



ASSESSMENT AND MANAGEMENT OF POTENTIAL IMPACT ON SPECIFIC MNES

SCENIC RIM TRAIL - THORNTON TRAILHEAD TO
SPICERS CANOPY NATURE RESERVE, QLD

EPBC 2016/7847
Gainsdale Pty Ltd
ACN 008 971 499

EPBC Number

2016/7847

Project Name

Scenic Rim Trail – Thornton Trailhead to Spicers Canopy Nature Reserve, Qld

Proponent

Gainsdale Pty Ltd

ACN 008 971 499

Proposed Action

Gainsdale Pty Ltd will establish a 53 km multi-day walk from the privately-owned Thornton View Nature Refuge to the privately-owned Spicers Peak Nature Reserve, via the Main Range National Park and Gondwana Rainforests of Australia World Heritage Area. The walk is to be known as the Scenic Rim Trail, and will follow a series of existing tracks in the Park connected by Class 5 walking tracks to be established by Gainsdale Pty Ltd. Two Ecocamps will be erected in the Park (outside of the World Heritage Area).

Location

Thornton Trailhead to Spicers Canopy Nature Reserve via Main Range National Park and Gondwana Rainforests of Australia World Heritage Area, Queensland

Date of Preparation

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Signed

Ben O'Hara

General Manager

Document Version Control

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1.1	10/07/17	Craig Miller	Peer review
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Acronyms and Abbreviations

Anon.	Anonymous
DoE	Department of the Environment (Commonwealth)
DoEE	Department of Environment and Energy (Commonwealth)
DNPSR	Department of National Parks, Sport and Racing (Queensland)
DNPRSR	Department of National Parks, Recreation, Sport and Racing (Queensland)
EMP	Environmental Management Plan
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
GRAWhA	Gondwana Rainforests of Australia World Heritage Area
MNES	Matters of National Environmental Significance
MRNP	Main Range National Park
NHP	National Heritage Place
NP	National Park
QPWS	Queensland Parks and Wildlife Service
SRT	Scenic Rim Trail
WHA	World Heritage Area

1. Introduction

Gainsdale Pty Ltd (Gainsdale) proposes to establish a multi-day bushwalking experience to be called the Scenic Rim Trail (the Trail) that traverses the Main Range National Park (Figure 1). The Park contains one of 42 reserves making up the Gondwana Rainforests of Australia World Heritage Area (GRAWHA). The Trail will start and finish on private property (Thornton View Nature Refuge and Spicers Peak Nature Reserve) (Figure 1).

The Trail was proposed in response to a Queensland Government initiative to facilitate ecotourism in the State's National Parks and World Heritage Areas, and is being developed in conjunction with the Department of National Parks, Sport, and Racing (DNPSR).

On 16 December 2016, the Trail was referred to the Department of Environment and Energy (DoEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The referral was made following a detailed development proposal and environmental management plan which concluded that the Trail would not have significant impact on any Matters of National Environmental Significance (MNES), including threatened species and the integrity of the World Heritage and Natural Heritage values (Tony Charters and Associates 2016).

On 23 February 2017, DoEE determined that the Trail is a controlled action (section 75 EPBC Act) which will be assessed by preliminary documentation (section 87 EPBC Act). On 30 March 2017, DoEE requested further information from Gainsdale to assess the impacts of the proposed action on specific MNES (section 95A(2) EPBC Act) (Annex 1).

This document responds to and satisfies DoEE's information request and describes the potential direct and facilitated impact of the Trail on specific MNES, namely the endangered Hastings River Mouse (Koontoo; *Pseudomys oralis*), the endangered Fleay's Barred Frog (*Mixophyes fleayi*), and the integrity of this part of the Gondwana Rainforest of Australia World Heritage Area and National Heritage Place. It also identifies specific actions that will be undertaken to avoid or mitigate potential impacts and which will inform the Environmental Management Plan (EMP) for the Trail.

The Environmental Management Plan (EMP) will integrate the conservation management requirements of the EPBC with Queensland State legislation (e.g. *Nature Conservation Act 1992*) requirements and will be presented as a separate document.

1.1. Objectives

The objectives of this document are to respond to the DoEE request for further information on the assessment of risk to specific MNES (Table 1), namely:

- Assessing the potential impact of the Trail on:
 - populations of Hastings River Mouse and Fleay's Barred Frog
 - ecological integrity of the Gondwana Rainforest of Australia World Heritage Area
 - ecological integrity of Gondwana Rainforest of Australia National Heritage Area
- Assessing proposed mitigation measures to determine if there is any significant residual impact
- Determine whether offsets are required to address significant residual impact

Table 1 Reference table indicating location of information fulfilling DoEE request

DoEE Reference number	Information request	Section and page numbers
2.1	Provide a map of Hastings River Mouse habitat, and a calculation of the area and quality of Hastings River Mouse (in hectares), within and adjacent to the entire project site.	Figure 5, Page 27 Figure 6, Page 28 Section 4.1, Page 25
2.2	Provide an assessment of the extent, nature, and severity of current threats to the Hastings River Mouse in the habitat identified, based on field surveys conducted in accordance with appropriate methodologies	Section 4.2, Page 29 Section 4.3, Page 32
3.1	Provide an evidence based, scientifically robust assessment of the likelihood, extent, and severity of the proposed actions impacts on the Hastings River Mouse.	Section 4.3, Page 32
4.1	Provide a description of each proposed avoidance or mitigation measure in relation to each identified impact.	Section 4.4, Page 41
4.2	Provide and assessment of the expected or predicted effectiveness of each proposed avoidance or mitigation measure	Section 4.4, Page 41
4.3	<p>If you are proposing to use an environmental management plan (EMP), provide an EMP that details the proposed avoidance and mitigation measures and how these measures will mitigate impacts to the Hastings River Mouse, including clear, measurable and time specific:</p> <ul style="list-style-type: none"> • Performance criteria • Environmental outcomes to be achieved • Auditing regime to measure the implementation and effectiveness of the EMP • Corrective actions to be taken if performance criteria and/or environmental outcomes are not being met <p>Detail all limitations of any EMPs prepared for the proposed action.</p>	EMP will be based on management actions and control measures in Section 4.4, Page 41 and will integrate required conditions
5.1	Provide a map/s of all Fleay's Frog habitat, and a calculation of the area of Fleay's Frog habitat, within and adjacent to the entire project site.	Figure 8, Page 46 Figure 9, Page 47
5.2	Provide an estimate of the abundance of Fleay's Frogs in the habitat identified in 5.1.	Section 5.2.1, Page 46
5.3	Provide an assessment of the quality of Fleay's frog habitat mapped from item 5.1.	Section 5.2, Page 46

5.4	Provide an assessment of the extent, nature, and severity of current threats (including the presence of chytrid fungal disease and feral Pigs) to Fleay's Frog in the habitat identified in 5.1.	Section 5.1, Page 45
6.1	Provide an evidence-based, scientifically robust assessment of the likelihood, extent, and severity of the proposed action's impacts on the Fleay's Frog.	Section 5.3, Page 48
7.1	Provide a description of each proposed avoidance or mitigation measure in relation to each identified impact.	Section 5.4, Page 55
7.2	Provide an assessment of the expected or predicted effectiveness of each proposed avoidance or mitigation measure.	Section 5.4, Page 55
7.3	<p>If you are proposing to use an environmental management plan (EMP), provide an EMP that details the proposed avoidance and mitigation measures and how these measures will mitigate impacts to the Fleay's Frog, including clear, measurable and time specific:</p> <ul style="list-style-type: none"> • Performance criteria • Environmental outcomes to be achieved • Auditing regime to measure the implementation and effectiveness of the EMP • Corrective actions to be taken if performance criteria and/or environmental outcomes are not being met <p>Detail all limitations of any EMPs prepared for the proposed action.</p>	EMP will be based on management actions and control measures in Section 5.4, Page 55 and will integrate required conditions
8.1	Provide an evidence-based assessment of the likelihood, extent, and severity of the proposed action's impacts on the world and national heritage values of the Gondwana Rainforests.	Section 6.3, Page 60
9.1	Provide a description of each proposed avoidance or mitigation measure in relation to each identified impact.	Section 6.4, Page 71
9.2	Provide an assessment of the expected or predicted effectiveness of each proposed avoidance or mitigation measure.	Section 6.4, Page 71
9.3	If you are proposing to use an environmental management plan (EMP), provide an EMP that details the proposed avoidance and mitigation measures and how these measures will mitigate impacts to the World and National Heritage values of the	EMP will be based on management actions and control measures in Section 6.4, Page 71 and will integrate required conditions

	<p>Gondwana Rainforests, including clear, measurable and time specific:</p> <ul style="list-style-type: none"> • Performance criteria • Environmental outcomes to be achieved • Auditing regime to measure the implementation and effectiveness of the EMP • Corrective actions to be taken if performance criteria and/or environmental outcomes are not being met 	
10.1	Provide an evidence-based assessment of the likelihood, extent, and severity of the proposed action's facilitated impacts to all matters of national environmental significance.	Section 7, Page74
10.2	Provide a description of each proposed avoidance or mitigation measure in relation to each identified impact.	Section 7.4, Page 82
10.3	Provide an assessment of the expected or predicted effectiveness of each proposed avoidance or mitigation measure.	Section 7.4, Page 82
10.4	<p>If you are proposing to use an environmental management plan (EMP), provide an EMP that details the proposed avoidance and mitigation measures and how these measures will mitigate impacts, including clear, measurable and time specific:</p> <ul style="list-style-type: none"> • Performance criteria • Environmental outcomes to be achieved • Auditing regime to measure the implementation and effectiveness of the EMP • Corrective actions to be taken if performance criteria and/or environmental outcomes are not being met 	EMP will be based on management actions and control measures in Section 7.4, Page 82 and will integrate required conditions
11.1	Provide an assessment of whether the proposed action will have a residual significant impact on each affected MNES.	Section 7.4.4, Page 82
11.2	Propose a direct offset for MNES where a residual significant impact/s is identified in 11.1.	N/A
11.3, 11.4, 11.5, 11.6, 11.7	If the direct offset does not compensate for 100% of the impact ...	N/A
12.	Provide details on the social and economic costs and/or benefits of undertaking the proposed action	Section 8, Page 86

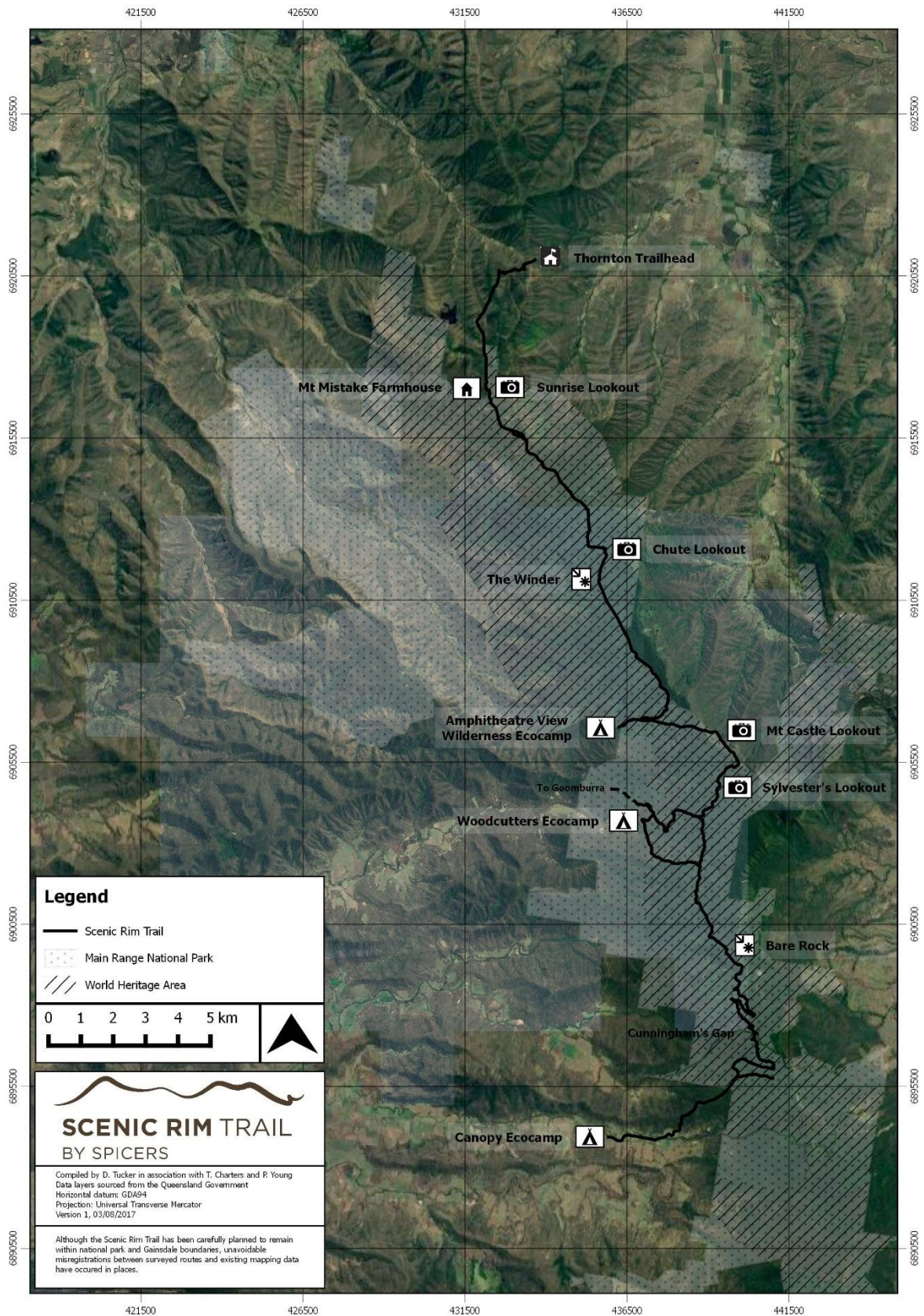


Figure 1 Location of the Scenic Rim Trail alignment with respect to the Main Range National Park and Gondwana Rainforests of Australia World Heritage Area

Note that the line width of the trails and tracks are exaggerated by a factor of ≥ 100 relative to the area of the WHA.

1.2. Main Range National Park and Gondwana Rainforests of Australia World Heritage Area

Main Range National Park (MRNP) protects 30,170 ha of the western part of the Scenic Rim of the Border Ranges (Figure 1). It was established in 1980, incorporating several smaller National Parks such as Cunningham's Gap National Park (which was established in 1909). The varied topography and geology of the Park has resulted in diverse plant communities, ranging from subtropical and cool temperate rainforest to wet and dry sclerophyll forest, montane heath, and rock pavement vegetation.

MRNP also contains the northernmost of the 42 reserves constituting the GRAWHA (17,794 ha). The GRAWHA protects the largest and most significant remaining stands of subtropical rainforest and nearly all the remaining Antarctic Beech (*Nothofagus moorei*) warm temperate rainforest in the world. It also includes large areas of cool tropical rainforest, and one of only two remaining large areas of Araucarian rainforest in Australia. The MRNP property provides a home for many rare and threatened plants and animals and ancient life forms, and contains more frog, snake, bird and marsupial species than anywhere else in Australia, and includes 31 species listed as MNES. MRNP does not, however, contain Antarctic Beech.

The World Heritage listing (in 1986 and extended in 1994) recognises that these forests represent the once extensive rainforests of the supercontinent Gondwana. In 2007, the GRAWHA was added to the Australian National Heritage List (referred hereafter within GRAWHA unless otherwise specified). This list accounts for natural, historic and Indigenous places of outstanding significance to the nation.

Management of the Gondwana Rainforests of Australia World Heritage property (DEH 2000) aims to:

- maintain species richness and genetic diversity
- ensure populations of threatened species remain viable
- control threatening processes, and
- maintain opportunities for continued natural evolution in wilderness areas.

Differences in the mountainous topography, altitude, aspect and soil characteristics lead to diversity in the park's plant communities, which range from subtropical and cool temperate rainforest to wet and dry sclerophyll forest, montane heath and rock pavement vegetation. Seven regional ecosystems (RE) have been mapped within the National Park. These include¹:

- Cool Subtropical Rainforest (RE12.8.4, RE12.8.5), defined as complex notophyll vine forest with scattered Bunya pine (*Araucaria bidwillii*)² and Hoop pine (*A. cunninghamii*). Characteristic canopy species include Black booyong (*Argyrodendron actinophyllum*), brush bloodwood (*Baloghia inophylla*), Australian nettle tree (*Dendrocnide excelsa*), and red cedar (*Toona ciliata*). It provides habitat for threatened plant species such as *Sarcochilus weinthalii*, and for cool subtropical species at the limits of their climatic range.
- Warm temperate rainforest (RE12.8.7), defined as a simple microphyll fern thicket with lilly pilly (*Syzygium smithii*) dominant canopy and including shrubs such as silky oak (*Orites excelsa*), brush muttonwood (*Rapanea howittiana*), and brush pepperbush (*Tasmannia insipida*).

¹ <https://environment.ehp.qld.gov.au/regional-ecosystems/>

² Bunya pine does not occur within the project area

- Wet sclerophyll forest (RE12.8.8), defined as Sydney bluegum (*Eucalyptus saligna*) or (flooded gum (*E. grandis*) tall open forest often with vine forest understorey. Other species include tallowwood (*E. microcorys*), white mahogany (*E. acmenoides*), Queensland brush box (*Lophostemon confertus*) and turpentine tree (*Syncarpia glomulifera* subsp. *glomulifera*).
- Grey gum open forest (RE12.8.14), defined as an open woodland comprising thin-leaved stringybark (*E. eugenioides*), grey gum (*E. biturbinata*), and yellow box (*E. melliodora*), and may include forest red gum (*E. tereticornis*), pink bloodwood (*Corymbia intermedia*), and narrow-leaved ironbark (*E. crebra*). These woodlands provide habitat for threatened plant species including *Sophora fraseri* and *Marsdenia longiloba*.

These forests have been mapped as cool subtropical rainforest, warm temperate rainforest, and eucalyptus dominant forest for the purposes of this document (Figure 2).

Strategic threats to values of the rainforests requiring management (DEH 2000) are:

- uncontrolled or inappropriate use of fire
- inappropriate recreation and tourism activities, including the development of tourism infrastructure, under the increasing visitor pressure from Australia, overseas and commercial ventures
- invasion by pest species including weeds, feral animals and fungal pathogens, and loss of biodiversity at all levels

The GRAWHA within the MRNP has a long history of human use and modification. While many intact natural areas remain, because of their inaccessibility or lack of desirable forestry trees, significant areas of the rainforest have been logged and are now regenerating. A few the old forestry tracks are now used for maintenance of the National Park, including for fire and feral animal control, and are also accessed by bush walkers (Figure 3).

The Queensland Parks and Wildlife Service (QPWS) are responsible for management of the MRNP, and have published a Master Plan for Queensland's parks and reserves (DNPRSR 2014), and a management statement identifying the Queensland Government's responsibilities and responses to these issues (DNPRSR 2013). DNPSR have advised Gainsdale that they are currently developing a visitor management strategy for the greater western Scenic Rim.

The Master Plan specifies that National Parks are to be managed for nature conservation and for people. Ecotourism, recreation, and heritage experiences are to be facilitated by the QPWS within the protected area estate. At present, there are 22 walking tracks and three developed campsites providing for day-use and longer walking opportunities within the MRNP (Figure 3). The three campsites can accommodate a maximum of 290 people in total per night. The Park is also renowned for off-track walking, with 24 remote bush camp sites, 7 of which are in the Trail area (Figure 3). The bush camp sites can accommodate a maximum of 8 people each, per night, with limited to no facilities. Camping may also be allowed in non-designated remote sites, but this requires approval by QPWS. All campers require permits from QPWS, enabling some control over maximum numbers staying in the Park at any one time.

Feral animals are widespread throughout the National Park, and their control is recommended by the strategic overview for management of the World Heritage Central Eastern Rainforests Reserves (DEH 2000) and implemented in MRNP through the QPWS Pest Management Plan. Weeds of significance occur in some locations and are subject to control by QPWS. The introduced chytrid fungus is also established in frog populations in the Park.

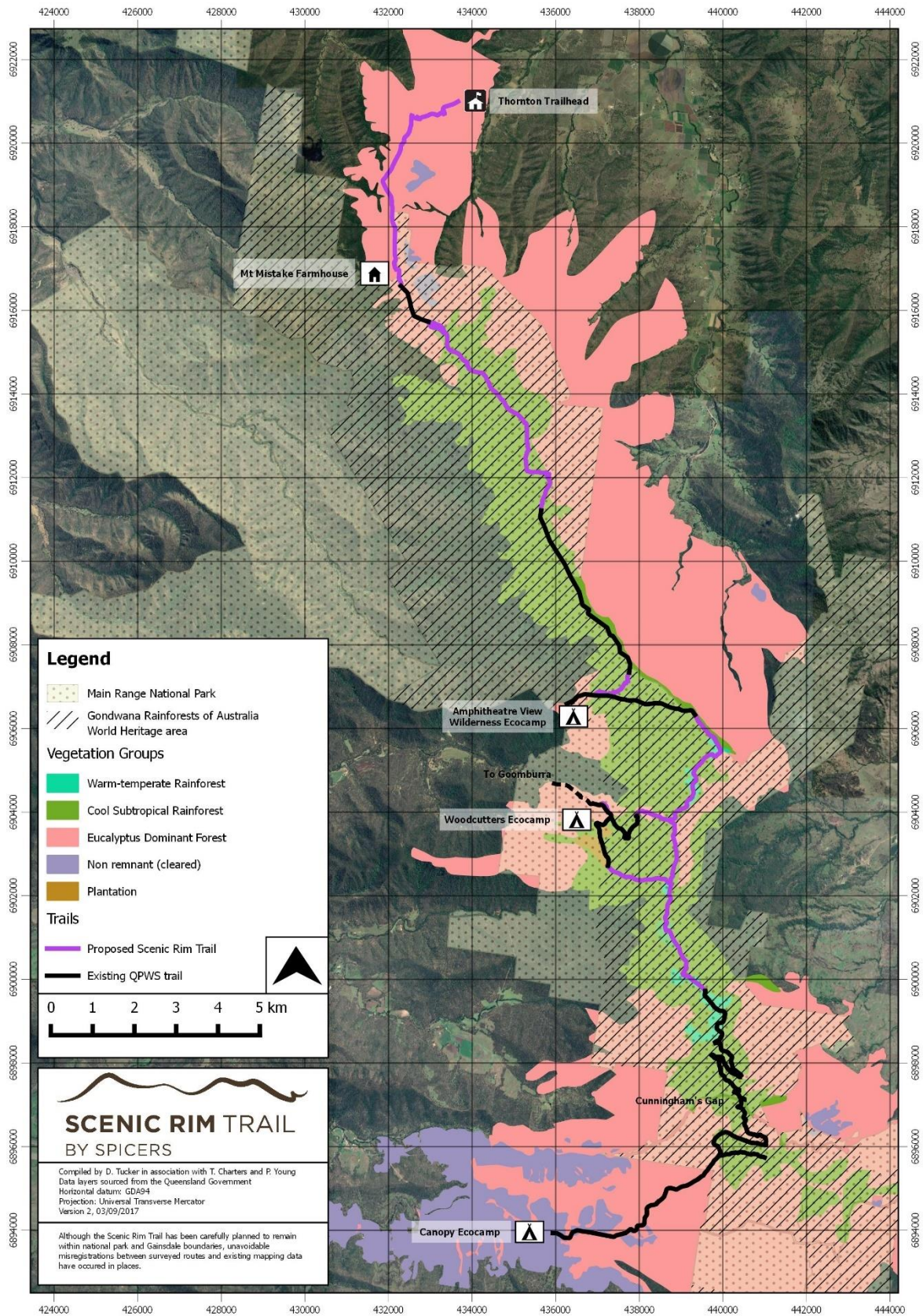


Figure 2 Forest communities of the Main Range National Park and Gondwana Rainforest of Australia WHA

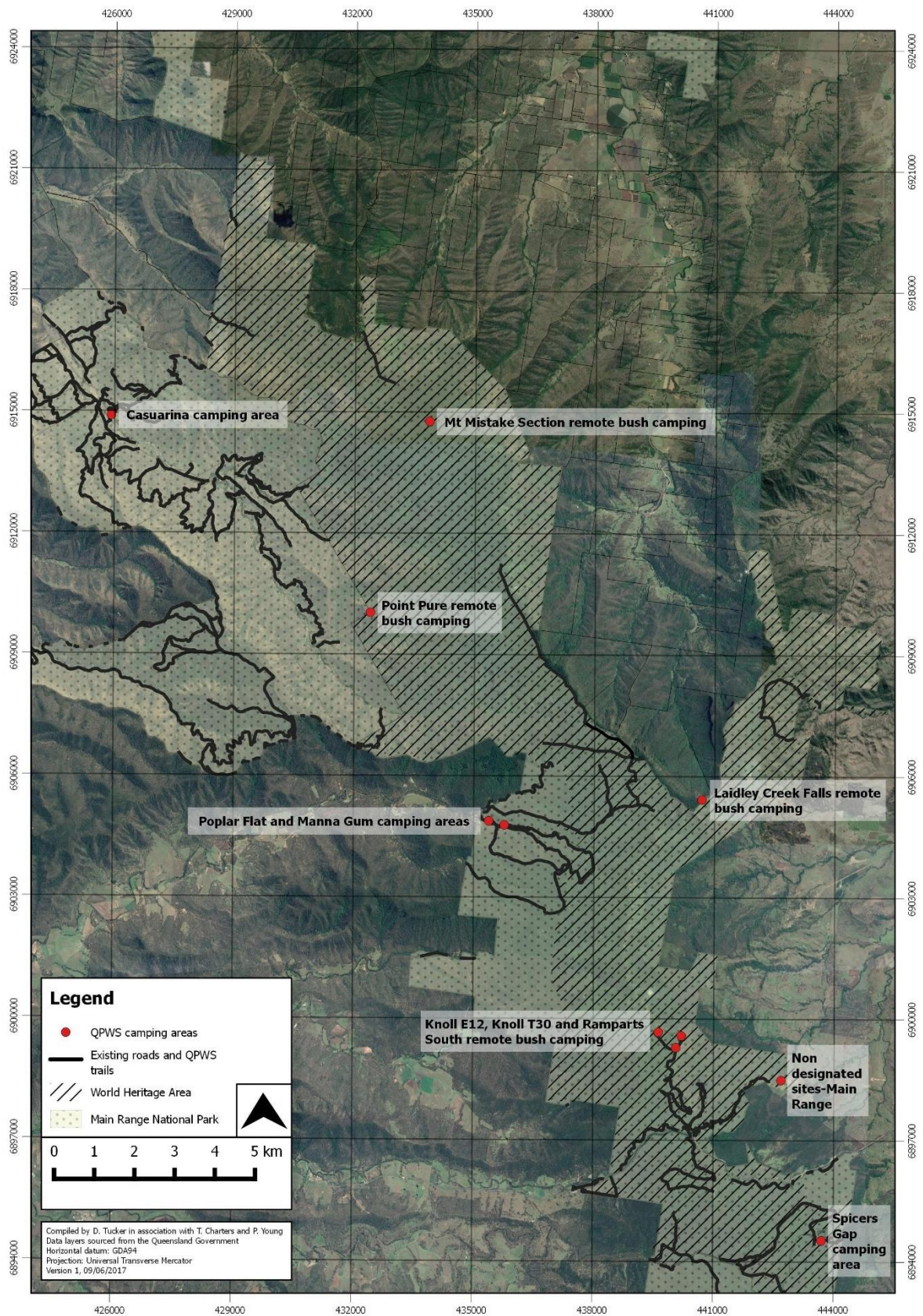


Figure 3 Location of existing tracks, trails, roads, and campgrounds within the Main Range National Park
 Note that many of the historic logging tracks and roads in the World Heritage Area have not been digitised and consequently are not included on this map. The previous Winder alignment is also not included as it is not a current track.

