ECOLOGICAL MONITORING PROGRAM ANNUAL REPORT 2021: YEAR 1 (OPERATION PHASE)

SCENIC RIM TRAIL, MAIN RANGE NATIONAL PARK

Prepared for
Spicers Retreats Hotels and Lodges Pty Ltd

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Project Author/s: Dr Penn Lloyd

Project Summary: This report provides the results of monitoring of Hastings River Mouse, Fleay's Frog, Mountain Frog and riparian habitat quality at the Scenic Rim Trail, Main Range National Park, in accordance with the requirements of the Scenic Rim Trail Management Plan.

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EXECUTIVE SUMMARY

BACKGROUND

Spicers Retreats Hotels and Lodges Pty Ltd (Spicers) have developed a multi-day bushwalking experience called the Scenic Rim Trail - Thornton Trailhead to Spicers Canopy Nature Reserve (SRT) that extends from Mt Mistake to Spicers Peak Nature Refuge, traversing the Main Range National Park (MRNP) in southern Queensland and the Gondwana Rainforests of Australia World Heritage Area. In addition to the walking tracks, the SRT Project constructed and now operates two new accommodation camps in Main Range National Park, the Amphitheatre Ecocamp and Woodcutters Ecocamp, the latter now known as Timber Getters Eco Cabins. The Commonwealth's conditions of approval for the project (EPBC 2016/7847) require annual monitoring to be undertaken in accordance with the commitments of the Scenic Rim Trail Management Plan (SRTMP).

STUDY OBJECTIVES

This report addresses the annual monitoring requirements for the terrestrial ecology matters through the 2020/21 reporting period summarised in brief in the table below. They include requirements for on-ground field surveys as well as comparison of data collected from the construction-phase surveys with baseline data to assess whether corrective action trigger thresholds are exceeded.

Matter	Monitoring requirements
Hastings River Mouse	***Monitoring method***: Trapping survey including 400 trap-nights within 100 m of Woodcutters EcoCamp boundaries and 400 trap-nights at a control site approximately 600 m north-west of Woodcutters EcoCamp. ***Correction trigger values***: The trigger for a management response will be the absence of or significant reduction in the presence of Hastings River Mouse during any annual trapping period and/or the capture of feral rodents during the live trapping.
Fleay's Frog	***Monitoring method***: At least two separate nocturnal surveys (two nights each) for adult frogs during ideal conditions, on transects upstream (control site) and downstream (impact site) of the crossings of Blackfellow Creek and Dalrymple Creek, as well as along the Cascades Trail. Tadpoles sampled by dip-netting in pools along the same transects three times. ***Correction trigger values***: The trigger for a management response will be if the population at an Impact site (downstream transect) is significantly less ($p < 0.05$, using Analysis of Variance) than the Control site (upstream transect).
Mountain Frog	***Monitoring method***: Two daytime surveys for calling male frogs along transects upstream and downstream of the crossings of Blackfellow Creek and Dalrymple Creek, as well as habitat adjacent to the SRT near Sylvester's Lookout. Supplementary sampling on an unnamed creek on Lookout Road. ***Correction trigger values***: The trigger for a management response will be if the population at an Impact site (downstream transect) is significantly less ($p < 0.05$, using Analysis of Variance) than the Control site (upstream transect).
Riparian habitat quality	***Monitoring method***: Monitoring key indicators of riparian habitat condition along transects 100 m upstream and 100 m downstream of the crossings of Blackfellow Creek and Dalrymple Creek: ***Correction trigger values***: The trigger for a management response will be any damage to riparian vegetation caused by walkers using the crossings, or by feral animals.

STUDY APPROACH

Field surveys were conducted by a suitably qualified person between 25th September 2020 and 27th March 2021. These surveys met the monitoring method requirements summarised above.

KEY RESULTS AND DISCUSSION

Hastings River Mouse

A total of six Hastings River Mouse captures occurred during two nights of trapping (duration of trapping survey curtailed due to forecast for rain), all in habitat closely adjacent to Woodcutters Ecocamp, with no captures at the control site. The assessment of whether corrective action is triggered based on the results of the first year of operation phase monitoring for Hastings River Mouse is summarised in the table below.

Corrective action trigger	Assessment	Corrective action required
Absence of or significant reduction in the presence of Hastings River Mouse during any annual trapping period.	The trapping rate for Hastings River Mouse increased between baseline and operation phase surveys in habitat surrounding Woodcutters Ecocamp but decreased at the control site. Therefore, no evidence of a decrease in the abundance of Hastings River Mouse attributable to the Project.	No corrective action required.
Capture of feral rodents during Hastings River Mouse trapping surveys.	No feral rodents were trapped.	No corrective action required.

Fleay's Frog

There was good Fleay's Frog activity at Blackfellow Creek on all surveys; however, there was unexpectedly limited frog activity and few frogs detected at Dalrymple Creek and the Cascades Trail on all surveys. This is likely to reflect subtle differences in conditions for Fleay's Frog activity between Blackfellow Creek and Dalrymple Creek during the surveys that are difficult to predict based on rainfall records for Mt Castle. The assessment of whether corrective action is triggered based on the results of the first year of operation phase monitoring for Fleay's Frog is summarised in the table below.

Corrective action trigger	Assessment	Corrective action required
The population at an Impact site (downstream transect) is significantly less ($p < 0.05$, using Analysis of Variance) than the Control site (upstream transect)	Frog and tadpole abundance decreased significantly between baseline and each of the construction and operation periods at both downstream 'impact' and upstream 'control' sites at Dalrymple Creek, but not Blackfellow Creek. However, there was no significant change in frog or tadpole abundance between the downstream and upstream transects at either Blackfellow Creek or Dalrymple Creek, indicating no significant impact under the BACI design.	No corrective action required.

Mountain Frog

No Mountain Frogs were detected during the first survey in September 2020. Mountain frogs were active calling on all three subsequent surveys in October 2020, but the number of frogs detected varied among sites and between surveys. The assessment of whether corrective action is triggered based on the results of the first year of operation phase monitoring for Mountain Frog is summarised in the table below.

Corrective action trigger	Assessment	Corrective action required
The population at an Impact site (downstream transect) is significantly less ($p < 0.05$, using Analysis of Variance)	Frog calling activity decreased significantly between baseline and operation periods at both downstream 'impact' and upstream 'control' sites at Blackfellow Creek and at the control site at Lookout Road. The absence of significant change	No corrective action required.

than the Control site (upstream transect).	in frog calling activity between the downstream and upstream transects at either site, together with the decline being consistent between Blackfellow Creek and the control site at Lookout Road indicate no significant impact under the BACI design.	

Riparian habitat quality

The assessment of whether corrective action is triggered based on the results of the first year of operation phase monitoring for riparian habitat quality is summarised in the table below.

Corrective action trigger	Assessment	Corrective action required
Any damage to riparian vegetation caused by walkers using the crossings, or by feral animals.	There was no evidence of damage to riparian vegetation or evidence of feral animal activity within 100 m upstream or downstream of the Dalrymple Creek crossing. There was evidence of Feral Pig activity downstream of the Blackfellow Creek crossing during the 2020/21 surveys; otherwise, no damage to riparian vegetation detected. Feral pigs were active in Blackfellow Creek during the baseline surveys, so the Feral Pig activity during the first year of operation is not attributable to the Project.	No corrective action required as QPWS already has Pig traps operational on the Winder Track above Blackfellow Creek.

ECOLOGICAL MONITORING PROGRAM ANNUAL REPORT 2021
YEAR 1 OPERATION PHASE

SCENIC RIM TRAIL, MAIN RANGE NATIONAL PARK

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Table of Terms and Abbreviations

BAAM	Biodiversity Assessment and Management Pty Ltd
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
MRNP	Main Range National Park
NC Act	Queensland *Nature Conservation Act 1992*
BAAM	Biodiversity Assessment and Management Pty Ltd
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
BAAM	Biodiversity Assessment and Management Pty Ltd
SD	Standard deviation, a measure of variability
SE	Standard error, a measure of variability
SRT	Scenic Rim Trail - Thornton Trailhead to Spicers Canopy Nature Reserve
SRTMP	Scenic Rim Trail Management Plan

1.0 INTRODUCTION

1.1 BACKGROUND

Spicers Retreats Hotels and Lodges Pty Ltd (Spicers) has developed a multi-day bushwalking experience called the Scenic Rim Trail - Thornton Trailhead to Spicers Canopy Nature Reserve (SRT) that extends from Mt Mistake to Spicers Peak Nature Refuge, traversing the Main Range National Park (MRNP) in southern Queensland and the Gondwana Rainforests of Australia World Heritage Area. The length of the Class 5 Trail is approximately 53 km and is made up of existing National Park public walking tracks, Queensland Parks and Wildlife Service (QPWS) management roads, existing walking tracks on private land and new walking tracks through Main Range National Park and adjacent private lands. In addition to the walking tracks, the SRT Project constructed and now operates two new accommodation camps in Main Range National Park, the Amphitheatre Ecocamp and Woodcutters Ecocamp, the latter now known as Timber Getters Eco Cabins.

The SRT Project (EPBC 2016/7847) received approval with conditions under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 18th January 2019, with variation of conditions approved on 2nd July 2019. Construction work commenced at Woodcutters Ecocamp after building approval was received on 20 September 2020 and construction was completed in April 2020. The Blackfellow Creek track crossing was established in October 2019 and the Dalrymple Creek track crossing was established in January 2020 as part of the new trail establishment that commenced in October 2019.

The Scenic Rim Trail Management Plan (SRTMP) sets out the management objectives and actions that Spicers has committed to undertaking during the construction and operational phases of the Scenic Rim Trail to fulfil the statutory requirements of the conditions of approval for the Project.

The Commonwealth Department of Environment and Energy (the Department) conditions of approval for the Scenic Rim Trail EPBC 2016/7847, dated 2nd July 2019, specify the following under conditions 14c and 14d:

> *14c. The SRTMP required under conditions 10-13 must specify the details of a 10-year annual ongoing monitoring program (including methodology, effort, timing, frequency and responsibilities) capable of predicting and detecting:*
>
> *i. a decrease of the population of Hastings River Mouse at the Woodcutters Ecocamp compared to the baseline population established under condition 8.a.;*
>
> *ii. a decrease of the population of Fleay's Frog and Mountain Frog at each crossing of the new trails at Blackfellow Creek and Dalrymple Creek compared to the baseline population established under condition 8.b.;*
>
> *iii. changes in water quality compared to the baseline established under condition 8.c. at either crossing of the new trails at Blackfellow Creek and Dalrymple Creek; and*
>
> *iv. a decrease of riparian habitat quality at either crossing of the new trails at Blackfellow Creek and Dalrymple Creek compared to the baseline established under condition 8.f.*
>
> *14d. The SRTMP required under conditions 10-13 must specify criteria that will trigger corrective action and indicative correction measures, if any decrease or change in water quality, populations or riparian habitat quality referred to in condition 14.c. is detected*.

Baseline data were collected during 2018/19 prior to the commencement of construction and operation and reported in BAAM (2018, 2019a,b).

1.2 OBJECTIVES OF THE ECOLOGICAL MONITORING STUDY

The objectives of the ecological monitoring study reported on in this report are to address the annual monitoring requirements set out in the SRTMP for the first year of operation for the following matters:

- Hastings River Mouse (*Pseudomys oralis*), listed as endangered under the EPBC Act and the Queensland *Nature Conservation Act 1992* (NC Act), at the Woodcutters Ecocamp;
- Fleay's Frog (*Mixophyes fleayl*), listed as endangered under the EPBC Act and NC Act, at each crossing of the new trails at Blackfellow Creek and Dalrymple Creek;
- Mountain Frog (*Philoria kundagungan*), listed as vulnerable under the NC Act, at each crossing of the new trails at Blackfellow Creek and Dalrymple Creek; and
- riparian habitat quality at the crossings of the new trails at Blackfellow Creek and Dalrymple Creek.

The monitoring requirements for these matters in the SRTMP are summarised in **Table 1.1** below. They include requirements for on-ground field surveys as well as comparison of data collected from the construction-phase surveys with baseline data to assess whether corrective action trigger thresholds are exceeded.

