HASTINGS RIVER MOUSE (*PSEUDOMYS ORALIS*) BASELINE SURVEY AND HABITAT MAPPING

SCENIC RIM TRAIL, MAIN RANGE

Prepared for
Spicers Retreats Hotels and Lodges Pty Ltd

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Project Title: Hastings River Mouse (*Pseudomys oralis*) baseline survey and habitat mapping, Scenic Rim Trail, Main Range

Project Author/s: Dr Penn Lloyd, Shelley Trevaskis, Adrian Caneris and Gavin Jones

Project Summary: This report presents the results of a baseline survey of Hastings River Mouse (*Pseudomys oralis*) where known and potential habitat for the species is located in the vicinity of the proposed Scenic Rim Trail and associated facilities. The survey included the collection of habitat type and structure data to describe habitat condition and for future reference in the monitoring program. Data from this field study, historical records and relevant literature have been drawn upon to map Hastings River Mouse habitat in relation to the trail.

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HASTINGS RIVER MOUSE (*Pseudomys oralis*) BASELINE SURVEY AND HABITAT MAPPING

SCENIC RIM TRAIL, MAIN RANGE

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Table of Abbreviations

BAAM	Biodiversity Assessment and Management Pty Ltd
BDCMP	Baseline Data Collection and Monitoring Plan
DoEE	Commonwealth Department of Environment and Energy
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
NC Act	Queensland *Nature Conservation Act 1992*
RE	Regional Ecosystem
SRTMP	Scenic Rim Trail Management Plan

1.0 INTRODUCTION

The Baseline Data Collection and Monitoring Plan (BDCMP) for the Scenic Rim Trail – Thornton Trailhead to Spicers Peak Nature Refuge Development Proposal (the Project), included as an appendix to the Scenic Rim Trail Management Plan (SRTMP), sets out the commitments of Spicers Retreats Hotels and Lodges Pty Ltd to meeting several conditions of Commonwealth approval 2016/7847 for the Project. Approval Condition 4(e)(i) specifies that baseline population data for Hastings River Mouse (*Pseudomys oralis*) must be obtained for the areas surrounding Woodcutters Ecocamp in Main Range National Park, where baseline population data includes, but is not limited to, population abundance, composition and distribution as determined and collected by a suitably qualified person over a timeframe that serves as a basis for comparison to data acquired after commencement of the action.

The BDCMP outlined the survey methods (including survey methodology, effort, timing, frequency and responsibility) for collecting the necessary baseline population data in accordance with survey guidelines set out in the Recovery Plan for the Hastings River Mouse (NSW DECC 2005) as follows:

> ***Methodology**: A targeted trapping survey shall be undertaken by a suitably qualified person using size A Elliott traps set out on 4-5 transects of 20-25 traps per transect through suitable habitat in the areas surrounding Woodcutters Ecocamp, placing the traps at least 10 m apart in suitable cover, focussed on shelter sites such as fallen logs, rock outcroppings and dense groundcover. The traps shall be baited with a standard mix of rolled oats, peanut butter, vegetable oil, honey and vanilla essence. Habitat suitability for Hastings River Mouse shall be assessed at detailed habitat assessment sites recording vegetation structural characteristics, the floristic diversity of groundcover vegetation and the general abundance of potential shelter sites for Hastings River Mouse.*
>
> ***Effort**: The minimum survey effort shall be 1-2 surveys including a single survey of 400 trap-nights (100 traps over four consecutive nights).*
>
> ***Timing and frequency**: The timing for the survey can be at any time of the year and the frequency shall be at least a single survey.*
>
> ***Responsibility**: A suitably qualified person, being a person who has professional qualifications, training, skills or experience relevant to the matter of concern, and who can give authoritative assessment, advice and analysis using relevant protocols, standards, codes of conduct, methods or literature.*

This report outlines the methods and results of surveys to obtain baseline population data for Hastings River Mouse at several locations in Main Range National Park, including in areas surrounding Woodcutters Ecocamp in accordance with the BDCMP. The survey extents and total survey effort outlined in this report exceed the minimum survey effort specified in the BDCMP. This report also draws on the results of the field surveys, historical data and scientific literature to map habitat for the species at a landscape scale in the vicinity of the Scenic Rim Trail.

2.0 ASSESSMENT APPROACH

2.1 HABITAT MAPPING

To gain an understanding of habitats used by Hasting's River Mouse in the southern Main Range, the relevant published literature was reviewed and high precision records (≤500 m precision, post-1990) obtained from the Queensland Government Wildlife Online (WildNet) database were overlaid on a Regional Ecosystem (RE) map to identify the association of records from the southern Main Range with vegetation communities. Potentially suitable habitat for Hasting's River

Mouse was then mapped throughout the Main Range National Park and environs on the basis of the identified RE associations to inform the selection of survey sites.

2.2 SURVEY SITE SELECTION

The identification of trapping survey sites was undertaken on the basis of the following two criteria:

- Proximity to proposed new hiking trails and accommodation camps, with trapping undertaken at proposed new hiking trail sections and accommodation camps; and
- Habitat suitability, based on the preliminary mapping of potentially suitable habitat and field assessment in relation to the known preferred habitat characteristics of the species as described in the published literature, with trapping focussed in the most suitable habitat areas.

Vegetation assessments were undertaken at trapping survey sites and at additional sites to describe vegetation species composition and structure as part of the assessment of habitat suitability for Hastings River Mouse.

2.3 SURVEY METHODS BACKGROUND

The minimum specifications for a trapping survey for Hastings River Mouse are as follows (NSW DECC 2005):

- The minimum trap effort at a locality must be 100 size A Elliott traps over four nights (400 trap nights) for areas up to 50 hectares of moderate or high quality habitat or both.
- For each 400 trap nights four transects should be established. Twenty-five traps should be placed along each transect. Each trap should be placed at approximately ten metre intervals in sites where suitable microhabitat occurs.
- Transects should be placed in suitable habitat to maximise capture e.g. near fallen trees, adjacent to rock outcrops, trees with basal cavities, dense grass, burrows of suitable size.
- Traps should be baited with peanut butter and rolled oats.

Habitat surveys should assess grass, sedge and mat-rush cover, heath cover, the availability of natural shelters (burrows, rock cavities, large trees with basal cavities, large logs), and the presence of rock outcroppings (escarpments, scree slopes, boulder fields) within 1 km (NSW DECC 2005).

2.4 SURVEY APPROACH

2.4.1 Trapping survey

The survey for Hastings River Mouse involved three periods of survey, as follows:

- a preliminary survey conducted over a 5-day period 7-11 November 2016 by Dr Penn Lloyd (Principal Ecologist) and Adrian Caneris (Principal Wildlife Expert); this preliminary survey included two nights of small-mammal trapping in the northern portion of the project area between the Thornton Trailhead and Mt Mistake (7-9 November) and two nights of small-mammal trapping in the central section of the project area in close proximity to the accommodation camps proposed at the Amphitheatre and Woodcutters (9-11 November);
- a targeted small-mammal trapping survey led by Dr Penn Lloyd and Adrian Caneris that involved three nights of trapping (4 nights of trapping were originally planned, but the arrival of inclement weather curtailed the survey) in the vicinity of the new trail section at Mt Mistake (15-18 May 2017) and four nights of trapping at two sites in the Goomburra section of Main Range NP, in the vicinity of the proposed accommodation camp at Woodcutters and in the next valley to the south of Woodcutters (to assess connectivity with records of the species to

the south) (22-26 May 2017); the targeted survey included detailed assessment of habitat at trapping survey sites; and

- a habitat assessment survey over two days in the Mt Mitchell portion of the proposed hiking trail (14-15 June 2017).

The trapping surveys involved setting 20 to 26 Elliott A traps in transects through suitable habitat, placing the traps at least 10 m apart in suitable cover, focussed on shelter sites such as fallen logs, rock outcroppings and dense groundcover. The traps were baited with a standard mix of rolled oats, peanut butter, vegetable oil, honey and vanilla essence. The traps were opened in the late afternoon and checked within two hours of sunrise each morning, with any trapped animals released close to the capture location once they had been identified.

2.4.2 Habitat assessment

The following vegetation characteristics were recorded at detailed habitat assessment sites:

- The canopy height range, median height and percentage canopy cover were estimated for each of the canopy (T1), subcanopy (T2, T3), shrub (S1) and groundcover layers, and the dominant species in each layer were recorded;
- The percentage cover of individual species in the canopy, subcanopy and shrub layers was measured using the line-intercept method along the full length of a 50 m tape located randomly in the habitat;
- The height and species identity of the tallest intercept with a measuring stick dropped vertically from the tape at 1 m intervals was recorded for each of 50 intervals along the 50 m tape; from these measures, the percentage vegetation cover and average height of groundcover vegetation was calculated;
- All groundcover species within each of five 1 m x 1 m quadrats spaced at 10 m intervals along the 50 m tape were identified and recorded, to quantify the floristic diversity of groundcover vegetation; and
- The general abundance of potential shelter sites for Hastings River mouse was noted.

3.0 RESULTS AND DISCUSSION

3.1 SPECIES PROFILE FOR HASTINGS RIVER MOUSE

Status: EPBC Act: Endangered; NC Act: Endangered.