2. Matters of National Environmental Significance (MNES)

Under the EPBC Act, actions that have, or are likely to have, a significant impact on MNES require approval from the Federal Minister for the Environment.

MNES under the EPBC Act include:

- Listed threatened species and ecological communities;
- World Heritage Properties; and
- National Heritage Places

2.1. Potential Impact of Actions on MNES

2.1.1. Criteria for Threatened Species

An action is likely to have a significant impact on a critically endangered or endangered species if there is the risk that it will:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species (Anon. 2013).

2.1.2. Criteria for World Heritage Areas

An action is likely to have a significant impact on the World Heritage values of a declared WHA (property) if there is a risk that it will cause:

- one or more of the World Heritage values to be lost
- one or more of the World Heritage values to be degraded or damaged, or
- one or more of the World Heritage values to be notably altered, modified, obscured or diminished (Anon. 2013).

Actions will be considered to have a significant impact on biological, ecological, or other environmental values if they:

- reduce the diversity or modify the composition of plant and animal species in all or part of a World Heritage property
- fragment, isolate or substantially damage habitat important for the conservation of biological diversity in a World Heritage property
- cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a World Heritage property, and
- fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a World Heritage property
- Involve construction of buildings, roads, or other structures, vegetation clearance, or other actions with substantial, long-term or permanent impacts on relevant values

- Introduce noise, odours, pollutants or other intrusive elements with substantial, long-term or permanent impacts on relevant values

2.1.3. Criteria for National Heritage Places

An action is likely to have a significant impact on the National Heritage values of a World Heritage property or National Heritage place if there is a risk that it will cause:

- one or more of the National Heritage values to be lost
- one or more of the National Heritage values to be degraded or damaged, or
- one or more of the National Heritage values to be notably altered, modified, obscured or diminished (Anon. 2013).

Actions will be considered to have a significant impact on biological, ecological, or other environmental values if they:

- modify or inhibit ecological processes in a National Heritage place
- reduce the diversity or modify the composition of plant and animal species in a National Heritage place
- fragment or damage habitat important for the conservation of biological diversity in a National Heritage place
- cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a National Heritage place, and
- fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a National Heritage place
- Involve construction of buildings, roads, or other structures, vegetation clearance, or other actions with substantial, long-term or permanent impacts on relevant values
- Introduce noise, odours, pollutants or other intrusive elements with substantial, long-term or permanent impacts on relevant values

3. Project Actions with Potential for Impact on MNES

The Trail is described in detail in the development proposal and environmental management plan (Tony Charters and Associates 2016), and is summarised here. Readers are referred to Tony Charters and Associates (2016) for further detail if required.

The actions that have been assessed in providing this additional information to DoEE are:

- Re-opening a portion of the Winder forestry track
- Forming a series of mainly Class 5 Australian Standard (AS 2156) tracks (Photo 1) with minimal track hardening and some safety features, and connecting to existing Class 3 and 4 walking tracks³
- Forming short sections of Class 3 and Class 4 Australian Standard (AS 2156) tracks with hardening, drainage, and alignment to minimise impacts and provide a safer walking environment in steep locations.
- Road or track use by Gainsdale clients and staff, and independent walkers⁴
- Establishing two Ecocamps, with associated infrastructure
- Use of the two Ecocamps by Gainsdale clients and staff

3.1.1. Existing Management Roads, Fire Trails, and Walking Tracks within the National Park

The MRNP incorporates a network of snig tracks, logging access roads, and fire management lines from old forestry operations. A few these are currently used for park and fire management, and it is proposed that the following will be part of the greater Trail (Figure 4):

- Mt Castle western fire line from Amphitheatre View Wilderness Ecocamp to Mt Castle lookout
- Northern fire line from northern boundary of Main Range National Park
- Winder forestry road
- Banshee fire trail
- The part of the Cascade walking track from the Woodcutters Ecocamp to the intersection of the Ridge Track (which is also a management road)

There are twenty-two Class 2 to 4 walking tracks within the Main Range National Park⁵ and it is anticipated that the following tracks will be part of the greater Trail (Figure 4):

- Bare Rock to Cunningham's Gap
- Cunningham's Gap to Mt Mitchell
- Cascade and Ridge Tracks
- Winder Track to Mt Castle Lookout walking track
- Mt Castle Lookout walking track

The Park is regarded as a valued environment for remote area off-track walking, and remote bush camping is an allowed activity.

³ The Class 5 standard is a rough unformed track with minimal to no modification of the natural environment, and is generally suited to experienced bush walkers. Class 3 tracks may have hardened surfaces to prevent erosion, and Class 4 tracks are a distinct but largely unmodified rough track.

⁴ Risks posed by independent walkers are considered in Section 7.

⁵ <https://www.npsr.qld.gov.au/parks/main-range/pdf/main-range-park-guide-april2011.pdf>



Photo 1 Example of a Class 5 walking track, Main Range National Park (source: Tony Charters and Associates)

3.1.2. Re-opening Winder Forestry Track

The Trail would re-open the former Winder forestry track to connect the existing section of the Winder management track in the south, with the Northern fire line to the north (Figure 4). This will involve clearing regenerating vegetation along the old alignment to create a 2.5m wide management road and walking track. Canopy trees > 2.5m in height will not be disturbed. Small-scale specialised earth moving equipment will be used, and disturbance to the road surface will be avoided where possible. Clean source road base will be applied only where there is a clear surface or drainage issue. The linear footprint will be 1.55ha over 5.7km, and comprise of 1.5 ha of rainforest regrowth and 0.05 ha of grasses and shrubs in *Eucalyptus* forest. The former forestry road follows the crest of the Mistake Range, about 500 m inland from the scarp, and traverses through logged cool subtropical rainforest. The original road alignment has been colonised by a range of saplings and vines characteristic of the intact and regenerating rainforest, including stinging nettle (*Urtica incisa*), blackwood (*Acacia melanoxylon*), and native mulberry (*Hedycarya angustifolia*), with dense areas of shield fern (*Lastreopsis decomposita*) and vines at ground level (Tony Charters and Associates 2016).

Surveys conducted for the Trail have determined that the area is largely weed free (Tony Charters and Associates 2016).

3.1.3. Establishing New Tracks

The following new tracks are proposed to be established in the MRNP to create the Trail (Figure 4):

- 5.7 km of Class 5 track, and All Terrain 4WD access to the Ecocamps, via the retired section of the Winder forestry track. This includes two Class 5 deviation-tracks parallel to Winder forestry track to access sites of amenity.
- 2.76 km of principally Class 5 track linking the Winder Management Track to the Amphitheatre View Wilderness Ecocamp. This track will cross Blackfellow Creek, which provides breeding habitat for Fleay's Barred Frog. Sections of Class 3 track will be used in the descent to and ascent from the creek.
- 4.5 km of principally Class 5 track linking Mt Castle Lookout and the Cascades Trail. This track will cross Dalrymple Creek at its upper source; this creek provides breeding habitat for Fleay's Barred Frog. Sections of Class 3 track will be used in the descent to and ascent from the creek.
- 1.7 km of principally Class 5 track linking Sylvester's Lookout and the Bare Rock Trail. This section provides the most direct access south for the public who will not be using Woodcutters Ecocamp. A section of Class 3 track will be used for the descent to and ascent from the creek.
- 4.9 km of mainly Class 4 track linking the Banshee Fire Line to Bare Rock
- 0.5 km upgrade to Class 3 of Mt Mitchell Track to Spicers Peak Nature Reserve

Most of the tracks in the World Heritage Area will traverse warm temperate rainforest, transitioning into cool tropical rainforest on the highest ridges (Figure 2).

3.1.4. Establishing Ecocamps

Two Ecocamps, Amphitheatre View Wilderness Ecocamp and Woodcutters Ecocamp, are proposed (Figure 4). Modular units will be established at the two sites for accommodation, communal meeting, and toilet facilities. Each Ecocamp is intended to House up to 10 guests plus two guides, and be self-sufficient for energy and water supply, and waste treatment.

Amphitheatre View Wilderness Ecocamp will have a footprint of approximately 0.05 ha, requiring clearance of 40-50 small trees (less than 6m high) and 160-200 shrubs in *Eucalyptus* open forest. This vegetation type is classified as a regional ecosystem of least concern conservation status under *Queensland's Nature Conservation Act 1992*. No EPBC listed plant species were found at this site during surveys for the Project (Tony Charters and Associates 2016).

Woodcutters Ecocamp will have a footprint of approximately 0.05 ha, requiring clearance of 10-15 small trees and 80-100 shrubs, plus ferns, vines and forbs in regenerating tall open *Eucalyptus* forest. This area has been subject to historic logging, clearing, and ground disturbance, and is situated on a pad previously constructed for forestry activities. This Ecocamp is outside of the GRAWHA, but is adjacent to Hastings River Mouse habitat, upslope and downslope of the pad. The public Manna Gum campground is approximately 1km from this site and is connected via an existing track (Figure 5).

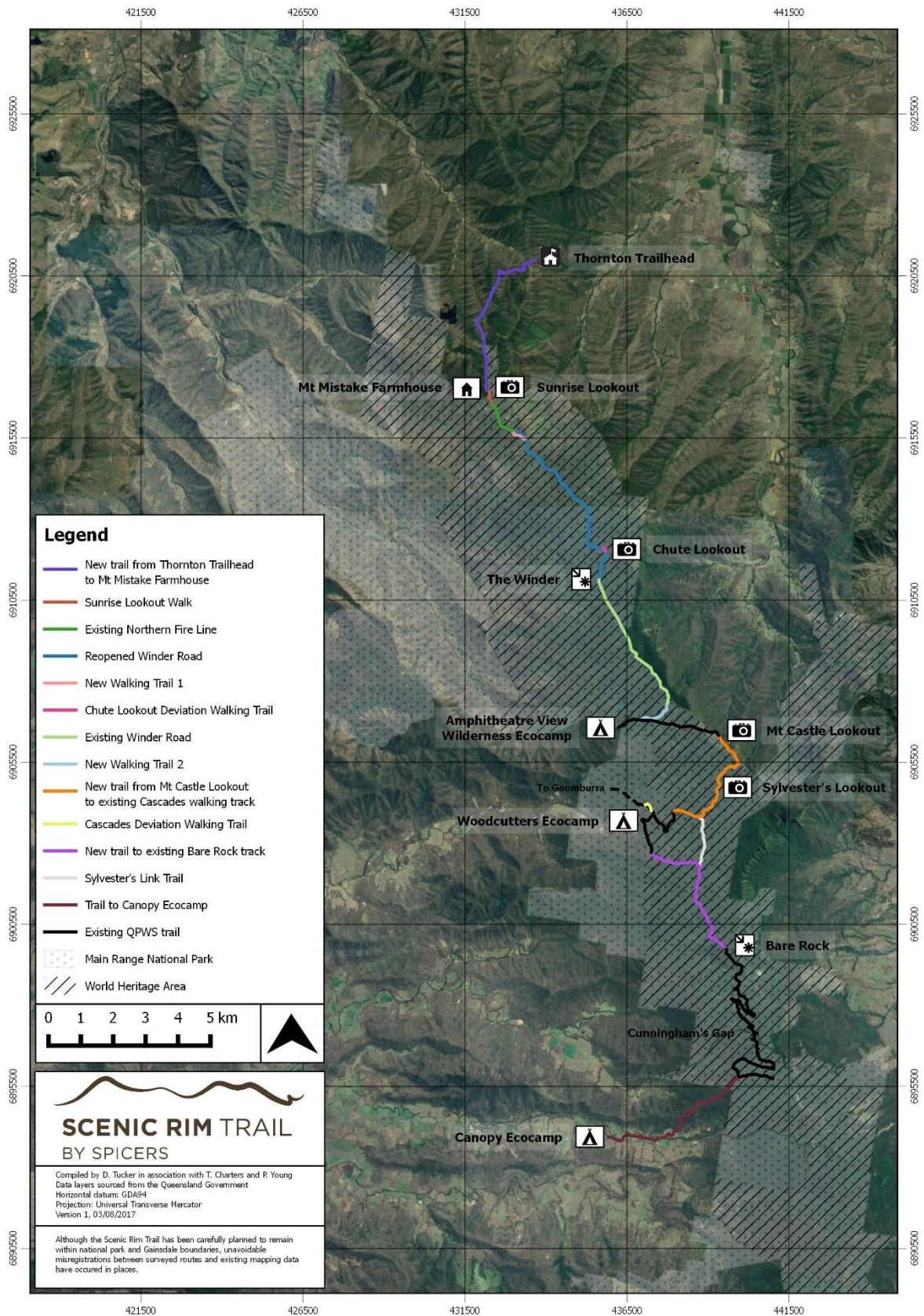


Figure 4 Location of existing tracks connecting to new tracks to form the Scenic Rim Trail within the Main Range National Park and Gondwana Rainforests of Australia World Heritage Area

4. Hastings River Mouse

The Hastings River Mouse (Photo 2) is listed as endangered under the EPBC Act because of its reduced, limited, and disjunct distribution, small local population sizes, and low reproductive rate. Its modern distribution is thought to be limited by genetic, climatic and vegetation factors, occupying only a small part of the potential habitat. Current populations occur in isolated areas >500m above sea level, and are distributed from the Mount Royal National Park, NSW, through to the Gondwana Rainforests of Australia, Qld. It is thought that most localised populations are > 10 - > 50 individuals. (NSW DEC 2005).



Photo 2 Hastings River Mouse caught during surveys near the proposed Woodcutters Ecocamp (source: BAAM)

The Hastings River Mouse recovery plan (NSW DECC 2005) considers that potential threatening processes for this species include:

- genetic isolation
- fire
- grazing
- loss of habitat
- predation
- forestry activities

Specific objectives of the recovery plan include:

- Increase understanding of the ecology and management of the Hastings River Mouse, particularly in relation to disturbance and threatening processes.

- Ensure that Hastings River Mouse populations and habitats are identified and managed to minimise impact from developments and activities.

4.1. Potential and Known Habitat of Hastings River Mouse in Relation to the Trail Alignment

The Hastings River Mouse is mostly herbivorous and granivorous, and its habitat is open wet or dry sclerophyll forests and woodlands with native grass, sedge, rush, fern, or heath understorey. The availability of dense vegetative ground cover in the height range of 10–75 cm, and the presence of structures such as tree root hollows, boulders, or fallen logs, providing cover from predators, are thought to be key habitat conditions (NSW DECC 2005).

The creation of gaps in forest canopy is considered an important factor in maintaining habitat for this species (Law *et al.* 2016). Habitat models have previously discounted forest – non-forest edges as suitable habitat for Hastings River Mouse, although some animals have been found to use edge habitat (Graham *et al.* 2005). In fact, the highest density of Hastings River Mouse recorded in the MRNP are in the immediate vicinity of the Ranger Station on the western edge of the Cunningham Highway (BAAM 2017a; Annex 3).

Individuals tend to have overlapping home ranges of < 2 ha, with no significant difference in home range size observed between sexes (Meek *et al.* 2006). They are primarily nocturnal, and can move several hundred metres in a night. Their movements are affected by small scale features of their environment, with fallen logs being important refuge sites, but they are not necessarily limited by roads or other human developments. Hastings River Mouse have been captured close to roads and logging tracks, and have been observed crossing these following release (Pyke and Read 2002).

Potential habitat has been mapped based on REs associated with records of Hastings River Mouse (BAAM 2017a). Figure 5 displays the location of Hastings River Mouse trapping and vegetation survey sites, and shows known and potential habitat, including potential habitat to the north of the northernmost recorded Hastings River Mouse capture (Figure 6). The total area of potential habitat within the MRNP that include previous Hastings River Mouse observations and the Trail network is 14,300 ha. There are 31,676 ha of potential habitat between the southern Main Range and the New South Wales border. As noted in BAAM 2017a, not all of this is suitable habitat, as habitat quality for Hastings River Mouse is determined by ground cover type and time since last disturbance.

4.1.1. Abundance of Hastings River Mouse

Only two Hastings River Mouse have been caught during Trail surveys for this species (Figure 6; BAAM 2017a). The overall trapping success for two years of surveys is 0.4% of 1460 trap nights. Both captures were relatively near the proposed Woodcutters Ecocamp and the existing Manna Gum campground. Eight Bush rats (*Rattus fuscipes*) to one Hastings River Mouse were captured at the Woodcutters site in 2016, and ten to one in 2017. Twenty Brown Antechinus (*Antechinus stuartii*) were also caught in this area during 2017. Most surveys have found Hastings River Mouse to be a relatively small proportion of the rodent community in which they occur (NSW DECC 2005). Law *et al.* (2016) have demonstrated a strong negative relationship between rats (*Rattus* and *Melomys*) and Hastings River Mouse, suggesting that there is competition between the two species, although ground cover type may have a greater influence on community composition.

4.1.2. Assessment of Habitat Quality for Hastings River Mouse

Vegetation surveys were conducted at four sites to assess their habitat quality for Hastings River Mouse (Figure 5; BAAM 2017a).

4.1.2.1 Mt Mistake

The Mt Mistake site was dominated by RE 12.8.14 (grey gum open forest), largely with sparse groundcover, and was classified as marginal habitat. Burning of the western slopes in November 2016 rendered this habitat currently unsuitable for Hastings River Mouse. Sections on the eastern slopes near the southern end of the fire trail were assessed as providing suitable habitat, however trapping surveys in this area did not capture any Hastings River Mouse in 2016.

4.1.2.2 Amphitheatre Ecocamp

The proposed Amphitheatre Ecocamp provides potential habitat with a mixture of REs 12.8.1 (*Eucalyptus campanulata* tall open forest with shrubby to grassy understorey) and 12.8.14 over a groundcover of *Doodia aspera* fern and *Xanthorrhoea glauca* grass tree. Grasses and mat rush, preferred by Hastings River Mouse, were sparse, and native rats were relatively abundant. Consequently, this habitat was assessed as unsuitable for Hastings River Mouse.

4.1.2.3 Woodcutters Ecocamp

The area around the proposed Woodcutters Ecocamp provides potential habitat for Hastings River Mouse, with REs 12.8.1 and 12.8.14 over a groundcover of dense mat-rush (*Lomandra longifolia*) and the grasses *Poa labillardierei* and *Imperata cylindrica*, particularly to the north and west of the Ecocamp. The grassy groundcover to the north east is sparser and less dominated by mat-rush. Shelter sites, including hollow logs and rocky outcrops are abundant throughout. Two Hastings River Mouse have been trapped in this general area.

The pad for the proposed Ecocamp is assessed as not suitable for Hastings River Mouse, being dominated by ferns, native raspberry (*Rubus parvifolius*), and rainforest saplings. The rainforest ecotone fringing the north, east, and southern boundaries of the Ecocamp is dominated by Lantana (*Lantana camara*), ferns, and rainforest trees, and lacks mat-rush and grassy groundcover. Consequently, construction of the Woodcutters Ecocamp will not reduce or fragment the habitat of Hastings River Mouse.

The inset in Figure 6 demonstrates the surveyed perimeter and area of the Woodcutters Ecocamp and its relative position near Hastings River Mouse habitat.

4.1.2.4 Southern Valley (Goomburra)

No Hastings River Mouse were trapped in the next valley to the south of Dalrymple Creek Valley although this habitat was assessed as suitable for Hastings River Mouse. It may provide connecting habitat between the Hastings River Mouse recorded in Dalrymple Creek Valley, near Woodcutters Ecocamp, and a record of Hastings River Mouse from the tributary of North Branch Creek further to the south (BAAM 2017a).

4.1.2.5 Mt Mitchell section

Habitat in the Mt Mitchell section of the Trail, towards Canopy Ecocamp, was identified as being suitable for Hastings River Mouse. There have been no surveys conducted here to date, however they have been observed to be abundant at the Ranger Station next to the Cunningham Highway to the north of this site (BAAM 2017a).

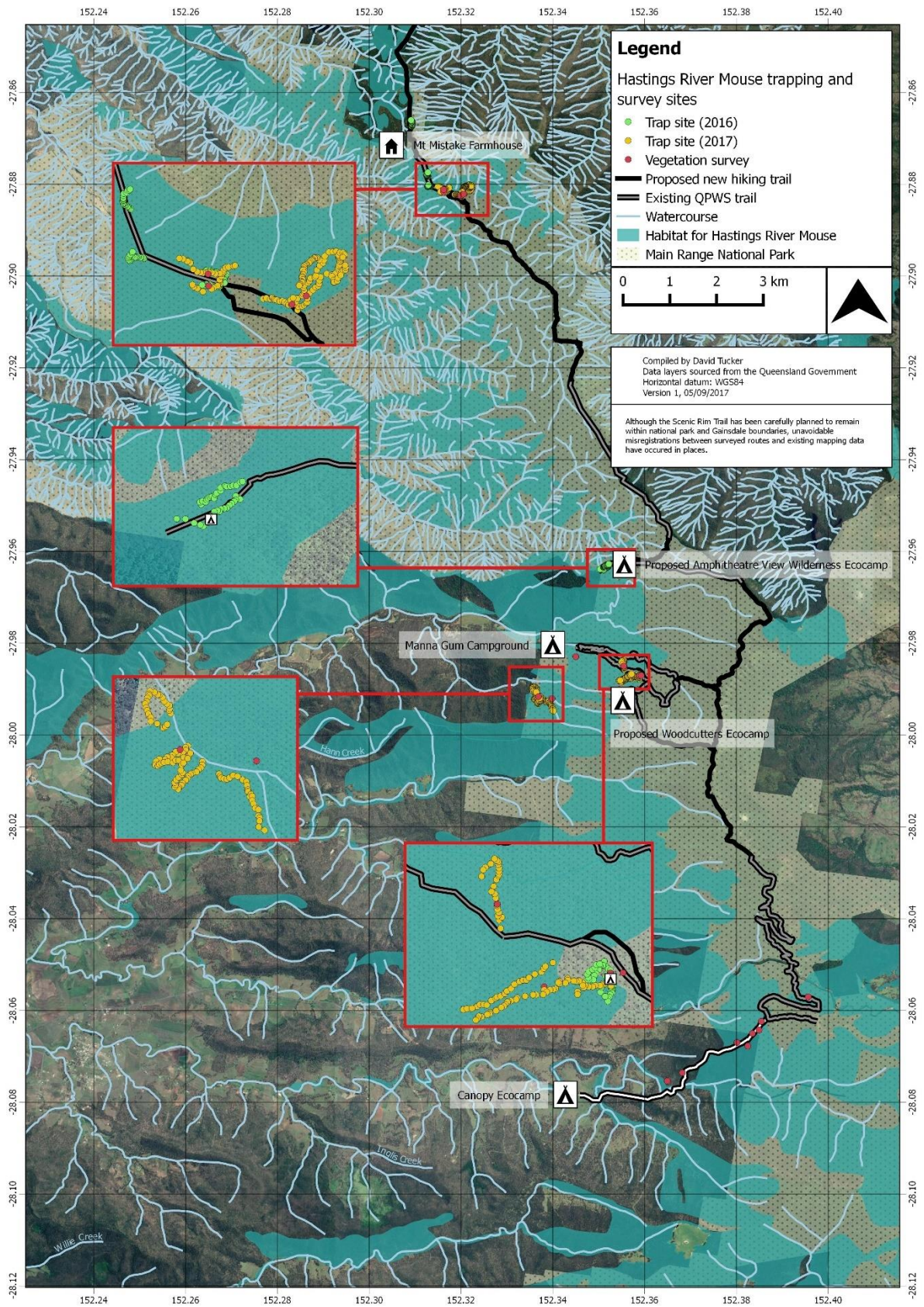


Figure 5 Hastings River Mouse trapping and vegetation survey sites

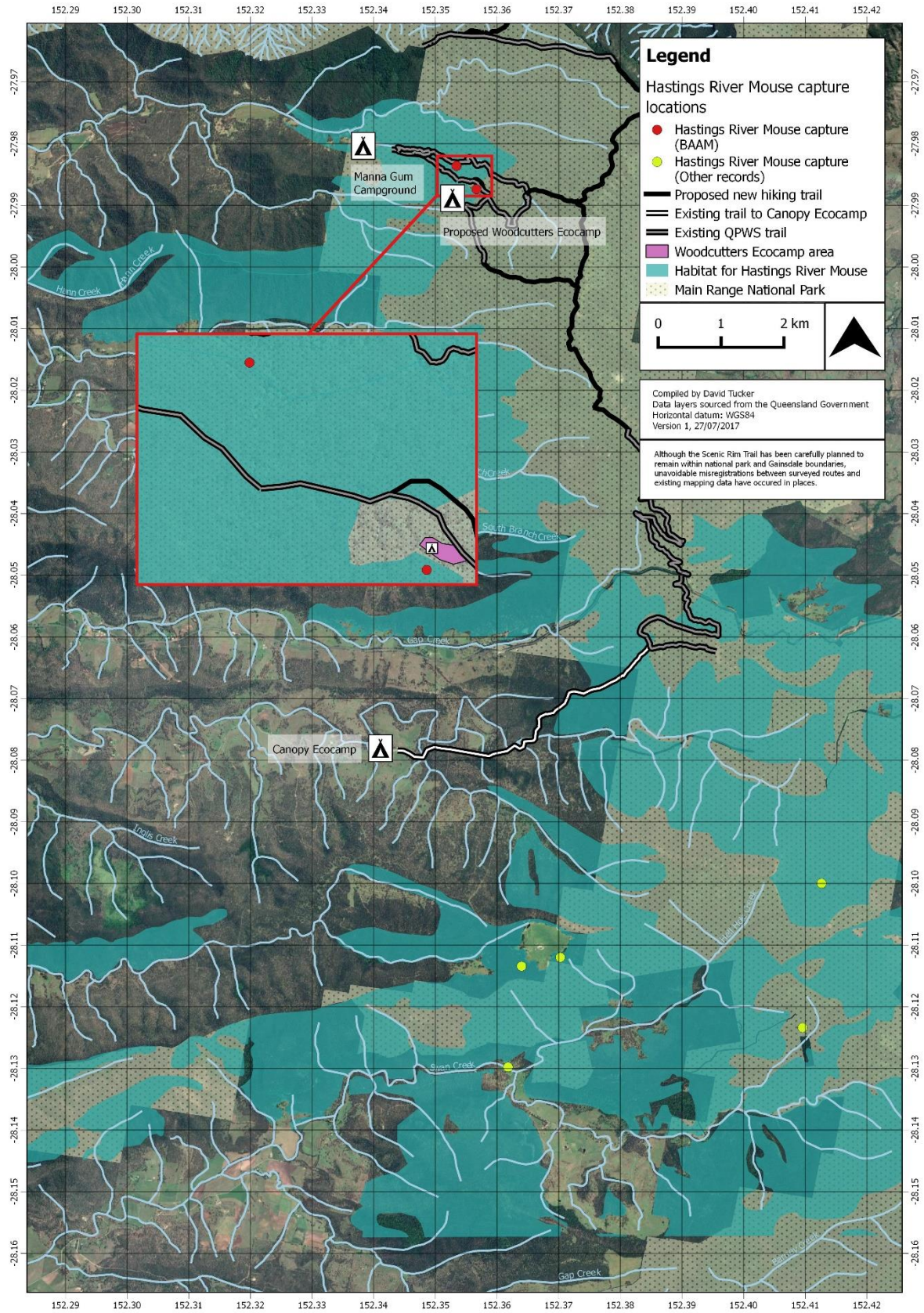


Figure 6 Location of Hasting River mouse captures and potential habitat

4.2. Threatening Processes to Hastings River Mouse in Proximity to the Trail Alignment

4.2.1. Genetic Isolation

The national Hastings River Mouse population is considered to have been significantly fragmented and reduced in distribution in the last 200 years due mainly to connecting habitat loss through vegetation clearance and altered fire regimes. Reduced gene flow between isolated populations potentially increases local population vulnerability to extinction because of susceptibility to new diseases and reduced capacity to adapt to changing environmental conditions.