Table 1.1. Summary of ecological monitoring requirements in the SRTMP addressed in this report.

Matter	Monitoring requirements
Hastings River Mouse	***Location***: Transects within 100 m of the Woodcutters EcoCamp boundaries in Hastings River Mouse habitat and at a control site in habitat above Dalrymple Creek, approximately 600 m north-west of Woodcutters EcoCamp. ***Survey method***: Targeted trapping survey using size-A Elliott traps baited with peanut butter and rolled oats. Traps placed preferentially in local-scale habitat to maximise the likelihood of capture e.g. near fallen trees, adjacent to rock outcrops, trees with basal cavities, dense grass, and burrows of suitable size. Traps set in the late afternoon and checked again within two hours of sunrise to identify and release all animals live-trapped overnight. The total number of individuals of all rodent species trapped each night on each transect to be recorded and the capture rate to be standardised as captures per 100 trap nights. Habitat assessment at each of four habitat assessment sites, recording the following vegetation characteristics: (1) the canopy height range, median height and percentage canopy cover for each of the canopy, subcanopy, shrub and groundcover layers using a line-intercept method along a 50 m transect, and the dominant species in each layer; (2) the floristic species richness of groundcover vegetation within each of five 1 m x 1 m quadrats spaced at 10 m intervals along the 50 m transect; and (3) the general abundance of potential shelter sites for Hastings River Mouse. ***Effort***: 400 trap-nights (4 transects of 25 traps over four consecutive nights) in habitat within 100 m of Woodcutters EcoCamp boundaries and 400 trap-nights (4 transects of 25 traps over four consecutive nights) at the control site. ***Timing***: Spring, when risk of hypothermia is low; following three days of dry conditions and the forecast does not predict rain heavy rain. ***Frequency***: One period of four consecutive nights, annually, for ten years. ***Correction trigger values***: The trigger for a management response will be the absence of or significant reduction in the presence of Hastings River Mouse during any annual trapping period and/or the capture of feral rodents during the live trapping.

Matter	Monitoring requirements
Fleay's Frog	***Location***: Transects upstream and downstream of the crossings of Blackfellow Creek and Dalrymple Creek, as well as along the Cascades Trail. ***Survey method***: Nocturnal survey along transects upstream (100m) and downstream (100m) of the crossings of Blackfellow Creek and Dalrymple Creek, and the Cascades Trail. Each nocturnal survey to start at least 45 minutes after sunset and involve walking slowly and quietly along the transect listening for calling frogs and searching for frogs based on reflective eye-shine from the light of a head-torch, and pausing at intervals to use call-playback to stimulate calling (in accordance with the 'Audio strip transect survey' method). Supplementary monitoring to occur along the Cascades Track from Manna Gum Campground to the Dalrymple Creek crossing point (a 2,700 m long transect survey). The position of all frogs seen or heard along the transects to be recorded using a hand-held GPS. Fleay's Barred Frog larvae (tadpoles) to be monitored by dip-netting in five pools per 100m transect (upstream and downstream of each creek crossing point) during the day. The total number of Fleay's Barred Frog tadpoles captured (and subsequently released) in each of two 5-second sweeps of the net at each pool to be recorded. ***Effort***: At least two separate surveys (two nights each) for adult frogs during ideal conditions, at each of the crossing points. Tadpoles to be surveyed in three sample periods per year. ***Timing***: Frog surveys in the late breeding season within the period January-March, when the substrate and leaf litter are wet after a rainfall event of at least 20 mm, but not during strong stream flow conditions within the first week after heavy rainfall. Larval surveys during base stream flow conditions, i.e. not during strong stream flow conditions within the first week after heavy rainfall, once in the early breeding season and twice in the late breeding season. ***Frequency***: Two adult surveys and three larval surveys, annually, for ten years. ***Correction trigger values***: The trigger for a management response will be if the population at an Impact site (downstream transect) is significantly less ($p < 0.05$, using Analysis of Variance) than the Control site (upstream transect).
Mountain Frog	***Location***: Transects upstream and downstream of the crossings of Blackfellow Creek and Dalrymple Creek, as well as Rainforest spinach habitat adjacent to the SRT near Sylvester's Lookout. Supplementary sampling of a control site on an unnamed creek on Lookout Road. ***Survey method***: Daytime survey for calling male frogs along transects upstream (100m) and downstream (100m) of the crossings of Blackfellow Creek and Dalrymple Creek, as well as Rainforest spinach habitat adjacent to the SRT near Sylvester's Lookout. The audio strip-transect survey method to be applied, including call-playback, and the number and location of calling frogs to be recorded on hand-held GPS. ***Effort***: At least two separate survey days at each site. ***Timing***: Between September to early November, the main calling period for Mountain Frog at Main Range National Park. ***Frequency***: Two survey days, annually, for ten years. ***Correction trigger values***: The trigger for a management response will be if the population at an Impact site (downstream transect) is significantly less ($p < 0.05$, using Analysis of Variance) than the Control site (upstream transect).
Riparian habitat quality	***Location***: Transects upstream and downstream of the crossings of Blackfellow Creek and Dalrymple Creek. ***Survey method***: Monitoring of the following key indicators of riparian habitat condition: • Extent of trampling of sensitive groundcover vegetation along the riparian bank; • Extent of erosion along the hiking trail in the vicinity of the creek crossings; • Extent of feral pig tracks, scats, diggings or mud wallows; • Extent of domestic cattle tracks, pugging, scats or browsing of groundcover vegetation; • Extent of sediment in the in-stream channel; • Extent of damage to riparian bank stability; and • Extent of weeds. Supplementary monitoring of riparian vegetation at the crossings using fixed photo points. ***Effort***: The 100m transect upstream and downstream of the Blackfellow Creek and Dalrymple Creek crossings to be walked and the species and condition of the vegetation, the condition of the creek bank, and instream habitat condition, within a 5 m strip either side of the creek to be recorded. ***Timing***: In conjunction with the frog surveys. ***Frequency***: Once, annually, for ten years. ***Correction trigger values***: The trigger for a management response will be any damage to riparian vegetation caused by walkers using the crossings, or by feral animals.

The SRTMP further requires that all monitoring, assessment, and reporting is to be undertaken by a suitably qualified person, defined in the conditions of approval for EPBC 2016/7847 as a person who has professional qualifications, dated 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.

2.0 STUDY APPROACH

2.1 FIELD SURVEYS

Field surveys were undertaken in accordance with the monitoring survey requirements of the SRTMP summarised in **Table 1.1** above.

2.2 RAINFALL DATA

As an indicator of rainfall within the study area during the survey period to inform frog survey planning, daily rainfall data were sourced for the Mt Castle rain gauge station located at the headwaters of Blackfellow Creek at the end of Lookout Road in Main Range National Park (Bureau of Meteorology 2021). The Mt Castle rain gauge data are only publicly available for 24 hours after each day. Therefore, data from the Cunningham's Gap rainfall station further south in Main Range National Park were sourced for the analysis of seasonal rainfall patterns (Bureau of Meteorology 2021).

2.3 ANALYSIS

Survey data were compared with baseline survey data reported in BAAM (2018, 2019a,b) and construction phase data (BAAM 2020) using analysis of variance (ANOVA) within a before-after, control-impact (BACI) design. Average counts are reported together with the standard deviation (SD) or standard error (SE), which are measures of the variability in the counts. Data were log-transformed where necessary to meet assumptions of normality.

2.4 SUITABLY QUALIFIED PERSON AND PERMITS

All field surveys were undertaken by Dr Penn Lloyd (Principal Ecologist) and Lizzy Buckby (Project Ecologist). Penn is a suitably qualified person who has a PhD in zoology and more than 25 years of field experience as an ecologist, has published 62 peer-reviewed scientific publications in ecology and has authored over 230 consultancy reports, and is a Certified Environmental Practitioner (Ecology Specialist) with the Environment Institute of Australia and New Zealand (EIANZ).

Survey activities were conducted in accordance with the following permits:

- Scientific Purposes permit WA0024832 valid to 19/07/2025; and
- Permit WITK17726616 to take, use, keep or interfere with cultural or natural resources (Scientific Purpose) in national parks, including Main Range National Park, valid to 02/03/2023; and
- Animal Ethics Committee approval number CA 2018/01/1143.

3.0 RESULTS AND DISCUSSION

3.1 CLIMATIC CONDITIONS PRECEDING SURVEY

The latter half of 2019 through to the middle of January 2020 was a period of unprecedented drought conditions for Main Range National Park and the surrounding region. Total rainfall through

2019 was 337 mm, approximately one third of the long-term average of 1,028 mm (**Figure 3.1**), and substantially less than the previous lowest annual rainfall total of 646 mm since records at Cunningham's Gap began in 1977 (Bureau of Meteorology 2021). Total rainfall through 2020 was 1,165 mm, slightly above average.

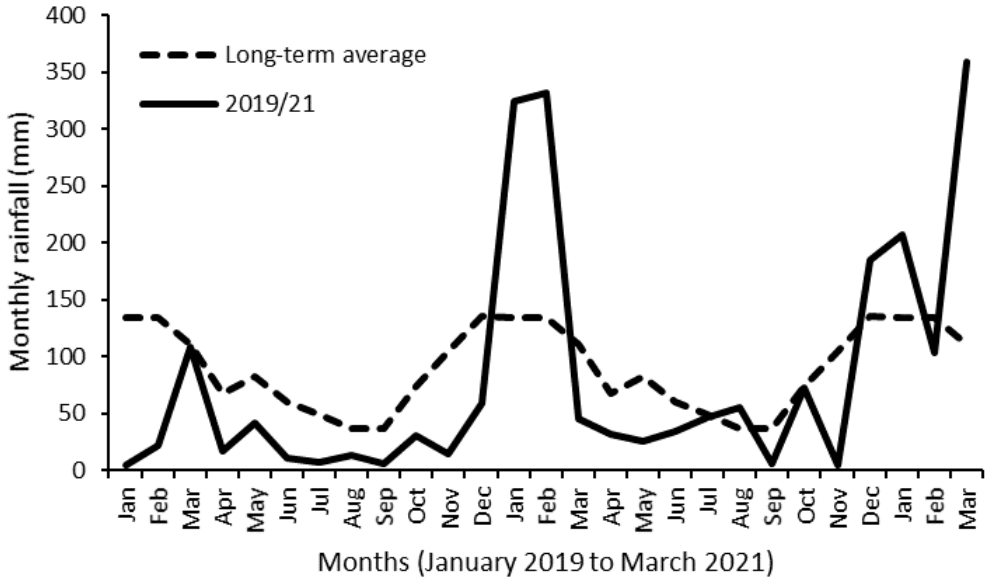


Figure 3.1. Monthly rainfall at Cunningham's Gap in MRNP over the period January 2019 to March 2021 compared to the long-term average (source: Bureau of Meteorology 2021).

3.2 HASTINGS RIVER MOUSE

3.2.1 Survey timing and conditions

The monitoring survey for Hastings River Mouse was undertaken over three days and two consecutive nights from 19th to 21st October 2020. Conditions through the survey were mild and dry, with no rainfall; however, the survey was terminated early after two nights of trapping due to forecast of potentially heavy rainfall that would have compromised the welfare of any trapped animals.

