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FLEAY'S BARRED FROG (*Mixophyes fleayi*) AND MOUNTAIN FROG (*Philoria kundagungan*) BASELINE SURVEY

SCENIC RIM TRAIL, MAIN RANGE

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Table of Abbreviations

BAAM	Biodiversity Assessment and Management Pty Ltd
DPEMP	Development Proposal and Environmental Management Plan
EPBC Act	*Commonwealth Environment Protection and Biodiversity Conservation Act 1999*
NC Act	*Queensland Nature Conservation Act 1992*

1.0 INTRODUCTION

1.1 BACKGROUND

The Scenic Rim Trail –Thornton Trailhead to Spicers Peak Nature Refuge is a commercial proposal to establish a multi-day bushwalking experience in the Main Range on the western part of the Scenic Rim, including through parts of Main Range National Park and the Gondwana Rainforests of Australia World Heritage Area. The length of the proposed 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 (Tony Charters and Associates 2016).

The Commonwealth Department of Environment and Energy (the Department) proposed conditions of approval for the Scenic Rim Trail EPBC 2016/7847 specify under Condition 8b that works must not commence at new creek trails (the portion of new trails situated within a 100 m of Blackfellow Creek crossing and Dalrymple Creek crossing) until the collection of baseline population data for Fleay's Barred Frog (*Mixophyes fleayi*) and Mountain Frog (*Philoria kundagungan*) within 100 metres upstream and downstream of each crossing of the new trails at Blackfellow Creek and Dalrymple Creek, in accordance with the Baseline Data Collection and Monitoring Plan (BDCMP) for the Project has been completed. Baseline population data means data including, but not limited to, population abundance, composition and distribution as determined and collected by a suitably qualified person over a timeframe that serves as a sound basis for comparison to data acquired after commencement of the action.

1.2 STUDY OBJECTIVES

The primary objectives of this study are to collect and report on the baseline population data for Fleay's Barred Frog and Mountain Frog collected in accordance with the methods outlined in the BDCMP to ensure compliance with the proposed conditions of approval of EPBC 2016/7847.

2.0 FIELD SURVEY APPROACH

2.1 SURVEY METHODS BACKGROUND

Fleay's Barred Frog breeding males are known to call actively along the banks of rainforest streams within the period September to March (the activity period); therefore, any survey based on detecting the advertisement calls of males of this species should be conducted within this time period, but not during or within one week of heavy rainfall or strong stream flow (Commonwealth of Australia 2010), as stream-breeding frogs do not generally call during heavy rainfall or strong stream flow conditions since such conditions are unsuitable for egg-laying. The Commonwealth survey guidelines recommend that survey methods include call playback and spotlighting while walking transects along the stream (minimum transect length of 200 m) under conditions when the substrate and leaf litter is wet (Commonwealth of Australia 2010). The minimum survey effort for Fleay's Barred Frog is at least four separate survey occasions in the activity period, including a minimum of two nights under ideal conditions (Commonwealth of Australia 2010).

The New South Wales *Threatened species survey and assessment guidelines: field survey methods for fauna (Amphibians)* recommends that surveys for Mountain Frog should be conducted during the months of September to February and involve listening for calling males in areas of suitable habitat during the day. A minimum of one 200-metre transect per water body should be surveyed, with a repeated survey occurring on a second day. However, Mountain Frog calling data collected using continuously recording songmeters by Liam Bolitho, a post-graduate student at Southern Cross University, in Main Range National Park in 2016 showed that Mountain Frogs were calling most actively in September and October at one location and September to December at a second location, but with limited calling activity thereafter; these data suggest that the peak calling

period for Mountain Frog in Main Range National Park is September to early November (Liam Bolitho, personal communication).

Table 2.1 below summarises the survey methods (including survey methodology, effort, timing, frequency and responsibility) for the collection of baseline population data for Fleay's Barred Frog and Mountain Frog in the BDCMP, based on the survey considerations outlined above.

Table 2.1. Description of baseline population data collection survey methods (including survey methodology, effort, timing, frequency and responsibility) for Fleay's Barred Frog and Mountain Frog.