The Hastings River Mouse recovery plan (NSW DECC 2005) considers that this threatening process is of less significance than habitat loss or predation.

4.2.2. Predation by and Competition with Introduced Species

There are four introduced predator species occurring within and adjacent to the Trail area⁶ which may opportunistically prey on the Hastings River Mouse, i.e. Pigs (*Sus scrofa*) (Photo 3), cats (*Felis catus*), dogs (*Canis lupus familiaris*), and foxes (*Vulpes vulpes*).

Two potential competitor species, i.e. the feral rodents' House mouse (*Mus musculus*) and Black rat (*Rattus rattus*), also occur within the GRAWHA and MRNP⁶. Incidentally, native rat species such as *Rattus fuscipes* may also competitively exclude Hastings River Mouse, although this may be influenced more by the diversity and availability of ground cover than population interaction (Law *et al.* 2016).



Photo 3 Feral Pig on an animal trail, recorded by infra-red camera near Mt Mistake (source: BAAM)

⁶ *Introduced animals of Gondwana Rainforests of Australia World Heritage area*, WetlandInfo, Department of Environment and Heritage Protection, Queensland, viewed 28 April 2017, <<https://wetlandinfo.ehp.qld.gov.au/wetlands/facts-maps/wildlife/?AreaID=world-heritage-area-gondwana-rainforests-of-australia&Kingdom=animals&SpeciesFilter=Introduced>>.

4.2.2.1 Pigs

Predation, habitat degradation, competition, and disease transmission by feral Pigs have been listed as a key threatening process under the EPBC Act, and a national threat abatement plan has been developed (Anon. 2017a). Feral Pigs are mobile animals with relatively large home ranges. They are opportunistic omnivores and will eat small mammals if they can catch them, although they are not considered to be significant predators of these (Choquenot *et al.* 1996). They are also habitat modifiers and can change plant species composition through rooting in organic matter and soil (Photo 4). They are known to preferably inhabit creek lines with vegetative cover in hot environments, as these provide food, corridors for movement, and shelter from heat (Saunders and Kay 1991; Caley 1997).

Damage from feral Pigs was first observed in MRNP in 2001 (Hines *et al.* 2001). Surveys conducted for the Trail observed a relatively high frequency of Pigs and Pig sign along the length of the eastern escarpment edge and the Winder forestry track alignment (Figure 7; BAAM 2017c; Annex 5). A family of Pigs was also observed on a fire break to the west of the proposed Amphitheatre View Ecocamp. All indications are that Pigs have invaded and are continuing to move in from the eastern foothills of the Great Dividing Range.



Photo 4 Ground vegetation damage in rainforest of Main Range National park through Pig rooting (source: Tony Charters and Associates)

4.2.2.2 Cats

Predation by feral cats is listed as a key threatening process under the EPBC Act, and a national threat abatement plan has been developed (Anon. 2015). Cats are solitary carnivores and will hunt and eat small to medium-sized mammals, birds, reptiles, amphibians, fish and invertebrates. Mammals tend to be the preferred prey item when available. Remains of Hastings River Mouse have been found in native owl pellets and fox scats, but not cat scat (Pyke and Read 2002). Feral cats occupy home ranges that vary from less than one square kilometre up to 20–30 square kilometres in areas where resources are scarce (all references in Anon. 2015).

No sign of cats was found in potential Hastings River Mouse habitat of the Trail area during pest surveys, but they are known to occur in the Park (BAAM 2017c).

4.2.2.3 Dogs

Predation by dogs has been listed as a key threatening process under the EPBC Act, particularly to medium to large macropods and some ground dwelling birds. They also prey on feral cats and European foxes, suppressing the population and hunting activities of these species (e.g. Wang and Fisher 2012). Dogs tend to hunt in groups or packs and are generalist predators and scavengers. They will maintain territories particularly where resources are scarce. To date there has been no national threat abatement plan developed.

The only evidence of feral dogs was a fresh track on the western slopes of Mt Mitchell, on an existing vehicle track (Photo 5; Figure 7; BAAM 2017c). Feral dogs are controlled through irregular baiting in response to livestock attacks, and they are likely to occur at low densities throughout the southern Main Range.



Photo 5 Wild dog track recorded near Mt Mitchell (source: BAAM)

4.2.2.4 Foxes

Predation by foxes is listed as a threatening process under the EPBC Act, and a national threat abatement plan has been developed (DEWHA 2008). It is noted that the QPWS have not included foxes in their MNRP Pest Management Plan. Foxes have a wide dietary range, but preferentially prey on small to medium sized, ground-dwelling and semi-arboreal mammals and ground-nesting birds. Their home range in forest can be from 60ha to 500ha. Foxes may use tracks to access prey, particularly those prey also using the tracks, but they are also found in dense bush away from tracks (Meek and Saunders 2000).

No sign of foxes was found in potential Hastings River Mouse habitat of the Trail area during vegetation and live capture surveys (BAAM 2017c).

4.2.2.5 *Introduced Rodents*

The effect of introduced rodents such as the Black rat and House mouse on native rodents such as the Hastings River Mouse is poorly studied in Australia. Competition for resources and predation of juveniles are two potential threatening processes, although they may be at a competitive disadvantage in intact habitats with existing native rodent populations (Stokes *et al.* 2009; Law *et al.* 2016).

No sign of introduced rodents was found in potential Hastings River Mouse habitat of the Trail area during vegetation and live capture surveys (BAAM 2017a).

4.2.3. Fire

Fire is a potential threatening process, through burning of habitat and direct mortality of individuals in small populations. However, it may also have been the factor that maintained Hastings River Mouse habitat in intact forests in the past by creating canopy gaps and ecotones, and encouraging regeneration of ground and shrub tier vegetation (Law *et al.* 2016). A recent fire near Mt Mistake has reduced the availability of potential Hastings River Mouse habitat, but this may return following ground cover regeneration and early succession.

QPWS maintain a patch-based cool burning regime to reduce the potential of wildfire in the National Park.

4.3. Risk Assessment - Potential Impact of the Trail on Hastings River Mouse

This section discusses the risk of significant impacts on the population of Hastings River Mouse within the MRNP and GRAWHA caused by Trail actions. The assessment follows the process outlined in the DoEE *Environmental Management Plan Guidelines* (Anon. 2014), and applies the precautionary principle to risk assessment where scientific knowledge or data is poor or absent. The risks posed by Trail actions on this MNES are identified in Section 2.1.1 and the risk assessment is summarised in Table 2.

4.3.1. Re-opening Winder Forestry Track

4.3.1.1 *Long term decrease in population size*

Re-opening of the Winder forestry track poses a potential risk of causing a long-term decrease in Hastings River Mouse population size if it provides access by Pigs to Hastings River Mouse habitat which would not otherwise have been accessible. The vegetation and area around the Winder forestry track is rainforest and does not provide suitable habitat itself for Hastings River Mouse.

Feral Pigs have been spreading through the MRNP since about 2001, and their sign has been observed at many locations along the Trail alignment (Photo 3, Photo 9), including the Mt Mistake area, the existing Northern fire trail, the existing Winder forestry track and historic alignment, Sylvester's link trail, and to the west of the proposed Amphitheatre View Ecocamp (Figure 7). It is likely that Pigs (and other predators) will use the re-opened Winder forestry track for ease of movement, but their movement and spread throughout the Park has already passed this point and is not contingent on the re-opened track. Feral Pigs will also use formed tracks to move throughout their home range but will also create their own tracks through the bush, as seen in Photo 3.

It is not known whether Pigs and other introduced predators will target or opportunistically prey on Hastings River Mouse, or whether the rate of predation would exceed the capacity of the local population to sustain itself (Banks 1999; Shore *et al.* 2002).

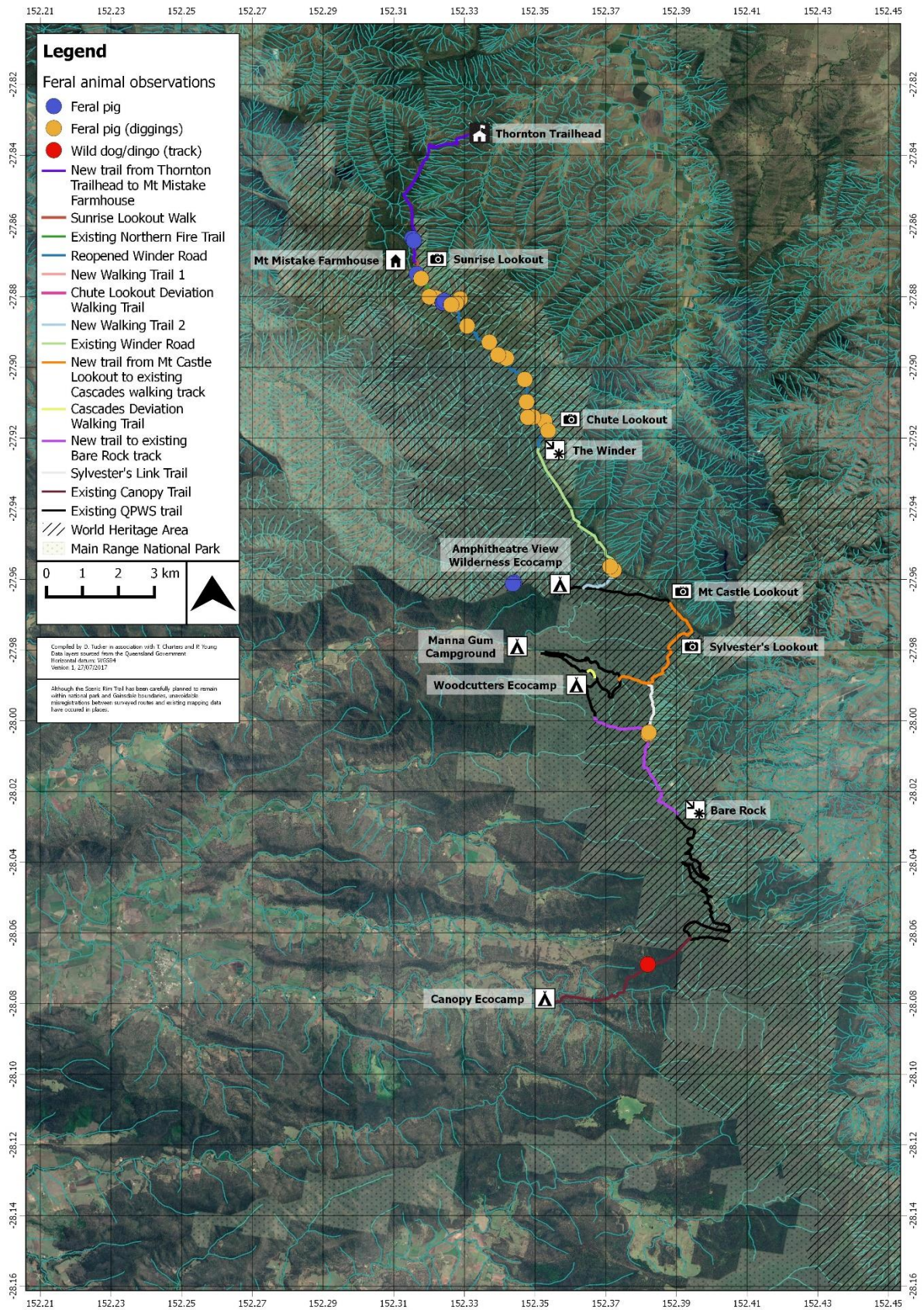


Figure 7 Feral Pig and wild dog observations and sign on the Trail alignment

The surveys conducted for the Trail suggest that the Hastings River Mouse population is small relative to other native rodent populations in the Park, and that it is at the northernmost extent of

its range (BAAM 2017a). The small local population would likely be vulnerable to increased predation pressure if there was no immigration into the area from other Hastings River Mouse populations.

Feral species in MRNP are subject to control under the QPWS Pest Management Strategy, and Pig control is an extremely high priority. For example, a Pig trap has been established on an open section of the Winder management track. Re-opening the Winder forestry track will provide increased access for park management and the targeting of feral predators such as Pigs that may preferentially use this track for movement through the Park. This will offset any increase in the rate of Pig movement that may be caused by the re-opened track and has the potential to provide a net positive impact for biodiversity in the National Park and World Heritage Area.

Pigs and other feral predators are likely to use the re-opened track, but the action of re-opening of the Winder forestry track is unlikely to directly or indirectly cause an increase in the rate of predation by Pigs on Hastings River Mouse as they are already resident in the Park to the north, south, east and west of the alignment. Therefore, the consequence of re-opening the track on Hastings River Mouse is minor. The potential unmitigated risk of the Trail causing a long-term decrease in Hastings River Mouse population size through facilitated predator movement is therefore assessed as low (Table 2).

Control measures to address this risk for Hastings River Mouse are described in Section 4.4.

4.3.1.2 Reduction in area of occupancy

The Winder forestry track does not pass through Hastings River Mouse habitat (Figure 5), therefore there is no risk of reducing the area of occupancy of Hastings River Mouse.

4.3.1.3 Fragmentation of existing population

The Winder forestry track does not pass through Hastings River Mouse habitat (Figure 5), therefore there is no risk of fragmenting an existing population.

4.3.1.4 Adversely affecting habitat

The Winder forestry track does not pass through Hastings River Mouse habitat (Figure 5), therefore there is no risk of adversely affecting habitat critical to the survival of Hastings River Mouse.

4.3.1.5 Disrupting breeding cycle

The Winder forestry track does not pass through Hastings River Mouse habitat (Figure 5), therefore there is no risk of disrupting the Hastings River Mouse breeding cycle.

4.3.1.6 Modifying habitat availability or quality

The Winder forestry track does not pass through Hastings River Mouse habitat (Figure 5), therefore there is no risk of modifying, destroying, removing, isolating, or decreasing the availability or quality of Hastings River Mouse habitat.

4.3.1.7 Establishment of invasive species

Invasive species with the potential to be harmful to Hastings River Mouse already exist in and/or are currently invading the Park (BAAM 2017c). Their movement may be facilitated by existing tracks and the re-opened Winder forestry track (Figure 3, Figure 5), but the re-opening of the Winder forestry track will not specifically cause the establishment of these species in Hastings River Mouse habitat where they do not already exist. Feral Pig sign, for example, has been observed all along the existing Winder management track and its previous alignment (Figure 7). Therefore, there is no risk of the re-opened Winder forestry track causing harmful invasive species to become established in Hastings River Mouse habitat.

Control measures designed to address the risk of introduced species preying on or destroying the habitat of Hastings River Mouse are described in Section 4.4.

4.3.1.8 Introduction of disease

There is no risk of the re-opened Winder forestry track resulting in the introduction of disease or disease vectors into the Hastings River Mouse population that cannot already be spread there via existing tracks or vectors.

4.3.1.9 Interference with species' recovery

The Winder forestry track does not pass through Hastings River Mouse habitat (Figure 5), and there are currently no recovery plan actions for Hastings River Mouse in the MRNP. Therefore, there is no direct risk of the re-opened Winder forestry track interfering with the recovery of this species. The low risk of increased predation through facilitated Pig movement is addressed in Section 4.3.1.1.

Control measures designed to improve the conservation management of Hastings River Mouse in the MRNP are described in Section 4.4.

4.3.2. Establishing New Tracks

4.3.2.1 Long term decrease in size of population

The establishment of Class 5 walking tracks (and short sections of Class 3 and 4 tracks) through rainforest (Photo 1) and Eucalypt-dominated forest poses a potential risk of causing a long-term decrease in Hastings River Mouse population size by contributing to the ongoing invasion of MRNP by feral Pigs and the movement of other predators. New tracks will be directly responsible if they provide access to Hastings River Mouse habitat which would not otherwise have been accessible.

As previously noted, feral Pigs are currently spreading through the MRNP (Figure 7) and they can use existing tracks through Hastings River Mouse habitat for this process (Figure 5, Figure 6). The establishment of new Class 5 tracks is unlikely to add to the rate of Pig dispersal and establishment.

It is possible that predators may use new Class 5 tracks for movement, however this is unlikely to be additional to existing access, therefore the potential consequences are minor. The potential risk of new Class 5 tracks facilitating feral species movement into Hastings River Mouse habitat and causing a long-term decrease in population size is considered low (Table 2).

Control measures to address this potential risk to Hastings River Mouse are described in Section 4.4.

4.3.2.2 Reduction in area of occupancy

There will be no new tracks established in confirmed Hastings River Mouse habitat. Therefore, there is no risk of reducing the area of occupancy for Hastings River Mouse.

4.3.2.3 Fragmentation of existing population

There will be no new tracks established in confirmed Hastings River Mouse habitat. Therefore, there is no risk of fragmenting the existing Hastings River Mouse population.

4.3.2.4 Adversely affecting habitat

There will be no new tracks established in confirmed Hastings River Mouse habitat. Therefore, there is no risk of adversely affecting Hastings River Mouse habitat.

4.3.2.5 Disrupting breeding cycle

There will be no new tracks established in confirmed Hastings River Mouse habitat. Therefore, there is no risk of disrupting the Hastings River Mouse breeding cycle.

4.3.2.6 Modifying habitat availability or quality

There will be no new tracks established in confirmed Hastings River Mouse habitat. Therefore, there is no risk of modifying, destroying, removing, isolating, or decreasing the availability or quality of Hastings River Mouse habitat.

4.3.2.7 Establishment of invasive species

Invasive species with the potential to be harmful to Hastings River Mouse already exist in or are currently invading the Park (BAAM 2017c). Their movement may be facilitated by existing and new tracks (Figure 3, Figure 5, Figure 6), but the new tracks are unlikely to be the cause of these species establishing in Hastings River Mouse habitat where they do not already exist. Therefore, there is no risk of the re-opened Winder forestry track causing harmful invasive species to become established in Hastings River Mouse habitat where they otherwise wouldn't.

Control measures designed to address the risk of introduced species preying on or destroying the habitat of Hastings River Mouse are described in Section 4.4.

4.3.2.8 Introduction of disease

There will be no new tracks established in confirmed Hastings River Mouse habitat. Therefore, there is no risk of the introduction of disease or disease vectors into the Hastings River Mouse population that cannot already be spread there via existing tracks or vectors.

4.3.2.9 Interference with species' recovery

There will be no new tracks established in confirmed Hastings River Mouse habitat. Therefore, there is no risk of the new tracks interfering with the recovery of this species.

Control measures designed to improve the conservation management of Hastings River Mouse in the MRNP are described in Section 4.4.

4.3.3. Establishing Ecocamps

4.3.3.1 Long term decrease in size of population

The Ecocamp footprints are outside of Hastings River Mouse habitat (BAAM 2017a), therefore there is no risk of their establishment causing a long-term decrease in the population size.

4.3.3.2 Reduction in area of occupancy

The Ecocamp footprints are outside of Hastings River Mouse habitat (BAAM 2017a), therefore there is no risk of their establishment reducing the area of occupancy of Hastings River Mouse.

4.3.3.3 Fragmentation of existing population

The Ecocamp footprints are outside of Hastings River Mouse habitat (BAAM 2017a), therefore there is no risk of their establishment fragmenting the existing Hastings River Mouse population.

4.3.3.4 Adversely affecting habitat

The Ecocamp footprints are outside of Hastings River Mouse habitat (BAAM 2017a), therefore there is no risk of their establishment adversely affecting critical Hastings River Mouse habitat.

4.3.3.5 Disrupting breeding cycle

The Ecocamps will be established outside of breeding habitat (BAAM 2017a), therefore there is no risk of this disrupting the breeding cycle.

4.3.3.6 Modifying habitat availability or quality

The Ecocamp footprints are outside of Hastings River Mouse habitat (BAAM 2017a), therefore there is no risk of their establishment modifying the availability or quality of Hastings River Mouse habitat.

4.3.3.7 Establishment of invasive species

Construction of the Woodcutters Ecocamp poses a potential risk to the Hastings River Mouse population through the potential transport of commensal rodents, i.e. Black rat and House mouse from the factories and subsequent introduction into Hastings River Mouse habitat.

The Black rat and House mouse have the potential to be competitors with Hastings River Mouse, although published data suggest that the relative risk of invasion is low (Stokes *et al.* 2009; Law *et al.* 2016). They are not currently found around the proposed Ecocamps (BAAM 2017a), but have the potential to be transported in construction materials.

The risk of introducing commensal rodents into Hastings River Mouse habitat is low, given that it is possible, however the consequences are minor, given the competitive advantage of existing native species populations (Table 2).

Control measures to address this risk to Hastings River Mouse are described in Section 4.4.

4.3.3.8 Introduction of disease

There is no risk of Ecocamp establishment resulting in the introduction of disease or disease vectors into the Hastings River Mouse population that cannot already be spread there via existing tracks or vectors.

4.3.3.9 Interference with species' recovery

The Ecocamps lie outside of Hastings River Mouse habitat. Therefore, there is no risk of Ecocamp construction interfering with the recovery of this species.

Control measures designed to improve the conservation management of Hastings River Mouse in the MRNP are described in Section 4.4.

4.3.4. Ecocamp Operation

4.3.4.1 Reduction in area of occupancy

Operation of the Woodcutters Ecocamp poses a potential risk to the Hastings River Mouse population through reducing the area of habitat occupancy around the camp perimeter with the presence of artificial lighting and/or noise.

Lighting

The effect of highly-lit urban environments, or highly-lit infrastructure in otherwise dark environments, is causing concern for wildlife conservation, given that natural light and day-night cycles directly and indirectly influence many biological and ecological processes (Gaston *et al.* 2013). Ambient and artificial light alters the risk environment for potential prey species such as small mammals because it influences the ability of nocturnal predators to detect and capture them. Consequently, small mammals may change their foraging behaviour during moonlit nights or under artificially-lit conditions to avoid predators (Brown and Kotler 2004; Longcore and Rich 2004; Wolfe and Summerlin 1989). A study investigating the foraging behaviour of Santa Rosa beach mice (*Peromyscus polionotus leucocephalus*) under two "wildlife-friendly" light types discovered that the mice exploited fewer food patches near both types of light than in areas with little light, and harvested fewer seeds within patches near the non-bug-attracting lights (Bird 2004).

It is unknown how Hastings River Mouse will respond to lighting or light spill from the Woodcutters Ecocamp. They may avoid foraging in habitat subject to light spill, may be more cautious when foraging in light spill areas, or not be affected at all. The scale of Hastings River Mouse habitat relative to the potential scale of light spill from the Ecocamp footprint (Figure 6) suggests that any reduction in available habitat would be negligible. It would only pose a significant impact if the

reduction in habitat (quality or extent) reduced the reproductive fitness and viability of the local population, which is unlikely. This assessment based on the published literature is supported by the highest density of Hastings River Mouse in the southern Main Range occurring in the immediate vicinity of the Ranger Station on the western edge of the Cunningham Highway (BAAM 2017a).

The use of lighting at Woodcutters Ecocamp is considered to pose a low risk to the Hastings River Mouse population viability through reducing the area of habitat occupancy, due to the likelihood of disturbance being unlikely and with minor consequences if it does occur (Table 2).