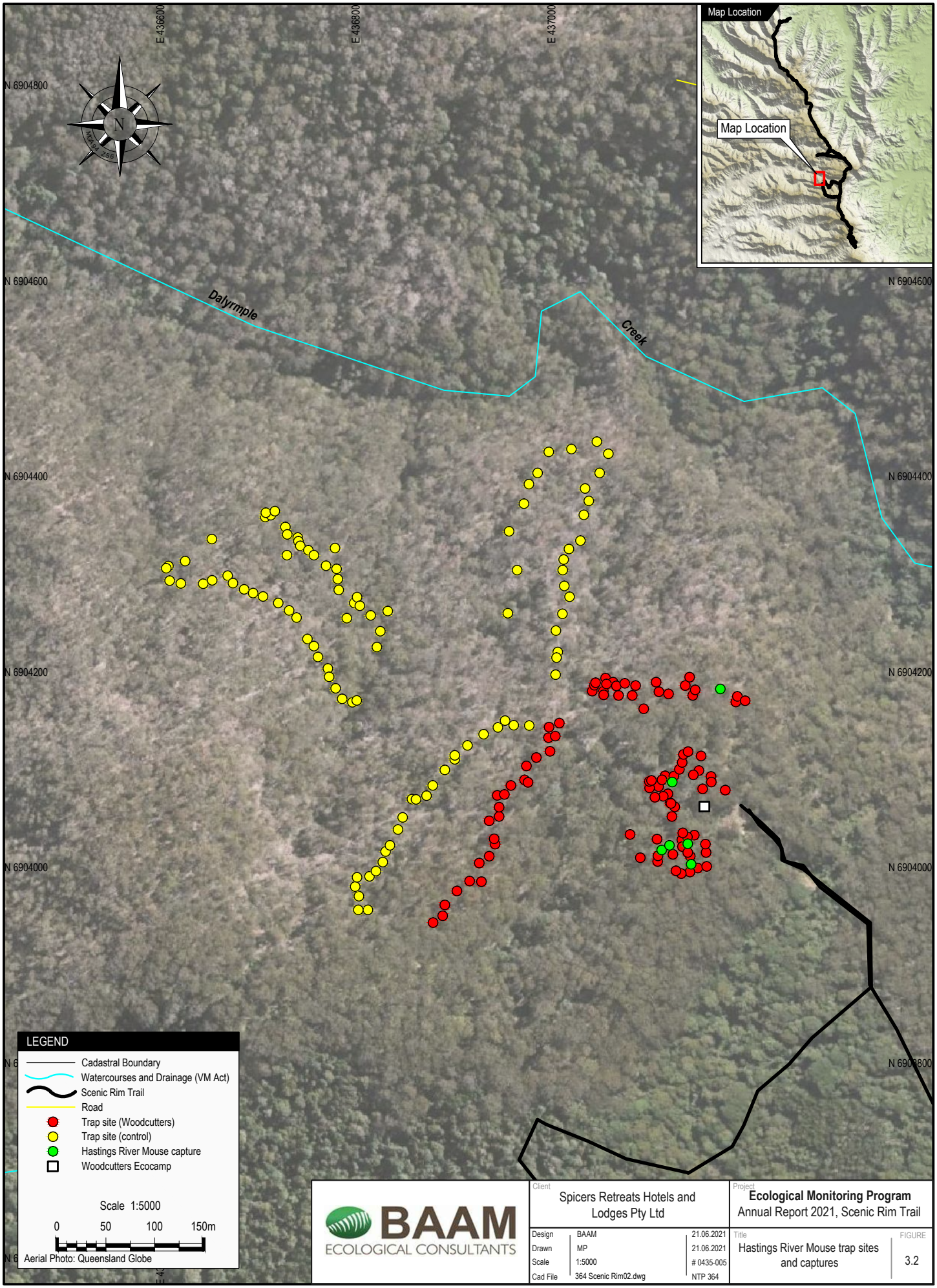
3.2.2 Trapping survey results

The locations of the trapping transects and trap locations are shown in **Figure 3.2** 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 trapping survey results for the survey of 29 to 21 October 2020.

Species	Common name	EPBC[1]	NCA[1]	Woodcutters (200 trap nights)	Control (200 trap nights)	Total
Antechinus stuartii	Brown Antechinus		LC	2		2
Melomys cervinipes	Fawn-footed Melomys		LC	3		3
Pseudomys oralis	Hastings River Mouse	E	E	6		6
Rattus fuscipes	Bush Rat		LC		1	1
Rattus lutreolus	Swamp Rat		LC		1	1
Bellatorias frerei	Major Skink		LC		3	3
Egernia cunninghami	Cunningham's Skink		LC		1	1
Total				**11**	**6**	**17**

[1] Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) and Queensland *Nature Conservation Act 1992* (NCA): E = endangered; LC = least concern, I = introduced.



BAAM ECOLOGICAL CONSULTANTS

Client	Spicers Retreats Hotels and Lodges Pty Ltd	Project	**Ecological Monitoring Program** Annual Report 2021, Scenic Rim Trail
Design	BAAM	21.06.2021	
Drawn	MP	21.06.2021	
Scale	1:5000	# 0435-005	
Cad File	364 Scenic Rim02.dwg	NTP 364	
Title	Hastings River Mouse trap sites and captures	FIGURE	3.2

A total of six Hastings River Mouse captures occurred (**Photo 3.1**), all in habitat closely adjacent to Woodcutters Ecocamp (**Photo 3.2**), with no captures at the control site (see **Figure 3.2** for capture locations).

Photo 3.1 Hastings River Mouse captured close to Woodcutters Ecocamp in October 2020.

Photo 3.2 Hastings River Mouse capture site on hillslope above Woodcutters Ecocamp.

3.2.3 Comparison with baseline and construction survey results

The trapping rate for rats (*Rattus* spp.) at Woodcutters was high during the baseline survey, decreased slightly during construction and reduced to zero during the first year of operation survey, and the trapping rate was variable at the control site between surveys (**Table 3.2, Figure 3.3**). The total small mammal trapping rate decreased between baseline and construction at both Woodcutters and the control site, decreased further between the construction and operation phases at Woodcutters but remained the same at the control site. The decrease between baseline and construction phases may reflect the unusually severe drought conditions at the time of the construction survey. While small mammal populations in arid regions of Australia are known to decrease during droughts and increase in years of above-average rainfall (Dickman *et al*. 1999, Dickman *et al*. 2001), the influence of rainfall on small mammal population dynamics is variable in tropical or rainforest habitats (Heinsohn and Heinsohn 1999, Madsen and Shine 1999).

Table 3.2. Comparison of trapping rates (number trapped per 100 trap nights) in habitat surrounding Woodcutters Ecocamp and a control site between the baseline survey prior to the commencement of the Project, in the year of construction and in the first year of operation.

Taxon	Baseline (2016/17) trapping rate		Construction (2019) trapping rate		Operation (2020) trapping rate	
	Woodcutters (400 trap nights)	Control (100 trap nights)	Woodcutters (400 trap nights)	Control (400 trap nights)	Woodcutters (200 trap nights)	Control (200 trap nights)
Hastings River Mouse	0.25	1.00	0.75	0.50	3.00	0.00
Rattus spp.	5.00	2.00	4.50	0.00	0.00	1.00
Total small mammals	10.75	6.00	8.25	1.00	5.50	1.00

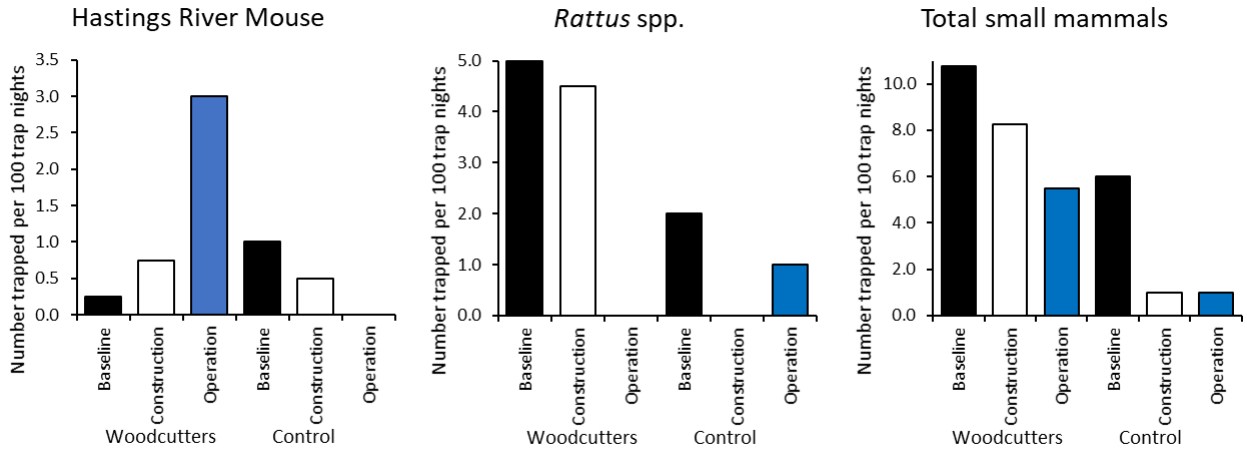


Figure 3.3. Comparison of trapping rates (number trapped per 100 trap-nights) between baseline (2016/17), year of construction (2019) and first year of operation (2020) surveys.

The trapping rate for Hastings River Mouse increased between baseline and construction and increased again between construction and operation phase surveys in habitat surrounding Woodcutters Ecocamp but decreased at the control site (**Figure 3.3**). While these changes must be interpreted with caution due to the small numbers trapped, there is no evidence of a decrease in the abundance of Hastings River Mouse attributable to Project construction or operation activities. The increase in the Hastings River Mouse trapping rate at Woodcutters paralleled a decrease in the trapping rate of rats. A reduction in the abundance of native rats at Woodcutters may have favoured Hastings River Mouse, consistent with the results of a study that found a strong negative relationship between Hasting River Mouse occupancy and native rat abundance; native rats are thought to compete for resources with Hastings River Mouse (Law *et al*. 2016).

3.2.4 Habitat assessment results

The habitat assessment results at two transects in Hastings River Mouse habitats adjacent to Woodcutters Ecocamp and two transects in habitats at the control site are presented in **Appendix A**. Percentage groundcover and groundcover species richness were equivalent to baseline conditions, having increased by comparison with the construction period conditions in 2019 when unprecedented drought conditions were experienced.

3.2.5 Corrective action triggers

The assessment of whether corrective action is triggered based on the results of the first year of operations monitoring is summarised in **Table 3.3** below.

Table 3.3. Assessment of corrective action triggers in accordance with the SRTMP.

Corrective action trigger	Assessment	Corrective action required
Absence of or significant reduction in the presence of Hastings River Mouse during any annual trapping period.	The trapping rate for Hastings River Mouse increased between baseline and operation phase surveys in habitat surrounding Woodcutters Ecocamp but decreased at the control site. Therefore, no evidence of a decrease in the abundance of Hastings River Mouse attributable to the Project.	No corrective action required.
Capture of feral rodents during Hastings River Mouse trapping surveys.	No feral rodents were trapped.	No corrective action required.

3.3 FLEAY'S FROG

3.3.1 Survey timing and conditions

The timing and rainfall conditions of the Fleay's Frog monitoring surveys are summarised in **Table 3.4** below.

Table 3.4. Summary of Fleay's Frog survey timing and conditions.