Fleay's Barred Frog	Mountain Frog
Methodology: • surveys to be undertaken during optimal weather conditions defined as when the substrate and leaf litter are wet after recent rainfall, but not within the first week after heavy rainfall; • call and foraging frog surveys undertaken along 200m transects upstream and downstream of each crossing point using the 'Audio strip transect survey' method; • call surveys to record location and numbers of calling males; • surveying the presence and relative abundance of Fleay's Barred Frog tadpoles during the day, using dip-netting in five pools per 200m transect (one transect upstream and one transect downstream of each crossing point) to capture tadpoles for species identification and subsequent release, and recording the total number of Fleay's Barred Frog tadpoles captured in each of two 5-second sweeps of the net at each pool; and • foraging frog surveys along the Cascades track from Manna Gum Campground to the Dalrymple Creek crossing point (a 2,700m long transect survey through prime foraging habitat) repeated on each survey night, recording locations of all frogs encountered. **Effort**: 200m transects upstream and downstream of each of the Blackfellow Creek and Dalrymple Creek crossing points, and a 2,700m long transect survey on the Cascades track, repeated on at least four nights at each site. A minimum of two nights under ideal conditions. **Timing and frequency**: Between September-March; at least four separate nights of survey at each of the crossing points. **Responsibility**: A suitably qualified person.	**Methodology**: Survey will focus on known and potential Mountain Frog habitat within 50m of proposed new trail sections using the following survey method: • call surveys focused on areas of suitable habitat during the day recording numbers and locations of calling males; • if the habitat is large enough, a 200m transect will be surveyed using the 'audio strip transect survey' method, including a 200m transect upstream and downstream of each of the Blackfellow Creek and Dalrymple Creek crossings; • if the habitat is small, the 'static (or point) call survey' method will be applied. **Effort**: A survey of all known and potential Mountain Frog habitat within 50m of proposed new trail sections, repeated on at least two days. **Timing and frequency**: A single survey between September-October (the time-period that monitoring undertaken by Liam Bolitho (Southern Cross University) shows to be the main calling period for this species at Main Range National Park). **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.

New trail sections cross Fleay's Barred Frog habitat at two locations, these being the points at which new trails cross Blackfellow Creek and Dalrymple Creek. A survey of Mountain Frog habitat and Rainforest Spinach (*Elatostema* spp., an indicator of potential Mountain Frog habitat) along the proposed alignment of new trails was conducted in June 2018 to identify all potential Mountain Frog habitat in proximity to new trail sections, particularly within 250m of high-precision historical records of Mountain Frog (BAAM 2018a). This survey resulted in two minor trail realignments to ensure new trail sections near Mt Mistake and north-west of Bare Rock did not approach within 50m of potential Mountain Frog habitat. Following these realignments, new trail sections cross

potential Mountain Frog habitat at the proposed Blackfellow Creek and Dalrymple Creek crossings, and approach within 50m of potential Mountain Frog habitat at only one other location, a rocky seep on the escarpment edge near Sylvesters Lookout approximately 30m from a new trail section. Consequently, Mountain Frog baseline surveys were restricted to these three localities. Mountain Frog surveys were also undertaken opportunistically at a control site selected for the water quality baseline assessment required under a separate approval condition, this being at a creek of similar size to Blackfellow Creek that is crossed by the Lookout Road. All surveys were undertaken in accordance with the methodology outlined in **Table 2.1**; however, the downstream strip-transect survey at Dalrymple Creek was 100m long, ending at a waterfall that prevented safe access further downstream of that point. The GPS coordinates for the starting and end points of all survey transects are included in **Appendix A**.

2.2 SURVEY TIMING AND CONDITIONS

Baseline surveys for the two threatened frog species were undertaken over the time period November 2016 to October 2018, summarised in more detail for each species in **Table 2.2** below. Three of the four Fleay's Barred Frog surveys at each of the survey sites were undertaken during ideal conditions for a call survey; the first of the four surveys was undertaken during ideal conditions for surveying for foraging frogs, but was not appropriate for a call survey since it occurred directly after heavy rainfall that resulted in high creek flow conditions; rainfall preceding the March 2017 survey included 48 mm recorded over the two days 13-14 March and approximately 100 mm recorded over 24 hours on 20-21 March at the Mount Castle rain-gauge (BoM 2018). All Mountain Frog surveys were undertaken during the peak calling activity period.