The risk posed by artificial lighting of the Ecocamp will be mitigated by the proposed control measures in Section 4.4.

Noise

Changes in animal behaviour in response to noise stimuli vary, and can range from a startle or predator-avoidance response to sudden noise, through to chronic deafness and masking of biologically important sounds used for communication or threat detection (Shannon *et al.* 2015). Most studies have focussed on noise impacts on birds or marine mammals, in response to chronic or acute noise such as from urban traffic, helicopters in wilderness areas, and military or seismic-survey explosions (Blickley and Patricelli 2010; Pater *et al.* 2009; Shannon *et al.* 2015). Studies on other taxa, including small terrestrial mammals, are rare.

One of the most common wildlife responses to loud noises is site abandonment, and evidence suggests that this usually occurs when frequent or chronic noise interferes with cue detection, or when more variable sounds are perceived as persistent threats (Francis and Barber 2013). Loud noise can also affect reproductive fitness, as maintaining increased vigilance can mean that animals miss opportunities for foraging or breeding. Predators may also avoid noisy areas because of the change in capacity to detect prey, and because of the increased vigilance of the prey. Some animals appear to habituate to consistent noise, suggesting that they learn that the noise is not a threat or, conversely, they cannot afford to maintain responsiveness to the most frequent noise events (Brown *et al.* 2012).

Abandonment of Hastings River Mouse habitat adjacent to the Ecocamps because of visitor noise will be a significant issue if the population is being forced into lower quality habitat, and/or this leads to reduced reproductive fitness in the population (Francis and Barber 2013; Shannon *et al.* 2015). Noise from the Ecocamps, such as sudden laughter, shouting, or general conversation may cause a startle response or avoidance of the site during a time of perceived threat, but habituation to noise, periods of inactivity at night when the Hastings River Mouse is typically foraging, periods without residents at the Ecocamp, and the extent of surrounding habitat suggest that it is unlikely to lead to habitat abandonment. The fact that the highest density of Hastings River Mouse in the southern Main Range occurs in the immediate vicinity of the Ranger Station on the western edge of the Cunningham Highway (BAAM 2017a) supports this assessment.

The potential intensity, frequency, and volume of noise from the Woodcutters Ecocamp is considered to pose a low risk to Hastings River Mouse population viability through reducing the area of habitat occupancy, as disturbance is possible, but with minor consequences if it does occur (Table 2).

The risks posed by noise from the Ecocamp will be mitigated by the proposed control measures in Section 4.4.

4.3.4.2 Fragmentation of existing population

The Ecocamp footprints are outside of Hastings River Mouse habitat (BAAM 2017a), therefore there is no risk of their operation fragmenting the Hastings River Mouse population.

4.3.4.3 Adversely affecting habitat

The Ecocamp footprints are outside of Hastings River Mouse habitat (BAAM 2017a), therefore there is no risk of their operation adversely affecting Hastings River Mouse habitat.

4.3.4.4 Disrupting breeding cycle

Operation of the Woodcutters Ecocamp poses a potential risk of disrupting the breeding cycle of Hastings River Mouse at the camp perimeter if artificial lighting and/or noise causes Hastings River Mouse to change their breeding behaviour. This is assessed as a low risk due to the extent and complexity of surrounding habitat making any impact unlikely to occur and with only minor consequences for the population if it did.

The risks posed by light or noise from the Ecocamp will be mitigated by the proposed control measures in Section 4.4.

4.3.4.5 Modifying habitat availability or quality

The Ecocamp footprints are outside of Hastings River Mouse habitat (BAAM 2017a), therefore there is no risk of their operation adversely affecting Hastings River Mouse habitat.

4.3.4.6 Establishment of invasive species

Operation of the Woodcutters Ecocamp poses a potential risk to the Hastings River Mouse population through facilitating the introduction of feral rodents, i.e. Black rat and House mouse into Hastings River Mouse habitat.

The Black rat and House mouse have the potential to be competitors with Hastings River Mouse, although published data suggest that the relative risk of competition is very low (Stokes 2009; Law *et al.* 2016). They are not currently found in the local area, but have the potential to be transported in food supplies and materials brought to the Ecocamps. Similarly, they may also be introduced through activities associated with independent campers at the nearby Manna Gum campsite (Figure 6).

The unmitigated risk of introducing commensal rodents into Hastings River Mouse habitat is low, given that it is possible, but the consequences would be minor, given that successful establishment and competition is unlikely (Table 2).

Control measures to address this risk to Hastings River Mouse are described in Section 4.4.

4.3.4.7 Introduction of disease

There is no risk that operation of the Ecocamps will cause the introduction of disease or disease vectors into the Hastings River Mouse population that cannot already be spread there via existing tracks and vectors.

4.3.4.8 Interference with species' recovery

The Ecocamps lie outside of Hastings River Mouse habitat (Figure 6), and there are currently no recovery plan actions for Hastings River Mouse in the MRNP. Therefore, there is no risk of the Ecocamps interfering with the recovery of this species. The low risks posed by light, noise and feral rodents are addressed in Sections 4.3.4.1, 4.3.4.4, and 4.3.4.6.

Control measures designed to improve the conservation management of Hastings River Mouse in the MRNP are described in Section 4.4.

Table 2 Risk assessment of potential significant impact to the Hastings River Mouse population in the Project Area

Risk	Action				
	Re-opening Winder forestry track	Track establishment	Road or track use	Ecocamp establishment	Ecocamp operation
Long-term decrease in population size	Low	Low	Nil	Nil	Nil
Reduced area of occupancy	Nil	Nil	Nil	Nil	Low
Fragmentation of population	Nil	Nil	Nil	Nil	Nil
Adverse effect on critical breeding habitat	Nil	Nil	Nil	Nil	N/A
Disruption of breeding cycle	Nil	Nil	Nil	Nil	Low
Critical loss or degradation of habitat	Nil	Nil	Nil	Nil	N/A
Introduction of critical invasive species	Nil	Nil	Nil	Low	Low
Introduction of critical disease	Nil	Nil	Nil	Nil	Nil

4.4. Environmental Management Measures - Avoidance and Mitigation of Potential Impacts on Hastings River Mouse

4.4.1. Performance Targets and Control Measures

The performance targets and control measures for avoiding or mitigating the direct or indirect impact of the Trail on Hastings River Mouse are presented in Table 3. These performance targets are based on the criteria for determining significant impact on endangered species.

4.4.2. Environmental Monitoring

Surveys of potential Hastings River Mouse habitat for the Trail have recorded only two occurrences over two surveys. Populations of Hastings River Mouse are typically small, i.e. <50, and the first occurrence extended the known range of this species. Research and further survey effort is required to determine the population dynamics of the local population.

Consequently, Gainsdale will:

- Develop and implement a Hastings River Mouse survey program in collaboration with QPWS and University of Queensland, applying NSW DECC (2005) guidelines for survey effort, to monitor population dynamics
- Fund a research project in collaboration with QPWS and University of Queensland to improve understanding of Hastings River Mouse population and metapopulation dynamics in the MRNP

4.4.3. Corrective Actions

The corrective actions for managing any adverse impacts on the Hastings River Mouse population that may occur despite the control measures are presented in Table 4. Detection of feral Pigs, Black rats, or House mice at the Woodcutters Ecocamp will trigger an immediate management response.

4.4.4. Residual Risk Assessment

Predation of Hastings River Mouse and disturbance of Hastings River Mouse habitat by Pigs is a potential threat to the Hastings River Mouse population in MRNP, and this is likely to be a continuing threat irrespective of the Trail. Understanding the rate of these impacts and their effect on the population will be critical in determining the degree of Pig control required and in providing a measure of success. The QPWS is responsible for Pig control in the MRNP, and their Pest Management Strategy identifies this as an extremely high priority. Co-funding of targeted Pig control by Gainsdale is anticipated to maintain the risk of Pigs to Hastings River Mouse at low.

Light and noise control measures at the Ecocamps will reduce the risk of habitat abandonment by Hastings River Mouse at the camp perimeter, and of potential increased rates of predation, to negligible.

Feral rodent control measures at base camp and the Ecocamps will reduce the likelihood of feral rodent introduction to Hastings River Mouse habitat from the Ecocamps to unlikely, and will keep the risk at low.

4.4.5. Proposed Offsets

There will be no risk of significant impact to this MNES if the relevant control measures are undertaken. Consequently, there will be no need for an offset of any kind.

Table 3 Control measures for managing the risks to Hastings River Mouse

Performance Target	Control Measures	Timeframe
No long-term decrease in population size due to feral Pigs using Trail	<ul style="list-style-type: none"> Collaborate with QPWS to review and update QPWS feral animal control plan following Trail approval, to ensure that there is adequate protection of the Hastings River Mouse population along the new area of open Trail Contribute to funding of feral Pig control operations, including but not limited to traps and cameras, within the Trail area as determined by agreement with QPWS and in line with measures in other areas of the Park Contribute to feral animal surveillance within the Trail area to inform the QPWS feral animal control plan in line with an agreed program 	Following project approval; by agreement with QPWS
No invasion by feral rodents of habitat near Ecocamps	<ul style="list-style-type: none"> Obtain a permit from QPWS to capture and kill any non-native rodents accidentally introduced to the site Contractually require that suppliers of Ecocamp construction materials ensure that the materials are rodent free upon leaving the industrial site Ensure that food, supplies, and walkers' gear is packed in rodent free environment prior to leaving base camp, and that this gear will be packed into rodent proof containers for transport to the Ecocamps Inform walkers of importance of maintaining the rodent free status of the Ecocamps Ensure that food scraps are collected and contained in rodent proof containers for removal from the Ecocamps Ensure that Ecoguides record and immediately report observations of non-native rodents or sign to Gainsdale 	Following project approval; ongoing
Ensure light levels from Ecocamp at perimeter of Hastings River Mouse habitat do not exceed 0.29 Lux ⁷	<ul style="list-style-type: none"> Lights will be on only when needed Only the area requiring lighting for comfort or security will be lit Lighting will be no brighter than required to provide for safety and comfort Exterior lights will be long wavelength (amber or red), and the interior lights will have low blue light emissions Exterior lights will be linked to movement sensors to minimise duration of lighting Ecocamp buildings will have window screening to minimise light spill External lighting is shielded from the camp perimeter 	Ongoing during occupancy

⁷ Equivalent to an average full moon

	<ul style="list-style-type: none"> The trunks of any large trees felled for Ecocamp development will be hand laid outside of the perimeter to provide extra cover for Hastings River Mouse movement and foraging 	
Ensure that noise levels from the Ecocamp at the perimeter of Hastings River Mouse habitat do not exceed 45 dB LAeq and 60 dB LAmax ⁸ between 6pm – 7am	<ul style="list-style-type: none"> Noise dampening materials will be used in construction of the Ecocamp infrastructures to ensure that noise levels from inside are below conversational level at the perimeter of the Ecocamp Ecoguides will inform clients of the potential impact of noise on Hastings River Mouse, and moderate conversational or other noise levels after dusk Trees felled for Ecocamp development will be hand laid outside of the perimeter to provide extra cover for Hastings River Mouse movement and foraging 	Ongoing during occupancy

Table 4 Trigger values and corrective measures to address adverse impacts on Hastings River Mouse population

Trigger	Corrective Measures	Timeframe
Research and monitoring determines increased threat by feral Pigs to Hastings River Mouse	<ul style="list-style-type: none"> Contribute to funding of <i>ad hoc</i> feral animal control, if monitoring determines that this is required to protect the Hastings River Mouse population Identify new management techniques or approaches through the research project 	By agreement with QPWS
Feral rodents found in Ecocamp infrastructure or surrounding habitat	<ul style="list-style-type: none"> Immediately increase feral rodent control at base camp where food and supplies are packed Mobilise live trapping regime around the Ecocamp infrastructure and perimeter within one week of observation Continue live trapping until the feral rodents are captured and killed, or for one week if no rodents are captured, or for four more days if feral rodents are captured on last night of trapping 	Immediately upon trigger
Lighting at Ecocamp perimeter exceeds trigger level	<ul style="list-style-type: none"> Review lighting design and seek alternative design or technological options 	Within 4 weeks of trigger
Noise at Ecocamp perimeter exceeds trigger level	<ul style="list-style-type: none"> Review noise control protocols for Ecocamp use and moderate user behaviour Install further noise dampening materials in infrastructure if warranted 	Within 4 weeks of trigger

⁸ World Health Organisation (1999) Guidelines for community noise. WHO, Geneva.

5. Fleay's Barred Frog

Fleay's Barred Frog (Photo 6) is listed as endangered under the EPBC Act. It is one of five species of upland stream-dwelling frog which has declined in south-east Queensland in recent decades, and this species has disappeared completely from the Bunya Mountains and Mount Tamborine in Queensland (Hines *et al.* 2002).



Photo 6 Fleay's Barred Frog, near Dalrymple Creek (source: BAAM)

This species has a narrow and disjunct distribution in rainforest, Antarctic Beech forest, and the wetter eucalypt forests, from the Great Dividing Range in south-east Queensland to Yabbra Scrub in north-east New South Wales. Fleay's Barred Frog are found from near sea level to approximately 1000 m altitude, but are most commonly recorded at mid-elevation sites between 400 and 800 m (Hines *et al.* 2002).

The recovery plan for stream frogs of south east Queensland (Hines *et al.* 2002) and the most recent conservation advice from the DoEE (Anon. 2017b) considers that the known and potential threatening processes for this species include:

- Chytridiomycosis caused by chytrid fungus
- Habitat damage by feral Pigs
- Habitat damage by domestic stock
- Habitat clearing and disturbance (land management)
- Invasive weeds

The overall objective of the recovery plan is:

- To significantly improve the conservation status and long-term survival of each species through protection of its habitat, and through location of additional populations or expansion of existing populations into areas currently uninhabited.

Key conservation actions (Anon 2017b) include:

- Minimising the spread of chytrid fungus by implementing suitable hygiene protocols
- Developing and implementing translocation strategies to create additional populations
- Controlling feral Pigs in the Main Ranges
- Monitoring damage by feral Pigs and implementing control measures
- Investigating and where appropriate applying assisted reproductive strategies such as captive rearing and translocation

5.1. Threatening Processes to Fleay's Barred Frog Within and Adjacent to the Trail Area

5.1.1. Predation and Habitat Destruction by Feral Pigs

Feral Pigs are regarded as a potential threatening process for Fleay's Barred Frog within the MRNP and GRAWHA. Feral Pigs are highly mobile and tend to have large home ranges. They are opportunistic omnivores and will eat frogs, while also degrading frog habitat by digging or rooting through leaf litter for food (Photo 4). They can also change habitat quality by facilitating the introduction of weeds, enriching soil nutrient status through their wastes, and affecting water quality through sedimentation.

Predation and habitat degradation by feral Pigs have been listed as a key threatening process under the EPBC Act, and a threat abatement plan has been developed (Anon. 2017a). The overarching goals of the feral Pig threat abatement plan (Anon. 2017a) are:

- To prevent further species and ecological communities from becoming threatened or extinct due to predation, habitat degradation, competition and disease transmission by feral Pigs, and
- to improve protection for EPBC-listed species and ecological communities currently threatened by feral Pigs

Abundant fresh feral Pig diggings have been observed along the Project alignment, including on the Winder management track above the proposed new trail section (Figure 7; Photo 9; BAAM 2017c; Annex 4).

5.1.2. Infection by Chytrid Fungus

Fleay's Barred Frog is considered at moderate threat of extinction because of infection by chytrid fungus (*Batrachochytrium dendrobatidis*) (Anon. 2016). Infection of amphibians by chytrid fungus is listed under the EPBC Act as a threatening process, and a draft threat abatement plan has been developed (Anon. 2016). The highly infectious chytrid fungus has been implicated in mass die-offs and species extinctions of frogs that have occurred globally since the 1970s. The fungus has spread to all climatically suitable (i.e. cool and wet) areas in eastern Australia, and upland populations of frogs have experienced the greatest number of declines and extinctions (references in Anon. 2016).

There are no proven methods to eradicate or control this disease in the wild, and captive management is regarded by the Recovery Plan as the key action available to prevent species extinction. However, recent research suggests that some populations are developing an immunity to the fungus, and are stabilising after initial infection (Newell *et al.* 2013; Quick *et al.* 2015).

5.2. Potential and Known Habitat of Fleay's Barred Frog Within and Adjacent to the Trail Area

Adult Fleay's Barred Frog are typically found in the leaf litter along the banks of permanent fast-flowing streams in forested areas, with the males rarely moving more than 20m from the stream (Doak 2005). Males call during the breeding season from rocks in the streams, from pools at the margins of these streams, or from the forest floor. During the breeding season, the female lays eggs on bedrock in the shallow riffle zone of the stream or in small depressions amongst submerged leaf litter or gravel. After hatching, tadpoles are found in pools of water, and may occur all year round in some locations.

Figure 8 and Figure 9 show the area of suitable Fleay's Barred Frog breeding habitat, i.e. within a 40m riparian corridor at Blackfellow and Dalrymple creeks.

Females will extensively range, and can be found foraging in suitable rainforest habitat along ridge-tops hundreds of metres from the nearest stream. They appear to favour foraging along cleared roads and walking tracks when these are present (Doak 2005).

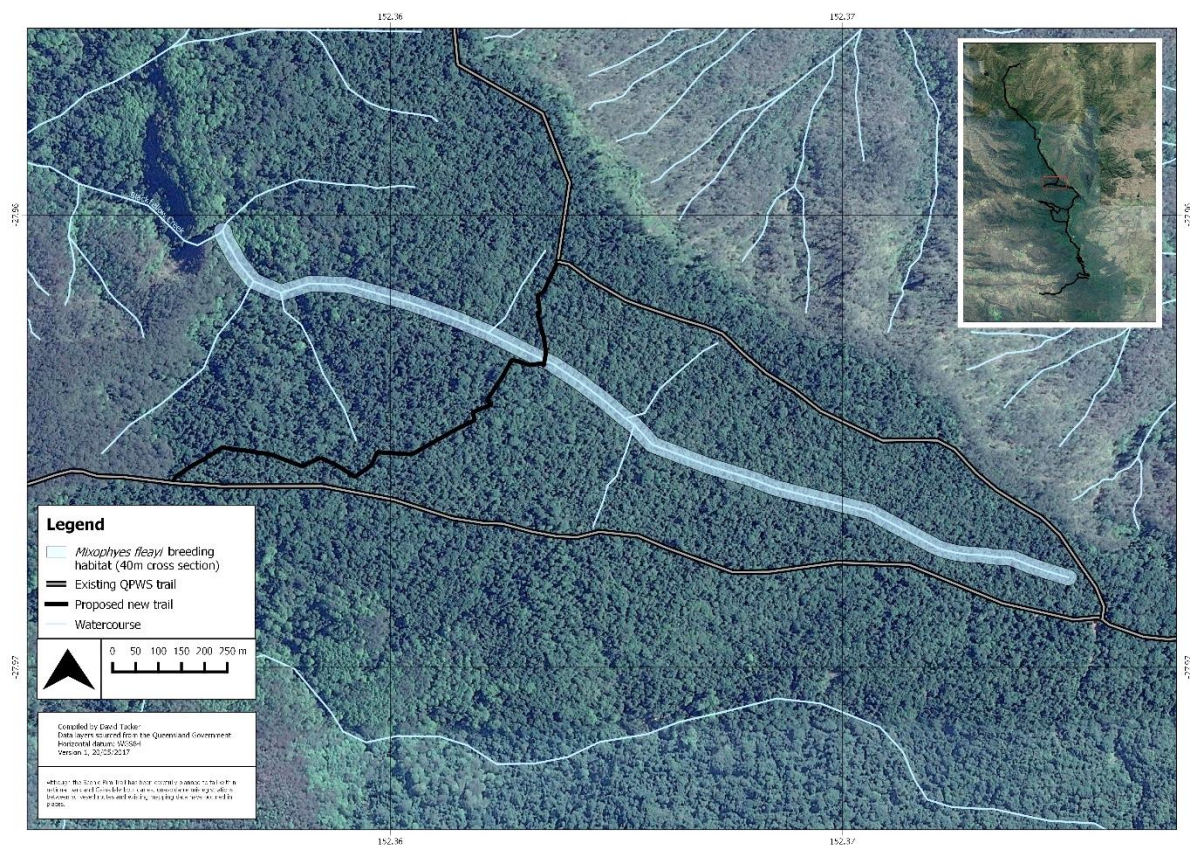


Figure 8 Fleay's Barred Frog breeding habitat alongside Blackfellow Creek, with proposed creek crossing

5.2.1. Abundance of Fleay's Barred Frog

5.2.1.1 Blackfellow Creek

Seven Fleay's Barred Frog were detected at locations along upper Blackfellow Creek, above the proposed crossing point with a relative abundance of 4 frogs observed/hour (frogs/hr) (BAAM 2017b). These frogs were found on level, more open ground within 30 m of the creek banks and all were exhibiting foraging behaviour. No frogs were observed on the rainforest slopes or ridgeline. No frogs were heard calling or responded to call-playback during the nocturnal spotlighting survey, and

this is attributable to the survey taking place during high stream flow conditions after moderately heavy rainfall (BAAM 2017b).

Dip-netting confirmed that this species' tadpoles occurred relatively abundantly in all the small pools along the length of the creek surveyed, both above and below the proposed creek crossing point.

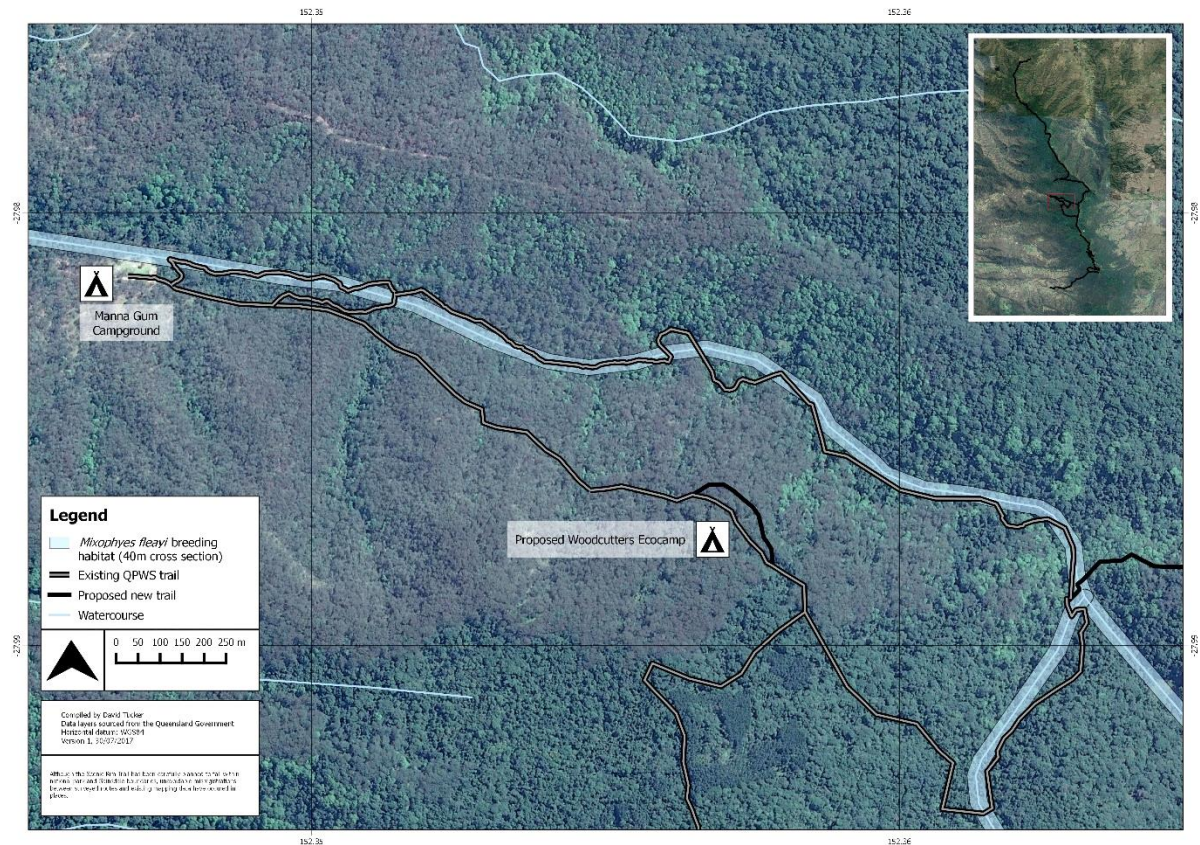


Figure 9 Fleay's Barred Frog breeding habitat alongside Dalrymple Creek, with existing and proposed creek crossings

5.2.1.2 Dalrymple Creek

Forty-Three Fleay's Barred Frog were observed foraging up to 50m from the banks of Dalrymple Creek, along the length of the Cascades Trail between the proposed crossing point and the Manna Gum campground, downstream (Figure 10) (BAAM 2017b). This section of Dalrymple Creek has multiple in-stream crossings by the existing Cascades Trail (Figure 9). A single Fleay's Barred Frog was observed on the rock platform at the proposed crossing point itself. The relative abundance was 3 frogs/hr along the creek survey sections, and 31.5 frogs/hr along the Cascades Trail. No frogs were heard calling or responded to call-playback during the nocturnal spotlighting survey, and this is attributable to the survey taking place during high stream flow conditions after moderately heavy rainfall (BAAM 2017b).

Tadpoles of this species occurred relatively abundantly in all the pools along the length of creek surveyed, both above and below the existing crossing point.

5.2.2. Assessment of Habitat Quality for Fleay's Barred Frog

The proposed crossing point of Blackfellow Creek is on a narrow, shallow, run and riffle section of the creek with gently sloping banks on either side (Photo 7). The crossing will not require any engineering or construction work, although bush rock steps will be installed into and out of the creek. The upper reaches of the Creek, near the proposed crossing point, have a similar morphology

and instream conditions and will require a formed track. The riverbanks are covered with rainforest spinach (*Elatostema reticulatum*), confirming that the banks of the creek are perennially damp. Blackfellow Creek and its riparian zone provide good quality breeding habitat for the frogs (BAAM 2017b).