Distribution: Hastings River Mouse is patchily distributed from far south-eastern Queensland to near Muswellbrook in New South Wales. It was first recorded in Queensland in 1969, having been thought to be extinct (Townley 2008) and was not recorded between 1971 and 1993, when it was trapped near the original location. The Gambubal section of Main Range National Park is a stronghold for the species in Queensland and is significant at the national scale (DECC 2005; Woinarski *et al*. 2014). In 1994 the species was found at a second Queensland location, near Lamington National Park (Gynther and O'Reilly 1995, Gynther *et al.* 1996). More recently, it has been recorded at Cunningham's Gap and North Branch Creek (Ian Gynther, personal communication).

Habitat and Ecology: Hastings River Mouse inhabits open eucalypt forest at altitudes from 300-1250 m a.s.l. It shows a preference for areas with a dense groundcover of grasses, sedges or mat-rushes (*Lomandra* spp.), or shrubby heath (Pyke and Read 2002, Graham *et al.* 2005, Townley 2008). In Queensland, the species is mostly found on volcanic soils with *Eucalyptus campanulata* (Meek 2012). Important structural features include dense groundcover 10-75 cm in height and the presence of shelter sites (Woinarski *et al*. 2014). The species uses a variety of nest sites, including

holes in the ground, cavities in boulder piles, hollow logs, epiphytes at ground level and cavities in the roots of large trees (Townley 2008). Graham *et al*. (2005) described hollow logs as an important habitat feature, and rock piles and root holes also appear to be critical features (Meek 2012).

Hastings River Mouse appears to require periodic disturbance to habitat to produce mid-successional vegetation. The species' occupancy rates are known to be higher after moderate-intensity logging disturbance and to decline if habitat disturbance (e.g. from moderate-intensity logging or occasional, patchy fire) is excluded for more than 30 years (Law *et al*. 2016). This relationship appears to be mediated to some extent by competition with rats (*Rattus* and *Melomys* species), including Bush Rat, since a strong negative relationship between Hasting River Mouse occupancy and rat abundance has been demonstrated (Law *et al.* 2016).Too frequent or too infrequent fire both produce unsuitable habitat (Meek 2012); while the optimal fire regime remains uncertain the interim guidelines recommend a range of patchy fire treatments, from areas of fire exclusion to areas burned once every 8-20 years and 5-10 years (NSW DECC 2005).

Females show strong site fidelity, some using the same nest site for more than two years. Males may use several nests in a home range of up to 2 ha (Townley 2008). The species eats leaves, stems, seeds, flowers, pollen, fungi and insects (Meek 2012).

Threats: The species is threatened by predation by Cats *Felis catus* and Red Fox *Vulpes vulpes*, inappropriate fire regime (Townley 2008; Meek 2012; Woinarski *et al*. 2014), grazing (Townley 2008; Woinarski *et al*. 2014), removal of rocks, logs and dead trees (Meek 2012), inbreeding and habitat loss and fragmentation (Woinarski *et al*. 2014).

3.2 POTENTIALLY SUITABLE HABITAT MAPPING

A total of 22 historical high precision records of Hasting's River Mouse in the southern Main Range were associated with the following REs as dominant components of the surrounding vegetation:

- RE 12.8.1 (*Eucalyptus campanulata* tall open forest with shrubby to grassy understorey on Cainozoic igneous rocks): 14 records;
- RE 12.8.14 (*Eucalyptus eugenioides, E. biturbinata, E. melliodora +/- E. tereticornis, Corymbia intermedia* woodland on Cainozoic igneous rocks): 7 records; and
- RE 11.3.23 (*Eucalyptus conica, E. nobilis, E. tereticornis, Angophora floribunda* woodland on alluvial plains. Basalt derived soils): 1 record.

Many records appeared to be closely associated with ecotones between REs 12.8.1 or 12.8.14 and adjacent notophyll vine forest (i.e. rainforest), and all records were from altitudes ranging from 560 m to 1150 m a.s.l. Using Queensland Government Regional Ecosystem mapping (Version 10), potentially suitable habitat for Hasting's River Mouse within Main Range National Park and environs was mapped as including any mapping polygon in which any of REs 12.8.1, 12.8.14 or 11.3.23 were a dominant (≥50% proportion) component of the vegetation community (see **Figure 3.1**). The resulting map of potentially suitable habitat informed the selection of trapping survey sites i.e. trapping survey sites were selected to be located within potentially suitable habitat, especially where this occurred in proximity to rainforest or eucalypt forest with rainforest species dominating the understorey.

3.3 SURVEY CONDITIONS

The preliminary survey was undertaken during partly cloudy, warm and dry weather conditions. The only rainfall during the survey occurred as late evening showers of approximately 10 mm overnight on 9 November 2016. The targeted trapping surveys in May 2017 were undertaken during partly cloudy to clear conditions with relatively mild temperatures and no rainfall.

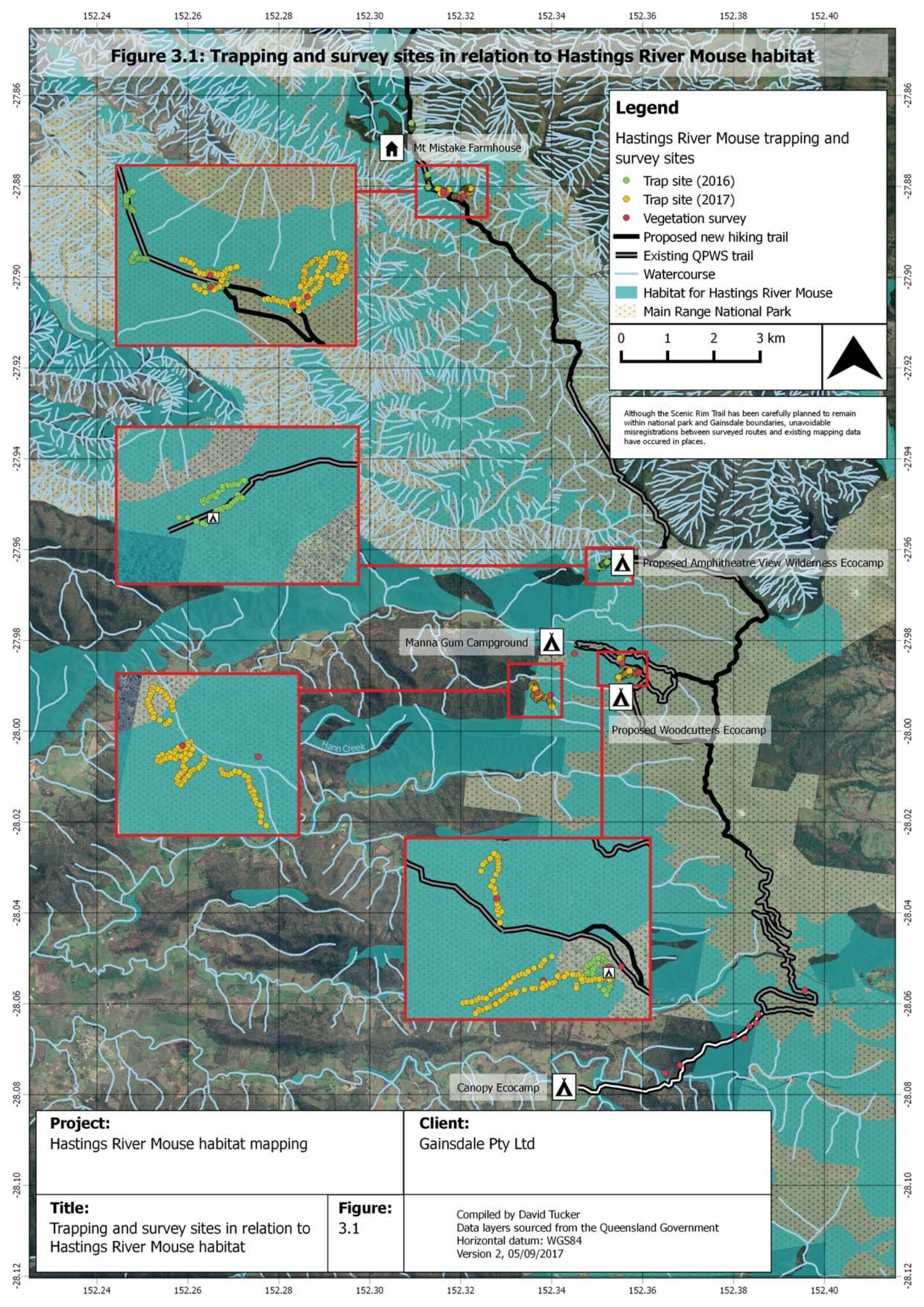
Figure 3.1: Trapping and survey sites in relation to Hastings River Mouse habitat
Legend
Hastings River Mouse trapping and survey sites
Trap site (2016)
Trap site (2017)
Vegetation survey
Proposed new hiking trail
Existing QPWS trail
Watercourse
Habitat for Hastings River Mouse
Main Range National Park
0 1 2 3 km
Although the Scenic Rim Trail has been carefully planned to remain within national park and Gainsdale boundaries, unavoidable misregistrations between surveyed routes and existing mapping data have occured in places.
Mt Mistake Farmhouse
Proposed Amphitheatre View Wilderness Ecocamp
Manna Gum Campground
Proposed Woodcutters Ecocamp
Hann Creek
Canopy Ecocamp
152.24
152.26
152.28
152.30
152.32
152.34
152.36
152.38
152.40
-27.86
-27.88
-27.90
-27.92
-27.94
-27.96
-27.98
-28.00
-28.02
-28.04
-28.06
-28.08
-28.10
-28.12
Project:
Hastings River Mouse habitat mapping
Client:
Gainsdale Pty Ltd
Title:
Trapping and survey sites in relation to Hastings River Mouse habitat
Figure:
3.1
Compiled by David Tucker
Data layers sourced from the Queensland Government
Horizontal datum: WGS84
Version 2, 05/09/2017

3.4 HASTINGS RIVER MOUSE TRAPPING SURVEY RESULTS

The locations of the 2016 and 2017 trapping surveys are shown in **Figure 3.1** in relation to the mapping of potentially suitable habitat for Hastings River Mouse. The trapping survey effort and capture results are summarised in **Table 3.1**.