Locality	Survey timing	Survey conditions
Blackfellow Creek crossing (250m strip-transect upstream, 200m strip transect downstream) altitude 920-940m	04/02/2021 (nocturnal 22:26 to 23:00)	**Ideal conditions for a call survey**. Warm, partly cloudy evening; 3 days after 18 mm rainfall with a further 6 mm the day before the survey; leaf litter and substrate damp, and low stream flow. No frogs calling independently and no response to call playback.
	25/02/2021 (nocturnal 21:59 to 23:00)	**Ideal conditions for a call survey**. Mild, overcast, humid evening with fine drizzle from dense mist; 24 mm rainfall fell 2 days before the survey with a further 10 mm the day before the survey; leaf litter and substrate wet, and low stream flow. Frogs chorusing independently and responding to call playback.
	26/02/2021 (nocturnal 19:11 to 19:53)	**Ideal conditions for a call survey**. Mild, partly cloudy, evening; 24 mm rainfall fell 3 days before the survey with a further 10 mm 2 days before the survey; leaf litter and substrate wet after a brief light shower immediately prior to the survey, and low stream flow. Frogs chorusing independently and responding to call playback.
	27/03/2021 (nocturnal 18:35 to 19:33)	**Ideal conditions for a call survey**. Mild, partly cloudy and dry evening; 212 mm rainfall over 3 days ending 3 days before the survey; leaf litter and substrate moist; stream flow slightly elevated but water clear. Frogs chorusing independently and responding to call playback.
Dalrymple Creek crossing (200m strip-transect upstream, 100m strip transect downstream) altitude 770-800m	04/02/2021 (nocturnal 19:35 to 20:12)	**Ideal conditions for a call survey**. Warm, partly cloudy evening; 3 days after 18 mm rainfall with a further 6 mm the day before the survey; leaf litter and substrate damp, and low stream flow. No frogs calling independently and no response to call playback.
	25/02/2021 (nocturnal 19:11 to 19:41)	**Ideal conditions for a call survey**. Mild, partly cloudy evening; 24 mm rainfall fell 2 days before the survey with a further 10 mm the day before the survey; leaf litter and substrate damp; low stream flow. A few frogs calling independently; limited response to call playback.
	26/02/2021 (nocturnal 21:58 to 22:33)	**Ideal conditions for a call survey**. Mild, partly cloudy, evening; 24 mm rainfall 3 days before the survey with a further 10 mm 2 days before the survey; leaf litter and substrate damp; low stream flow. No frogs calling independently and no response to call playback.
	27/03/2021 (nocturnal 21:15 to 21:49)	**Ideal conditions for a call survey**. Mild, partly cloudy and dry evening; 212 mm rainfall over 3 days ending 3 days before the survey; leaf litter and substrate moist; stream flow slightly elevated but water clear. No frogs calling independently and no response to call playback.
Cascades Circuit trail (2,700m strip transect) altitude 700-780m	04/02/2021 (nocturnal 20:12 to 21:27)	**Ideal conditions for a call survey**. As per Dalrymple Creek survey conditions above. Some Fleay's Frogs calling independently along the lower reaches of trail.
	25/02/2021 (nocturnal 19:45 to 20:56)	**Ideal conditions for a call survey**. As per Dalrymple Creek survey conditions above. A few Fleay's Frogs calling independently.
	26/02/2021 (nocturnal 20:49 to 21:56)	**Ideal conditions for a call survey**. As per Dalrymple Creek survey conditions above. A few Fleay's Frogs calling independently.
	27/03/2021 (nocturnal 20:05 to 21:14)	**Ideal conditions for a call survey**. As per Dalrymple Creek survey conditions above. No Fleay's Frogs calling.

3.3.2 Frog survey results

Figures 3.4 to **3.6** show the locations of the survey transects and Fleay's Frog observations from the four nights of survey. The crossing point of Blackfellow Creek occurs approximately 70 m downstream of the originally proposed crossing point. In order to maintain equivalency with the baseline survey data, the frog surveys in 2020 and 2021 used the same survey transects that were used to collect the baseline survey data i.e. a 250m strip-transect upstream and 200m strip transect downstream of the originally proposed crossing point (**Figure 3.4**). **Table 3.5** below summarises the Fleay's Frog survey results from four nights of survey in the late summer season. While there was good frog activity at Blackfellow Creek on all surveys, there was unexpectedly limited frog activity and few frogs detected at Dalrymple Creek and the Cascades Trail on all surveys. This is likely to reflect subtle differences in conditions for Fleay's Frog activity between Blackfellow Creek and Dalrymple Creek during the surveys that are difficult to predict based on rainfall records for Mt Castle.

Table 3.5. Summary of total Fleay's Barred Frogs detected upstream and downstream of the proposed new trail crossings of Blackfellow Creek and Dalrymple Creek as well as along the Cascades Trail during each survey.

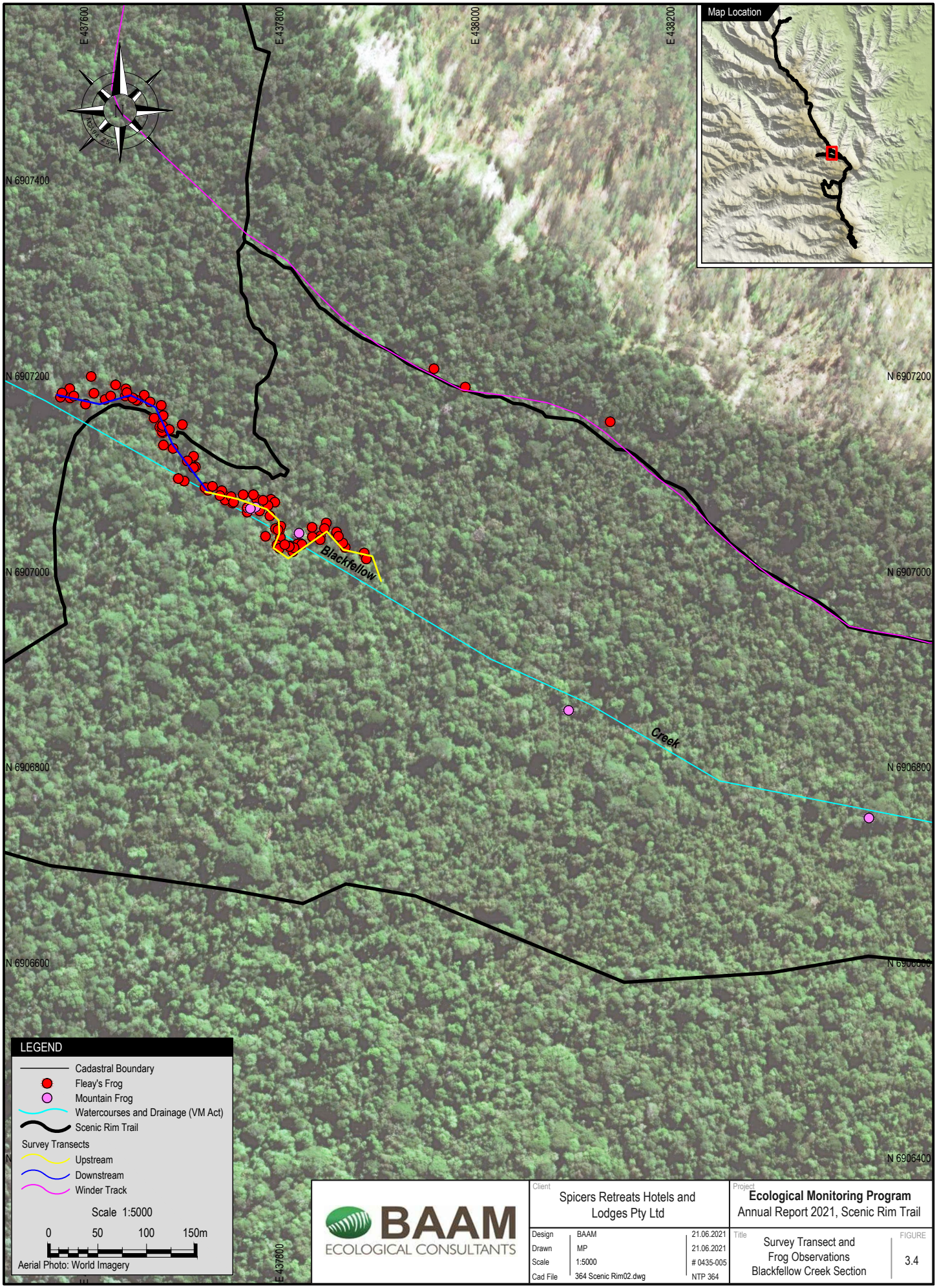
	Blackfellow Creek		Dalrymple Creek		Cascades Trail (2,700 m)
Date	Upstream (250 m)	Downstream (200 m)	Upstream (200 m)	Downstream (100 m)	
26/01/2020	23	29	9	4	49
19/02/2020	60	60	5	10	32
20/02/2020	47	82	5	7	42
12/03/2020	76	92	5	2	12
Average (±1SD)	***51.5 ± 22.4***	***65.8 ± 27.9***	***6.0 ± 2.0***	***5.8 ± 3.5***	***33.8 ± 16.1***

A single large Cane Toad was found on the Cascades Trail on the 27 March 2021 survey.

3.3.3 Tadpole survey results

At the time of the first tadpole survey on 22nd October 2020 (early season survey), there was limited low stream flow in both Blackfellow Creek and Dalrymple Creek after only 20 mm rainfall over the six weeks prior to the survey. Subsequent late-season surveys in early and late February 2020 took place after heavy rainfall in early January and moderate rainfall thereafter. All dip-netting surveys took place during base flow conditions.

The average number of Fleay's Barred Frog tadpoles captured per dip-net sweep varied between early- and late-season surveys at each of the two creeks, with typically greater abundance in the early-season survey (**Figure 3.7**).



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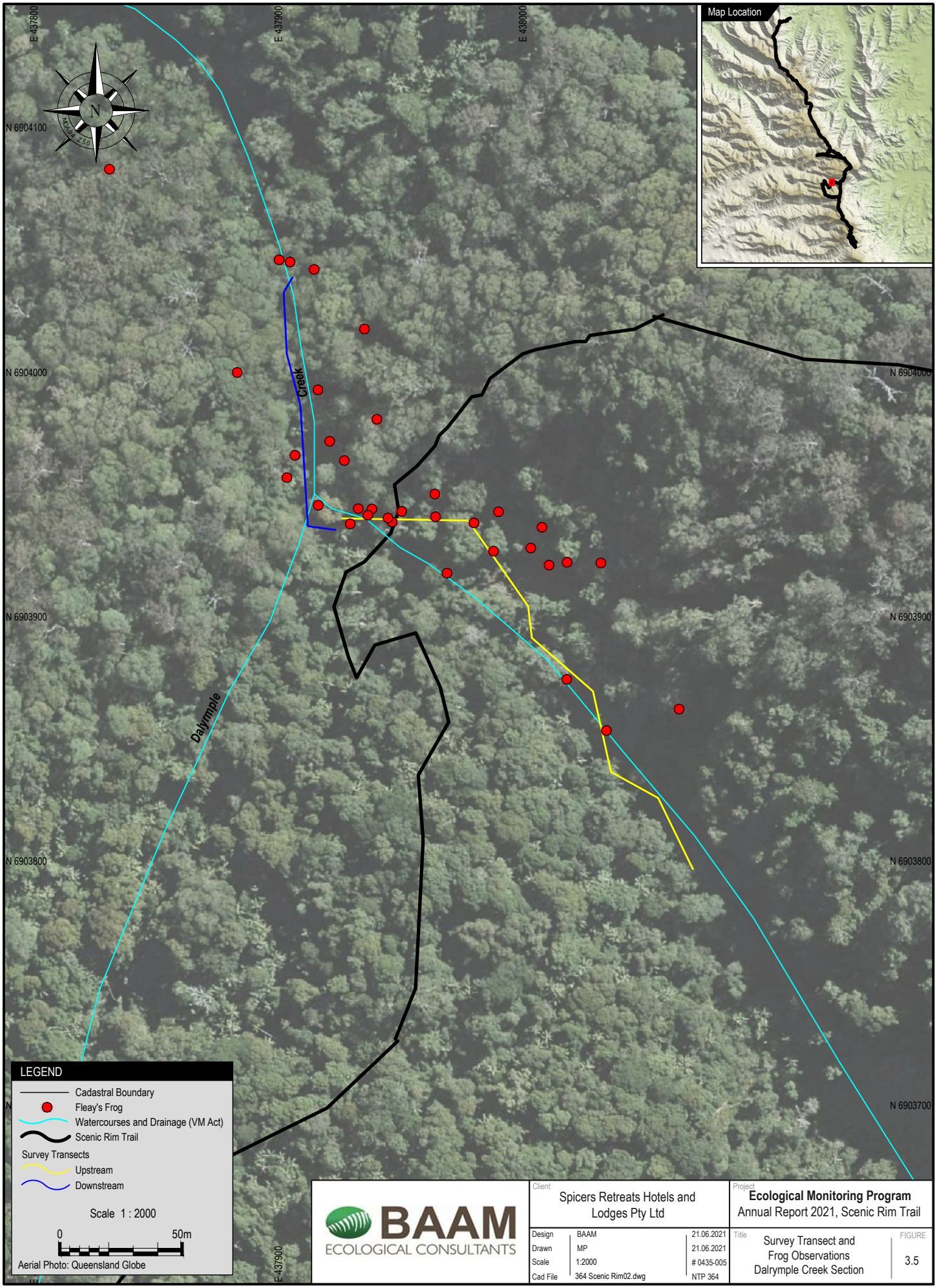
Project: **Ecological Monitoring Program** Annual Report 2021, Scenic Rim Trail