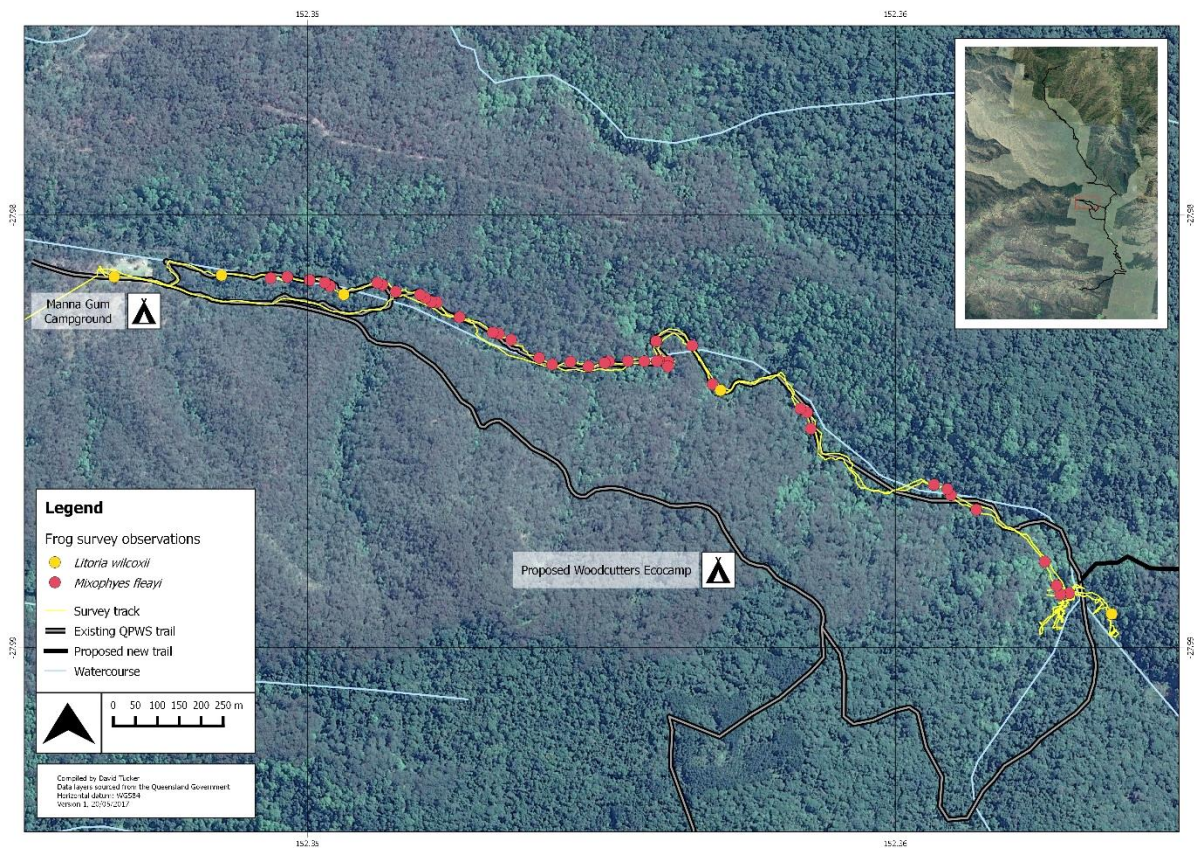


Figure 10 Fleay's Barred Frog observations along the Cascades trail

The proposed crossing points of the minor tributary of Dalrymple Creek are on a rock platform in shallow water. One is below a small waterfall, approximately 20 m above the junction of the tributary with Dalrymple Creek itself (Photo 8). The other is approximately 10 m upstream from the junction, on Dalrymple Creek. The banks on either side of the crossing points are composed of rock. Bush rock steps will be installed where necessary into and out of the creek, and stepping stones (400 mm²) will be installed where necessary in the creek. Rainforest spinach grows relatively abundantly along the banks of the full length of the surveyed Dalrymple Creek tributary, and patchily on the banks of Dalrymple Creek itself.

Dalrymple Creek and its tributary provide good quality breeding habitat for the frogs (BAAM 2017b). The crossing points themselves may provide a pad for calling males but they are unlikely to be used by the females for depositing eggs.

5.3. Risk Assessment - Potential Impact of the Project on Fleay's Barred Frog

This section discusses the risk of significant impacts on the population of Fleay's Barred Frog within the MRNP and GRAWHA caused by Trail actions. The assessment follows the process outlined in the DoEE *Environmental Management Plan Guidelines* (Anon. 2014), and applies the precautionary principle where scientific knowledge or data is poor or absent. The risks posed by Trail actions on this MNES are identified in Section 2.1.1 and the risk assessment is summarised in Table 5.



Photo 7 Blackfellow Creek crossing point, looking downstream (source: Tony Charters and Associates)



Photo 8 Dalrymple Creek tributary crossing point (source: Tony Charters and Associates)

5.3.1. Re-opening Winder Forestry Track

5.3.1.1 *Long term decrease in population size*

Re-opening of the Winder forestry track poses a potential risk of causing a long-term decrease in the population of Fleay's Barred Frog if it provides access for Pigs to Fleay's Barred Frog habitat which would not otherwise have been accessible.

While feral Pigs are not currently observed in Fleay's Barred Frog breeding habitat along Blackfellow or Dalrymple Creek, it is likely that they will spread there in time. Feral Pigs already occur in the MRNP, including the rainforest which constitutes frog habitat, and signs of them have been observed on the open section of the Winder forestry track and in the upper reaches of the Blackfellow Creek catchment (Figure 7; Photo 9). Given this, re-opening a section of the Winder forestry track is unlikely to increase the rate of spread throughout the MRNP. However, it will be possible to use the re-opened road to target Pig control if they are preferentially using it for movement across the landscape.

The consequence of pigs reaching this area and causing habitat destruction leading to population decline is considered moderate, as Pig control should result in habitat and population recovery, however it is unlikely that re-opening the Winder forestry track will increase the existing risk of Pig invasion and habitat damage. Consequently, the risk of the re-opened Winder forestry track causing a long-term decrease in the population of Fleay's Barred Frog is assessed as low (Table 5).

Control measures to address the low risk of increasing predation pressure and/or habitat destruction by feral Pigs on Fleay's Barred Frog are described in Section 5.4.

5.3.1.2 *Reduction in area of occupancy*

The Winder forestry track passes through rainforest, which is potential foraging habitat for female Fleay's Barred Frog. However, there will be no risk of reduction in Fleay's Barred Frog area of occupancy due to the relative scale of the track to the area of rainforest.

5.3.1.3 *Fragmentation of existing population*

The Winder forestry track passes through rainforest, which is female Fleay's Barred Frog foraging habitat. However, there will be no risk of fragmenting the Fleay's Barred Frog population as Fleay's Barred Frog use tracks as foraging habitat and these tracks do not impede frog movement.

5.3.1.4 *Adversely affecting habitat*

Re-opening of the Winder forestry track poses a potential risk of adversely affecting habitat critical to the survival of the species, if it provides access for Pigs to Fleay's Barred Frog habitat which would not otherwise have been accessible.

Feral Pigs already occur in the MRNP, including the open section of the Winder forestry track closest to Fleay's Barred Frog breeding habitat (Figure 7; Photo 9). While feral Pigs are not currently observed in Fleay's Barred Frog breeding habitat along Blackfellow or Dalrymple Creek, their sign has been observed in the upper reaches of Blackfellow Creek, and it is likely that they will spread there in time. Given this, re-opening a section of the Winder forestry track is unlikely to increase the rate of spread throughout the MRNP. However, it will be possible to use the re-opened road to target Pig control if they are preferentially using it for movement across the landscape.

The consequence of pigs reaching this area and causing critical-habitat degradation is considered moderate, as Pig control should result in habitat recovery, however it is unlikely that re-opening the Winder forestry track will increase the existing level of Pig invasion. Consequently, the risk of the re-opened Winder forestry track causing critical-habitat destruction is assessed as low (Table 5).

Control measures to address the risk of habitat destruction by feral Pigs on Fleay's Barred Frog are described in Section 5.4.

5.3.1.5 Disrupting breeding cycle

The Winder forestry track passes through rainforest, which is potential foraging habitat for female Fleay's Barred Frog, but does not pass through riparian breeding habitat. Therefore, there will be no risk of disrupting the Fleay's Barred Frog breeding cycle.

5.3.1.6 Modifying habitat availability or quality

The Winder forestry track passes through rainforest, which is potential foraging habitat for female Fleay's Barred Frog. However, there will be no risk of reduction in Fleay's Barred Frog area of occupancy due to the relative scale of the track to the area of rainforest and the fact that female Fleay's Barred Frog use tracks for foraging.



Photo 9 Pig wallow on the Winder forestry track (source: Tony Charters and Associates)

5.3.1.7 Establishment of invasive species

Re-opening of the middle section of Winder forestry track poses no risk of establishing invasive species into Fleay's Barred Frog habitat as key invasive species such as Pigs are already present and

spreading in the area (Figure 7; Photo 9). It will be possible to use the re-opened road to target Pig control if they are preferentially using it for movement across the landscape.

5.3.1.8 Introduction of disease

The Winder forestry track does not pass through waterways, therefore re-opening the track poses no risk of introducing disease to the population.

5.3.1.9 Interference with species recovery

Re-opening the Winder forestry track poses no risk to recovery of the Fleay's Barred Frog population. The risk of facilitated feral Pig movement and resulting habitat destruction is addressed in Sections 5.3.1.1 and 5.3.1.4.

5.3.2. Track Establishment

5.3.2.1 Long term decrease in population size

Establishment of tracks to, and crossing, Dalrymple Creek and Blackfellow Creek poses a potential risk of facilitating feral Pig movement into riparian breeding habitat, leading to a long-term decrease in Fleay's Barred Frog populations. The consequences of Pigs reaching these habitats is considered moderate, as habitat and populations will recover following Pig control. Existing trails currently provide multiple potential access points for Pigs to Fleay's Barred Frog breeding habitat on Dalrymple and Blackfellow Creek (Figure 8, Figure 9), therefore it is considered unlikely that the new tracks will increase Pig movement into these areas.

Consequently, establishing tracks to and crossing Fleay's Barred Frog breeding habitat poses a low risk of causing a long-term decrease in the frog population size (Table 5).

Control measures to address the unmitigated risk to Fleay's Barred Frog are described in Section 5.4.

5.3.2.2 Reduction in area of occupancy

There will be no clearance of frog breeding or foraging habitat through establishment of the Trail, as demonstrated in Photo 1. Consequently, there is no risk of reducing the area of occupancy for Fleay's Barred Frog.

5.3.2.3 Fragmentation of existing population

There will be no fragmentation of frog breeding or foraging habitat through establishment of the track, as these do not form a barrier to frog movement. Similarly, the presence of instream stepping stones will not form a barrier to tadpole movement.

Consequently, there is no risk of fragmenting the Fleay's Barred Frog population through track establishment.

5.3.2.4 Adversely affecting habitat

Establishment of tracks to, and crossing, Dalrymple Creek and Blackfellow Creek poses a potential risk of adversely affecting habitat critical to the survival of the species, if rainforest or riparian vegetation is cleared and instream habitat modified.

There will be minimal to no impact on rainforest or riparian vegetation during track establishment, as vegetation clearance is not required, other than for the placement of bush rock steps into and out of the creeks, and the area of the crossing is insignificant compared to the total area of breeding habitat along these creeks (Figure 8, Figure 9). There will be no instream construction that could disturb male frog calling spots, or egg laying spots.

Female frogs forage widely in the rainforest, and it is possible that some may preferentially use the track during nocturnal foraging (Doak 2005), as observed for the Cascades trail.

The establishment of a Class 5 track (with short sections of Class 3 and 4 tracks) through rainforest, crossing Blackfellow Creek and a tributary to Dalrymple Creek, is considered to pose a low risk to critical frog breeding habitat due to damage to breeding habitat being unlikely and the consequences being minor because of the relative scale (Table 5).

Control measures to address this unmitigated risk are described in Section 5.4.

5.3.2.5 Disrupting breeding cycle

There will be no vegetation disturbance or use of machinery in establishing the tracks crossing the creeks, and placement of stepping stones will occur outside of the breeding season. Consequently, there will be no risk of disruption of the Fleay's Barred Frog breeding cycle.

5.3.2.6 Modifying habitat availability or quality

There will be no vegetation or instream disturbance, consequently there will be no risk modifying Fleay's Barred Frog habitat availability or quality.

5.3.2.7 Establishment of invasive species

Establishment of tracks to, and crossing, Dalrymple Creek and Blackfellow Creek poses a potential risk of facilitating an invasive species that is harmful becoming established in frog habitat by enabling feral Pig movement to riparian areas.

While feral Pigs are not currently observed in Fleay's Barred Frog breeding habitat along Blackfellow or Dalrymple Creek, it is likely that they will spread there in time. Feral Pigs already occur in the MRNP, including the rainforest which constitutes frog habitat (Figure 7; Photo 9). The consequences of Pigs reaching these habitats is considered moderate, as habitat and populations will recover following Pig control. Existing trails currently provide multiple potential access points for Pigs to Fleay's Barred Frog breeding habitat on Dalrymple and Blackfellow Creek (Figure 8, Figure 9), therefore it is considered unlikely that the new tracks will increase Pig movement into these areas.

Consequently, establishing tracks to and crossing Fleay's Barred Frog breeding habitat poses a low risk of facilitating an invasive species that is harmful becoming established in frog habitat (Table 5).

Control measures to address the unmitigated risk to Fleay's Barred Frog are described in Section 5.4.

5.3.2.8 Introduction of disease

The chytrid fungus is already present in the Fleay's Barred Frog population at both creek crossings (Section 5.1.2, BAAM 2017b). Therefore, there is no risk of introducing this disease to the population.

5.3.2.9 Interference with species recovery

Establishment of the tracks and creek crossings poses no risk to the viability or recovery of Fleay's Barred Frog as they will not affect frog population dynamics.

5.3.3. Track Use

5.3.3.1 Long term decrease in population size

As demonstrated by the existence of a healthy Fleay's Barred Frog population and existing tracks in the area (e.g. Figure 10), track use poses no risk of long-term decrease in the population of Fleay's Barred Frog.

5.3.3.2 Reduction in area of occupancy

Track use poses no risk of reducing the area of occupancy of Fleay's Barred Frog.

5.3.3.3 Fragmentation of existing population

Track use poses no risk of fragmenting the Fleay's Barred Frog population.

5.3.3.4 Adversely affecting habitat

The use of these tracks by walkers poses a potential risk of adversely affecting habitat critical to the survival of the species if track walkers damage riparian vegetation, or modify instream habitat during the breeding season. This is more likely with independent walkers (see Facilitated Impacts, section 7), than with guided groups.

The section of Dalrymple Creek surveyed for this document includes multiple in-stream crossings of the creek by the existing Cascades Trail. The presence of Fleay's Barred Frog and tadpoles at this site demonstrates that the existing public walking trail has not prevented the species from successfully breeding in this location (BAAM 2017b). Furthermore, the chosen route of the track is the most natural crossing point as it is the only route that avoids deep and shear rock faces, and is therefore unlikely to result in alternative desire lines being formed by independent walkers, unless they choose to walk up or down the creek line.

The use of the new Class 5 tracks by walkers, crossing Blackfellow Creek and a tributary to Dalrymple Creek, is considered to pose a low risk to critical frog breeding habitat due to the likelihood of disturbance being possible but the consequences for the population are minor due to the potential scale of disturbance relative to the extent of habitat (Table 5).

Control measures to address the low risk to breeding habitat through track use are described in Section 5.4.

5.3.3.5 Disrupting breeding cycle

There will be no disruption of the frog breeding cycle through actions associated with the Trail, as walking the track will occur during daylight hours when the frogs are not actively breeding, and the presence of stepping stones will ensure that stream crossings will not affect egg laying, hatching, or tadpole survival.

Consequently, there is no risk of Trail use disrupting the breeding cycle of Fleay's Barred Frog.

5.3.3.6 Modifying habitat availability or quality

The use of these tracks by walkers poses a potential risk of modifying habitat availability or quality if track walkers damage riparian vegetation, or modify instream habitat during breeding season. This is more likely with independent walkers (see Facilitated Impacts, section 7), than with the guided groups envisaged by the Project.

The section of Dalrymple Creek surveyed for this document includes multiple in-stream crossings of the creek by the existing Cascades Trail. The presence of Fleay's Barred Frog and tadpoles at this site demonstrates that the existing public walking trail has not prevented the species from successfully breeding in this location (BAAM 2017b). Furthermore, the chosen route of the track is the most natural crossing point and is therefore unlikely to result in alternative desire lines being formed by independent walkers, unless they choose to walk up or down the creek line.

The use of the new Class 5 tracks by walkers, crossing Blackfellow Creek and a tributary to Dalrymple Creek, is considered to pose a low risk to critical frog breeding habitat due to the likelihood of

disturbance being possible but the consequences for the population are minor due to the potential scale of disturbance relative to the extent of habitat (Table 5).

Control measures to address the low risk to breeding habitat through track use are described in Section 5.4.

5.3.3.7 *Establishment of invasive species*

Track use poses no risk of introducing invasive species.

5.3.3.8 *Introduction of disease*

The Fleay's Barred Frog survey has demonstrated that chytrid fungus is present in the frog population in the Trail area of Dalrymple and Blackfellow creeks (Section 5.1.2, BAAM 2017b). The continued existence of Fleay's Barred Frog suggests that the population has stabilised following initial infection, with immunity to the fungus now established in the population (Newell *et al.* 2013; Quick *et al.* 2015).

It is noted that the source of Blackfellow Creek starts near an unsealed public carpark, and that members of the public walk in this area, potentially spreading chytrid to and from this site. Similarly, there is public access to Blackfellow and Dalrymple creeks via existing walking tracks. There are no practicable controls for this other than banning access or providing public footpaths.

Consequently, there is no risk of Trail users introducing chytrid to the Fleay's Barred Frog population of Blackfellow Creek or Dalrymple Creek. Nevertheless, Gainsdale will ensure boot sterilisation of its clients walking the Trail.

5.3.3.9 *Interference with species recovery*

Track use poses no risk of interfering with the viability or recovery of the Fleay's Barred Frog population. The section of Dalrymple Creek surveyed for this document includes multiple in-stream crossings of the creek by the existing Cascades Trail. The presence of Fleay's Barred Frog and tadpoles at this site demonstrates that the existing public walking trail has not prevented the species from successfully breeding in this location (BAAM 2017b).

5.4. Environmental Management Measures - Avoidance and Mitigation of Potential Impacts on Fleay's Barred Frog

5.4.1. Performance Targets and Control Measures

The performance targets and control measures for avoiding or mitigating the direct or indirect impact of the Trail on Fleay's Barred Frog is presented in Table 6. The performance targets are based on the criteria for determining significant impact on endangered species.

5.4.2. Environmental Monitoring

Surveys have determined an apparently healthy population of Fleay's Barred Frog at the Blackfellow and Dalrymple creeks. Gainsdale will:

- Develop and implement an Fleay's Barred Frog monitoring program at the two stream crossing sites and a control site prior to Trail commencement, following Commonwealth survey guidelines (Commonwealth of Australia 2010)
- Develop and implement a riparian vegetation monitoring program through fixed photopoints to determine whether habitat is being affected by passage
- Review monitoring data to determine whether Trail is adversely impacting the Fleay's Barred Frog population or habitat

5.4.3. Corrective Actions

The corrective actions for managing any adverse impacts on the Fleay's Barred Frog population occurring despite the control measures are presented in Table 7. The trigger values are qualitative at this point as there is no robust measure of the population size or population dynamics. These trigger values will be made quantitative once the monitoring program provides adequate baseline data.

5.4.4. Residual Risk Assessment

Predation of Fleay's Barred Frog and disturbance of Fleay's Barred Frog habitat by Pigs is a potential threat to the Fleay's Barred Frog population in MRNP, and this is likely to be a continuing threat irrespective of the Trail. Understanding the rate of these impacts and their effect on the population will be critical in determining the degree of Pig control required and in providing a measure of success. The QPWS is responsible for Pig control in the MRNP, and their Level 2 Pest Management Strategy identifies this as an extremely high priority. Co-funding of targeted Pig control by Gainsdale is anticipated to maintain the risk of Pigs to Fleay's Barred Frog at low.

The control measures to manage walkers accessing the Dalrymple and Blackfellow Creeks and crossing them is anticipated to reduce the likelihood of habitat damage to unlikely, with the risk being low to negligible.

5.4.5. Proposed Offsets

There will be no risk of significant impact to this MNES if the relevant control measures are undertaken. Consequently, there will be no need for an offset of any kind.

Table 5 Risk assessment of potential significant impact to the Fleay's Barred Frog population in the Trail Area

Risk	Action				
	Re-opening Winder Management Track	Track establishment	Road or track use	Ecocamp establishment	Ecocamp operation
Long-term decrease in population size	Low	Low	Nil	Nil	Nil
Reduced area of occupancy	Nil	Nil	Nil	Nil	Nil
Fragmentation of population	Nil	Nil	Nil	Nil	Nil
Adverse effect on critical breeding habitat	Low	Low	Low	Nil	Nil
Disruption of breeding cycle	Nil	Nil	Nil	Nil	Nil
Critical loss or degradation of habitat	Nil	Nil	Low	Nil	Nil
Introduction of critical invasive species	Nil	Low	Nil	Nil	Nil
Introduction of critical disease	Nil	Nil	Nil	Nil	Nil
Interference with species recovery	Nil	Nil	Nil	Nil	Nil

Table 6 Control measures for managing the risks to Fleay's Barred Frog

Performance Target	Control Measures	Timeframe
No long-term decrease in population size due to feral Pigs using Trail	<ul style="list-style-type: none"> Collaborate with QPWS to review and update QPWS feral animal control plan following Trail approval, to ensure that there is adequate protection of the Fleay's Barred Frog population along the new area of open Trail Contribute to funding of feral Pig control operations, including but not limited to traps and cameras, within the Trail area as determined by agreement with QPWS and in line with measures in other areas of the Park Contribute to feral animal surveillance within the Trail area to inform the QPWS feral animal control plan in line with an agreed program 	Following project approval; by agreement with QPWS
No adverse impact on riparian vegetation	<ul style="list-style-type: none"> Establish a tightly defined stream crossing area to avoid damage to riparian vegetation Place large in-stream stepping stones to minimise creek bed disturbance Ecoguides will brief track walkers on the significance of Fleay's Barred Frog and the need to protect riparian vegetation and in-stream habitat Ecoguides will ensure that each group of track walkers know to follow the correct track line when approaching, entering, or leaving the creek 	Following project approval; ongoing

Table 7 Trigger values and corrective measures to address adverse impacts on Fleay's Barred Frog population

Trigger	Corrective Measures	Timeframe
Observation of feral Pigs or their diggings in Fleay's Barred Frog breeding habitat	<ul style="list-style-type: none"> Contribute to funding of <i>ad hoc</i> feral animal control, if monitoring determines that this is required to protect the Fleay's Barred Frog population 	By agreement with QPWS
Adverse impact on riparian vegetation	<ul style="list-style-type: none"> Reinstate controls for defining the track alignment and stream crossing area 	Within 4 weeks of trigger

6. Gondwana Rainforests of Australia World Heritage Property and National Heritage Place

6.1. World Heritage List Criteria

Sites must be of outstanding universal value and meet at least one out of ten selection criteria to be included on the World Heritage List. The Gondwana Rainforests of Australia meet three criteria, including the following two ecological criteria:

- (ix) to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.
- (x) to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

The Gondwana Rainforests of Australia reserves contain a wide range of plant and animal lineages and communities with origins in Gondwana, many of which are now restricted largely or entirely to the Gondwana Rainforests, and the region is regarded as a distinct centre of endemism for several families and genera (Laidlaw *et al.* 2011; Weber *et al.* 2014). Key examples that were provided as evidence for world heritage listing include (Hunter 2004):

- Ferns from families having origins in Pangea, including tree ferns such as *Cyathea australis* and *Dicksonia antarctica* (Cyatheaceae and Dicsoniaceae), the club moss *Lycopodium deuterodensum* (Lycopodiaceae), and the coral fern *Gleichenia rupestris* (Gleicheniaceae).
- Pre-angiosperm groups such as the hoop pine and bunya pine, which are the sole representatives of the Araucarians (the most ancient and phylogenetically primitive of the world's conifers).
- Early angiosperm lineages which contribute to this property being a secondary centre of endemism for early angiosperm lineages that complements the Wet Tropics. Primitive families such as Winteraceae, e.g. *Tasmannia insipida*, Monimiaceae, e.g. *Wilkiea huegeliana*, and Atherospermataceae, e.g. *Daphnandra tenuipes*, have undergone little evolutionary change since Gondwanan times
- Families including Proteaceae, Nothofagaceae, Casuarinaceae, Berberidopsidaceae, Myrtaceae, Eucryphiaceae, Cunoniaceae, Escalloniaceae and Pittosporaceae demonstrate the early radiation of the flowering plants.
- Several of the oldest lineage of Corvida, including the lyrebird *Menura alberti*.
- All frogs in families having Gondwanan origins, e.g. Fleay's Barred Frog.
- Crayfish in the family Parastacidae, e.g. *Eustacus jagara*.

More than 540 species of plants from over 250 genera occur within the Main Range National Park, and at least 20 of these are rare or threatened. Three hundred and thirteen species of vertebrate fauna have also been recorded, including 197 bird species, 53 reptile species, 47 mammal species, and 16 amphibian species. Twenty-nine of these are considered rare or threatened at international, national, or state level.

6.2. Threatening Processes to World and National Heritage Values and Integrity

Legal protection of the Gondwana Rainforests of Australia World Heritage Area has meant that these reserves can continue the ongoing evolution and development of their terrestrial and aquatic

ecosystems and communities, without threat of clearance or conversion to other ecosystem types. Climate change is likely to be both a threatening and driving process for this ongoing evolution and community development (Hughes 2003), including through amplifying the threat of other processes, e.g. fire. However, the extent of the protected forests may provide some buffering to climate change impacts.