Table 3.1. Summary of small-mammal trapping survey effort and results.

Section	Transect	Effort (trap-nights)	Species	Captures
8-11 November 2016				
Mt Mistake	1	40 (20x2 nights)	Brown Antechinus (*Antechinus stuartii*)	1
Mt Mistake	2	40 (20x2 nights)	Cunningham's Skink (*Egernia cunninghami*)	1
Mt Mistake	3	40 (20x2 nights)	Cunningham's Skink (*Egernia cunninghami*)	1
Mt Mistake	4	40 (20x2 nights)	Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*)	2
			Swamp Rat (*Rattus lutreolus*)	2
Mt Mistake	5	40 (20x2 nights)	Bush Rat (*Rattus fuscipes*)	2
			Cunningham's Skink (*Egernia cunninghami*)	1
Amphitheatre	1&2	100 (50x2 nights)	Bush Rat (*Rattus fuscipes*)	10
			Fawn-footed Melomys (*Melomys cervinipes*)	3
Woodcutters	1&2	100 (50x2 nights)	**Hastings River Mouse (*Pseudomys oralis*)**	**1**
			Bush Rat (*Rattus fuscipes*)	8
			Fawn-footed Melomys (*Melomys cervinipes*)	1
			Brown Antechinus (*Antechinus stuartii*)	1
15-26 May 2017				
Mt Mistake	1	75 (25x3 nights)		0
Mt Mistake	2	75 (25x3 nights)	Bush Rat (*Rattus fuscipes*)	1
Mt Mistake	3	75 (25x3 nights)	Brown Antechinus (*Antechinus stuartii*)	5
Mt Mistake	4	75 (25x3 nights)	Swamp Rat (*Rattus lutreolus*)	3
			Bush Rat (*Rattus fuscipes*)	2
Mt Mistake	5	50 (25x2 nights)	Bush Rat (*Rattus fuscipes*)	1
Mt Mistake	6	50 (25x2 nights)	Bush Rat (*Rattus fuscipes*)	1
Woodcutters (Goomburra)	1	100 (25x4 nights)	Brown Antechinus (*Antechinus stuartii*)	11
			Bush Rat (*Rattus fuscipes*)	8
Woodcutters	2	100 (25x4 nights)	Brown Antechinus (*Antechinus stuartii*)	2
Woodcutters	3	100 (25x4 nights)	Brown Antechinus (*Antechinus stuartii*)	6
			Swamp Rat (*Rattus lutreolus*)	3
			Bush Rat (*Rattus fuscipes*)	1
			Fawn-footed Melomys (*Melomys cervinipes*)	1
Woodcutters	4	100 (25x4 nights)	**Hastings River Mouse (*Pseudomys oralis*)**	**1**
			Brown Antechinus (*Antechinus stuartii*)	1
			Swamp Rat (*Rattus lutreolus*)	1
			Bush Rat (*Rattus fuscipes*)	1
			Fawn-footed Melomys (*Melomys cervinipes*)	2
S valley (Goomburra)	1	75 (25x3 nights)	Brown Antechinus (*Antechinus stuartii*)	1
			Yellow-footed Antechinus (*Antechinus flavipes*)	1
S valley	2	75 (25x3 nights)	Brown Antechinus (*Antechinus stuartii*)	3
			Bush Rat (*Rattus fuscipes*)	1
S valley	3	75 (25x3 nights)		0
S valley	4	75 (25x3 nights)	Bush Rat (*Rattus fuscipes*)	1
Total effort by site				
Mt Mistake		560		
Amphitheatre		100		
Woodcutters		500		
S valley		300		
Total		**1460**		

Hastings River Mouse was captured at a single site, in the vicinity of the proposed Woodcutters accommodation camp, where a single individual was trapped on the second night of the 2016 survey at a position approximately 30 m upslope of the western boundary of the proposed ecocamp

at an elevation of 935 m, and a single individual was trapped on the third night of the 2017 survey at a position close to Dalrymple Creek 480 m to the north-west of Woodcutters ecocamp at an elevation of 708 m (see **Figure 3.2** for locations). The overall trapping success rate for Hastings River Mouse at Woodcutters was 0.4% during 500 trap-nights of survey effort, comparable to the trapping success rate of 0.8% recorded on the Lamington Plateau (Gynther 1996). Despite the considerable trapping effort (560 trap nights) in the relatively limited extent of suitable habitat in proximity to a proposed new section of hiking trail at Mt Mistake, no Hastings River Mouse was trapped.

The vegetation community of the first Hastings River Mouse capture was RE 12.8.1 (20-35 m tall canopy tree layer dominated by *Eucalyptus campanulata* with *E. saligna* associated). The groundcover vegetation was dense (90% vegetation cover), relatively tall (average height of vegetation ± 1 standard deviation: 43±25 cm) and dominated by the mat-rush *Lomandra longifolia* (36% cover), *Poa labillardierei* (14%) and *Imperata cylindrica* (6%) (see **Photo 3.1**). The vegetation community of the second Hastings River Mouse capture was RE 12.8.14 (20-35 m tall canopy tree layer dominated by *Eucalyptus campanulata* and *E. eugenioides* with *E. saligna, E. biturbinata* and *Lophostemon confertus* associated). The groundcover vegetation was dense (89% vegetation cover), relatively tall (average height of vegetation: 34±27 cm) and dominated by *Poa labillardierei* (20% cover) and *Lomandra longifolia* (10%) (see **Photo 3.2**).

Photo 3.1. Habitat at the Hastings River Mouse capture location 30 m upslope of the Woodcutters ecocamp site.

Photo 3.2. Habitat at the Hastings River Mouse capture location 480 m downslope to the north-west of the Woodcutters ecocamp site.

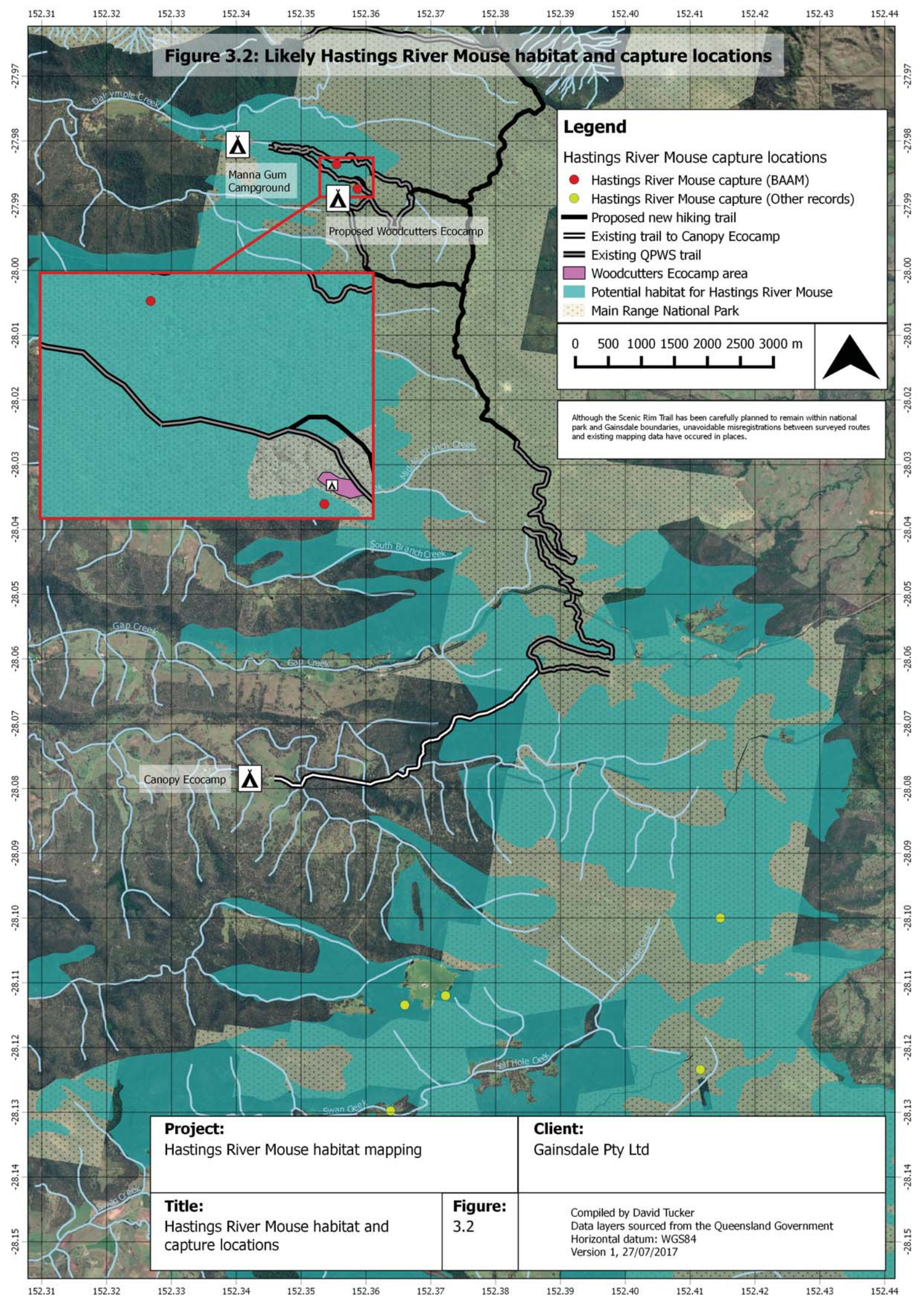
Figure 3.2: Likely Hastings River Mouse habitat and capture locations
Legend
Hastings River Mouse capture locations
Hastings River Mouse capture (BAAM)
Hastings River Mouse capture (Other records)
Proposed new hiking trail
Existing trail to Canopy Ecocamp
Existing QPWS trail
Woodcutters Ecocamp area
Potential habitat for Hastings River Mouse
Main Range National Park
0 500 1000 1500 2000 2500 3000 m
Although the Scenic Rim Trail has been carefully planned to remain within national park and Gainsdale boundaries, unavoidable misregistrations between surveyed routes and existing mapping data have occured in places.
Manna Gum Campground
Proposed Woodcutters Ecocamp
Canopy Ecocamp
Dalrymple Creek
South Branch Creek
Gap Creek
Swan Creek
Project:
Hastings River Mouse habitat mapping
Client:
Gainsdale Pty Ltd
Title:
Hastings River Mouse habitat and capture locations
Figure:
3.2
Compiled by David Tucker
Data layers sourced from the Queensland Government
Horizontal datum: WGS84
Version 1, 27/07/2017