Table 2.2 Baseline threatened frog survey details.

Locality	Survey timing	Survey conditions
Fleay's Barred Frog		
Blackfellow Creek crossing (200m strip-transect upstream, 200m strip transect downstream) altitude 920-940m	20 March 2017 (nocturnal 18:20 to 20:05)	Warm, humid evening; steady rainfall from around 15:00 and throughout the survey period, with heavy rain for a short period in the half hour before the survey started, which precipitated a rapid temporary rise in the flow of water in the creek itself; leaf litter and substrate wet. Ideal conditions for foraging frogs but not for a call survey.
	4 October 2018 (nocturnal 21:30-22:15)	**Ideal conditions for a call survey**. Cool evening following a light shower of <10mm in the late afternoon that broke a dry spell; leaf litter and substrate wet.
	5 October 2018 (nocturnal 18:25-19:10)	**Ideal conditions for a call survey**. Cool overcast evening following at least 10mm light showers since the previous evening, with light showers starting again towards the end of the survey; leaf litter and substrate wet.
	7 October 2018 (nocturnal 22:10-22:50)	**Ideal conditions for a call survey**. Mild overcast evening following at least 20mm of light showers the previous two days, with a light shower during the survey; leaf litter and substrate wet.
Dalrymple Creek crossing (200m strip-transect upstream, 100m strip transect downstream) altitude 770-800m	21 March 2017 (nocturnal 18:20 to 19:00)	Heavily overcast, warm, humid evening with occasional light showers following heavy rainfall the previous evening that resulted in high flow conditions in Dalrymple Creek; leaf litter and substrate wet. Ideal conditions for foraging frogs but not for a call survey.
	4 October 2018 (nocturnal 18:30-19:30)	**Ideal conditions for a call survey**. Cool evening following a light shower of <10mm in the late afternoon that broke a dry spell; leaf litter and substrate wet.
	5 October 2018 (nocturnal 21:15-22:00)	**Ideal conditions for a call survey**. Cool overcast evening with continuous light showers following at least 10mm light showers since the previous evening; leaf litter and substrate wet.
	7 October 2018 (nocturnal 18:50-20:00)	**Ideal conditions for a call survey**. Mild overcast evening following at least 20mm of light showers the previous two days; leaf litter and substrate moist.
Cascades Circuit trail (2,700m strip transect) altitude 700-780m	21 March 2017 (nocturnal 19:10 to 20:30)	Heavily overcast, warm, humid evening with occasional light showers following heavy rainfall the previous evening; leaf litter and substrate wet. Ideal conditions for foraging frogs.
	4 October 2018 (nocturnal 19:30-20:30)	Cool evening following a light shower of <10mm in the late afternoon that broke a dry spell; leaf litter and substrate wet. Ideal conditions for foraging frogs.