There are several other threatening processes which will affect the integrity of the heritage values, and which require management. The strategic overview for management of the Gondwana Rainforests of Australia World Heritage property (DEH 2000) identifies these as:

- Feral animals - Pigs, foxes, cats, wild dogs, cane toads
- Weeds - mistflower, lantana, camphor laurel, Madeira vine
- Pathogens – chytrid fungus
- Fire – uncontrolled or inappropriate

These threatening processes are common for many of the vulnerable and endangered species in the MRNP and GRAWHA, and management of these processes is expected to provide a wide range of benefits. The QPWS have developed a Pest Management Strategy and a Fire Management Strategy for the park (which includes prescribed burns) and this is progressively being implemented (DNPRSR 2013).

Inappropriate recreation and tourism activities, including the development of tourism infrastructure is also regarded as a potential issue, particularly if these cause a MNES to be significantly impacted. Consequently, the QPWS is managing the Park to ensure that opportunities for outdoor recreation are provided in a largely remote and natural setting, while protecting its nature conservation and heritage values (DNPRSR 2013).

6.3. Risk Assessment - Potential Impact of the Project on the World and National Heritage Values of the Gondwana Rainforests of Australia

This section discusses the risk of significant impacts of actions on the values and integrity of the World Heritage property, i.e. criteria (ix) and (x), and National Heritage place. The assessment follows the process outlined in the DoEE *Environmental Management Plan Guidelines* (Anon. 2014), and applies the precautionary principle where scientific knowledge or data is poor or absent. The potential risks for these MNES are identified in in Section 2.1.2 and 2.1.3, and the risk assessment is summarised in Table 8.

6.3.1. Re-opening of Winder Forestry Track

6.3.1.1 *Modify or inhibit ecological processes of a National Heritage Place*

It has been suggested that re-opening of the Winder forestry track (Figure 11) poses a potential risk of modifying or inhibiting ecological processes of a National Heritage place through fragmentation.

Fragmentation, as a spatial process, is the breaking an intact area of forest into smaller, disparate pieces, with consequent ecological impacts such as habitat loss, barriers to movement, and reduced dispersal of propagules across the landscape (Forman 1995, Turner 2005). The creation of a 2.5 m wide track along the previous Winder forestry track alignment through largely regenerating rainforest will not be fragmenting rainforest habitats or vegetation communities in any spatial or ecological sense. It is loosely representative of the spatial process of dissection (i.e. creating wide linear pathways through intact forest) (Forman 1995, Turner 2005). The ecological effects of

dissection may be like fragmentation if the dissecting corridor is wide enough to be a barrier to species movement or that it affects key ecological processes such as propagule dispersal.

Laurance *et al.* (2004) found that 30 – 40 m wide roads through Amazon rainforest inhibited the movement of forest-dependent insectivorous birds. This was mitigated where regrowth had reduced the distance and edge between the forested areas. Conversely, frugivorous species and gap or edge generalist species were not inhibited in any way. The re-opened Winder forestry track will maintain canopy cover, as canopy species over 2.5 m tall will not be cleared within the 2.5 m wide alignment. Dispersal of seeds by highly mobile frugivorous birds in Australian rainforests is a key driver of forest regeneration and succession (Moran 2007, Moran and Catterall 2014) and the re-opening of the Winder forestry track will not impact their movement nor the dispersal of seeds by these birds throughout the landscape.

MNES species such as the Long-nosed potoroo or Black-breasted button-quail which prefer forest conditions with dense cover may preferentially avoid the track but are unlikely to have their movement or foraging impacted by it, particularly as the edge community becomes denser and grass grows in the middle of the track. Conversely, MNES species such as stream clematis or hairy-joint grass may preferentially recruit or colonise the edges of the track, as they would a canopy gap. Some MNES animal species, such as Fleay's Barred Frog, may choose to forage on the open track in preference to the forest floor (Doak 2005).

Re-opening the Winder management track through regenerating rainforest poses a very low risk to the ecological processes of the rainforest, with respect to fragmentation or dissection. The likelihood of fragmentation of key processes at a micro scale is unlikely as no examples have been found during Trail surveys, and any consequences of such micro-fragmentation are likely to be minor (Table 8).

If encountered, the risks will be mitigated by the proposed control measures (Section 6.4).

6.3.1.2 Reduce diversity or modify composition of plant or animal species

Edge effect

Re-opening of the Winder forestry track (Figure 11) through cool subtropical rainforest poses a potential risk of reducing the diversity or modifying the composition of plant or animal species in all or part of a World Heritage or National Heritage property, through the development of an edge community rather than interior forest conditions. Creation of an edge between ecosystems leads to changed ecological processes and a change in plant and animal communities within the edge zone (e.g. Magrach *et al.* 2014).

The former forestry track alignment traverses through previously logged cool subtropical rainforest at various stages of recovery, i.e. the re-opened track will pass through plant communities that are largely dominated by pioneer or gap species. The original road alignment has been colonised by a range of species including stinging nettle (*Urtica incisa*), blackwood (*Acacia melanoxylon*), and native mulberry (*Hedycarya angustifolia*), with dense areas of shield fern (*Lastreopsis decomposita*) and vines at ground level (Tony Charters and Associates 2016). The canopy in logged areas is broken and uneven, although some parts of the track form a tunnel underneath an intact canopy.

Re-opening of the Winder forestry track will require the clearance of regenerating trees and shrubs and will create a 2.5 m wide internal edge within the ground and shrub tier of the forest. Canopy rainforest trees greater than 2.5 m tall will not be cleared along the alignment, maintaining canopy cover. Light levels at the ground will increase slightly where vegetation is cleared, and may result in conditions favoured by pioneer or gap species of the rainforest (Denslow 1987, Turton 1991, Wright *et al.* 2003, Asner *et al.* 2004). The species that respond to the changed conditions and recruit into

the edge of the new track will be the same as in the currently regenerating forest areas, although the edge vegetation may be slightly denser and more diverse than further into the regenerating cutover areas because of their age and lower light levels. Tropical and sub-tropical rainforests have high rates of primary productivity, and hence are resilient to natural and human induced disturbance if allowed to recover (Turton 2005, Pickering 2010).

The animal communities of forest edges and regenerating forest gaps tend to be different to those of interior and late successional forest (e.g. Goosem 2000; Graham *et al.* 2005; Law *et al.* 2016). For example, Goosem (2000) found that the composition of a small-mammal community near the edge of an unsealed road through rainforest in North Queensland was different to that of the forest interior. Generalist species such as *Melomys cervinipes* which favour forest gaps predominated at the edge while species such as *Rattus fuscipes* which favour interior habitat were rarely found at the edge. This pattern was most obvious at sites where the road clearing width was 20m and there was no canopy closure, and less pronounced where canopy closure was maintained across smaller 12m clearings.

The edge created by the re-opened track, at 2.5 m wide, is unlikely to adversely or significantly influence the animal community in regenerating forest, as these species already favour such conditions. The re-opened track is unlikely to result in typical edge conditions in places where there is intact canopy cover, because the light levels at the ground will only be marginally affected. Disturbance at the edge of this track will provide sites for establishment of local shrub or canopy species.

Re-opening the Winder forestry track through regenerating rainforest poses a very low risk to the ecological integrity of the rainforest, with respect to edge community formation. The likelihood of the rainforest plant and animal community changing through the succession of an edge community is rare and the consequences of this are minor given the likely small scale of any change. The potential for weeds, however, to invade the forest community through the edge and change its structure or composition is discussed below.

Weed invasion

Re-opening of the Winder forestry track (Figure 11) through cool subtropical rainforest poses a potential risk of reducing the diversity or modifying the composition of plant or animal species in all or part of a World Heritage or National Heritage property, through facilitating the spread of weeds. Many weed species within the MRNP have been identified by QPWS, in their Level 2 Pest Management Strategy, as having the potential to significantly impact the rainforest. Surveys conducted for the Trail have identified that the track alignment is largely weed free (Tony Charters and Associates 2016), and therefore the spread and colonisation of weeds with the potential to affect to future composition of the regenerating forest will be of concern.

Weeds are common alongside existing 4WD tracks in the National Park, particularly in open sunny places and in rainforest - open forest ecotones (Tony Charters and Associates 2016). Lantana (*Lantana camara*) is ubiquitous, except at higher altitudes, and fireweed is present in disturbed and grassy open forest and woodland. Ruderal species, i.e. short-lived plants such as Cobblers Pegs (*Bidens pilosa*), are present in the open spaces, however native coloniser grasses and herbs were found to predominate on the edges of 4WD track edges where there is canopy shade (Tony Charters and Associates 2016).

The process of re-opening the track will disturb vegetation and soil and this can create sites for weed colonisation and establishment until or unless the disturbed soil is colonised by native species. A

study in North Queensland rainforest disturbed after Cyclone Larry found that many of the herbaceous weeds and light-demanding shrubs that recruited into the area after disturbance were a transient component of the regenerating rainforest vegetation and did not penetrate intact forest (Murphy *et al.* 2008). They did note that some fleshy-fruited and shade-tolerant woody species have the potential to have a longer-term effect on rainforest succession and future forest composition. Such species pose a threat to the integrity of the GRAWHA and will require specific management attention.

Weed seeds may be carried by vehicles, animals, or on the boots and clothing of people walking the track. These are likely to be the small seeds of herbaceous species (Pickering and Mount 2010), most of which would be considered ruderal and would be outcompeted by native species given the adjacent native seed source and particularly under low light conditions. Most of the woody weeds, such as lantana, privet (*Ligustrum lucidum*), and even asparagus fern, which have the potential to invade rainforest are likely to be spread by birds or other animals rather than people (e.g. Stansbury 2001; Moran *et al.* 2004; Gosper *et al.* 2005). Blackberry is an exception to this, as it may be spread in human faeces as well as by birds and other animals.

Re-opening the Winder forestry track through regenerating rainforest poses a low risk to the ecological integrity of the rainforest, with respect to weed establishment. The likelihood of weeds of significance colonising some of the edges of the track is likely although the consequences of this are minor, i.e. they can be reversed with appropriate levels of management (Table 8).

The risks posed by weeds of significance will be addressed by the proposed control measures (Section 6.4).

Feral animals

Re-opening of the Winder forestry track through cool subtropical rainforest poses a potential risk of reducing the diversity or modifying the composition of plant or animal species in all or part of a World Heritage or National Heritage property, through facilitating the spread of feral animals. The most significant threat to biodiversity in the GRAWHA are Pigs, which have relatively recently invaded the Park.

The pest survey demonstrates that Pigs are invading from the eastern side of the GRAWHA, and that they are present along the unopened section of the Winder forestry track and to the west of the Amphitheatre View Ecocamp (Figure 7, BAAM 2017c). While the presence of roads and tracks can simplify Pig movement through an area or into new habitat, they are not restricted to moving through their home range on human-formed tracks (Photo 3). Targeted control measures on the track will be more cost-effective than attempting to control them in inaccessible parts of their range, if Pigs do preferentially use the re-opened Winder forestry track for movement.

Re-opening the Winder forestry track through regenerating rainforest poses a low risk to the ecological integrity of the rainforest, with respect to feral predators. Feral pests are likely to use the track for movement, but the consequences of this will be minor as Pigs already exist in the area and the track can be used to target pest control (Table 8).

The risks posed by feral animals will be addressed by the proposed control measures (Section 6.4).

6.3.1.3 Fragment, isolate, or substantially damage critical habitat for biodiversity

As noted in section 6.3.1.1, fragmentation, as a spatial process, is the breaking an intact area of forest into smaller, disparate pieces, with consequent ecological impacts such as habitat loss, barriers to movement, and reduced dispersal of propagules across the landscape (Forman 1995,

Turner 2005). The creation of a 2.5 m wide corridor along the previous Winder forestry track alignment through largely regenerating rainforest will not be fragmenting rainforest habitats or vegetation communities in any spatial or ecological sense, although it is loosely representative of the spatial process of dissection (creating wide linear pathways through intact forest) (Forman 1995, Turner 2005). The ecological effects of dissection may be like fragmentation if the dissecting corridor is wide enough to be a barrier to species movement or that it affects key ecological processes such as propagule dispersal. As previously noted, this is unlikely to occur because of the scale of the track relative to the scale of the forest, and the capacity of key processes to occur despite the presence of the track.

There is no risk of fragmenting, isolating or substantially damaging critical habitat for biodiversity through re-opening the Winder forestry track.

6.3.1.4 Cause long-term reduction in rare, endemic, or unique species

Re-opening of the Winder forestry track through cool subtropical rainforest poses a potential risk of causing a long-term reduction through facilitating the spread of feral animals. The most significant threat are Pigs, which have relatively recently invaded the Park.

The pest survey (BAAM 2017c) demonstrates that Pigs are invading from the eastern side of the GRAWHA, and that they are present at both ends of the Winder forestry track. While the presence of roads and tracks can simplify Pig movement through an area or into new habitat, they are not restricted to moving through their home range on human-formed tracks (Photo 3).

Targeted control measures on the track will be more cost-effective than attempting to control them in inaccessible parts of their range, if Pigs do preferentially use the re-opened Winder forestry track for movement

Re-opening the Winder forestry track through regenerating rainforest poses a low risk to the ecological integrity of the rainforest, with respect to feral predators. Feral pests are likely to use the track for movement and the consequences of this are minor, i.e. they can be reversed with appropriate levels of management (Table 8).

The risks posed by feral animals will be addressed by the proposed control measures (Section 6.4).

6.3.1.5 Fragment, isolate, or substantially damage critical habitat for rare, endemic, or unique species

It has been suggested that re-opening of the Winder forestry track (Figure 11) poses a potential risk of fragmenting, isolating, or substantially damaging habitat important for the conservation of biological diversity in a World Heritage or National Heritage property. If fragmentation occurs, it may also pose a potential risk of modifying or inhibiting ecological processes in a National Heritage place.

Fragmentation, as a spatial process, is the breaking an intact area of forest into smaller, disparate pieces, with consequent ecological impacts such as habitat loss, barriers to movement, and reduced dispersal of propagules across the landscape (Forman 1995, Turner 2005). The creation of a 2.5 m wide corridor along the previous Winder forestry track alignment through largely regenerating rainforest will not be fragmenting rainforest habitats or vegetation communities in any spatial or ecological sense, although it is loosely representative of the spatial process of dissection (creating wide linear pathways through intact forest) (Forman 1995, Turner 2005). The ecological effects of dissection may be like fragmentation if the dissecting corridor is wide enough to be a barrier to species movement or that it affects key ecological processes such as propagule dispersal.

The impact of road corridors on native biodiversity and in natural areas of Australia has been reviewed by Donaldson and Bennett (2004). They identified that roads have the potential to alter

habitat through creating edge effects, or changing microclimatic conditions by removing canopy vegetation. Roads may also provide conduits for the movement of plants and animals, both feral and native. In some instances, they may act as barriers to the movement of animals or propagules, creating disjunct and isolated populations and communities.

Laurance *et al.* (2004) found that 30 – 40 m wide roads through Amazon rainforest inhibited the movement of forest-dependent insectivorous birds. This was mitigated where regrowth had reduced the distance and edge between the forested areas. Conversely, frugivorous species and gap or edge generalist species were not inhibited in any way. Dispersal of seeds by highly mobile frugivorous birds in Australian rainforests is a key driver of forest regeneration and succession (Moran 2007, Moran and Catterall 2014) and the re-opening of the Winder forestry track will not impact their movement nor the dispersal of seeds by these birds throughout the landscape.

MNES species such as the Long-nosed potoroo or Black-breasted button-quail which prefer forest conditions with dense cover may preferentially avoid the track but are unlikely to have their movement or foraging impacted by it, particularly as the edge community becomes denser and grass grows in the middle of the track. Conversely, MNES species such as stream clematis or hairy-joint grass may preferentially recruit or colonise the edges of the track, as they would a canopy gap. Some MNES animal species, such as Fleay's Barred Frog, may choose to forage on the open track in preference to the forest floor (Doak 2005).

Re-opening the Winder management track through regenerating rainforest poses a low risk to the ecological integrity of the rainforest, with respect to fragmentation or dissection. The likelihood of fragmentation of critical habitats at a micro scale is possible although no examples of such MNES have been found during Trail surveys, and the consequences of fragmentation are minor (Table 8). If encountered, the risks will be mitigated by the proposed control measures (Section 6.4).

6.3.2. Track establishment

6.3.2.1 *Modify or inhibit ecological processes of a National Heritage place*

The establishment of Class 5 tracks will not substantially damage vegetation, but may locally increase the occurrence of soil erosion. This risk is considered low, as the likelihood is possible, depending on location, slope and soil characteristics, but the consequences are likely to be minor relative to other occurrences of natural erosion or mass movement. Short sections of Class 3 and 4 tracks will be formed to reduce and mitigate the risk of erosion posed by track establishment.

The risk of erosion posed by track establishment will be mitigated by the proposed control measures (Section 6.4).

6.3.2.2 *Reduce diversity or modify composition of plant and animal species*

There is no risk of track establishment reducing the diversity or modifying the composition of plant and animal species as only minimal individual plants will be removed, and the use of machinery will be limited to hand held tools and small motorised equipment for carrying materials to sections requiring Class 3 or 4 treatment. The scale of the tracks is small relative to the surrounding area (Photo 1).

6.3.2.3 *Fragment, isolate, or substantially damage critical habitat for biodiversity*

There is no risk of track establishment fragmenting, isolating, or substantially damaging critical habitat for biodiversity as only minimal individual plants will be removed, and the use of machinery will be limited to hand held tools and small motorised equipment for carrying materials to sections requiring Class 3 or 4 treatment. The scale of the tracks is small relative to the surrounding area (Photo 1).

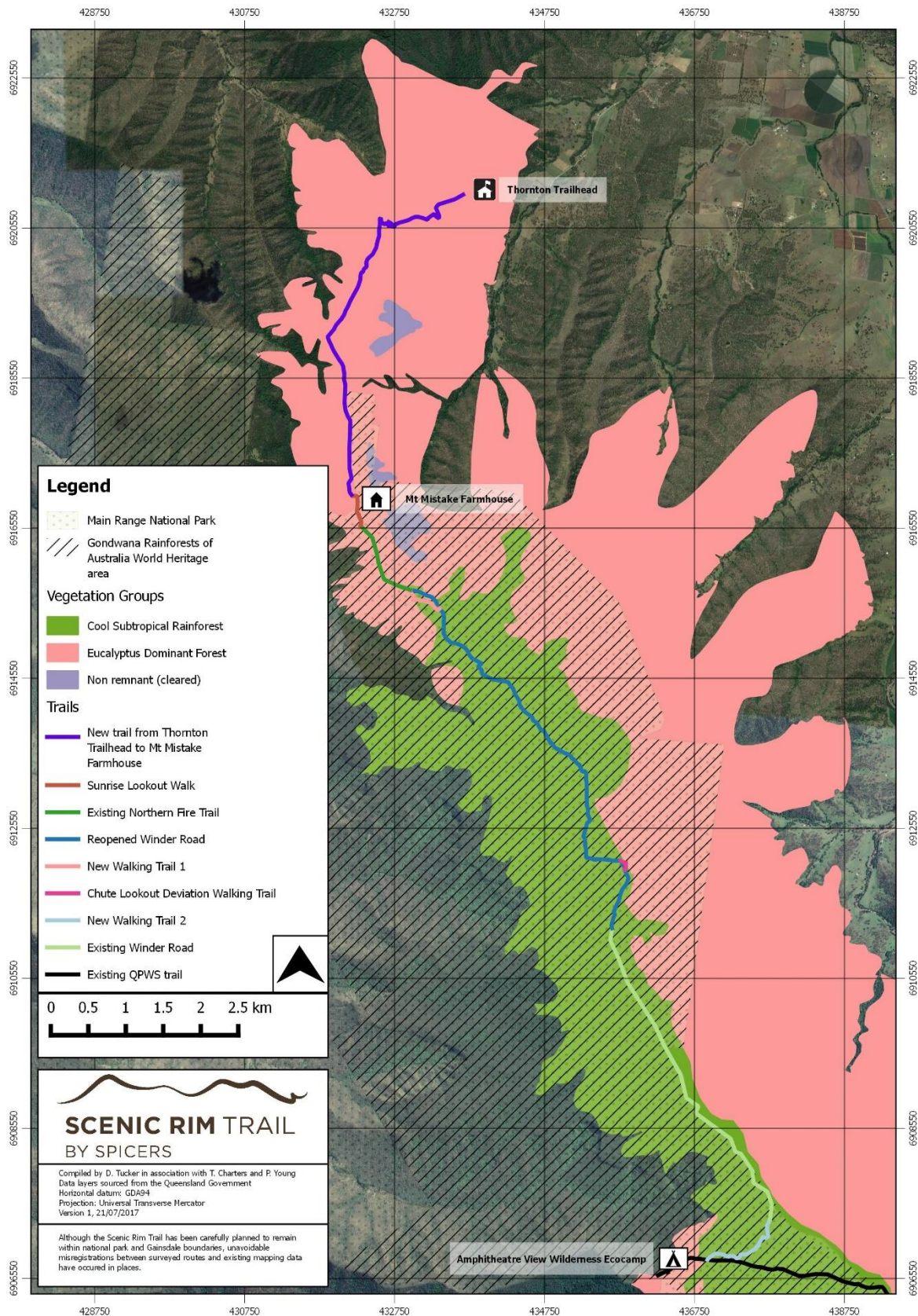


Figure 11 Alignment of the Winder forestry track, with proposed deviation walking tracks, and its connection to existing management roads in the northern section of the Scenic Rim Trail
 Note that the line width of the trails and tracks relative to the extent of forest are exaggerated by a factor of ≥ 40 .

6.3.2.4 *Cause long-term reduction in rare, endemic, or unique species*

The establishment of new Class 5 tracks has the potential to facilitate the movement of feral predators, particularly Pigs, throughout the area, and this could potentially cause the long-term reduction in rare, endemic, or unique species, e.g. Fleay's Barred Frog, Hastings River Mouse (Sections 4.3 and 5.3). However, as previously noted, Pigs and other feral species are not restricted to moving through their home range on human-formed tracks.

Further, there are several higher grade and more accessible tracks currently passing through the habitat of Hastings River Mouse, Fleay's Barred Frog, and other MNES (Figure 4, Figure 6, Figure 10). It is considered unlikely that the new tracks will increase the movement of Pigs through these areas than currently exists (Photo 9).

The new tracks pose a low risk of causing the long-term reduction in rare, endemic, or unique species. The likelihood of predators using the new tracks is possible, while the consequences relative to the existing presence of these predators is considered minor.

The risks posed by feral animals will be mitigated by the proposed control measures (Section 6.4).

6.3.2.5 *Fragment, isolate, or substantially damage critical habitat for rare, endemic, or unique species*

The establishment of new tracks poses a potential risk of fragmenting, isolating, or substantially damaging habitat important for the conservation of biological diversity, and/or fragmenting, isolating, or substantially damaging habitat for rare, endemic, or unique animal populations or species in a World Heritage or National Heritage property (Figure 12).

Formed tracks already exist through critical habitat of Hastings River Mouse (Figure 6) and Fleay's Barred Frog (Figure 10) and these do not to impact the movement of either species (Doak 2005; Graham *et al.* 2005; Meek *et al.* 2006) and are unlikely to inhibit the movement of any other MNES species. Most of the walking tracks established as part of the Trail will be Class 5 (Photo 1), i.e. low impact with a footpad of approximately 60cm, apart from small sections which require Class 3 or 4 safety features or track hardening to minimise erosion. Very little vegetation will be affected during their establishment, and their alignment will be directed to avoid ecologically sensitive areas.

The risk of the tracks fragmenting, isolating, or substantially damaging critical habitat is low. The tracks are unlikely to fragment, isolate, or substantially damaging critical habitat, and the consequences if this did occur are minor (Table 8) mainly because of the scale and grade of the tracks.

The risks posed by track establishment will be mitigated by the proposed control measures (Section 6.4).

6.3.3. Track use

6.3.3.1 *Modify or inhibit ecological processes of a National Heritage Place*

Track use poses a risk of increasing rates of localised erosion, depending on soil type, slope, and time of use. This will be an issue of concern if it leads to increased sedimentation in waterways.

The risk is low, as the occurrence of localised track erosion is likely, although the scale of this means that the consequences should be minor.

The risks posed by track establishment will be mitigated by the proposed control measures (Section 6.4).

6.3.3.2 Reduce diversity or modify composition of plant and animal species

The establishment of new Class 5 tracks has the potential to reduce the diversity or modify the composition of plant or animal species through trampling outside of the intended track.

Studies have demonstrated that the disturbance associated with high-use recreational tracks usually extends between 2m and 3m from the track, as walkers seek to avoid wet areas and fallen debris, or have alternative desire line paths. The tracks established and used as part of the Trail will have consistent use by guided and independent walkers, but will not be a high-use track. For the most part, these tracks will be in subtropical rainforest with a fern and shrub understorey. This vegetation is relatively resistant to trampling and tracking and, while repeated tracking will damage vegetation, it will rapidly recover once any disturbance is removed because of the high levels of primary productivity in these forests (Turton 2005, Hill and Pickering 2009). A study of Tasmanian tracks in cool temperate rainforest found that no plant species were lost because of track impacts; in fact, the diversity of trackside vegetation was enhanced in some areas due to the edge effect (references in Donaldson and Bennett 2004).

Damage to certain types of vegetation, such as riparian vegetation, may have a greater impact on animal species because of their habitat requirements, e.g. as breeding habitat for Fleay's Barred Frog. However, existing tracks through such areas demonstrate that the risk is minimal. The section of Dalrymple Creek surveyed for Fleay's Barred Frog includes multiple in-stream crossings of the creek by the Cascades Trail (Figure 9). The presence of a healthy population of adult Fleay's Barred Frog and tadpoles at this site demonstrates that the existing public walking trail has not damaged riparian or forest habitat nor prevented the species from successfully breeding in this location (BAAM 2017b). Furthermore, the chosen route of this part of the Trail is the only practical crossing point due to shear rock faces upstream and downstream and is therefore unlikely to result in alternative desire lines being formed by independent walkers.

The risk of guided walkers substantially damaging habitat important for the conservation of biological diversity in a World Heritage or National Heritage property, and/or substantially damaging habitat for rare, endemic, or unique animal populations or species in a World Heritage or National Heritage property is considered low, with the likelihood of track use facilitating damage to the values of being possible but with minor consequences (Table 8). There may be a greater risk posed by independent walkers, and this is dealt with in section 7.