Design	BAAM	21.06.2021
Drawn	MP	21.06.2021
Scale	1:5000	# 0435-005
Cad File	364 Scenic Rim02.dwg	NTP 364

Title: Survey Transect and Frog Observations Blackfellow Creek Section

FIGURE 3.4



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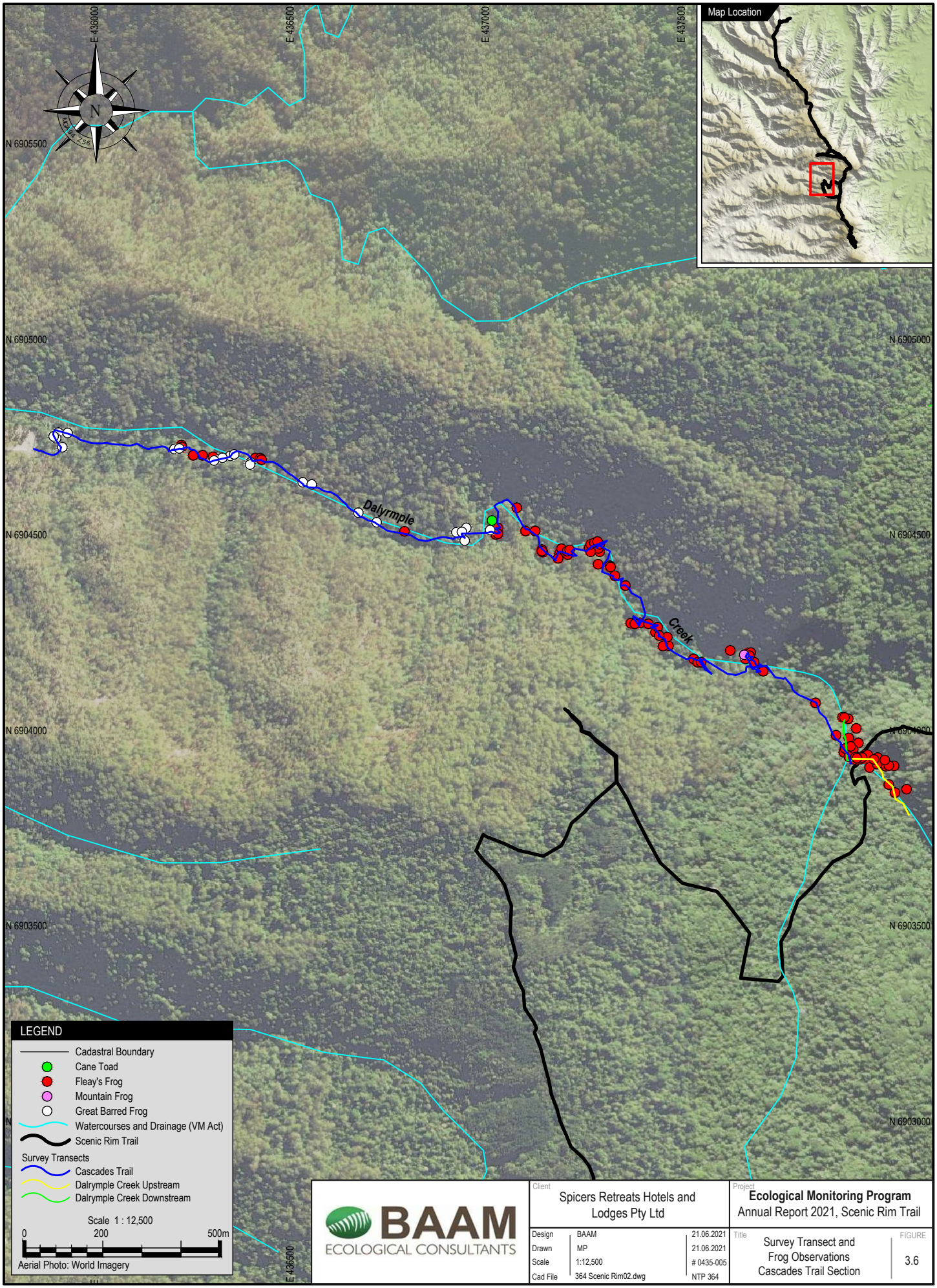
Design	BAAM	21.06.2021
Drawn	MP	21.06.2021
Scale	1:2000	# 0435-005
Cad File	364 Scenic Rim02.dwg	NTP 364

Title: Survey Transect and Frog Observations Dalrymple Creek Section

FIGURE 3.5



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Project	**Ecological Monitoring Program** Annual Report 2021, Scenic Rim Trail	
Design	BAAM	21.06.2021
Drawn	MP	21.06.2021
Scale	1:12,500	# 0435-005
Cad File	364 Scenic Rim02.dwg	NTP 364
Title	Survey Transect and Frog Observations Cascades Trail Section	FIGURE 3.6

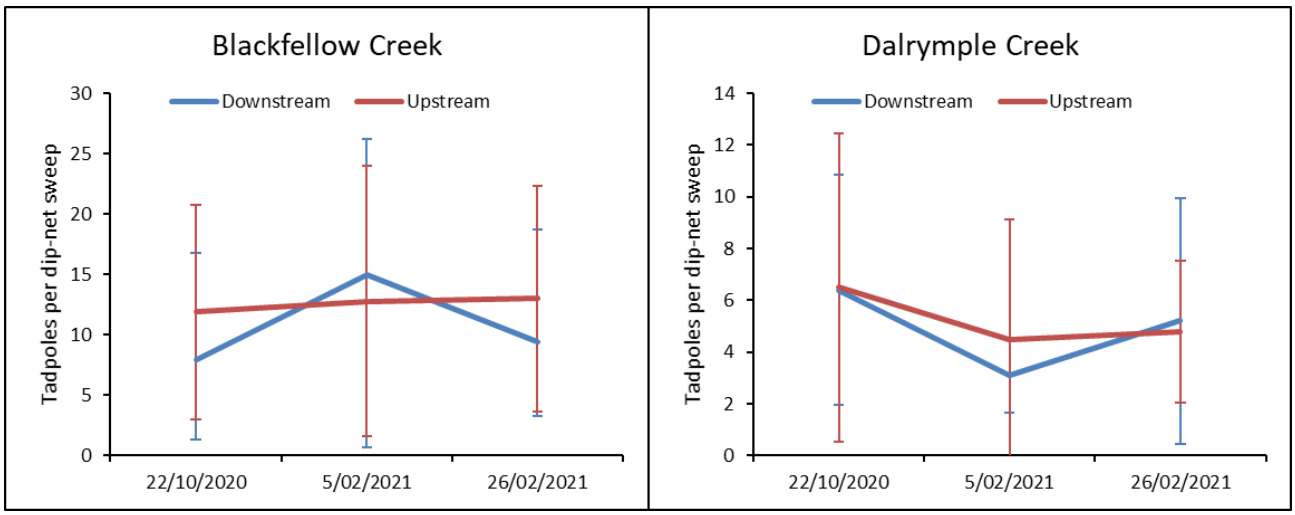


Figure 3.7. Average (±1SD) number of Fleay's Barred Frog larvae (tadpoles) captured per dip-net sweep in pools along each transect upstream and downstream of the crossing points on Blackfellow Creek and Dalrymple Creek.

3.3.4 Comparison with baseline and construction survey results

Adult frogs

To test for an impact on frog abundance in the BACI design, for each creek and for the Cascades Trail a two-way ANOVA was carried out on the number of frogs by location (upstream control, downstream impact) and period (baseline, construction). Normality checks and Levene's tests for homogeneity of variances were carried out and the assumptions were met. See **Figure 3.8** for a graphical summary of the data.

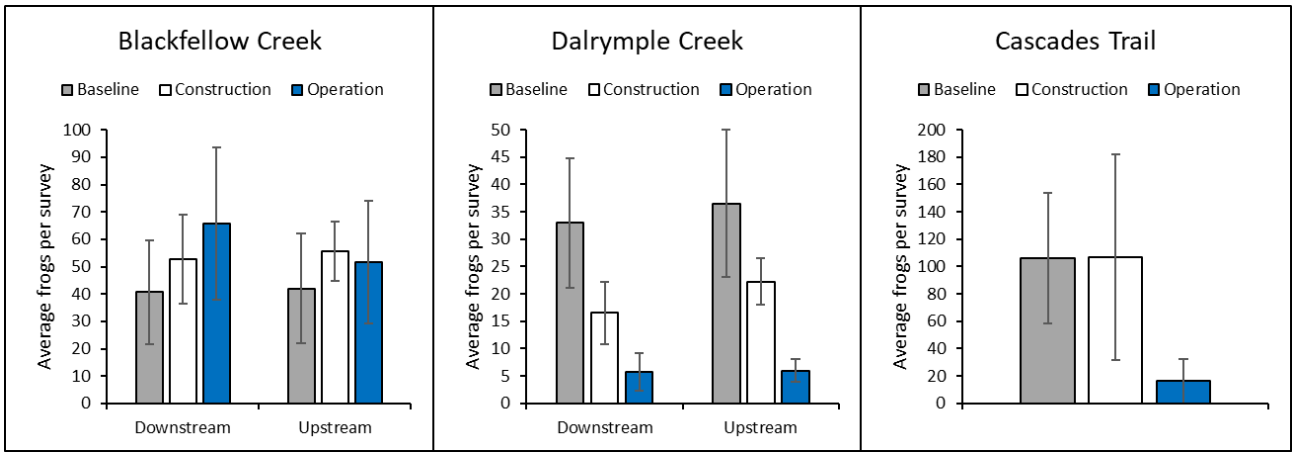


Figure 3.8. Comparison of the average (±1SD) number of Fleay's Frogs detected per survey upstream and downstream of the crossing points on Blackfellow Creek and Dalrymple Creek and along the Cascades Trail prior to the Project (baseline, 2018/19), during the construction period (2019/20) and during the first year of operation (2020/21).

At Blackfellow Creek, frog abundance did not vary significantly between locations ($F_{1,18} = 0.173$, $P = 0.68$) or between periods ($F_{2,18} = 1.584$, $P = 0.23$) and the interaction between location and period was non-significant ($F_{2,18} = 0.438$, $P = 0.65$). This indicates no significant impact under the BACI design.

At Dalrymple Creek, log-transformed frog abundance did not vary significantly between locations ($F_{1,18} = 1.268$, $P = 0.28$), varied significantly between periods ($F_{2,18} = 36.215$, $P < 0.001$) and the interaction between location and period was non-significant ($F_{2,18} = 0.194$, $P = 0.83$). A Tukey post-hoc test revealed significant pairwise differences in frog abundance between baseline and

construction ($P = 0.034$), between baseline and operation ($P < 0.001$) and between construction and operation ($P < 0.001$). Thus, frog abundance decreased significantly between baseline and construction and between construction and operation periods at both downstream 'impact' and upstream 'control' sites. Since this change did not differ between control and impact sites, it indicates no significant impact under the BACI design.

Along the Cascades Trail, frog abundance did not vary significantly between periods ($F_{2,9} = 2.562$, $P = 0.13$), indicating no significant change in frog abundance between the three periods.

Tadpoles

To test for an impact on tadpole abundance in the BACI design, for each creek a two-way ANOVA was carried out on log-transformed average tadpoles (per dip-net sweep) per sample by location (upstream control, downstream impact) and period (baseline, construction, operation). Normality checks and Levene's tests for homogeneity of variances were carried out and the assumptions were met. See **Figure 3.9** for a graphical summary of the data.

For Blackfellow Creek, tadpole abundance did not vary significantly between locations ($F_{1,14} = 1.292$, $P = 0.28$) or between periods ($F_{2,14} = 1.401$, $P = 0.28$) and the interaction between location and period was non-significant ($F_{2,14} = 0.034$, $P = 0.97$). This indicates no significant impact under the BACI design.