Locality	Survey timing	Survey conditions
	5 October 2018 (nocturnal 20:30-21:15)	Cool overcast evening with continuous light showers following at least 10mm light showers since the previous evening; leaf litter and substrate wet. Ideal conditions for foraging frogs.
	7 October 2018 (nocturnal 20:00-21:10)	Mild overcast evening following at least 20mm of light showers the previous two days; leaf litter and substrate moist.
Mountain Frog		
Blackfellow Creek crossing (200m strip-transect upstream, 200m strip transect downstream) altitude 920-940m	4 October 2018 (afternoon 14:30-15:15)	Mild afternoon in dry conditions following a dry spell.
	4 October 2018 (nocturnal 21:30-22:15)	Cool evening following a light shower of <10mm in the late afternoon that broke a dry spell.
	5 October 2018 (nocturnal 21:15-22:00)	Cool overcast evening with continuous light showers following at least 10mm light showers since the previous evening.
	7 October 2018 (nocturnal 18:50-20:00)	Mild overcast evening following at least 20mm of light showers the previous two days, with a light shower during the survey.
	25 October 2018 (09:50-11:00)	Mild partly cloudy day following a 1mm shower the previous day, and regular showers totaling 136 mm since 7 October.
Dalrymple Creek crossing (200m strip-transect upstream, 100m strip transect downstream) altitude 770-800m	4 October 2018 (nocturnal 18:30-19:30)	Cool evening following a light shower of <10mm in the late afternoon that broke a dry spell.
	5 October 2018 (afternoon 13:20-14:25)	Cool afternoon during continuous light showers following approximately 10mm light showers since the previous evening.
	5 October 2018 (nocturnal)	Cool overcast evening with continuous light showers following at least 10mm light showers since the previous evening.
	7 October 2018 (nocturnal)	Mild overcast evening following at least 20mm of light showers the previous two days.
	25 October 2018 (12:50-13:50)	Mild partly cloudy day following a 1mm shower the previous day, and regular showers totaling 136 mm since 7 October.
Sylvesters Lookout rock seep (static call survey) altitude 1030m	11 November 2016 (diurnal)	Warm, dry day; previous rainfall comprised light showers totaling approximately 10mm two days prior. Rock seep wet.
	4 October 2018 (afternoon)	Mild afternoon in dry conditions following a dry spell. Rock seep dry.
	5 October 2018 (morning)	Cool morning following <10mm light showers since the previous evening. Rock seep dry.
Lookout Road creek crossing (aquatic control site, 200m strip-transect upstream, 200m strip transect downstream) altitude 940-960m	4 October 2018 (afternoon)	Mild afternoon in dry conditions following a dry spell.
	5 October 2018 (morning)	Cool morning following approximately 12mm light showers since the previous evening.
	25 October 2018 (morning 08:50-09:10; upstream only)	Mild partly cloudy day following a 1mm shower the previous day, and regular showers totaling 136 mm since 7 October.

2.3 TESTING FOR THE PRESENCE OF CHYTRID FUNGUS

During the March 2017 survey, swab samples were collected from five Fleay's Barred Frog tadpoles in each of the two streams surveyed to test for the presence of chytrid fungus as an additional survey commitment not required to address approval conditions. These samples were sent to Cesar Laboratories for testing for the presence of chytrid fungus spores. DNA was extracted from each swab sample and then tested in triplicate as per the real-time Taqman PCR

assay method of Boyle *et al*. (2004), with total amounts of zoospores within a swab extraction estimated using a known zoospore standard. There are three results possible: Positive for chytrid (all 3 replicates test positive), Negative for chytrid (all 3 replicates test negative) and Equivocal (1 or 2 positives out of 3 replicates).

2.4 LITERATURE REVIEW

The published literature relating to the ecology and conservation of the two threatened frog species was reviewed to inform the field survey methodology and assessment of conservation status and current and emerging threats.

2.5 QUALIFICATIONS OF THE FIELD TEAM

The baseline threatened frog surveys were led by Dr Penn Lloyd (Principal Ecologist), a suitably qualified person, with assistance from Adrian Caneris (Principal Wildlife Consutlant), Lizzy Buckby (Project Ecologist) and Gavin Jones (Fauna Spotter/Catcher). Dr Penn Lloyd has a PhD in ecology and 25 years of field experience as a terrestrial ecologist. He has published 60 peer-reviewed scientific publications in ecology and has authored over 210 consultancy reports.

3.0 RESULTS AND DISCUSSION

3.1 SPECIES PROFILE FOR FLEAY'S BARRED FROG

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

Distribution: Fleay's Barred Frog is narrowly distributed from the Conondale Range in south-east Queensland south to Yabba Scrub in north-eastern New South Wales (Hines *et al.* 1999). Populations in the Conondale Ranges declined in the 1970's and the species was thought to be lost from the area since 1990-91 (Ingram and McDonald 1993). However, more recent surveys have located the species in the upper reaches of neighbouring streams but it appears to still be absent from lower reaches (Hines *et al.* 1999). Populations from Mount Tamborine and the Bunya Mountains now seem to be extinct (Curtis *et al*. 2012), but population densities in the Border Ranges have recovered following initial declines due to chrytrid fungus infection (Newell *et al*. 2013, Quick *et al.* 2015).