Figure 3.3 plots the average height of groundcover vegetation and either: (a) overall percentage cover of groundcover vegetation; or (b) percentage cover of mat-rush or tussock grass species (*Lomandra, Poa, Sarga* spp. that Hastings River Mouse is known to be associated with) at the various detailed habitat assessment sites (see **Appendix A** for further site details). Vegetation structure at the two sites at which Hastings River Mouse was captured (filled squares in **Figure 3.3**) was similar to vegetation structure at many of the sites assessed, confirming the general suitability of many areas for Hastings River Mouse (see further details in **Section 3.5** below).

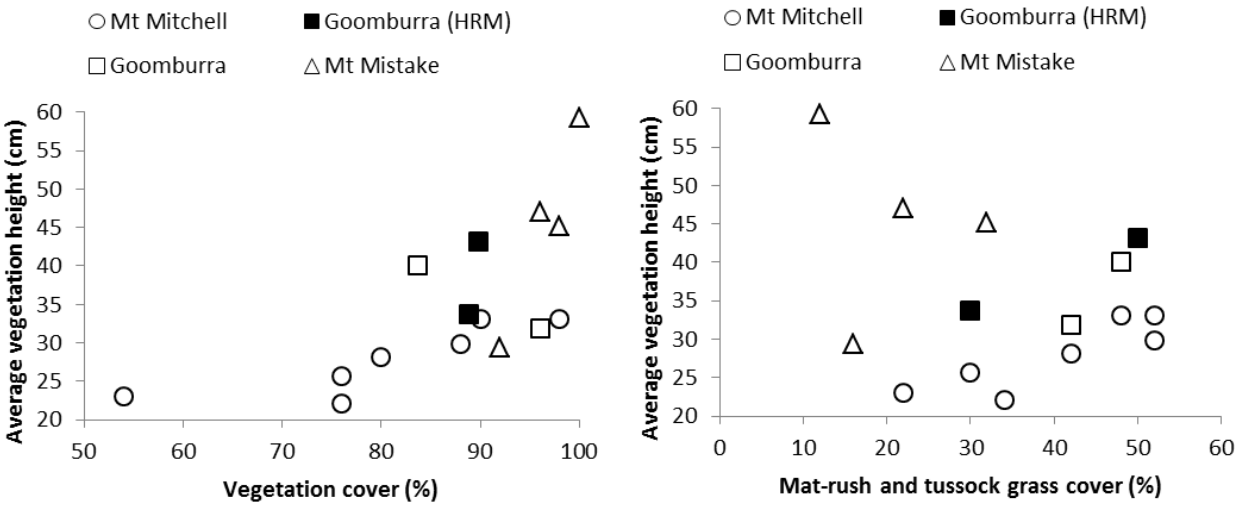

Figure 3.3. Plots of the average height of groundcover vegetation and either: overall percentage cover of groundcover vegetation (left); or percentage cover of mat-rush or tussock grass species (*Lomandra, Poa, Sarga* spp.) (right) at habitat assessment sites; filled symbols are sites where Hastings River Mouse was captured.

The trapping of Hastings River Mouse in the Dalrymple Creek valley extends the known northern limit of the species' distribution by approximately 3 km; previously, the northern-most record of the species was from North Branch Creek (Ian Gynther, personal communication; see **Figure 3.2** for the location of other records). Since there is no record of Hastings River Mouse north of Dalrymple Creek, the mapping of habitat for this species is limited to areas south of Dalrymple Creek (**Figure 3.2**).

3.5 HABITAT ASSESSMENT

3.5.1 Mt Mistake section

Potentially suitable habitat for Hasting River Mouse is widespread in the northern portion of Main Range National Park at Mt Mistake in the form of vegetation communities dominated by RE 12.8.14. However, much of this habitat is characterised by an only moderately dense to relatively sparse groundcover dominated by the grasses *Themeda triandra* and *Imperata cylindrica*, with mat-rushes (*Lomandra* spp.) sparse or absent (**Photos 3.3** and **3.4**); these areas were assessed during the preliminary survey as likely to be marginal habitat for Hastings River Mouse. However, portions of RE 12.8.14 on the eastern slopes of the range in the vicinity of the start of the new trail section from the southern end of the fire-trail were assessed as providing suitable habitat for Hastings River Mouse (**Photos 3.5** and **3.6**); therefore the targeted trapping during the 2017 survey focussed the trapping effort in the relatively limited extent of this more suitable habitat. The western slopes of the range had also burned in late November 2016, rendering this habitat largely unsuitable for Hastings River Mouse at the time of the second survey in May 2017.

While the proposed hiking trail on the freehold properties (Lots 144/CC761, 209/CC761 and 180/CC1945) to the north of the national park passes through RE 12.8.14 along the escarpment edge, the long history of livestock grazing means that there is insufficient ground cover for Hastings River Mouse in these areas (**Photos 3.7** and **3.8**).

Photo 3.3. RE 12.8.14 on steep western slopes in Mt Mistake portion of Main Range National Park with relatively sparse groundcover dominated by *Themeda triandra*, with minimal shelter sites; marginal habitat for Hastings River Mouse.

Photo 3.4. RE 12.8.14 on ridge top in Mt Mistake portion of Main Range National Park with moderately dense groundcover dominated by *Themeda triandra,* with minimal shelter sites; marginal habitat for Hastings River Mouse.

Photo 3.5. RE 12.8.14 close to rainforest in Mt Mistake portion of Main Range National Park with diverse, dense groundcover dominated by *Poa labillardieri* grass with patchy mat-rush *Lomandra longifolia* and moderately abundant shelter sites; suitable habitat for Hastings River Mouse.

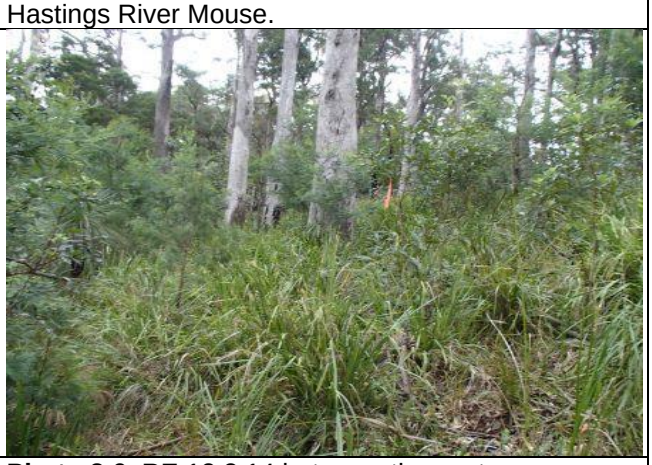

Photo 3.6. RE 12.8.14 between the eastern escarpment cliffs and rainforest in Mt Mistake portion of Main Range National Park with diverse, dense groundcover dominated by the mat-rush *Lomandra longifolia* and abundant shelter sites; suitable habitat for Hastings River Mouse.

Photo 3.7. RE 12.8.14 on private grazing property north of Main Range National Park with closely-cropped groundcover and minimal shelter sites; unsuitable habitat for Hastings River Mouse.

Photo 3.8. RE 12.8.14 on private grazing property north of Main Range National Park with closely-cropped groundcover and minimal shelter sites; unsuitable habitat for Hastings River Mouse.

3.5.2 Amphitheatre ecocamp

Potentially suitable habitat for Hasting River Mouse in the vicinity of the proposed ecocamp at the Amphitheatre occurs as a mixture of REs 12.8.1 and 12.8.14. While suitable shelter sites were abundant, the groundcover in this area is dominated either by *Doodia aspera* fern (southern side) or *Xanthorrhoea glauca* grasstree (northern side), with relatively sparse cover of the grass and mat-rush species preferred by Hastings River Mouse (**Photos 3.9** and **3.10**). Furthermore, native rats (*Rattus* and *Melomys* species) were relatively abundant at this site (see **Table 3.1**). Therefore, habitat at the Amphitheatre ecocamp site was assessed as unsuitable for Hastings River Mouse.