The risks posed by the tracks facilitating damage will be mitigated by the proposed actions (Section 6.4).

6.3.3.3 Fragment, isolate, or substantially damage critical habitat for biodiversity

Guided walking along the track alignments selected to avoid ecologically sensitive areas poses no risk of fragmenting, isolating, or substantially damaging critical habitat for biodiversity.

6.3.3.4 Cause long-term reduction in rare, endemic, or unique species

Guided walking along the track alignments selected to avoid ecologically sensitive areas poses no risk of causing the long-term reduction in rare, endemic, or unique species.

6.3.3.5 Fragment, isolate, or substantially damage critical habitat for rare, endemic, or unique species

Guided walking along the track alignments selected to avoid ecologically sensitive areas poses no risk of fragmenting, isolating, or substantially damaging critical habitat for rare, endemic, or unique species

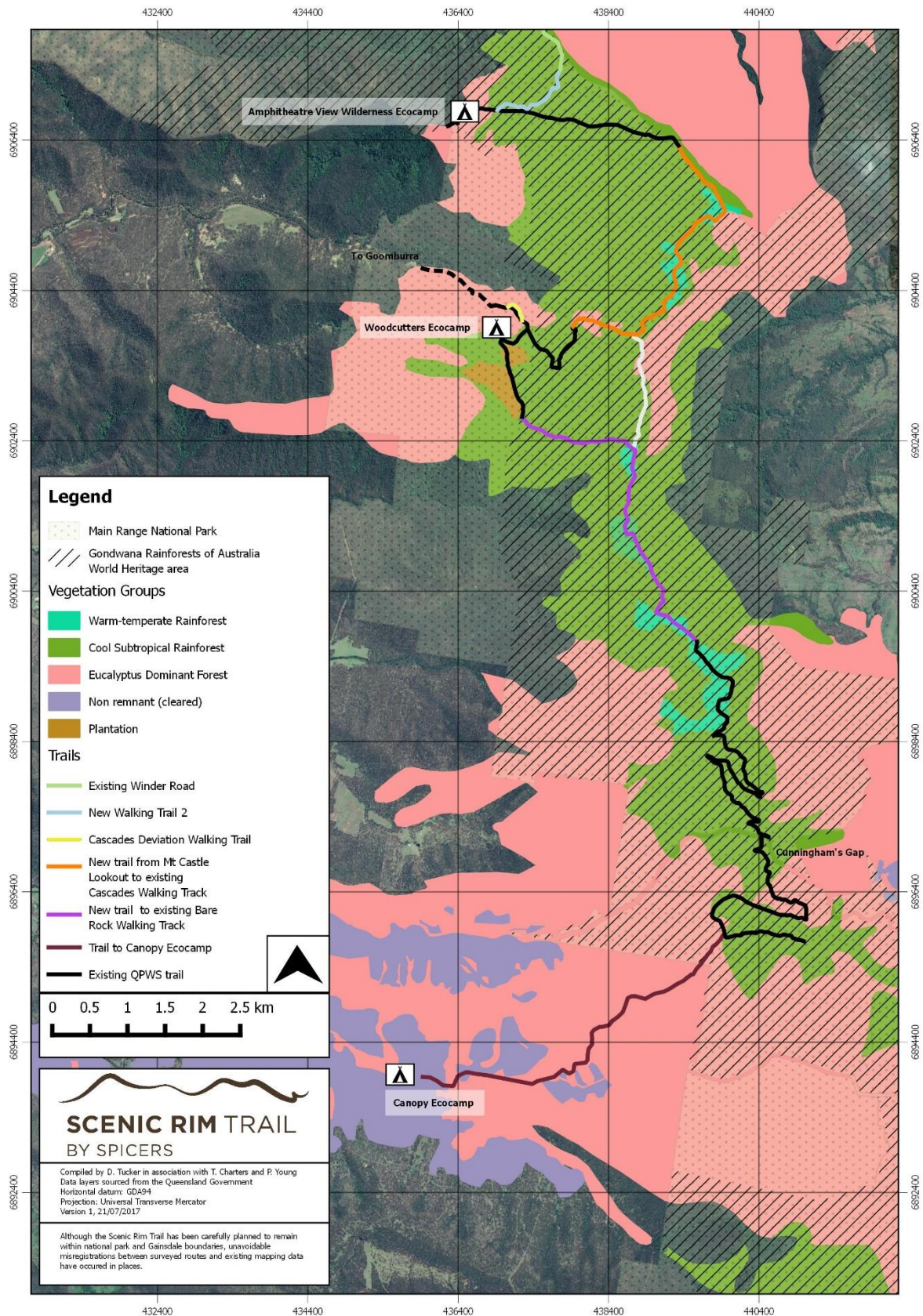


Figure 12 Location of proposed and existing walking tracks forming the southern section of the Scenic Rim Trail
 Note that the line width of the trails and tracks relative to the extent of forest are exaggerated by a factor of ≥ 40 .

Table 8 Risk assessment for potential significant impact to World Heritage Area and National Heritage Place values

Risk ⁹	Actions				
	Re-opening Winder Forestry Track	Track establishment	Road or track use	Ecocamp establishment	Ecocamp operation
Modify or inhibit ecological processes of a National Heritage Place	Low	Nil	Low	Nil	Nil
Reduce diversity or modify composition of plant and animal species	Low	Nil	Nil	Nil	Nil
Fragment, isolate, or substantially damage critical habitat for biodiversity	Low	Low	Low	Nil	Nil
Cause long-term reduction in rare, endemic, or unique species	Low	Low	Nil	Nil	Nil
Fragment, isolate, or substantially damage critical habitat for rare, endemic, or unique species	Low	Low	Nil	Nil	Nil

⁹ The risk criteria for significant impact are the same for World Heritage and National Heritage values, with “Modify or inhibit ecological processes of a National Heritage Place” being an additional criterion for National Heritage values.

6.4. Environmental Management Measures – Avoidance and Mitigation of Potential Impact of the Project on the World and National Heritage Values of the Gondwana Rainforests of Australia

6.4.1. Performance Targets and Control Measures

The performance targets and control measures for avoiding or mitigating the direct or indirect impact of the Trail on World Heritage and National Heritage values are presented in Table 9. The performance targets are based on the criteria for determining significant impact on World Heritage and National Heritage ecological values. These are qualitative rather than quantitative, because of the lack of baseline data. The research, survey, and monitoring programs proposed by Gainsdale are intended to address this.

6.4.2. Environmental Monitoring

Survey, monitoring, and research programs are proposed for Hastings River Mouse (section 4.4.2) and Fleay's Barred Frog (section 5.4.2). To complement this, Gainsdale will:

- Contribute to feral animal surveillance and monitoring within the Trail area to inform the QPWS feral animal control program
- Implement a weed surveillance and monitoring program along the track for priority weeds listed in the QPWS Level 2 Pest Management Strategy
- Monitor implementation of all control measures by Gainsdale staff

6.4.3. Corrective Actions

The corrective actions for managing any adverse impacts on the ecological values of the World Heritage and National Heritage area occurring despite the control measures are presented in Table 10. The trigger values are qualitative at this point as there is no robust measure of the values.

6.4.4. Residual Risk Assessment

Predation and habitat disturbance by Pigs is a threat to biodiversity, including MNES species, and the ecological integrity of the GRAWHA. This is likely to be a continuing threat irrespective of the Trail as Pigs are continuing to invade and spread in the MRNP. The QPWS are responsible for Pig control in the MRNP, and their Level 2 Pest Management Strategy identifies this as an extremely high priority. Co-funding of targeted Pig control by Gainsdale is anticipated to reduce the risk of Pigs to MNES to low, however Pig control will have to be sustained and the intensity of control tied to the mortality rate for the most sensitive MNES. This may or may not be Hastings River Mouse or Fleay's Barred Frog.

The weed control and surveillance measures, combined with Gainsdale funded weed control on the Winder forestry track will reduce the risk of reduction in the diversity or change in composition of the plant or animal species through weed invasion along the Winder forestry track to low.

6.4.5. Proposed Offsets

There will be no risk of significant impact to this MNES if the relevant control measures are undertaken. Consequently, there will be no need for an offset of any kind.

Table 9 Control measures for managing the risks to World Heritage and National Heritage Values

Performance Target	Control Measures	Timeframe
No significant modification or inhibition of ecological processes of a National Heritage Place	<ul style="list-style-type: none"> • Avoid areas of sensitive vegetation or fragile soils when determining track alignments • Direct water laterally off tracks to minimise longitudinal flow, erosion, and sedimentation of creeks • Align tracks to minimise likelihood of alternative tracks being formed by independent walkers • Undertake track hardening using clean sourced roadbase where assessment indicates risk of erosion 	Following project approval; ongoing during construction
No substantial damage to habitat important for the conservation of biological diversity	<ul style="list-style-type: none"> • Avoid areas of sensitive vegetation or fragile soils when determining track alignments • Direct water laterally off tracks to minimise longitudinal flow, erosion, and sedimentation of creeks • Align tracks to minimise likelihood of alternative tracks being formed by independent walkers 	Following project approval; ongoing during construction
No reduction in the diversity or change in composition of the plant or animal species along the Winder forestry track	<ul style="list-style-type: none"> • Align the new track within the footprint of the old Winder forestry road • Not clearing established canopy trees or large regenerating canopy trees • Aligning the track so that flows of water are not impeded or directed in such a way that they cause erosion of track or track-edge soil • Applying mulch or slash from cleared vegetation to bare soil at track edge, where available and appropriate, to minimise weed colonisation and favour native vegetation establishment • Hardening track surface where necessary to avoid erosion and subsequent impacts on adjacent vegetation • Minimising soil disturbance as far as practicable where machinery is used • Water blasting or steam cleaning machinery prior to moving to site to remove soil and weed seeds • Develop and implement a weed control strategy, consistent with the QPWS Pest Management Strategy, for its properties at the starting point and completion of the Trail • Train Ecoguides in weed identification and require reporting of weed colonisation or invasion • Contribute to funding of weed control along the Trail • Water blast dirt and seeds from a dedicated all-terrain 4WD vehicle servicing the Ecocamps, and then ensure that it is dry, before entry to the National Park 	Following project approval; ongoing during construction; ongoing

	<ul style="list-style-type: none"> • Ensure that walkers' boots are cleaned and sterilised, and clothes and equipment are brushed down before entering the National Park • Ensure that guided walkers stick to the defined path • Ensure that equipment required, e.g. water blaster, boot sterilisation facilities, are supplied and maintained 	
No long-term reduction in rare, endemic, or unique plant or animal populations or species	<ul style="list-style-type: none"> • Collaborate with QPWS to review and update QPWS feral animal control plan following Trail approval, to ensure that there is adequate protection of the World Heritage and National Heritage ecological values along the new area of open Trail • Contribute to funding of feral Pig control operations, including but not limited to traps and cameras, within the Trail area as determined by agreement with QPWS and in line with measures in other areas of the Park • Contribute to feral animal surveillance within the Trail area to inform the QPWS feral animal control plan in line with an agreed program 	By agreement with QPWS

Table 10 Trigger values and corrective measures to address adverse impacts on World Heritage and National Heritage Values

Trigger	Corrective Measures	Timeframe
Track erosion	<ul style="list-style-type: none"> • Harden the track to Class 3 or 4 standard where erosion is likely to occur because of soft and/or deep sediments • Install minimal drainage lines to direct water flow where natural drainage line will result in water flowing down track and causing erosion 	Within 4 weeks of trigger
Observation of feral pests in MNES habitat	<ul style="list-style-type: none"> • Contribute to funding of <i>ad hoc</i> feral Pig control, if monitoring determines that this is required to protect the World and National Heritage ecological values along the Trail 	By agreement with QPWS
Observation of invasive weeds along Trail margins	<ul style="list-style-type: none"> • Lay mulch or slash on areas of disturbed soil along re-opened Winder forestry track • Contribute to funding <i>ad hoc</i> weed control operations along the Trail as agreed with QPWS • Refresh staff training in weed identification as required • Retrain staff on the required control measures and responsibilities for removing weed seeds from clients' boots, clothing, and equipment 	By agreement with QPWS; ongoing

7. Facilitated Impacts on the World and National Heritage Values of the Gondwana Rainforests of Australia Property

Section 527E of the EPBC Act considers that impacts on MNES may be caused as a direct consequence of an action or as an indirect consequence of that action.

A facilitated impact is an indirect consequence of a primary action. Where a primary action significantly facilitates or enables the taking of a secondary action by another person, the reasonably foreseeable facilitated impacts of the secondary action must be assessed as impacts of the primary action (Section 527E(2) EPBC Act). DoEE has suggested that the Trail is likely to facilitate impacts to MNES through increased Trail use by people other than clients of Gainsdale. The three potential modes of impact are: a) increased use of the Trail and/or behaviours on the Trail by independent walkers adversely affecting MNES such as Fleay's Barred Frog, b) independent walkers using part of the Trail to access other points of interest in the Park or WHA, and their subsequent behaviour off the Trail leading to adverse impacts on MNES, or c) the potential development of bush camping areas along the Trail by QPWS.

The Masterplan for Queensland's parks and forests stipulates that National Parks and other reserves are to be managed for nature conservation and for people, and that management is to enable ecotourism, recreation, and heritage experiences within the protected area estate (DNPRSR 2014). There are currently 22 designated walking tracks and three developed campsites (accommodating 290 people total per night) providing for day-use and longer walking opportunities within the MRNP. However, the Park is also renowned for off-track walking, and this is encouraged by QPWS with the provision of 24 remote bush camp sites (accommodating 8 people per site per night), 7 of which are in the Trail area (Figure 3). Camping is also allowed in non-designated sites, but this requires approval by QPWS.

All campers in MRNP require permits from QPWS, enabling some control over maximum numbers staying in the Park at any one time. QPWS have identified that visitor use of this area is low, with 451 permitted camping nights being recorded between July 2016 and June 2017, averaging 1.24 camping nights per day for the whole of MRNP. The three remote camps near the Trail had 5-6 camping nights for this period. QPWS have advised Gainsdale that similar camps in the nearby Lamington National Park averaged about 200 camper nights over this period.

Campers are advised to take care with fire and toileting, and not to disturb native plants and animals within the Park (subject to penalties under the NC Act). However, there are limited controls on visitor behaviour or route choice, particularly off track and in remote sites, and no active controls on the potential introduction or spread of weed seeds or diseases such as chytrid fungus.

Several trails currently cross through habitat of the Hastings River Mouse and Fleay's Barred Frog, two MNES considered for this document. This includes the Cascades Trail (Figure 9) which crosses Dalrymple Creek multiple times, bisecting riparian breeding habitat and rainforest foraging habitat. The Manna Gum campground, like the proposed Woodcutters Ecocamp, is adjacent to Hastings River Mouse habitat and tracks to the campsite pass through Hastings River Mouse habitat (Figure 6). These are not considered to pose threats to the populations of Hastings River Mouse and Fleay's Barred Frog, and are not regarded as threatening processes in the respective recovery plans (Hines *et al.* 2002; NSW DECC 2005).

It is generally accepted that greater recreational use of a protected area results in greater impact. This is moderated, however, by the resistance and resilience of the environment, and the behaviour

of the users (Pickering 2010). Different activities can obviously have different impacts on plant communities and ecosystems. It is also generally accepted that the smaller the area that may be affected by recreational impacts, the better. While tracks can have a small footprint relative to the size of a protected areas, they can facilitate access to previously inaccessible sites, and provide greater opportunity for adverse effects.

Bush walking is a relatively low impact activity, compared to horse riding, mountain biking, or 4WD use. However, high levels of bush walking in sensitive sites can cause problems, as can the spread of pathogens and weeds on walkers' clothing and equipment. Recreational users will also differ in their behaviour and in the degree in which they follow minimum impact codes or regulations, meaning that some people have the potential to cause greater adverse impacts than others.

Consequently, behaviours or actions currently carried out by walkers in the MRNP and GRAWHA are likely to be the same as those that may be facilitated by the Trail. The key question is whether the Trail facilitates additive impacts through increased numbers of independent walkers, and whether these are significant to MNES.

7.1. Facilitated Threatening Processes

7.1.1. Trampling - vegetation resistance and resilience

The ability of vegetation to withstand disturbance before damage occurs defines its resistance to use, and this ability differs between species, life forms, communities, and ecosystems (Pickering 2010, Turton 2005). Grasslands tend to be more resistant than forest understorey, which in turn is more resistant than heaths or herb fields, while subtropical ecosystems are more resistant than temperate ecosystems, which are more resistant than montane ecosystems (Pickering 2010).

Subtropical rainforest is relatively resistant to visitor use, as demonstrated through experimental trials (Hill and Pickering 2009). Hill and Pickering (2009) found that it took 1,475 passes in a mixed forest ground cover community to cause a 50% decline in vegetation cover (resistance index), whereas 20 passes in a North American subalpine forest erect fern-forb community caused a 50% decline in cover. They also found that a fern understorey in a south-east Queensland *Eucalyptus* forest had a relatively low resistance to trampling (at 210 passes), a tussock grass understorey in a paperbark forest had moderate resistance (at 360 passes), while a disturbed grassland dominated by native and introduced grass species had the highest resistance (at 860 passes).

The capacity of vegetation to recover from use, and the time taken to recover, are measures of the resilience of plant communities and ecosystems. Environments with high resistance do not necessarily have high resilience, as observed in Australian alpine and sub alpine grasslands, which have high resistance to trampling, but recover very slowly once damage is done (Pickering 2010). Conversely, tropical and subtropical rainforests have moderate to high resilience to visitor impacts due to high levels of primary productivity and plant regeneration (Turton 2005). Disturbance regimes are key ecological processes in these rainforests, and are responsible for maintaining high levels of species diversity through gap creation and patch dynamics (e.g. Turton 1991, 2005).

The resistance and resilience of a plant community or ecosystem may vary over time due to weather or seasonal variability. For example, there is likely to be more soil erosion or compaction, and more vegetation damage during wet conditions than during dry conditions. Conversely, soils may be more friable when dry, and vegetation may be more susceptible to damage during drought conditions (including from accidental fire). Soil erosion is often a consequence of high-impact activities such as 4WD, horse riding, or mountain biking, but walking can also cause localised erosion through frequency of use or tracking through sensitive sites. The intensity of use combined with soil type,

rainfall, and topography can all influence the degree of erosion that occurs at a site. Compacted soils and rock areas may experience little to no erosion while deep humus soils may be particularly susceptible.

The establishment of formal tracks is therefore a strategy to reduce the impact of informal tracks created through recreational use in susceptible vegetation communities and ecosystems.

7.1.2. Weeds – Dispersal by Walkers

The spread of weeds and pathogens by bush walkers are two of the most important indirect impacts in protected areas (Pickering 2010). Propagules may be introduced to new areas, while trampling or nutrient addition from waste may create conditions suitable for their establishment and survival. Most of the species of weeds carried by bush walkers on their boots and clothing are common track and roadside weeds, and these are surprisingly consistent across countries and continents (Pickering 2010). A wide range of ruderal herbaceous species are growing in open conditions along the edges of 4WD tracks in MRNP, whereas the edges with low light levels under the forest canopy are dominated by native grasses and other native early succession species (Tony Charters and Associates 2016).

Very few woody weeds with the potential to invade the rainforest, except for blackberry, will have their seeds spread by humans. Most of the woody weeds listed in the QPWS Pest Management Strategy are spread by birds or other animals, or wind and water, rather than human activity *per se* (Gosper *et al.* 2005).

7.1.3. Pathogens – Dispersal by Walkers

The chytrid fungus is present in frog populations in MRNP, and will spread naturally between populations of frogs through infected animals and spores in water (BAAM 2017b). It has been suggested that it may also be spread through wet soil, e.g. on the boots of walkers, but there is no evidence that it can survive outside water bodies (Anon. 2006). Cleaning or sterilising of boots is recommended as a precautionary measure only (Phillott *et al.* 2010).

7.1.4. Establishment of Bush Camps

Gainsdale have proposed that two new remote access bush camps be established adjacent to the Trail and managed by QPWS to provide for the potential increase in independent walker numbers and avoid informal bush camping. Surveys have identified three potential camp sites near the northern boundary of the park (Figure 13) and one in eucalypt forest just to the north of the start of the existing Winder track, near the Mt Castle Lookout carpark (Figure 14). All sites are in grassy areas under open woodland where minimal understorey disturbance would be required.

The two camp sites are anticipated to be like other remote bush camping sites, i.e. a grassy pad up to 125m², catering to a maximum of 8 campers per night. The potential sites are located outside of critical MNES habitat. Gainsdale has offered to provide toilet facilities to avoid bush toileting, however sensitive bush toileting would be expected of all campers as *per the status quo* should this not be accepted.

Two small rain catchment shelters are also proposed, one near the northern campsite and the other at the campsite near the Mt Castle Lookout carpark. Both sites are disturbed and have vehicle access for refilling at times of low rainfall.

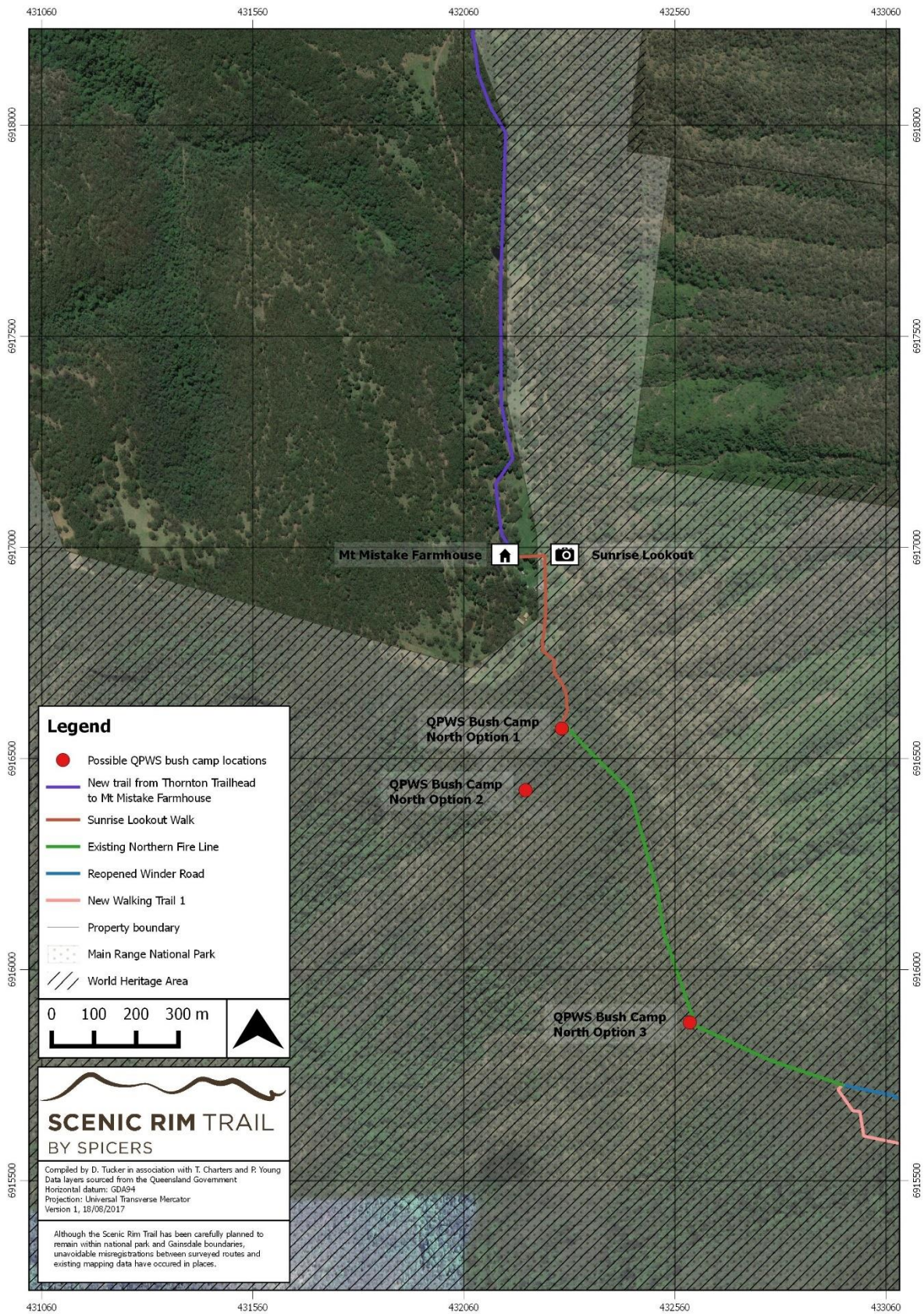


Figure 13 Location of three potential QPWS bush camp options along the Northern fire line

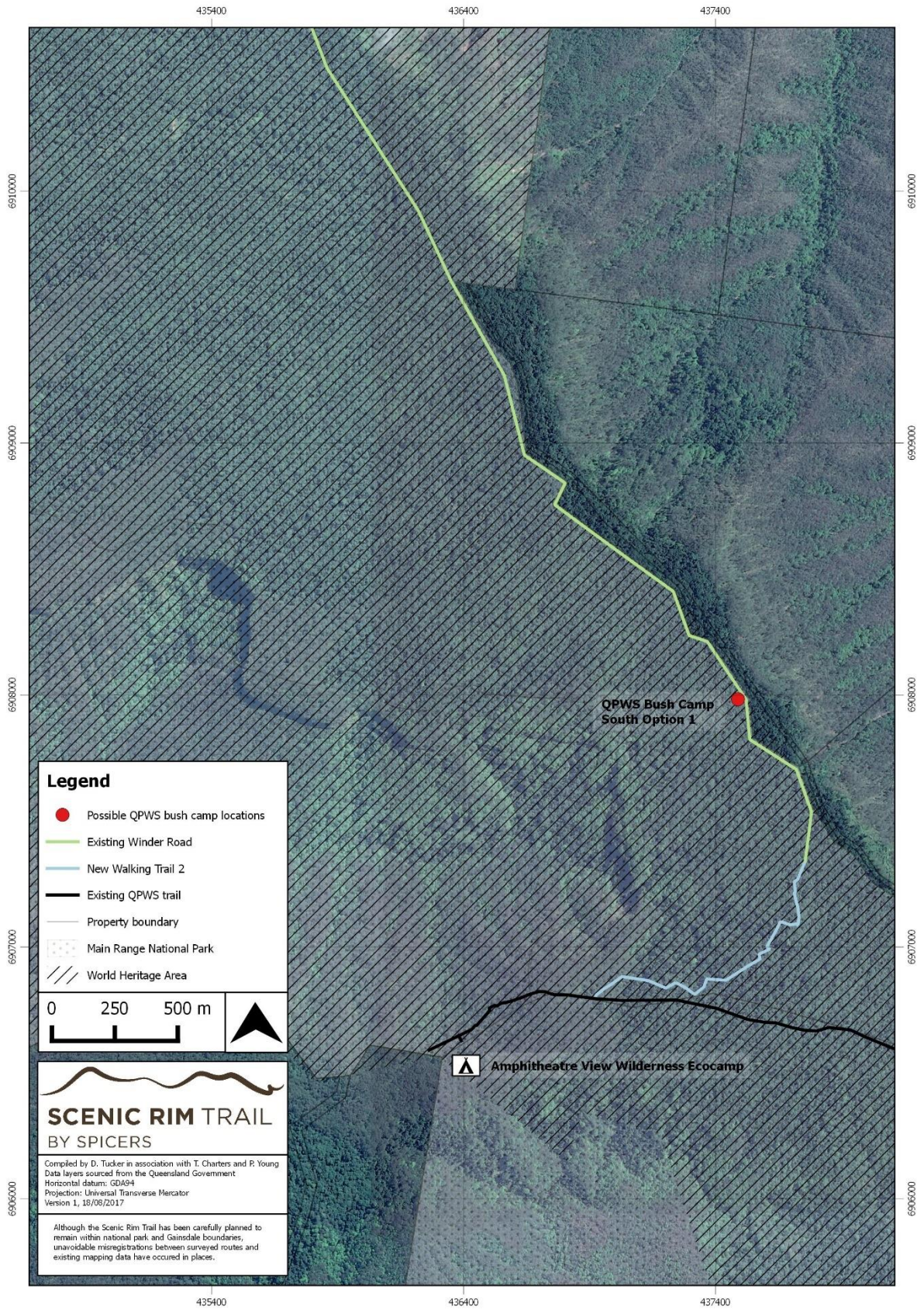


Figure 14 Location of the potential QPWS bush camp option at the southern end of the Winder forestry track

7.2. Projected Number of Independent Walkers Using the Trail

Gainsdale has recommended to QPWS that the number of independent walkers using the Trail be limited by the existing permit system to 792 walkers per year for the first three years. This is almost double the numbers currently remote bush camping in the whole MRNP, but is still low when compared to the Lamington National Park. The proposed limit would allow for environmental monitoring and adaptations to management practices as required, after which the number of permitted walkers would then be increased to 1386 walkers per year.