For Dalrymple Creek, tadpole abundance did not vary significantly between locations ($F_{1,14} = 0.212$, $P = 0.75$), varied significantly between periods ($F_{2,14} = 5.075$, $P = 0.022$) and the interaction between location and period was non-significant ($F_{2,14} = 0.120$, $P = 0.89$). A Tukey post-hoc test revealed significant pairwise differences in tadpole abundance between baseline and construction ($P = 0.049$) and between baseline and operation ($P = 0.039$), but not between construction and operation ($P = 0.99$). Thus, the decrease in tadpole abundance between baseline and each of the construction and operation periods did not differ between control and impact sites, indicating no significant impact under the BACI design.

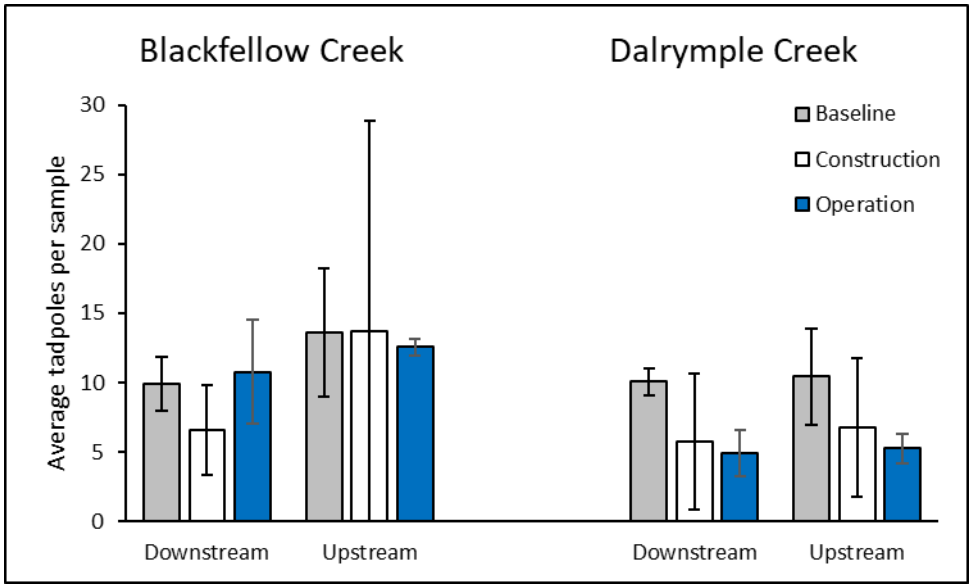


Figure 3.9. Comparison of the average (±1SE) number of Fleay's Frog larvae (tadpoles) captured per dip-net sweep in pools along each transect upstream and downstream of the crossing points on Blackfellow Creek and Dalrymple Creek prior to the Project (baseline, 2018/19), during the construction period (2019/20) and during the first year of operation (2020/21).

3.3.5 Corrective action triggers

The assessment of whether corrective action is triggered based on the results of the first year of construction monitoring is summarised in **Table 3.6** below.

Table 3.6. Assessment of corrective action triggers for Fleay's Frog in accordance with the SRTMP.

Corrective action trigger	Assessment	Corrective action required
The population at an Impact site (downstream transect) is significantly less ($p < 0.05$, using Analysis of Variance) than the Control site (upstream transect)	Frog and tadpole abundance decreased significantly between baseline and each of the construction and operation periods at both downstream 'impact' and upstream 'control' sites at Dalrymple Creek, but not Blackfellow Creek. However, there was no significant change in frog or tadpole abundance between the downstream and upstream transects at either Blackfellow Creek or Dalrymple Creek, indicating no significant impact under the BACI design.	No corrective action required.

3.4 MOUNTAIN FROG

3.4.1 Survey timing and conditions

The timing and rainfall conditions of the Mountain Frog monitoring surveys are summarised in **Table 3.7** below. The four surveys exceeded the minimum requirement for two surveys.

Table 3.7. Summary of Mountain Frog survey timing and conditions.

Locality	Survey timing	Survey conditions
Blackfellow Creek crossing (250m strip-transect upstream, 200m strip transect downstream) altitude 920-940m	25 September 2020 (13:00-13:22)	Mild and dry, six days after last rainfall event of 19 mm. No Mountain Frogs calling.
	20 October 2020 (14:55-15:40)	Clear, mild, substrate damp, one day after rainfall of 9 mm. A single Mountain Frog calling.
	22 October 2020 (11:40-12:30)	Mild, overcast, three days after rainfall of 9 mm. A single Mountain Frog calling.
	30 October 2020 (12:00-12:30)	Warm, partly cloudy; 74 mm over 8-day period ending with 16mm on the day before the survey; low stream flow. Mountain Frogs calling.
Dalrymple Creek crossing (200m strip-transect upstream, 100m strip transect downstream) altitude 770-800m	25 September 2020 (16:30-16:45)	Conditions as for Blackfellow Creek. No Mountain Frogs calling.
	20 October 2020 (11:00-11:40)	Conditions as for Blackfellow Creek. No Mountain Frogs calling.
	22 October 2020 (15:05-15:35)	Conditions as for Blackfellow Creek. No Mountain Frogs calling.
	30 October 2020 (8:30-9:15)	Conditions as for Blackfellow Creek. No Mountain Frogs calling, but two calling further downstream on the Cascades Circuit.
Sylvesters Lookout rock seep (static call survey) altitude 1030m	25 September 2020 (14:40-14:45)	Conditions as for Blackfellow Creek. No Mountain Frogs calling.
	20 October 2020 (14:05-14:10)	Conditions as for Blackfellow Creek. No Mountain Frogs calling.
	22 October 2020 (13:30-13:40)	Conditions as for Blackfellow Creek. No Mountain Frogs calling.
	30 October 2020 (13:10-13:20)	Conditions as for Blackfellow Creek. Mountain Frogs calling below the cliff face.

Locality	Survey timing	Survey conditions
Lookout Road creek crossing (aquatic control site, 200m strip-transect upstream, 200m strip transect downstream) altitude 940-960m	25 September 2020 (13:55-14:30)	Conditions as for Blackfellow Creek. No Mountain Frogs calling.
	20 October 2020 (16:23-17:00)	Conditions as for Blackfellow Creek. Mountain Frogs calling.
	22 October 2020 (7:57-8:51)	Conditions as for Blackfellow Creek. Mountain Frogs calling.
	30 October 2020 (10:20-11:20)	Conditions as for Blackfellow Creek. Mountain Frogs calling.

3.4.2 Frog survey results

No Mountain Frogs were detected during the first survey in September 2020. Mountain frogs were active calling on all subsequent surveys, but the number of frogs detected varied among sites and between surveys (**Table 3.8**). The locations of Mountain Frog records are shown in **Figures 3.4, 3.6** and **3.10**. During the survey of 30 October 2020, the full length of Blackfellow Creek upstream of the monitoring transects was also surveyed; only two additional Mountain Frogs were detected calling (**Figure 3.4**) but these are not included in the data presented in **Table 3.8**. No Mountain Frogs were recorded within the habitat area close to a new trail section at the top of the escarpment cliffs near Sylvester's Lookout where several frogs were detected calling during the baseline surveys; however, several Mountain Frogs were calling below the cliffs at Sylvester's Lookout on the survey of 30 October 2020 (**Figure 3.10, Table 3.8**). The habitat area close to a new trail section at the top of the escarpment cliffs remained too dry to support Mountain Frog throughout the 2020 surveys.

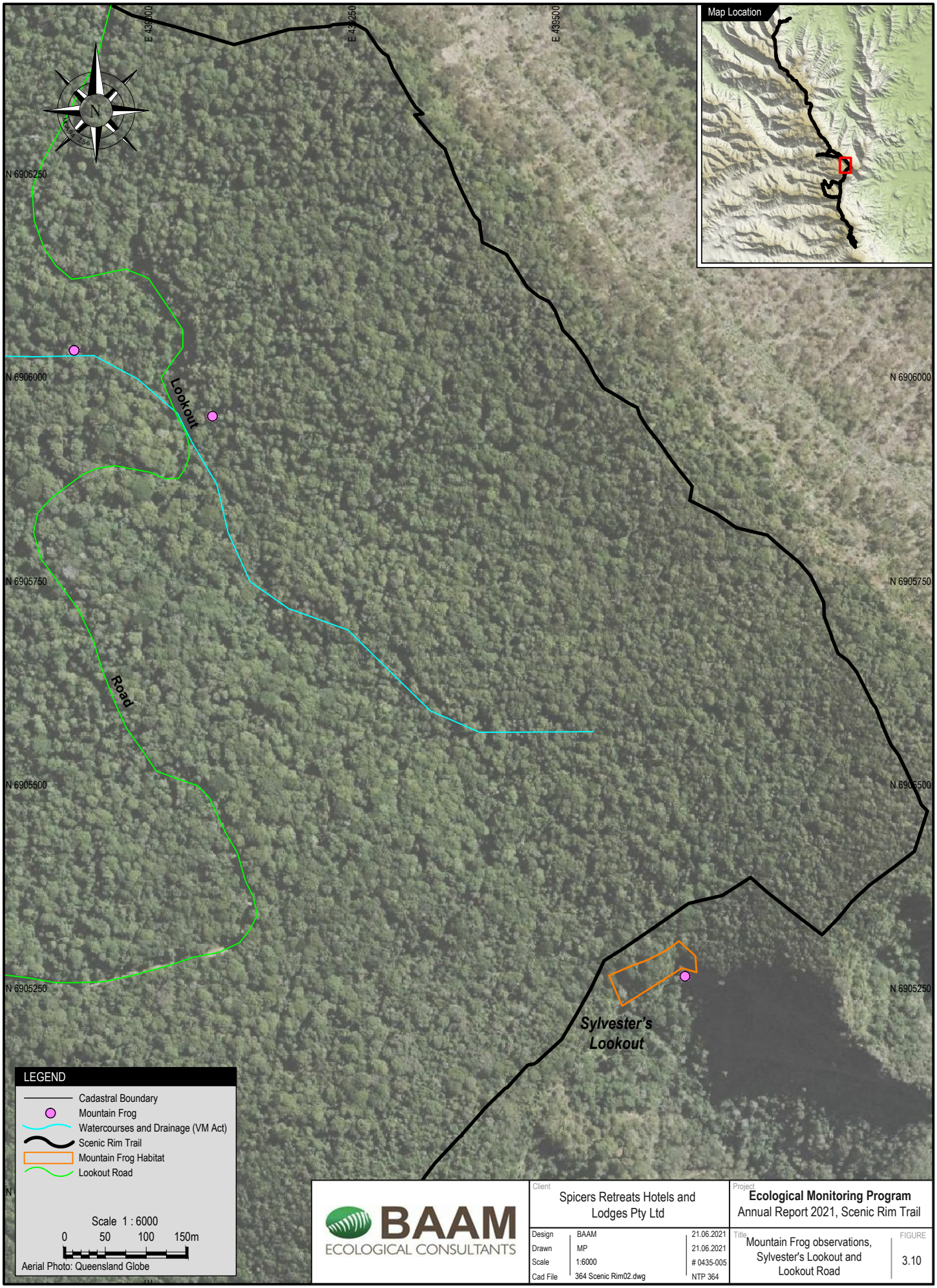
Table 3.8. Summary of total Mountain Frogs detected upstream and downstream of the proposed new trail crossings of Blackfellow Creek and Dalrymple Creek as well as close to the trail at Sylvester's Lookout and a control site on Lookout Road during each survey, together with the average (± 1 standard deviation).