Photo 3.9. Southern slope at the proposed Amphitheatre ecocamp with dense groundcover of *Doodia aspera* fern but sparse grass and mat-rush cover; unsuitable habitat for Hastings River Mouse.

Photo 3.10. Northern slope at the proposed Amphitheatre ecocamp with sparse groundcover dominated by *Xanthorrhoea glauca* grasstree; unsuitable habitat for Hastings River Mouse.

3.5.3 Woodcutters ecocamp (Goomburra)

Potentially suitable habitat for Hasting River Mouse in the vicinity of the proposed ecocamp at Woodcutters occurs as a mixture of REs 12.8.1 and 12.8.14, with rainforest in close proximity. The groundcover vegetation on the mountain slopes to the north and west of the ecocamp is relatively tall and dense understorey is dominated by the mat-rush *Lomandra longifolia* (30-40%) and the grasses *Poa labillardierei* (14-16%) and *Imperata cylindrica* (6%) (**Photo 3.11**). The grassy groundcover vegetation on the lower slopes to the north-east of the ecocamp tends to be sparser and less dominated by mat-rush (**Photo 3.12**). Potential shelter sites are relatively abundant throughout and include abundant large hollow-bearing logs and rock outcroppings on the steep slopes.

Photo 3.11. Upper mountain slopes to the west and north of Woodcutters ecocamp with relatively tall, dense groundcover dominated by the mat-rush *Lomandra longifolia*; known habitat for Hastings River Mouse.

Photo 3.12. Lower mountain slopes to the north-east of Woodcutters ecocamp with grassy, more open groundcover with scattered mat-rush *Lomandra longifolia*; known habitat for Hastings River Mouse.

The proposed pad area for the ecocamp itself, which corresponds to the historically levelled ground around the old woodcutters hut, is not suitable habitat for the species, since the groundcover has minimal grass and mat-rush cover and is dominated by ferns and native raspberry shrubs, with numerous species of rainforest tree saplings becoming established in the shrub and sapling layers (**Photos 3.13** to **3.16**). The rainforest ecotone habitat that fringes the ecocamp site on the northern, eastern and southern boundaries is similarly not suitable habitat for the species due to the absence of mat-rush or grassy groundcover and the dominance of Lantana, ferns, native raspberry or a variety of rainforest trees; while the vegetation community of these areas corresponds to an ecotone between RE 12.8.1 and RE 12.8.4 (complex notophyll vine forest with *Araucaria* spp.), they were ground-truthed as unsuitable for Hastings River Mouse (**Figure 3.2**). Therefore the ecocamp location is at the edge of Hastings River Mouse habitat in the local area and construction of the proposed ecocamp will not fragment the species' habitat.

Photo 3.13. Old loggers hut on historically-levelled ground in the centre of the Woodcutters ecocamp site (looking north-west), showing sparse groundcover.

Photo 3.14. Southern end of the Woodcutters ecocamp site (looking south), showing groundcover dominated by ferns and native raspberry.

Photo 3.15. Northern end of the Woodcutters ecocamp site (looking north), showing groundcover dominated by ferns.

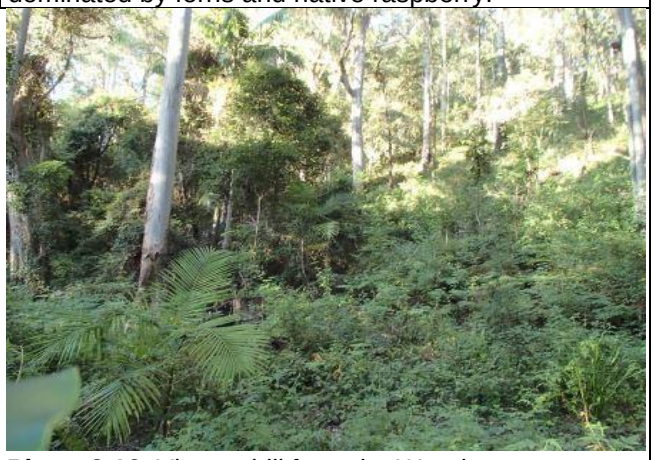

Photo 3.16. View uphill from the Woodcutters ecocamp site along the ecotone between rainforest understorey (foreground and top left, unsuitable for Hastings River Mouse) and mat-rush understorey (top right, suitable for Hastings River Mouse).

3.5.4 Southern valley (Goomburra)

While no Hastings River Mouse was trapped in the next valley to the south of the Dalrymple Creek valley, habitats in the valley were assessed as being suitable for Hastings River Mouse (**Figure 3.3, Appendix A**), and likely provide a link between Hastings River Mouse records in the Dalrymple Creek valley (this study) and a record of Hastings River Mouse from a tributary of North Branch Creek further to the south (see **Figure 3.2**).

3.5.5 Mt Mitchell section

Habitats in the Mt Mitchell section of the proposed hiking trail were assessed as generally suitable for Hastings River Mouse, having good cover of the two tussock grass species *Poa labillardierei* and *Sarga leiocladum*, despite the mat-rush *Lomandra longifolia* being relatively sparse (**Figure 3.3, Appendix A**). The Mt Mitchell section has not been subject to trapping surveys targeting Hastings River Mouse, with the exception of a recent trapping survey in grassy eucalypt woodland habitat corresponding to RE 11.8.8 (*Eucalyptus albens, E. crebra* woodland on Cainozoic igneous rocks) in close proximity to the Main Range National Park ranger station located on the southern edge of the Cunningham Highway west of Cunningham's Gap. This survey found Hastings River Mouse to be present at the highest density recorded in Queensland to date, with individuals trapped in close proximity to the ranger station buildings. The abundant availability of refuge sites (rock walls, buildings) and relatively high frequency of disturbance from burning the perimeter of the ranger station for asset protected from wildfire may provide particularly suitable habitat for the species at this site (Ian Gynther, personal communication).

3.5.6 Overview of habitat availability

Potentially suitable habitat for Hastings River Mouse corresponding to REs 12.8.1, 12.8.14 and 11.3.23 is widely available in close association with rainforest (REs 12.8.4, 12.8.5) throughout the southern Main Range (see **Figures 3.1** and **3.2**). Based on the habitat mapping shown in **Figure 3.2**, there are 31,676 ha of habitat for Hastings River Mouse along the southern Main Range between Dalrymple Creek in the north and the New South Wales border in the south, including 14,300 ha within Main Range National Park. Widely scattered records of Hastings River Mouse throughout the southern Main Range (south from the Dalrymple Creek valley to the NSW border) confirm occupancy of these habitats by Hastings River Mouse. In the context of the apparently large areas of Hastings River Mouse habitat in the southern Main Range, any minor indirect impacts of the construction and operation of the Woodcutters ecocamp are likely to be negligible.

3.6 EXTENT, NATURE, AND SEVERITY OF CURRENT THREATS

No current threats to Hastings River Mouse were detected in the areas of known habitat for the species in Main Range National Park. No evidence of feral cats, red foxes or introduced rodent species were detected during the various surveys, the habitat is protected from grazing and appropriate fire regimes are implemented as part of the management of the ecological values of Main Range National Park.

4.0 REFERENCES

Graham, K., Blackwell, G. and Hochuli, D. (2005). Habitat use by the Hastings River Mouse, *Pseudomys oralis*. *Australian Zoologist* 33: 100-107.

Gynther I.C. and O'Reilly P.S. (1995). A new locality for the Hastings River Mouse, *Pseudomys oralis*, in southeast Queensland. *Memoirs of the Queensland Museum* 38: 513-518.

Gynther I., Townley, S. and O'Reilly P. (1996). New records of the Hastings River Mouse *Pseudomys oralis* from the Lamington Plateau, South-east Qld. *Australian Mammal Society Newsletter* November 1996: Pp. 30.

Law, B., Brassil, T. and Gonsalves, L. (2016). Recent decline of an endangered, endemic rodent: does exclusion of disturbance play a role for Hastings River Mouse (*Pseudomys oralis*)? *Wildlife Research* 43: 482-491.

Meek, P. (2012). 'Hastings River Mouse,' In *Queensland's threatened animals*. (eds.) L.K. Curtis, A.J. Dennis, K.R. McDonald, P.M. Kyne & S.J.S. Debus, CSIRO Publishing, Collingwood. pp. 406-407.

NSW DECC (2005). Recovery Plan for the Hastings River Mouse (*Pseudomys oralis*), department of Environment and Climate Change (NSW), Hurstville.

Pyke, G.H. and Read, D.G. (2002). Hastings River Mouse *Pseudomys oralis*: a biological review. *Australian Mammalogy* 24: 151-176.

Townley, S. (2008). 'Hastings River Mouse *Pseudomys oralis*,' In *The mammals of Australia*. Third Edition. (eds.) S. Van Dyck, & R. Strahan, Reed New Holland, Sydney. pp. 646-647.

Woinarski, J.C.Z., Burbidge, A.A. and Harrison, P.L. (2014). The action plan for Australian mammals 2012. CSIRO Publishing, Collingwood.

APPENDIX A

Habitat assessment site data

Appendix A Habitat Assessment Site Data

Table A.1: Summary of vegetation communities and habitat structure at detailed and rapid habitat assessment sites.

