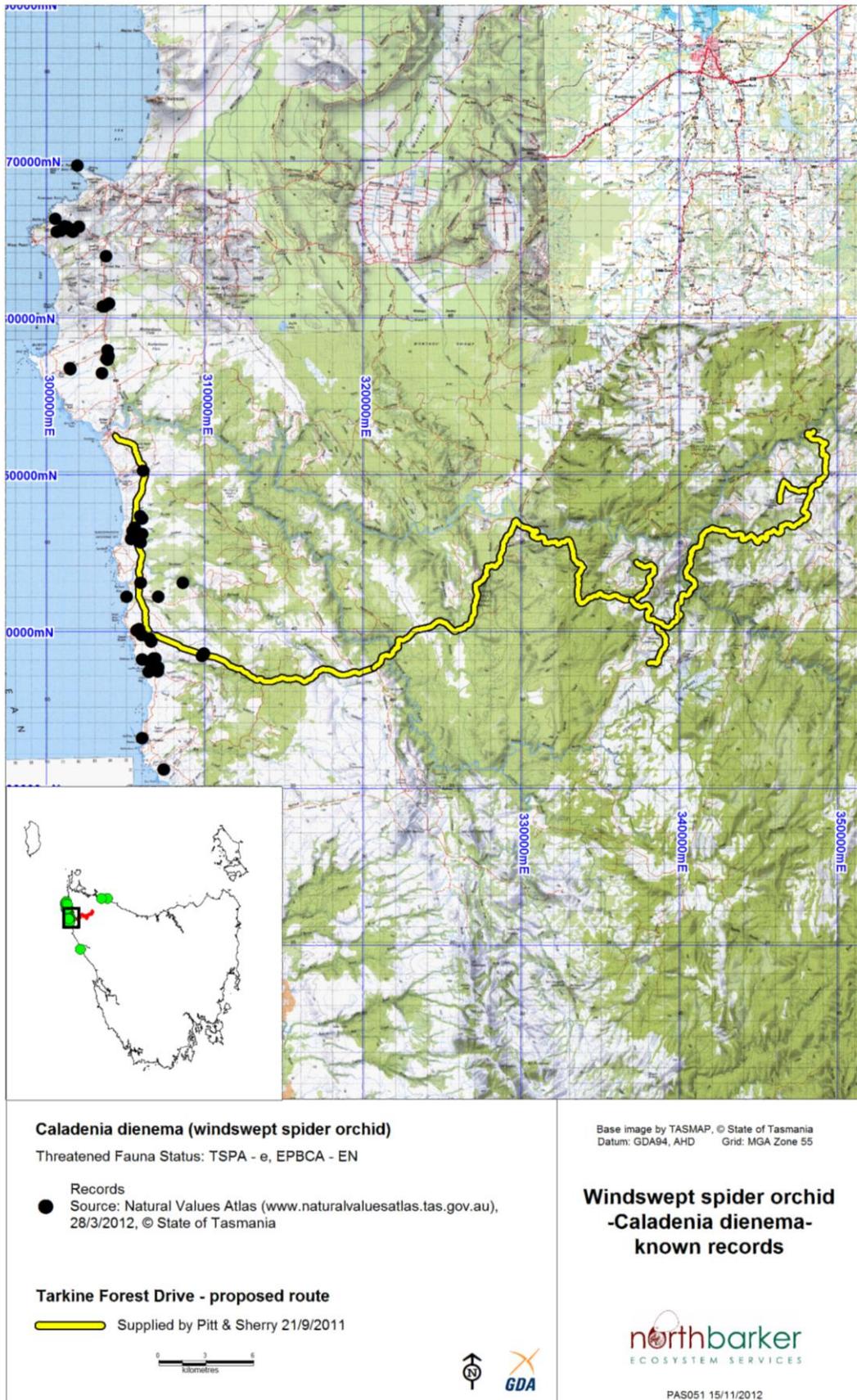


Figure 4.12 - Distribution of windswept spider orchid (Source: Natural Values Atlas March 2012)

Known threats

The key threat to windswept spider orchid is clearance of habitat in the near-coastal areas of the west and northwest coasts. Recently, the key threat has included inappropriate fire regimes which have resulted in changes to the vegetation types supporting the species. In summary, the threats to the species include the following (Threatened Species Section 2010):

- Land clearance (including agricultural and coastal development)
- Development on public land (many populations of the species are within the Arthur-Pieman Conservation Area)
- Inappropriate fire regime (greater abundance at sites subject to higher intensity summer fires)
- Recreational activities (further development of recreational activities within the Arthur-Pieman Conservation Area)
- Cattle agistment (Arthur-Pieman Conservation Area is subject to cattle grazing through agistment licences)
- *Phytophthora cinnamomi* (no populations are currently effected; however, there is a potential to introduce or spread through recreational activities within the Arthur-Pieman Conservation Area)
- Stochastic risks (less than 250 mature individuals from fewer than 20 subpopulations).

The impacts of the proposed action are discussed in Section 5. No land clearance associated with road widening is shown for the area of most likely habitat associated with the heathland sections of Segments A, B and C. In the vicinity of habitat, road widening is limited to Segments A & the start of B (Appendix A maps 2 & 4). No change to the level of recreational activities such as 4 wheel driving that could impact on habitat is anticipated. No changes to cattle grazing are anticipated. Stochastic risks such as physical disturbance may potentially occur in the vicinity of unknown plants although this is considered remote.

There are no known pests or diseases that impact on this species. Although the species is not directly susceptible to *Phytophthora cinnamomi*, the plant pathogen can alter the composition of the heathy habitat by displacing heathy species with tolerant graminoids. This could affect the habitat suitability for the orchid. Fire outbreaks are not likely to adversely affect this species directly as the habitat is unlikely to be flammable during the spring flowering period. Orchids are adapted to fire and typically benefit from periodic burns. Fire is used as a tool for habitat management for heathland orchids (Threatened Species Section 2010).

Survey

This species was the target of extension surveys in the Arthur Pieman Area in and around known populations and likely habitat ((Wapstra et al. 2010).

The roadsides along Segments A & B in the vicinity of known populations were targeted for survey in 2009 (as outlined in section 4.9.2).

The species was confirmed to occur at various locations in heathland between Temma Rd and Couta Rocks including one site 30m off the Temma Rd (NBES 2011).