Date	Blackfellow Creek		Dalrymple Creek		Lookout Road		Sylvester's Lookout
	Upstream (250 m)	Downstream (200 m)	Upstream (200 m)	Downstream (100 m)	Upstream (200 m)	Downstream (200 m)	
25/09/2020	0	0	0	0	0	0	0
20/10/2020	1	0	0	0	0	6	0
22/10/2020	1	0	0	0	0	11	0
30/10/2020	3	0	0	0	1	3	Several
Average (±1SD)	***1.3 ± 1.3***	***0 ± 0***	***0 ± 0***	***0 ± 0***	***0.3 ± 0.5***	***5.0 ± 4.7***	

3.4.3 Comparison with baseline and operation survey results

There was a significant reduction in male Mountain Frog calling activity (from some activity to zero activity) between baseline and construction periods at Blackfellow Creek and the Lookout Road control site (**Figure 3.11**). There was no Mountain Frog calling activity upstream and downstream of the Dalrymple Creek crossing during either the baseline or construction periods. Since the upstream control and Lookout Road control sites were similarly affected, the decrease during the construction period is attributed to the unprecedented drought conditions and not any Project activity. Male Mountain Frogs were active calling during three of the four surveys during the first year of operation.

To test for an impact on frog abundance in the BACI design between baseline and operation periods, for each of Blackfellow Creek and the Lookout Road control site a two-way ANOVA was carried out on the number of frogs by location (upstream control, downstream impact) and period (baseline, operation).



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Design	BAAM	21.06.2021
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Scale	1:6000	# 0435-005
Cad File	364 Scenic Rim02.dwg	NTP 364

Title: Mountain Frog observations, Sylvester's Lookout and Lookout Road

FIGURE 3.10

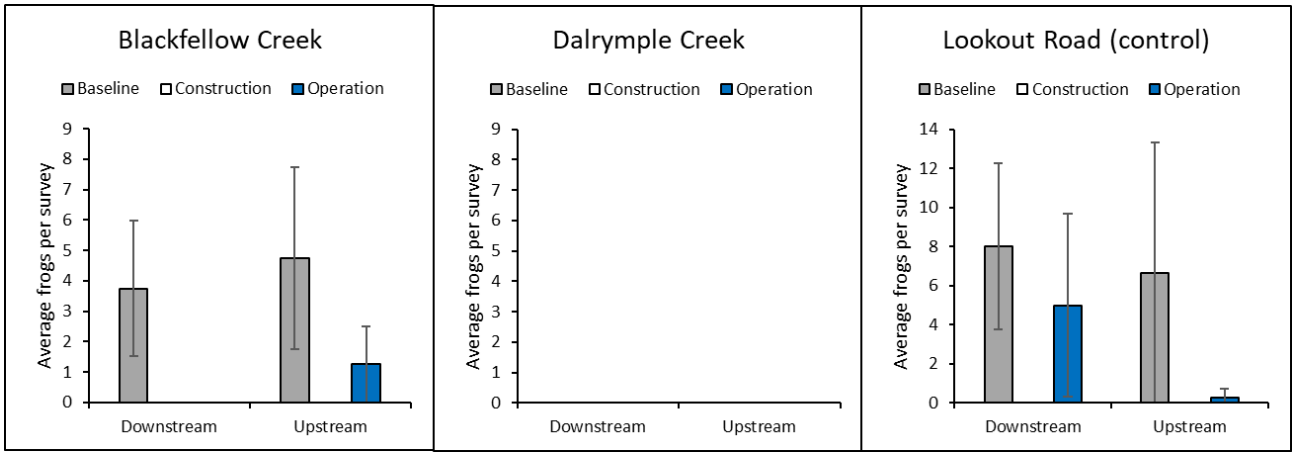

Figure 3.11. Comparison of the average (±1SD) number of Mountain Frogs detected calling per survey upstream and downstream of the crossing points on Blackfellow Creek and Dalrymple Creek and on the Lookout Road control site prior to the Project (baseline, 2018), during the construction period (2019) and during the first year of operation (2020).

At Blackfellow Creek, log-transformed frog calling activity did not vary significantly between locations ($F_{1,12} = 2.712$, $P = 0.13$), varied significantly between periods ($F_{1,12} = 21.117$, $P < 0.001$) and the interaction between location and period was non-significant ($F_{1,12} = 1.078$, $P = 0.32$). Thus, the decrease in frog calling activity between baseline and operation periods did not differ between control and impact sites, indicating no significant impact under the BACI design.

Similarly, at Lookout Road, log-transformed frog calling activity did not vary significantly between locations ($F_{1,9} = 3.397$, $P = 0.098$), varied significantly between periods ($F_{1,9} = 6.255$, $P = 0.034$) and the interaction between location and period was non-significant ($F_{1,9} = 0.850$, $P = 0.38$). The significant decrease in frog calling activity between baseline and operation periods is consistent with that observed at Blackfellow Creek and suggests the reduced calling activity is related either to differences in seasonal conditions between the two time periods or to carry-over effects of the severe drought conditions the year before.

3.4.4 Corrective action triggers

The assessment of whether corrective action is triggered based on the results of the first year of construction monitoring is summarised in **Table 3.8** below.

Table 3.8. Assessment of corrective action triggers for Mountain Frog in accordance with the SRTMP.

Corrective action trigger	Assessment	Corrective action required
The population at an Impact site (downstream transect) is significantly less ($p < 0.05$, using Analysis of Variance) than the Control site (upstream transect).	Frog calling activity decreased significantly between baseline and operation periods at both downstream 'impact' and upstream 'control' sites at Blackfellow Creek and at the control site at Lookout Road. The absence of significant change in frog calling activity between the downstream and upstream transects at either site, together with the decline being consistent between Blackfellow Creek and the control site at Lookout Road indicate no significant impact under the BACI design.	No corrective action required.

3.5 RIPARIAN HABITAT CONDITION

3.5.1 Blackfellow Creek

Blackfellow Creek within 100m upstream and downstream of the new trail crossing is a high-energy headwater perennial stream located in the bed of a steep valley on an escarpment plateau. The stream has a bankfull width of 3-6m and comprises a series of mostly shallow pools separated by short riffle zones, with occasional pools that reach a depth of a little over 0.5m. The streambed is stable, having a range of sediment sizes and comprised of consolidated (tightly arranged and packed) material, with a channel that is in a relatively natural state (not deepened or infilled) with bed and bar sediments roughly the same size. Many pools have a bedrock bed with loose cobbles and limited fine sediments (**Photos 3.3** and **3.4**).

The creek is located in complex notophyll vine forest, a type of rainforest. The concave creek banks are continuously vegetated, with a moderate abundance of trailing bank vegetation. The banks are stable, with little evidence of erosion and little potential for future problems evident. The riparian zone groundcover comprises native vegetation, leaf litter, fallen tree logs or bedrock. The ground vegetation at the stream edges and along the banks is dominated by Rainforest Spinach (*Elatostema reticulatum*), with patchy co-dominance by *Pollia crispata*. A variety of ferns occur frequently, particularly Soft Bracken (*Calochlaena dubia*) and *Asplenium attenuatum*, Scaly Treefern (*Cyathea cooperi*), Bangalow Palm (*Archontophoenix cunninghamiana*), *Cordyline petiolaris* and a variety of rainforest tree saplings occur commonly along the banks in the shrub layer. There was no evidence of introduced plant weed species anywhere along the creek.

Photo 3.3 Blackfellow Creek photo-point within 100m downstream of the crossing point, October 2018.

Photo 3.4 Blackfellow Creek photo-point within 100m downstream of the crossing point, September 2020.

The crossing point of Blackfellow Creek occurs approximately 70 m downstream of the originally proposed crossing point, on a narrow section of the stream with gently sloping banks on either side (**Photos 3.5** to **3.8**). The stream bed at the crossing point is bedrock. Construction of the crossing point involved the raking of surface litter along the track-line on the gently-sloping banks on each side of the crossing, with no other soil disturbance, and there was no disturbance to the bedrock across the crossing itself. Consequently, construction of the trail involved negligible disturbance to the riparian habitats of Blackfellow Creek. No change to the condition of the crossing point was observed during the first year of operation surveys.

Photo 3.5 Crossing of Blackfellow Creek; view of eastern approach, February 2021.

Photo 3.6 Crossing of Blackfellow Creek; view of western approach, February 2021.

Photo 3.7 Crossing of Blackfellow Creek; view downstream of crossing, February 2021.

Photo 3.8 Crossing of Blackfellow Creek; view upstream of crossing, February 2021.

Rainforest Spinach, the predominant groundcover along the stream banks is a weak-stemmed herb that is highly sensitive to trampling i.e. trampling impacts are readily identifiable and immediately apparent. There was no evidence of groundcover vegetation trampling either upstream or downstream of the crossing point. By comparison with the baseline surveys of 2017/18, there was evidence of quite extensive dieback of Rainforest Spinach and tree-ferns in the riparian zone both upstream and downstream of the crossing point during the 2019/20 construction period surveys. This was attributed to the unprecedented drought conditions through 2019 that resulted in there being no flow in Blackfellow Creek during the October and December 2019 surveys. The cover of rainforest spinach had partially but not fully recovered by the 2020/21 surveys.

Table 3.9 below summarises the status of key indicators of riparian habitat quality at Blackfellow Creek during the first year of operation of the new section of the Scenic Rim Trail that crosses Blackfellow Creek.

Table 3.9. Operation phase status of key indicators of riparian habitat quality within 100m upstream and downstream of the crossing of Blackfellow Creek during 2019/20.

Key indicator	Within 100m upstream	Within 100m downstream
Evidence and extent of trampling of sensitive groundcover vegetation along the riparian bank	No evidence of trampling during any of the surveys.	No evidence of trampling during any of the surveys.

Key indicator	Within 100m upstream	Within 100m downstream
Evidence and extent of erosion along the hiking trail in the vicinity of the creek crossings	No evidence of erosion during any of the surveys.	No evidence of erosion during any of the surveys.
Evidence and extent of feral pig and/or domestic cattle activity	No evidence of feral pigs or domestic cattle.	There was evidence of renewed regular feral pig use of a mud wallow on the creek bank that was in active use by feral pigs in 2018/19. No evidence of domestic cattle.
Evidence and extent of sediment in the in-stream channel	Occasional vegetated side bars, some showing erosion from recent high water flows; limited sediment in pools, which had a range of sediment sizes.	Occasional vegetated side bars, some showing erosion from recent high water flows; limited sediment in pools, which had a range of sediment sizes.
Evidence and extent of damage to riparian bank stability	No damage to bank stability.	No damage to bank stability.
Evidence and extent of weeds	No weeds present.	No weeds present.
Mt Mistake Spiny Crayfish population	A total of 22 active burrows detected within 100m upstream of the constructed crossing point (compared to baseline of 58 burrows within 150m of initially proposed crossing point in 2018/19, and 30 active burrows in 2019/20), confirming a healthy population.	A total of 11 active burrows detected within 100m downstream of the constructed crossing point (compared to baseline of 18 burrows within 100m of initially proposed crossing point in 2018/19, and 9 active burrows in 2019/20), confirming a healthy population.

3.5.2 Dalrymple Creek

Dalrymple Creek within 100 m upstream and downstream of the new trail crossing is a high-energy headwater perennial stream located in the bed of a steep valley. The stream is sharply incised in the valley and has a bankfull width of 5-10 m above the crossing and 10-15m below the crossing below the junction with another stream. The stream above the crossing comprises a series of mostly shallow pools separated by short riffle zones or flows over bedrock, with occasional pools that reach a depth of a little over 0.5 m (**Photos 3.9** and **3.10**). The stream below the proposed crossing has larger, deeper pools interspersed with short riffle zones or flows over bedrock slopes or platforms (**Photos 3.11** and **3.12**).

Photo 3.9 Dalrymple Creek photo-point within 100m upstream of the crossing point, October 2018.

Photo 3.10 Dalrymple Creek photo-point within 100m upstream of the crossing point, October 2020.

3.11 Dalrymple Creek photo-point within 100m downstream of the crossing point, October 2018.

Photo 3.12 Dalrymple Creek photo-point within 100m downstream of the crossing point, October 2020.

The streambed is stable, having eroded to bedrock over much of its length within the assessment area, with a channel that is in a relatively natural state (not deepened or infilled) with bed and bar sediments roughly the same size. Many pools have a bedrock bed with loose cobbles and limited fine sediments.