Site: HA1 Mt Mitchell (SG1) 28.062347 S 152.387422 E	**Representative photograph**
Canopy (T1): Height range 15-25m; Median height 22m; Cover: 70% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus biturbinata* (64%); *E. eugenioides* (38%); *E. quadrangulata* **Sub-canopy (T2):** Height range 7-14m; Median height 10m; Cover: 40% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (44%); **Sub-canopy (T3):** Height range 3-6m; Median height 5m; Cover: 10% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (13%); *Acacia melanoxylon* (13%); *Acacia irrorata* (4%); *Xanthorrhoea glauca* (4%); *Eucalyptus* saplings (1%); **Shrub (S1):** Height range 1-2m; Median height 2m; Cover: 50% Dominant species and % cover along 50m tape (where relevant): *Xanthorrhoea glauca* (21%); *Allocasuarina torulosa* (1%); *Eucalyptus* saplings (4%); *Ageratina adenophora** (<1%); *Pittosporum undulatum; Polyscias elegans; Psychotria loniceroides; Acacia melanoxylon* **Groundcover:** Height range 0-1m; Mean height 0.3m; Cover: 80% Dominant species: *Poa labillardierei* (30%), *Themeda triandra* (12%), *Sarga leiocladum* (12%), *Imperata cylindrica* (10%). **Notes**: Shelter sites include rock outcroppings within several hundred metres and relatively sparse large fallen logs.	
Site: HA2 Mt Mitchell (SG2) 28.064244 S 152.386921 E	**Representative photograph**
Canopy (T1): Height range 20-25m; Median height 24m; Cover: 80% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus eugenioides* (57%); *E. biturbinata* (39%); *E. quadrangulata* (12%). **Sub-canopy (T2):** Height range 5-10m; Median height 8m; Cover: 40% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (57%); *Eucalyptus biturbinata; Lophostemon confertus.* **Shrub (S1):** Height range 1-4m; Median height 3m; Cover: 50% Dominant species and % cover along 50m tape (where relevant): *Xanthorrhoea glauca* (12%); *Allocasuarina torulosa* (3%); *Myrsine sp.* (2%). **Groundcover:** Height range 0-0.5m; Mean height 0.2m; Cover: 76% Dominant species: *Poa labillardierei* (34%), *Themeda triandra* (24%). **Notes**: Shelter sites include rock outcroppings within several hundred metres and relatively sparse large fallen logs.	

Site: HA3 Mt Mitchell (SG3) 28.064995 S 152.385476 E	**Representative photograph**
Canopy (T1): Height range 15-19m; Median height 16m; Cover: 40% Dominant species and cover along 50m tape (where relevant): *Eucalyptus biturbinata* (33%); *E. eugenioides* (12%); *E. melliodora* (6%); *Angophora floribunda* **Sub-canopy (T2):** Height range 9-12m; Median height 10m; Cover: 40% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (35%) **Sub-canopy (T3):** Height range 3-5m; Median height 4m; Cover: 10% Dominant species and % cover along 50m tape (where relevant): *Exocarpos cupressiformis* (4%); *Angophora floribunda* (1%); *Eucalyptus biturbinata* (2%); *Allocasuarina torulosa; Acacia melanoxylon; Eucalyptus* saplings. **Shrub (S1):** Height range 1-2m; Median height 2m; Cover: 30% Dominant species and % cover along 50m tape (where relevant): *Xanthorrhoea glauca* (7%); *Allocasuarina torulosa* (4%); *Acacia melanoxylon* **Groundcover:** Height range 0-1m; Mean height 0.3m; Cover: 90% Dominant species: *Themeda triandra* (28%), *Poa labillardierei* (26%), *Sarga leiocladum* (22%). **Notes**: Shelter sites include nearby rock outcroppings on steep slopes and sparse large fallen logs.	
Site: HA4 Mt Mitchell (SG4) 28.073538 S 152.37023 E	**Representative photograph**
Canopy (T1): Height range 15-25m; Median height 25m; Cover: 90% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus eugenioides* (96%); *E. biturbinata* (11%) **Sub-canopy (T2):** Height range 5-10m; Median height 8m; Cover: 40% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (50%); *Acacia irrorata; Lophostemon confertus.* **Shrub (S1):** Height range 1-3m; Median height 2m; Cover: 30% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (3%); *Lophostemon confertus* (3%); *Lantana camara** (3%); *Acacia melanoxylon.* **Groundcover:** Height range 0-0.5m; Mean height 0.2m; Cover: 54% Dominant species: *Poa labillardierei* (22%), *Imperata cylindrica* (16%). **Notes**: Shelter sites include relatively sparse large fallen logs and nearby small surface rock piles.	
Site: HA5 Mt Mitchell (SG5) 28.066945 S 152.38213 E	**Representative photograph**
Canopy (T1): Height range 20-30m; Median height 25m; Cover: 90% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus biturbinata* (48%); *E. eugenioides* (26%); *E. melliodora* (14%). **Sub-canopy (T2):** Height range 5-12m; Median height 10m; Cover: 50% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (69%); *Angophora floribunda* (12%); *Eucalyptus biturbinata* (2%); *Exocarpos cupressiformis*; *Acacia melanoxylon* . **Shrub (S1):** Height range 1-3m; Median height 2m; Cover: 10% Dominant species and % cover along 50m tape (where relevant): *Xanthorrhoea glauca* (3%); *Allocasuarina torulosa* (2%); *Acacia melanoxylon* (<1%); *Exocarpos cupressiformis.* **Groundcover:** Height range 0-1m; Mean height 0.3m; Cover: 76% Dominant species: *Themeda triandra* (40%), *Poa labillardierei* (16%), *Sarga leiocladum* (14%). **Notes**: Shelter sites include relatively sparse large fallen logs.	

Site: HA6 Mt Mitchell (SG6) 28.067733 S 152.38447 E	**Representative photograph**
Canopy (T1): Height range 20-30m; Median height 26m; Cover: 85% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus melliodora* (28%); *E. eugenioides* (12%); *E. biturbinata* (8%); *Angophora floribunda; Lophostemon confertus.* **Sub-canopy (T2):** Height range 7-15m; Median height 9m; Cover: 50% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (38%); *Acacia irrorata* (14%); *Angophora floribunda* (12%); *Eucalyptus biturbinata; Acacia melanoxylon.* **Shrub (S1):** Height range 1-3m; Median height 2m; Cover: 20% Dominant species and % cover along 50m tape (where relevant): *Lantana camara** (1%); *Ageratina adenophora** (<1%); *Harpullia pendula* (2%); *Eucalyptus s*aplings*; Allocasuarina torulosa; Xanthorrhoea glauca.* **Groundcover:** Height range 0-1m; Mean height 0.3m; Cover: 98% Dominant species: *Poa labillardierei* (36%), *Themeda triandra* (18%), *Sarga leiocladum* (12%). **Notes**: Shelter sites include relatively sparse large fallen logs.	
Site: HA7 Mt Mitchell (SG7) 28.069686 S 152.377556 E	**Representative photograph**
Canopy (T1): Height range 20-25m; Median height 25m; Cover: 60% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus melliodora* (42%); *E. eugenioides* (24%); *E. biturbinata.* **Sub-canopy (T2):** Height range 6-15m; Median height 10m; Cover: 60% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (5%); *Lophostemon confertus* (2%); *Angophora floribunda* (10%); *Eucalyptus biturbinata* (2%); *Acacia melanoxylon* (2%); *Harpullia pendula; Exocarpos cupressiformis.* **Shrub (S1):** Height range 1-2m; Median height 1m; Cover: 20% Dominant species and % cover along 50m tape (where relevant): *Lantana camara** (1%); *Eucalyptus s*aplings*; Allocasuarina torulosa; Xanthorrhoea glauca.* **Groundcover:** Height range 0-1m; Mean height 0.3m; Cover: 88% Dominant species: *Sarga leiocladum* (34%), *Themeda triandra* (20%), *Poa labillardierei* (18%). **Notes**: Shelter sites include relatively sparse large fallen logs.	

Site: Q01 Mt Mitchell 28.057025 S 152.397627 E	Representative photograph
Canopy (T1): Height range 15-25m; Median height 20m; Cover: 50% Dominant species: *Eucalyptus biturbinata* (d), *Eucalyptus quadrangulata* (sd). **Sub-canopy (T2):** Height range 4-12m; Median height 9m; Cover: 60% Dominant species: *Allocasuarina torulosa* (d), *Lophostemon confertus; Eucalyptus quadrangulata; Xanthorrhoea glauca; Acacia melanoxylon.* **Shrub (S1):** Height range 1-3m; Median height 2m; Cover: 20% Dominant species: *Xanthorrhoea glauca* (d), *Allocasuarina torulosa; Polyscias elegans; Cissus hypoglauca; Pimelea neo-anglica.* **Groundcover:** Height range 0-1m; Median height 0.2m; Cover: 10% on recently burned side of trail; 80% on unburned side of trail. Dominant species: *Poa labillardierei* (d), *Themeda triandra, Imperata cylindrica, Hibbertia scandens, Pimelea neo-anglica.* **Notes**: Shelter sites include nearby rock outcroppings on the escarpment and relatively sparse large fallen logs.	 