The permit system regulates the number of walkers by requiring them to stay at existing bush camps, although it does not control walkers using the tracks for visits of less than one day, and cannot regulate those walkers and campers who choose not to register and camp outside of the bush camps.

There will be no public shuttle at the southernmost end of the Trail, so it is anticipated that most walkers will finish their walk at the Cunningham's Gap public carpark.

7.3. Potential Impacts of Independent Walkers Facilitated by the Trail

The use of the Trail by an increased number of independent walkers pose potential risks to MNES.

7.3.1. MNES – Threatened species

7.3.1.1 Long term decrease in size of population

There is no risk of use of the Trail by independent walkers causing a long-term decrease in the population size of threatened species in the MRNP or GRAWHA. The threatening processes for these species are introduced predators and climate change.

7.3.1.2 Reduction in area of occupancy

The use of the Trail by independent walkers will not reduce the area of occupancy for threatened species in the MRNP or GRAWHA. The two, new, proposed bush camps will be in areas of disturbed vegetation and outside of critical habitat for MNES. This will reduce the likelihood of bush camping in critical MNES habitat. Consequently, there is no risk of the Trail facilitating a reduction in the area of occupancy of a threatened species.

7.3.1.3 Fragmentation of existing population

The use of the Trail by independent walkers will not fragment an existing population of threatened species in the MRNP or GRAWHA. The two, new, proposed bush camps will be in areas of disturbed vegetation and outside of critical habitat for MNES. This will reduce the likelihood of bush camping in critical MNES habitat. Consequently, there is no risk of the Trail facilitating fragmentation of an existing population of a threatened species.

7.3.1.4 Adversely affecting habitat

The use of the Trail by independent walkers may adversely affect the habitat of Fleay's Barred Frog, if they choose to walk up or down the riparian margins by the new crossings in numbers great enough to damage riparian vegetation. This is a low risk, as steep rock faces occur upstream and downstream of the crossings suggesting that this is unlikely, and the regenerative capacity of riparian vegetation is high indicating that the consequences would be minor.

Control measures designed to address this facilitated risk are described in Section 7.4.

7.3.1.5 Disrupting breeding cycle

The use of the Trail by independent walkers may disrupt the breeding cycle of Fleay's Barred Frog, if they choose to walk up or down the creek bed by the new crossings during the breeding season. This

is a low risk, as the creek beds are not a natural passage (Photo 7, Photo 8) suggesting that this would be a rare occurrence, and the scale of impact relative to the extent of the creeks would be minor.

Control measures designed to address this facilitated risk are described in Section 7.4.

7.3.1.6 Modifying habitat availability or quality

The use of the Trail by independent walkers may modify the availability or quality of Fleay's Barred Frog riparian habitat, if they choose to walk up or down the riparian margins by the new crossings in numbers great enough to damage riparian vegetation. This is a low risk, as steep rock faces occur upstream and downstream of the crossings suggesting that this is unlikely, and the regenerative capacity of riparian vegetation is high indicating that the consequences would be minor.

Control measures designed to address this facilitated risk are described in Section 7.4.

7.3.1.7 Establishment of invasive species

The use of the Trail by independent walkers will not introduce invasive species into the habitat of Fleay's Barred Frog or Hastings River Mouse, unless this was done maliciously and with intent. The presence or absence of the Trail is unlikely to be a factor in the decision made by such a person to take this action. Consequently, there is no risk of the Trail facilitating the establishment of invasive species.

7.3.1.8 Introduction of disease

The use of the Trail by independent walkers is unlikely to introduce chytrid fungus into the population of Fleay's Barred Frog, as it is already endemic. There is the possibility of spreading new variants of the fungus, however the existing tracks and more accessible visitor infrastructure in the catchment mean that these would be the most likely entry point in the MRNP. Consequently, there is no risk of the Trail facilitating the introduction of disease into the Fleay's Barred Frog population.

7.3.1.9 Interference with species recovery

The use of the Trail by independent walkers is unlikely to be a threatening process for MNES species unless they choose to behave in a manner that is detrimental to the values of the MRNP or contrary to bushwalking codes¹⁰. There is a low risk of the Trail facilitating such behaviour, as the likelihood is rare, while the effects could be minor to high depending on the activity.

Control measures designed to address this facilitated risk are described in Section 7.4.

7.3.2. MNES – World Heritage and National Heritage values

7.3.2.1 Modify or inhibit ecological processes of a National Heritage Place

The use of the Trail by independent walkers is unlikely to modify or inhibit ecological processes responsible for the ecological integrity of this National Heritage place. There could be localised disturbance of vegetation if walkers create alternative pathways through the bush and there could be limited erosion if alternative tracks became heavily used. However, the likely scale of such use relative to the resilience and resistance of the subtropical rainforest suggests that this will be insignificant to rainforest health and integrity. Use of the Trail will not affect rainforest regeneration or succession.

Consequently, there is no risk of the Trail facilitating the modification or inhibition of ecological processes of this National Heritage place.

¹⁰ <https://www.bushwalkingnsw.org.au/bushwalkers-code/>

7.3.2.2 Reduce diversity or modify composition of plant or animal species

The use of the Trail by independent walkers may bring weed seeds and propagules into the GRAWHA, however these are unlikely to be weeds of significance for the rainforest and they will be unlikely to establish or invade beyond the edge of the track. Consequently, there is a low risk of the Trail facilitating the modification of the GRAWHA plant or animal species.

Control measures designed to address this facilitated risk are described in Section 7.4.

7.3.2.3 Fragment, isolate, or substantially damage critical habitat for biodiversity

The use of the Trail by independent walkers may cause damage to critical habitat for biodiversity if they create alternative pathways through critical habitat, e.g. riparian breeding habitat for Fleay's Barred Frog, and/or they choose to behave in a manner that is detrimental to the values of the MRNP or contrary to bushwalking codes. There is a low risk of the Trail facilitating such behaviour, as the likelihood is rare, while the effects could be minor to high depending on the activity.

Control measures designed to address this facilitated risk are described in Section 7.4.

7.3.2.4 Cause long-term reduction in rare, endemic, or unique species

The use of the Trail by independent walkers is unlikely to cause the long-term reduction in rare, endemic, or unique species. The most significant threatening processes to these are introduced predators and climate change. There is no risk of the Trail facilitating the long-term reduction in rare, endemic, or unique species.

7.3.2.5 Fragment, isolate, or substantially damage critical habitat for rare, endemic, or unique species

The use of the Trail by independent walkers may cause damage to critical habitat for rare, endemic, or unique species if they create alternative pathways through critical habitat, e.g. riparian breeding habitat for Fleay's Barred Frog, and/or they choose to behave in a manner that is detrimental to the values of the MRNP or contrary to bushwalking codes. There is a low risk of the Trail facilitating such behaviour, as the likelihood is rare, while the effects could be minor to high depending on the activity.

Control measures designed to address this facilitated risk are described in Section 7.4.

Table 11 Risk assessment of potential significant impact to MNES species and/or World Heritage and National Heritage values facilitated by the Trail

Long-term decrease in population size	Nil
Reduced area of occupancy	Nil
Fragmentation of population	Nil
Adverse effect on critical breeding habitat	Low
Disruption of breeding cycle	Low
Critical loss or degradation of habitat	Low
Introduction of critical invasive species	Nil
Introduction of critical disease	Nil
Interference with species recovery	Low
Modify or inhibit ecological processes of a National Heritage Place	Nil
Reduce diversity or modify composition of plant and animal species	Low

Fragment, isolate, or substantially damage critical habitat for biodiversity	Low
Cause long-term reduction in rare, endemic, or unique species	Nil
Fragment, isolate, or substantially damage critical habitat for rare, endemic, or unique species	Low

7.4. Environmental Management Measures – Avoidance and Mitigation of Potential Facilitated Impacts on World Heritage and National Heritage Values

7.4.1. Performance Targets and Control Measures

The performance targets and control measures for avoiding or mitigating the facilitated impact of the Trail on MNES species and/or World Heritage and National Heritage values are presented in Table 12. The performance targets are based on the criteria for determining significant impact on these values. These are qualitative rather than quantitative, because of the lack of baseline data. The research, survey, and monitoring programs proposed by Gainsdale are intended to address this.

QPWS have advised Gainsdale that standard NPSR safety, directional, and biosecurity signage would be established at intersection points with the existing tracks and the Trail, and along the Trail. Gainsdale will mask intersection points as far as practicable, to minimise unintentional access to the Trail.

7.4.2. Environmental Monitoring

Survey, monitoring, and research programs are proposed for Hastings River Mouse (section 4.4.2) and Fleay’s Barred Frog (section 5.4.2). To complement this, Gainsdale will:

- Contribute to feral animal surveillance and monitoring within the Trail area to inform the QPWS feral animal control program
- Implement a weed surveillance and monitoring program along the Trail for priority weeds listed in the QPWS Pest Management Strategy
- Monitor track use, erosion, and formation of alternative pathways by independent walkers
- Monitor implementation of all control measures by Gainsdale staff

Gainsdale will also fund a study of the plant and animal community that develops alongside and perpendicular to the re-opened Winder forestry track to test the proposition of no reduction in the diversity or change in composition of the plant or animal species along the Winder forestry track due to the clearance of vegetation and re-establishment of the track.

Gainsdale will report on monitoring and research, and make all data available for the visitor management strategy being developed by DNPSR for the western Scenic Rim.

7.4.3. Corrective Actions

The corrective actions for managing any adverse impacts on the MNES species and/or ecological values of the World Heritage and National Heritage area occurring despite the control measures are presented in Table 13. The trigger values are qualitative at this point as there is no robust measure of the values.

7.4.4. Residual Risk Assessment

Gainsdale will take all practicable steps to reduce the residual risk of facilitated impact to low or non-existent. As with all protected areas, it is the individual behaviour of track users that will

determine whether an impact is likely or not, and the proportion of users engaging in this behaviour that will determine its significance.

7.4.5. Proposed Offsets

There will be no risk of significant impact to this MNES if the relevant control measures are undertaken. Consequently, there will be no need for an offset of any kind.

Table 12 Control measures for managing the facilitated risks to MNES species, World Heritage and National Heritage Values

Performance Target	Control Measures	Timeframe
No adverse impact on riparian vegetation	<ul style="list-style-type: none"> Establish a tightly defined stream crossing area to avoid damage to riparian vegetation Place large in-stream stepping stones to minimise creek bed disturbance 	During construction
No adverse disruption of Fleay's Barred Frog breeding cycle	<ul style="list-style-type: none"> Establish a tightly defined stream crossing area to avoid damage to riparian vegetation Place large in-stream stepping stones to minimise creek bed disturbance 	During construction
No interference with species recovery	<ul style="list-style-type: none"> Signage to direct access and remind Trail users of appropriate environmental behaviour Align tracks to minimise likelihood of alternative tracks being formed by independent walkers 	During construction
No substantial damage to habitat important for the conservation of biological diversity	<ul style="list-style-type: none"> Signage to direct access and remind Trail users of appropriate environmental behaviour Align tracks to minimise likelihood of alternative tracks being formed by independent walkers New QPWS bush camps outside of WHA and specific MNES habitat established 	During construction
No reduction in the diversity or change in composition of the plant or animal species along the Trail	<ul style="list-style-type: none"> Signage to direct access and remind Trail users of appropriate environmental behaviour, including cleaning boots and equipment Align tracks to minimise likelihood of alternative tracks being formed by independent walkers Contribute to funding of QPWS approved weed control along the Trail 	During construction; by agreement with QPWS
No fragmentation of habitat for biodiversity, including rare, endemic, or unique species	<ul style="list-style-type: none"> Signage to direct access and remind Trail users of appropriate environmental behaviour Align tracks to minimise likelihood of alternative tracks being formed by independent walkers New QPWS bush camp locations outside of WHA 	During construction

Table 13 Trigger values and corrective measures to address adverse facilitated impacts on MNES species and World Heritage and National Heritage Values

Trigger	Corrective Measures	Timeframe
Adverse impact on riparian vegetation	<ul style="list-style-type: none"> Realignment of track if appropriate Create natural barriers to alternative pathways 	Within 4 weeks of trigger
Adverse disruption of Fleay's Barred Frog breeding cycle	<ul style="list-style-type: none"> Closure of Trail to independent walkers for duration of breeding season 	By agreement with QPWS
Interference with species recovery	<ul style="list-style-type: none"> Work with QPWS to identify appropriate visitor management measures 	By agreement with QPWS

Significant damage to habitat important for the conservation of biological diversity	<ul style="list-style-type: none"> Work with QPWS to identify and implement appropriate rehabilitation or restoration measures 	By agreement with QPWS
Significant reduction in the diversity or change in composition of the plant or animal species along the Trail	<ul style="list-style-type: none"> Contribute to funding <i>ad hoc</i> weed control operations along the Trail as agreed with QPWS Refresh EcoGuides training in weed identification as required 	By agreement with QPWS; within 4 weeks of trigger
Significant fragmentation of habitat for biodiversity, including rare, endemic, or unique species	<ul style="list-style-type: none"> Work with QPWS to identify and implement appropriate rehabilitation or restoration measures 	By agreement with QPWS

8. Social and Economic Costs and Benefits

The Scenic Rim Trail and its associated Ecocamps provide an expansion to the range and diversity of recreation and tourism products in the region. Apart from the direct benefits of infrastructure spending and operational management of the Scenic Rim Trail, the project will lift the tourism profile of the region and provide opportunities that are associated with catalyst projects. The Scenic Rim Trail project and the broader conservation projects of the Turner Family (via Gainsdale Pty Ltd) in the region also contribute to the presentation of the World Heritage values of the Gondwana Rainforests of Australia and the broad range of values recognised within the Main Range National Park and environs.

The Turner family has taken a long-term view to the Scenic Rim Trail project which complements the Hiddenvale UQ Wildlife Centre and existing lodge properties near the Scenic Rim, including Hiddenvale, Hidden Peaks, Spicers Canopy, and Spicers Peak Lodge. The investment in 8,000 ha of bushland in the region, the creation of Nature Refuges, the development of a network of lodges and now the concept of the Scenic Rim Trail, are also part of the overall vision to present the heritage values of the Scenic Rim in a way that will also achieve financial sustainability in the medium to long term. The Turner family appreciates that long-range walking products are a niche market and that the development of a reputation as an iconic experience takes time, and must involve excellence at every level. Primarily however, they see the project as a contribution to conservation and the broader community, with the medium-term financial objective being operational cost recovery. The investment by Gainsdale Pty Ltd creates a catalyst for other economic and social enterprises in the region.

In terms of direct economic benefits, the SRT will over 4 years create some 16 ongoing jobs. The project will see a workforce of some 26.5 full time equivalent jobs created (Table 14).

Table 14 Projected employment (person years) for the Scenic Rim Trail

	Year 1	Year 2	Year 3	Year 4	Year 5
Planning/Technical	3.5	4	2	1.5	0.5
Walking Trail Construction Crew	5				
Road Crew		2	0.25	0.25	0.25
Ecocamp Construction Crew		6			
EcoGuides		8	8	8	13
Support Crew		4	4	4	6.5
Catering, Food & Beverage		0.5	1	1	1.5
Cleaning, Maintenance		0.5	1.5	1.5	2
Monitoring, Survey	1	1.5	1.5	1	1
Sales, Marketing, Administration		1	1	1	1.5
Fulltime Equivalent Staff	4.5	32.5	19.25	18.25	26.25

These roles will be fulfilled by qualified personnel skilled in ecological services and hospitality. It is the Turners intent to recruit indigenous personnel to assist with the cultural heritage interpretation of the area and its natural values. The indigenous story of the region is rich and diverse with interpretations that can be shared with guests and the broader community. It is anticipated that the annual wages component for guides will grow from \$0.49M in year one to over \$1.1M per annum from year 4 onwards. These monies will be earned in a regional community where youth unemployment sits at 9.8% (ABS July 2017; <http://lmip.gov.au/PortalFile.axd?FieldID=2739719&.xls>).

There will also be many indirect benefits from this project for the local economy and community. In the construction phase, these will come mainly from the multiplier effect of the infrastructure spending, as well as from the flow-on marketing impacts through of building anticipation and awareness in the new product offering and the destination. In the operational phase, services will be required from businesses in the local region (e.g. mechanical services, food and beverage, maintenance services etc). There will also be a range of indirect economic benefits, for example:

- providing additional recreation and accommodation infrastructure and opportunities – this contributes to increased visitation to the region in general, longer stays, as well as the ancillary use of Scenic Rim Trail by independent walkers. (A high proportion of these visitors will likely purchase local accommodation at the start and finish of the trail as well as spend locally on transport, fuel, food supplies and other miscellaneous goods and services);
- diversifying the tourism product range in the region – which improves resilience by broadening the appeal of the destination to different market segments;
- improving accessibility to, and linkages between, products and attractions – which makes the destination more attractive and contributes to higher visitation and longer stays;
- lifting the ecotourism standards in innovation and best practice – which makes the destination as well as the product more competitive in the eyes of discerning customers;
- expanding ecotourism training, skills development, business experience and operational knowledge of staff – this contributes to the overall quality and capacity of the local workforce; and
- additional tourism marketing – which helps to attract more visitors and spending to the region in general.

8.1. Visitor Profile

For the year ended December 2016, Southern Queensland Country attracted 10% of domestic visitors to Queensland but only 2% of international visitors to Queensland. There were 2.4 million visitors to the region, with 38% travelling for visiting friends or relatives (VFR), 26% for business and 28% for holiday purposes. These visitors spent over \$891 million on the trips. The approximately 2.1 million domestic overnight visitors originated mostly from Regional Queensland, Brisbane and Regional NSW with the domestic average length of stay just over three nights. The 45,000 international visitors originated mostly from five top source markets Asia, Europe, North America, New Zealand and the United Kingdom with the average length of stay just over 30.5 nights.

For the year ended December 2016, Brisbane attracted the highest number of domestic and international visitors to Queensland (29% and 46% respectively). There were just over 6 million visitors to Brisbane. Over 41% travelled for VFR purposes and 27% travelled for holidays. The just over 6 million domestic overnight visitors originated mostly from Regional Queensland, Regional NSW, Sydney and Melbourne with the domestic average length of stay 3 nights. The 2.57 million international visitors originated mostly from China, New Zealand, the United Kingdom and USA with the average length of stay just over 20.5 nights.

8.2. Visitors Engaging in Bushwalking Experiences

Findings of a 2010 Adventure Tourism Market Report by George Washington University et al support the notion that adventure travellers represent a significant, growing market, indicating that the value of the global adventure market is US\$89 billion/yr. The report notes that more people intend to take adventure trips and these people intend to spend more than they have on their previous vacation. It also indicates that they have a desire to have natural, cultural and active experiences, and to engage more deeply with local communities. The study estimated the adventure market is 26% of the travelling population.

Australia is already recognised as possessing a high standard of world-class beauty and natural environments. In the year ending June 2016, 68 per cent (or 5.0 million) of international visitors engaged in some form of nature-based activity. The top international nature-based markets were China (17 per cent), the United Kingdom (11 per cent), New Zealand (10 per cent) and the USA (9 per cent). International nature-based visitors tend to be younger than other visitors with 33 per cent being aged 15-29 years. Annually, on average, there is a minimum of:

- 1.2 million international visitors who take a bushwalk on their trip
- 1.3 million domestic tourists who take a bushwalk on their trip staying overnight in QLD
- Domestic tourists who take a bushwalk on their trip have an average trip length of 5 nights and an average spend of \$186/night

For the ten years to 2012, domestic visitors that participated in a bushwalk on their trip:

- Came mainly from Sydney, Melbourne and other parts of NSW and were most commonly 35-44 years of age, then likely to be 45-55 or 25-34 years of age
- Those that stopped in Queensland on their trip came mainly from Brisbane, Tropical North Queensland, Sydney and other parts of NSW and were most commonly 35-44 years of age, then likely to be 45-55 or 25-34 years of age
- The average spend was \$186 per night and
- The average trip was length is 5 nights.

For the ten years to 2012, international visitors that participated in a bushwalk on their trip:

- Came mainly from: UK, New Zealand, USA, Japan, China and Germany.
- Longest average stays are by visitors from: Korea (74 days), France (65 days), Thailand (63 days), Germany (59 days) and India (53 days).
- The highest average spend per night is by visitors from: Singapore (\$128 per night), USA (\$108 per night), Switzerland (\$106 per night), China (\$103 per night), Malaysia (\$97 per night), New Zealand (\$93 per night).
- The key age brackets in terms of visitor numbers are: 55 and over and 15-24.
- The key age brackets in terms of average length of stay are: 15-24 (89 days), 25-34 (59 days), 35-44 (26 days), 55+ (24 days).
- The key age brackets in terms of average spend per night are: 45-54 (\$128/night), 35-44 (\$115/night), 55+ (\$91/night), 25-34 (\$86/night) and 15-24 (\$70/night).
- Visitor numbers are mostly higher for women than men, and women also show a slightly longer average length of stay.

8.3. Spicers' Experience

The experience of the Spicers Group in running tourism properties in the region has provided it with a good understanding of the market:

- A typical group had an average age of 55, were 70% female, contained 2-3 health professionals, with 70% of the group with previous walking experiences, mainly overseas.
- Selling to family or friend groups of 6-10 in number was the key to good sales and helped immeasurably in planning resources around walks.
- This market prefers to pay for most of their gear to be brought ahead each night by Spicers Group staff.

Based on research conducted into previous guests that have stayed at Spicers Group lodges there are very clear patterns that emerge:

- 67% are female
- Health and medical accounts for 17% of guests (Health and Medical; Bank/Finance; Education and Training and Hospitality accounts for 45% of guests)
- 29% are young families, 26% teenage families and 15% mature families
- The most important motivation identified for their break was to reconnect with family and loved ones, followed by 'rewarding myself'
- The most important decision triggers were – setting scenery, quality and value for money
- Guests identified the best part of the experience was food and wine (45%), personal attention (42%), accommodation comfort (24%), the environment (24%) and tranquillity (24%)
- Guest combined annual Family income reveals 43% earn \$120-250k, and 20% earn more than \$250k and
- Leisure market accounts for approx. 40% of business, special occasions approx. 48% and business 12%.

8.4. Expected Source Markets

Based on the above research, the Scenic Rim Trail concept will target:

- Active Explorers as described by Tourism and Events Queensland interested in nature based and adventure tourism.
- Intra and interstate visitors who are visiting Brisbane and the Southern Queensland Country (SQC) tourism regions primarily for VFR or holiday purposes, from Brisbane, Tropical North Queensland, Sydney and regional NSW aged 35-55 years of age.
- International visitors who are visiting Brisbane and the SQC region for primarily holiday purposes from New Zealand, China, the United Kingdom, Japan, the USA and Germany.
- In the Chinese market targeting the Self Challengers and in the New Zealand market the Independent Explorers as defined by TEQ.

8.5. Expenditure Rates

Domestic tourists who take a bush walk on their trip have an average spend of \$186/night.⁹

International tourists who take a bushwalk on their trip have an average spend of \$87.60/night¹⁰.

It is envisioned that in addition to the capital investment of the project, the project will attract around 1,400 walkers per annum from year four who will spend over a week in the local environment generating over \$5.0M per annum for expenditure in the local economy that is

traditionally dominated by rural enterprises. The subject proposal represents a diversification and development of a sustainable business in the region.

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10. Annexures

Annex 1 – DoEE Letter of 30 March 2017

Annex 2 – Consolidated Trail Maps

Annex 3 – BAAM Hastings River Mouse Survey

Annex 4 – BAAM Fleay’s Barred Frog survey

Annex 5 – BAAM Feral animal survey