The creek is located in complex notophyll vine forest. The concave, steeply-sloped creek banks are continuously vegetated, with a moderate abundance of trailing bank vegetation. The banks are stable, with little evidence of erosion and little potential for future problems evident; occasional bars of accumulated coarse sediment suggest occasional sediment inputs from landslips, a natural process in the very steep surrounding mountain slopes. The streambank surfaces and immediate riparian zone are covered by a mosaic of native vegetation, leaf litter, fallen tree logs and extensive areas of bedrock; exposed bedrock on the stream banks is substantially covered with moss.

The ground vegetation at the stream edges and along the banks is dominated by Rainforest Spinach (*Elatostema reticulatum*), with patchy co-dominance by *Pollia crispata*. Other groundcover species include Cunjevoi (*Alocasia brisbanensis*) and a variety of ferns, particularly Soft Bracken (*Calochlaena dubia*), Sickle Fern (*Pellaea nana*), Tender Brake (*Pteris umbrosa*) and Birds Nest Fern (*Asplenium australasicum*). Scaly Treefern (*Cyathea cooperi*), *Cordyline petiolaris* and a variety of rainforest tree saplings occur commonly along the banks in the shrub layer. There was no evidence of introduced plant weed species anywhere along the creek.

The constructed crossing point of Dalrymple Creek is approximately 30 m upstream of the originally proposed crossing point, thereby avoiding the trail descending a steep bank to reach the creek bed. Instead, the constructed trail uses a gentle slope to reach the bank of the creek, where there is a step down to cross the creek on a rock platform (**Photo 3.13**). The trail then tracks downstream along the edge of the creek (**Photo 3.14**), descending a short rockface along the side of a small waterfall before joining the existing Cascades Trail (**Photos 3.15** and **3.16**) approximately 20 m above the junction of Dalrymple Creek with a similar-sized tributary.

Photo 3.13 Crossing point on Dalrymple Creek where the trail steps down from the bank on the far side, February 2021.

Photo 3.14 Trail tracking along the left (southern) bank of Dalrymple Creek below the crossing point, February 2021.

Photo 3.15 Downstream from the crossing point on Dalrymple Creek, October 2018.

Photo 3.16 Downstream from the crossing point on Dalrymple Creek, February 2021.

There was no evidence of groundcover vegetation trampling either upstream or downstream of the proposed crossing point, as well as no evidence of feral pig visitation during any survey between September 2020 and March 2021. While there was evidence (dung piles) that domestic cattle had regularly ranged along the lower portion of the Cascades Circuit trail between October 2019 and January 2020, there was no evidence of domestic cattle visitation within 100 m upstream and downstream of the proposed new trail crossing during any survey during the operation phase. There was some evidence of recent Feral Pig diggings along the lower portion of the Cascades Circuit trail during the construction phase surveys but not during the operation phase surveys in 2020/21.

The total number of active Mt Mistake Spiny Crayfish burrows was 17 burrows within 100m upstream of the proposed crossing point and 1 burrow within 100m downstream of the proposed crossing point, confirming that Dalrymple Creek is an important habitat area for this species. The paucity of burrows along the downstream section is likely a consequence of the greater surface area of exposed bedrock and fewer earth banks. The maximum distance of burrows from the stream edge was two metres.

Table 3.10 below summarises the status of key indicators of riparian habitat quality at Dalrymple Creek during the first year of operation of the new section of the Scenic Rim Trail that crosses Dalrymple Creek.

Table 3.10. Operation phase status of key indicators of riparian habitat quality within 100m upstream and downstream of the new trail crossing of Dalrymple Creek.

Key indicator	Within 100m upstream	Within 100m downstream
Evidence and extent of trampling of sensitive groundcover vegetation along the riparian bank	No evidence of trampling.	No evidence of trampling.
Evidence and extent of erosion along the hiking trail in the vicinity of the creek crossings	No evidence of erosion during any of the surveys.	No evidence of erosion during any of the surveys.
Evidence and extent of Feral Pig and/or domestic cattle activity	None.	None.
Evidence and extent of sediment in the in-stream channel	Occasional vegetated and unvegetated side bars; limited sediment in pools, which have a range of sediment sizes.	Limited sediment in pools, which have a range of sediment sizes.
Evidence and extent of damage to riparian bank stability	No damage to bank stability.	No damage to bank stability.
Evidence and extent of weeds	No weeds present.	No weeds present.
Mt Mistake Spiny Crayfish population	A total of 17 active burrows (compared to baseline of 28 burrows in 2018/19) detected within 100m upstream of the crossing point, confirming a healthy population.	A total of 1 active burrows detected (compared to baseline of 3 burrows in 2018/19) within 100m downstream of the proposed crossing point.

3.5.3 Corrective action triggers

The assessment of whether corrective action is triggered based on the results of the first year of construction monitoring is summarised in **Table 3.11** below. There was evidence of recent Feral Pig activity downstream of the crossing at Blackfellow Creek and at multiple locations along the Winder Track during the 2020/21 surveys, but Feral Pigs were active in Blackfellow Creek and along the Winder Track throughout the 2018/19 baseline surveys, so the presence of Feral Pigs after the construction of the new trail section is not attributable to the Project. Queensland Parks and Wildlife Service (QPWS) also had a Feral Pig trap operational on the Winder Track upslope from the Blackfellow Creek trail through 2020/21; consequently, no corrective action is required.

Table 3.11. Assessment of corrective action triggers for riparian habitat condition in accordance with the SRTMP.

Corrective action trigger	Assessment	Corrective action required
Any damage to riparian vegetation caused by walkers using the crossings, or by feral animals.	There was no evidence of damage to riparian vegetation or evidence of feral animal activity within 100 m upstream or downstream of the Dalrymple Creek crossing. There was evidence of Feral Pig activity downstream of the Blackfellow Creek crossing during the 2020/21 surveys; otherwise, no damage to riparian vegetation detected. Feral pigs were active in Blackfellow Creek during the baseline surveys, so the Feral Pig activity during the first year of operation is not attributable to the Project.	No corrective action required as QPWS already has Pig traps operational on the Winder Track above Blackfellow Creek.

4.0 REFERENCES

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APPENDIX A

Habitat assessment site data

Table A.1: Vegetation composition and structure at Hastings River Mouse detailed habitat assessment sites.

Site: T1 Woodcutters	Representative photograph
Canopy (T1): Height range 20-35m; Median height 30m; Cover: 90% Dominant species: *Eucalyptus campanulata*; *E. saligna.* **Sub-canopy (T2):** Height range 5-10m; Median height 6m; Cover: 30% Dominant species: *Allocasuarina torulosa*; *Eucalyptus* saplings. **Shrub (S1):** Height range 1-2m; Median height 1m; Cover: 3% Dominant species: *Polyscias sambucifolia*, *E. campanulata, A. torulosa, Xanthorrhoea glauca* **Groundcover:** Height range 0-1m; Median height 0.4m; Cover: 50% Dominant species: *Lomandra longifolia*, *Oplismenus hirtellus*, *Doodia aspera, Hibbertia scandens*. **Notes**: Shelter sites include abundant large fallen logs with hollows. **Hastings River Mouse capture site: November 2016, October 2020**.	
Site: T2 Woodcutters	**Representative photograph**
Canopy (T1): Height range 20-35m; Median height 30m; Cover: 75% Dominant species: *Eucalyptus eugenioides*; *E. saligna*; *E. campanulata.* **Sub-canopy (T2):** Height range 6-12m; Median height 10m; Cover: 20% Dominant species: *Allocasuarina torulosa*; *Eucalyptus campanulata*; *Acacia melanoxylon*. **Shrub (S1):** Height range 1.5-5m; Median height 5m; Cover: 10% Dominant species: *Xanthorrhoea glauca*; *Eucalyptus* saplings. **Groundcover:** Height range 0-1m; Median height 0.5m; Cover: 45% Dominant species: *Lomandra longifolia*, *Rubus molucccanus, Cissus antarctica*. **Notes**: Shelter sites include scattered large fallen logs and nearby rock outcroppings in gullies. **Hastings River Mouse capture site: October 2019**.	
Site: T3 Woodcutters (control)	**Representative photograph**
Canopy (T1): Height range 15-25m; Median height 20m; Cover:85% Dominant species: *Eucalyptus biturbinata*; *E. eugenioides.* **Sub-canopy (T2):** Height range 6-12m; Median height 10m; Cover: 60% Dominant species: *Allocasuarina torulosa*; *Lophostemon confertus.* **Shrub (S1):** Height range 1.5-5m; Median height 2m; Cover: 28% Dominant species: *Acacia maidenii*; *Breynia oblongifolia*; *Lophostemon confertus*; *Exocarpus cupressiformis*; *Pimelea neoanglica*. **Groundcover:** Height range 0-1m; Median height 0.3m; Cover: 40% Dominant species: *Poa labillardierei*, *Imperata cylindrica*, *Themeda triandra*, *Lomandra longifolia, Eustrephus latifolius.* **Notes**: Shelter sites include scattered large fallen logs with hollows and small surface rock outcroppings. **Hastings River Mouse capture site: October 2019**.	
Site: T4 Woodcutters (control)	**Representative photograph**
Canopy (T1): Height range 15-25m; Median height 20m; Cover: 90% Dominant species: *Eucalyptus campanulata*; *E. eugenioides*; *E. saligna*; *E. biturbinata*; *Lophostemon confertus.* **Sub-canopy (T2):** Height range 6-12m; Median height 10m; Cover: 50% Dominant species: *Allocasuarina torulosa*; *Lophostemon confertus*. **Shrub (S1):** Height range 1.5-5m; Median height 2m; Cover: 14% Dominant species: *Xanthorrhoea glauca, Lophostemon confertus*; *Myrsine variablis*; *Lantana camara**. **Groundcover:** Height range 0-1m; Median height 0.3m; Cover: 92% Dominant species: *Poa labillardierei*, *Lomandra longifolia*, *Imperata cylindrica*, *Cissus antarctica.* **Notes:** Shelter sites include scattered large fallen logs and small surface rock outcroppings. **Hastings River Mouse capture site nearby: March 2017**.	

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

	Site			
Species	**T1**	**T2**	**T3**	**T4**
Acacia maidenii	20	20	20	20
Adiantum atroviride	0	0	0	100
Adiantum hispidulum	0	0	0	20
Allocasuarina torulosa	0	0	20	0
Asperula conferta	20	0	0	20
Breynia oblongifolia	0	0	0	80
Cayratia clematidea	0	40	0	60
Cissus antarctica	40	80	0	0
Cissus hypoglauca	0	20	0	0
Commelina diffusa	0	20	0	20
Desmodium gunnii	80	40	60	40
Desmodium rhytidophyllum	20	0	0	0
Dianella caerulea	60	60	60	20
Doodia aspera	100	0	60	20
Entolasia stricta	0	40	0	80
Eustrephus latifolius	20	20	80	40
Gahnia	0	20	0	0
Geitonoplesium cymosum	0	20	0	20
Geranium homeanum	20	20	60	40
Glycine clandestina	80	60	100	100
Gymnostachys anceps	0	0	0	20
Hardenbergia violeceae	0	0	0	20
Hibbertia scandens	80	0	40	40
Imperata cylindrica	0	20	20	60
Lobelia purpurascens	40	80	20	40
Lomandra longifolia	100	20	80	20
Myrsine variabilis	0	60	0	20
Oplismenus aemulus	0	0	0	60
Oplismenus hirtellus	100	80	100	40
Oxalis chnoodes	0	0	0	40
Pandorea pandorina	0	20	20	0
Plectranthus parviflorus	0	40	0	0
Poa labillardierei	40	0	40	40
Polyscias sambucifolia	40	40	0	0
Pteridium esculentum	40	0	0	0
Rubus molucccanus	0	60	0	20
Rubus parviflorus	20	0	40	80
Sarga leiocladum	0	0	0	20
Sigesbeckia orientalis	0	20	60	40
Smilax australis	0	0	0	20
Stephania japonica	20	0	0	20
Tetrastigma nitens	20	20	0	0
Themeda triandra	0	0	0	20

	Site			
Species	**T1**	**T2**	**T3**	**T4**
Xanthorrhoea glauca	0	20	0	0
Total groundcover species	**20**	**25**	**17**	**33**