Site: Q02 Mt Mitchell 28.075323 S 152.366927 E	**Representative photograph**
Canopy (T1): Height range 15-25m; Median height 20m; Cover: 70% Dominant species: *Eucalyptus nobilis* (d); *E. tereticornis.* **Sub-canopy (T2):** Height range 6-12m; Median height 8m; Cover: 20% Dominant species: *Angophora floribunda* (d), *Eucalyptus nobilis, Eucalyptus tereticornis.* **Shrub (S1):** Height range 1-2m; Median height 1m; Cover: 20% Dominant species: *Eucalyptus* saplings; *Bursaria spinosa.* **Groundcover:** Height range 0-0.5m; Mean height 0.2m; Cover: 95% Dominant species: *Poa labillardierei, Themeda triandra, Imperata cylindrica, Cymbopogon refractus, Aristida* spp. **Notes**: Shelter sites restricted to sparse large fallen logs.	
Site: Q03 Woodcutters Ecocamp site 27.987007 S 152.360869 E	**Representative photograph**
Canopy (T1): Height range 20-35m; Median height 30m; Cover: 80% Dominant species: *Eucalyptus saligna; Eucalyptus campanulata.* **Sub-canopy (T2):** Height range 3-15m; Median height 10m; Cover: 40% Dominant species: *Acacia maidenii; Polyscias elegans; Ficus sp.; Archontophoenix cunninghamiana; Neolitsea australiensis; Eucalyptus saligna; Eucalyptus campanulata; Allocasuarina torulosa; Cryptocarya obovata; Diospyros australis; Pennantia cunninghamii; Litsea reticulata.* **Shrub (S1):** Height range 1-3m; Median height 1.5m; Cover: 30% Dominant species: *Lantana camara*; Archontophoenix cunninghamiana; Polyscias elegans; Eupomatia laurina*; *Melicope hayesii; Neolitsea dealbata; Guioa semiglauca; Psychotria loniceroides.* **Groundcover:** Height range 0-1m; Median height 0.5m; Cover: 80% Dominant species: *Pteridium esculentum, Rubus rosifolius, Doodia aspera, Lomandra longifolia, Cissus antarctica, Cissus hypoglauca, Dianella caerulea, Marsdenia rostrata, Austrosteenisia glabristyla, Pimelea neo-angelica, Breynia oblongifolia, Dichondra repens, Desmodium gunnii, Stephania japonica, Smilax australis, Hydrocotyl laxifolia, Rubus moluccanus.* **Notes**: Shelter sites include abundant large fallen logs and historical woodcutters shack.	
Site: Q04 Woodcutters (E of ecocamp site) 27.986999 S 152.361251 E	**Representative photograph**
Canopy (T1): Height range 20-40m; Median height 30m; Cover: 70% Dominant species: *Eucalyptus saligna, Eucalyptus campanulata.* **Sub-canopy (T2):** Height range 3-15m; Median height 10m; Cover: 30% Dominant species: *Acacia maidenii; Polyscias elegans; Ficus sp.; Archontophoenix cunninghamiana; Homalanthus nutans; Ficus coronata; Dendrocnide excelsa; Cyathea spp.; Trema tomentosa; Gossia hillii* **Shrub (S1):** Height range 1.5-3m; Median height 2m; Cover: 90% Dominant species: *Lantana camara** **Groundcover:** Height range 0-1.5m; Median height 1m; Cover: 10% Dominant species: *Pteridium esculentum, Rubus rosifolius, Doodia aspera, Rubus moluccanus.* **Notes**: Shelter sites include abundant large fallen logs.	

Site: T1HA Woodcutters (GB1) 27.987383 S 152.36069 E	**Representative photograph**
Canopy (T1): Height range 20-35m; Median height 30m; Cover: 80% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus campanulata* (100%); *Eucalyptus saligna.* **Sub-canopy (T2):** Height range 5-10m; Median height 6m; Cover: 5% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (3%); *Polyscias sambucifolia* (1%); *Acacia maidenii; Eucalyptus* saplings. **Shrub (S1):** Height range 1-2m; Median height 1m; Cover: 20% Dominant species and % cover along 50m tape (where relevant): *Lantana camara** (1%), *Eucalyptus* saplings*, Allocasuarina torulosa, Xanthorrhoea glauca* **Groundcover:** Height range 0-1m; Median height 0.4m; Cover: 90% Dominant species: *Lomandra longifolia* (36%), *Poa labillardierei* (14%), *Imperata cylindrica* (6%). **Notes**: Shelter sites include abundant large fallen logs. **Hastings River Mouse capture location (11/11/2016)**.	
Site: T2HA Woodcutters (GB2) 27.991603 S 152.338865 E	**Representative photograph**
Canopy (T1): Height range 20-35m; Median height 30m; Cover: 90% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus campanulata* (44%); *E. saligna* (23%); *E. eugenioides* **Sub-canopy (T2):** Height range 6-12m; Median height 10m; Cover: 40% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (25%); *Eucalyptus eugenioides* (6%); *Eucalyptus* saplings; *Acacia melanoxylon* (10%); *Exocarpos cupressiformis* (8%); *Myrsine variabilis; Platycerium bifurcatum; Asplenium australasicum.* **Shrub (S1):** Height range 1.5-5m; Median height 5m; Cover: 5% Dominant species and % cover along 50m tape (where relevant): *Xanthorrhoea glauca* (4%); *Acacia melanoxylon* (2%); *Myrsine variabilis; Polyscias sambucifolia; Polyscias elegans.* **Groundcover:** Height range 0-1m; Median height 0.4m; Cover: 84% Dominant species: *Lomandra longifolia* (32%), *Poa labillardierei* (16%), *Imperata cylindrica* (6%). **Notes**: Shelter sites include scattered large fallen logs and nearby rock outcroppings in gullies.	
Site: T4HA Woodcutters (GB3) 27.98493 S 152.357445 E	**Representative photograph**
Canopy (T1): Height range 15-25m; Median height 20m; Cover: 90% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus campanulata* (48%); *E. eugenioides* (28%); *E. saligna* (26%); *E. biturbinata*; *Lophostemon confertus.* **Sub-canopy (T2):** Height range 6-12m; Median height 10m; Cover: 60% Dominant species and cover along 50m tape (where relevant): *Allocasuarina torulosa* (34%); *Lophostemon confertus* (25%). **Shrub (S1):** Height range 1.5-5m; Median height 2m; Cover: 10% Dominant species and cover along 50m tape (where relevant): *Xanthorrhoea glauca* (4%); *Lophostemon confertus* (3%); *Myrsine variablis* (3%); *Lantana camara**. **Groundcover:** Height range 0-1m; Median height 0.3m; Cover: 89% Dominant species: *Poa labillardierei* (20%), *Lomandra longifolia* (10%), *Cissus antarctica* (8%). **Notes**: Shelter sites include scattered large fallen logs and small surface rock outcroppings. **Hastings River Mouse capture nearby at 27.983582 S 152.357442 E approximately 30m upslope of Dalrymple Creek on 25/5/2017**.	

Site: Q01 Goomburra 27.982907 S 152.347001 E	**Representative photograph**
Canopy (T1): Height range 15-20m; Median height 18m; Cover: 75% Dominant species: *Eucalyptus eugenioides* (cd), *E. nobilis* (cd), *E. biturbinata, E. campanulata, Angophora floribunda* **Sub-canopy (T2):** Height range 3-8m; Median height 6m; Cover: 40% Dominant species: *Allocasuarina torulosa* (d), *Acacia maidenii, Acacia irrorata, Exocarpos cupressiformis* **Shrub (S1):** Height range 1-3m; Median height 1.5m; Cover: 10% Dominant species: *Allocasuarina torulosa* (d), *Acacia maidenii, Eucalyptus* saplings, *Xanthorrhoea glauca, Brachychiton populneus, Breynia oblongifolia.* **Groundcover:** Height range 0-1m; Median height 0.3m; Cover: 75% Dominant species: *Themeda* triandra (d), *Pteridium esculentum, Pimelea neo-angelica, Glycine tomentella, Dichondra repens, Desmodium gunnii, Plectranthus parviflorus, Lomandra multiflora, Gahnia aspera, Commelina diffusa, Asperula conferta, Lobelia purpurascens, Eustrephus latifolius.* **Notes**: Shelter sites restricted to scattered large fallen logs.	
Site: Q02 Goomburra southern valley 27.99204 S 152.341817 E	**Representative photograph**
Canopy (T1): Height range 20-45m; Median height 35; Cover: 80% Dominant species: *Eucalyptus saligna* (cd), *Lophostemon confertus* (cd), *E. biturbinata.* **Sub-canopy (T2):** Height range 5-18m; Median height 10m; Cover: 60% Dominant species: *Allocasuarina torulosa* (d), *Acacia irrorata, Angophora floribunda* **Shrub (S1):** Height range 1-4m; Median height 3m; Cover: 10% Dominant species: *Acacia maidenii, Polyscias elegans, Acacia irrorata, Pittosporum undulatum, Alectryon subcinereus, Myrsine variabilis, Pittosporum revolutum.* **Groundcover:** Height range 0-1m; Median height 0.5m; Cover: 95% Dominant species: *Doodia aspera* (cd), *Adiantum atroviride* (cd), *Poa labillardierei* (cd), *Lomandra longifolia, Themeda triandra, Cissus antarctica, Cissus hypoglauca, Pandorea pandorana, Aphanopetalum resinosum.* **Notes**: Shelter sites include abundant large fallen logs.	
Site: T5HA Goomburra southern valley (GB4) 27.991603 S 152.338865 E	**Representative photograph**
Canopy (T1): Height range 20-35m; Median height 30m; Cover: 70% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus biturbinata* (22%); *E. melliodora* (10%); *E. eugenioides.* **Sub-canopy (T2):** Height range 5-15m; Median height 8m; Cover: 50% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (38%); *Acacia irrorata* (5%); *Eucalyptus biturbinata* (13%); *Acacia melanoxylon, Eucalyptus eugenioides* (11%); *Myrsine variabilis, Angophora floribunda.* **Shrub (S1):** Height range 1-4m; Median height 3m; Cover: 20% Dominant species and % cover along 50m tape (where relevant): *Lantana camara** (16%); *Exocarpos cupressiformis* (6%); *Brachychiton populneus, Acacia melanoxylon* (2%); *Cissus antarctica, Pittosporum undulatum, Myrsine variabilis* (1%). **Groundcover:** Height range 0-1m; Median height 0.3m; Cover: 96% Dominant species: *Poa labillardierei* (38%), *Themeda triandra* (18%). **Notes**: Shelter sites include scattered large fallen logs and nearby small rock outcroppings in gullies.	

Site: T1HA Mt Mistake (MM1) 27.88212 S 152.322538 E	**Representative photograph**
Canopy (T1): Height range 20-30m; Median height 25m; Cover: 50% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus laevopinea* (36%), *E. campanulata* (18%), *E. quadrangulata.* **Sub-canopy (T2):** Height range 8-12m; Median height 10m; Cover: 1% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa, Brachychiton populneus.* **Shrub (S1):** Height range 1.5-4m; Median height 3m; Cover: 20%. Dominant species and % cover along 50m tape (where relevant): *Xanthorrhoea glauca,* (8%), *Allocasuarina torulosa* (3%), *Acacia maidenii* (16%), *Eucalyptus eugenioides* (1%), *Lophostemon confertus* (2%). **Groundcover:** Height range 0-1m; Median height 0.6m; Cover: 100% Dominant species: *Xanthorrhoea glauca* (26%), *Imperata cylindrica* (22%), *Hibbertia diffusa* (14%), *Lomandra longifolia* (6%), *Poa labillardierei* (6%). **Notes**: Shelter sites include scattered large fallen logs, loose surface rock and nearby escarpment cliffs.	
Site: T3HA Mt Mistake (MM2) 27.88115 S 152.31821 E	**Representative photograph**
Canopy (T1): Height range 20-30m; Median height 25m; Cover: 80% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus eugenioides* (90%), *E. campanulata*, *Lophostemon confertus, E. quadrangulata.* **Sub-canopy (T2):** Height range 8-12m; Median height 10m; Cover: 1% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (d). **Shrub (S1):** Height range 1.5-5m; Median height 3m; Cover: 30% Dominant species and % cover along 50m tape (where relevant): *Acacia maidenii* (18%), *Lophostemon confertus* (6%), *Allocasuarina torulosa, Xanthorrhoea glauca.* **Groundcover:** Height range 0-1m; Median height 0.5m; Cover: 98% Dominant species: *Imperata cylindrica* (30%), *Poa labillardierei* (22%), *Lomandra longifolia* (10%), *Ageratina adenophora** (10%). **Notes**: Shelter sites include scattered large fallen logs, loose surface rock and nearby escarpment cliffs.	
Site: T4HA Mt Mistake (MM3) 27.881674 S 152.318233 E	**Representative photograph**
Canopy (T1): Height range 20-22m; Median height 21m; Cover: 75% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus eugenioides* (55%), *Lophostemon confertus* (10%), *E. quadrangulata*. **Sub-canopy (T2):** Height range 8-15m; Median height 12m; Cover: 40% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (33%), *Acacia melanoxylon* (12%), *Eucalyptus biturbinata* (9%). **Shrub (S1):** Height range 0.5-3m; Median height 2m; Cover: 5% Dominant species and % cover along 50m tape (where relevant): *Lophostemon confertus* (1%), *Xanthorrhoea latifolius* (1%). **Groundcover:** Height range 0-1m; Median height 0.3m; Cover: 92% Dominant species: *Poa labillardierei* (16%), *Imperata cylindrica* (12%), *Sigesbeckia orientalis* (10%). **Notes**: Shelter sites include scattered large fallen logs, loose surface rock and nearby escarpment cliffs.	

Site: T4bHA Mt Mistake (MM4) 27.882493 S 152.321904 E	**Representative photograph**
Canopy (T1): Height range 20-30m; Median height 28m; Cover: 70% Dominant species and % cover along 50m tape (where relevant): *Eucalyptus laevopinea* (57%), *Eucalyptus quadrangulata* (7%). **Sub-canopy (T2):** Height range 5-9m; Median height 8m; Cover: 10% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (25%), *Eucalyptus laevopinea* (16%). **Shrub (S1):** Height range 1.5-4m; Median height 2.5m; Cover: 15% Dominant species and % cover along 50m tape (where relevant): *Allocasuarina torulosa* (5%), *Acacia maidenii* (3%), *Eucalyptus laevopinea* (2%), *Lophostemon confertus, Xanthorrhoea glauca* (6%). **Groundcover:** Height range 0-1m; Median height 0.5m; Cover: 96% Dominant species: *Poa labillardierei* (16%), *Imperata cylindrica* (22%), *Hardenbergia violacea* (10%), *Lomandra longifolia* (6%). **Notes**: Shelter sites include scattered large fallen logs, loose surface rock and nearby escarpment cliffs.	

Abbreviations: * = introduced species.

Table A.2: Frequency of occurrence (%) of groundcover species in five 1m x 1m quadrats at detailed habitat assessment sites.

	Habitat assessment site												
Species	**SG1**	**SG2**	**SG3**	**SG4**	**SG5**	**SG6**	**SG7**	**GB1**	**GB2**	**GB3**	**GB4**	**MM1**	**MM4**
Acacia irrorata											40		
Acacia maidenii												20	20
Acacia melanoxylon			20							20			
Acaena novae-zelandiae													20
Adiantum atroviride		20				60				80	20	20	60
*Ageratina adenophora**												20	40
*Ageratina riparia**										20			
Allocasuarina torulosa				20									
Archontophoenix cunninghamiana								20					
Asperula conferta		80		20	100	60	100				100		
Austrosteenisia glabristyla												20	60
*Bidens pilosa**							20						
Bothriochloa decipiens											20		
Breynia oblongifolia										20			
Carex appressa						20							
Cayratia clematidea										60			
Cissus antarctica										40	20		
Clematis glycinoides		20	20										
Commelina diffusa				20						20	60		
Cyanthillium cinereum					20		60					40	60
Cymbopogon refractus				20									
Desmodium brachypodum			20		60		20						
Desmodium gunnii	60	80	20	60	60	40	60	80	80	100	40	60	
Desmodium rhytidophyllum								40	20				
Dianella caerulea	20	60		20		20	60	100	80	20		20	20
Dichondra repens	20	20		80	40	20				80	40	20	20
Dioscorea transversa										80			
Doodia aspera		20				20		100	20	80		60	80
Echinopogon ovatus											40		
Entolasia stricta										60			
Eustrephus latifolius	20			80	80	20	60		40	80	100	40	40
Exocarpos cupressiformis									20				
Gahnia aspera			20										20
Galium migrans				40		100						60	
Geranium homeanum	100	20		60	40	80		80	60	40	100		80
Geranium solanderi							80						
Glycine clandestina	80	40	60	80	60	80	60	100	40	20	60	40	60
*Gomphocarpus physocarpus**						20							
Ground orchid		40				80	20						20
Hardenbergia violacea	20	20		20				100	60	20		40	40
Hibbertia diffusa												100	20
Hibbertia scandens	20	40				20		40	60	20			60

	Habitat assessment site												
Species	**SG1**	**SG2**	**SG3**	**SG4**	**SG5**	**SG6**	**SG7**	**GB1**	**GB2**	**GB3**	**GB4**	**MM1**	**MM4**
Hydrocotyle laxiflora						80					80		
Imperata cylindrica	60	60	20	80	40	100	20	60	60	60		100	60
Lepidosperma clipeicola	60	20	40									20	20
Lobelia purpurascens		60		40	80		80	20	60	60	80	80	60
Lomandra longifolia								100	80	80	60	20	20
Lomandra multiflora					20	20							
Marsdenia rostrata								20					
Maytenus sp.				20									
Microlaena stipoides											20		
Moss		20											
Myrsine sp.		20	20										
Myrsine variabilis									40	20			
Oplismenus aemulus	60	20		100	60	60	20			100	80	80	60
Oplismenus hirtellus								100	60				
Oxalis chnoodes										20		40	
Pandorea pandorina										20	40		
Pimelea curviflora												20	
Pimelea neo-angelica									20	20			
Plantago debilis											40		
Plectranthus parviflorus	60	100		20	80	100		40		60	40	60	40
Poa labillardierei	100	100		60	80	100	60	80	100	80	100	100	100
Polyscias sambucifolia								40	20				
Pseuderanthemum variabile										60			
Pseudonaphalium luteoalbum											20		
Pteridium esculentum													20
Pterosylis orchid										20	40		
Rubus parviflorus	100	80		60	40		20	20	40	20	100	20	
Rubus rosifolius													40
Sarga leiocladum	40		40		60	40	100						
Senecio quadridentatus							40						
Sigesbeckia orientalis				20							40		20
Solanum stelligerum	20		40		100	80							
Stephania japonica						20				40	80		
Themeda triandra	80	100	100	20			100				80		
Unidentified herb 1												20	
Unidentified herb 2				20									
Unidentified herb 3	60		60										
Unidentified herb 4				20									
Viola banksii		80						20	40				
Viola bettonicifolia					20								
Viola silicestris												100	80
Xanthorrhoea glauca			20				20		20			20	
Total groundcover species	**18**	**23**	**14**	**23**	**18**	**23**	**19**	**19**	**21**	**32**	**27**	**27**	**28**