Habitat and Ecology: Inhabits montane rainforest and adjoining tall open forests along lotic streams in which the species breeds (Curtis *et al*. 2012). Most records occur above 400 m, but they can be located in streams as low as 200 m (Goldingay *et al.* 1999).Typically found close to its breeding habitat along rainforests streams, but individuals, particularly adult females, can sometimes be located several hundred metres from breeding habitat, including along ridge tops in rainforest (Doak 2005).

Males call while perched on emergent rocks or on the nearby bank. Breeding occurs between July and April. Eggs are deposited in "nests" constructed in the shallow riffle zone of gently flowing streams. The nest consists of a shallow excavation in the stream bed or eggs are pasted directly onto bed rock. Unlike many frogs, *M. fleayi* does not appear to breed during and immediately after heavy rain. Rather the species breeds shortly after stream flow has slowed. This is presumably to avoid the threat of nests and tadpoles being washed downstream during high flow events (Stratford *et al*. 2010, Knowles *et al.* 2014).

Threats: Unclear, although the following possible processes have been suggested (Eyre *et al.* 1997; Hines *et al.* 1999, Curtis *et al*. 2012):

- Increased mortality due to the exotic pathogen, *Batrachochytrium* (chytrid fungus) is a strongly suspected cause of the population decline of Fleay's Barred Frog. *M. fleayi* suffering from chytrid fungus have been located at various locations (Berger *et al.* 1999).

- Loss and fragmentation of habitat;
- Habitat degradation, particularly of breeding sites due to disturbance by cattle and pigs leading to increased sedimentation of breeding habitat;
- Weed invasion (e.g. Mist Weed *Agerata riparia*) of riparian habitat potentially degrading breeding sites; and
- Predation by feral animals.

3.2 SPECIES PROFILE FOR MOUNTAIN FROG

Status: NC Act: Vulnerable.

Distribution: Mountain Frog has a restricted distribution that ranges from the Mistake Mountains in the north of Main Range National Park in south-east Queensland south to Ramornie State Forest, west of Grafton in New South Wales (Knowles *et al.* 2004; OEH 2018).

Habitat and Ecology: Mountain Frog is most common in montane subtropical and temperate rainforests where it inhabits shallow burrows in mud moss or in leaf-litter in the headwaters and along the edges of constantly flowing streams or around permanent soaks. It also occurs in wet eucalypt forests where rock outcrops or cliff bases hold surface moisture (OEH 2018).

Eggs are laid in small moist hollows beneath rocks or leaf litter in seepage areas, where the embryos complete their entire development and metamorphose. The tadpoles do not leave the nest until they emerge as metamorphlings (OEH 2018).

Threats: The following possible processes have been suggested:

- Climate change, due to the species restricted range, and specialized habitat restricted to montane rainforest with high rainfall (Hagger *et al.* 2012).
- Loss or damage to habitat through forestry or agricultural practices (Knowles *et al.* 2004, OEH 2018);
- Risk of local extinction due to small, scattered populations (OEH 2018); and
- Infection by amphibian chytrid fungus (OEH 2018).

3.3 FLEAY'S BARRED FROG BASELINE SURVEY RESULTS

3.3.1 Blackfellow Creek Section

No frogs were heard calling or responded to call-playback during the nocturnal spotlighting survey of 20 March 2017. However, this survey was undertaken during steady rain and in conditions of high stream flow immediately after heavy rainfall; therefore, frogs were not expected to be calling or responding to call-playback. Yet, the survey conditions were ideal for detecting frogs foraging (**Photo 3.1**); a total of seven Fleay's Barred Frogs were detected above the proposed crossing point but none were detected below the proposed crossing point. These frogs tended to be found on level, more open ground within 30 m of the creek banks and were all exhibiting foraging behaviour. Fleay's Barred Frogs were very active during the survey of 4 October 2018 following light showers that broke a dry spell, with frogs detected both foraging and calling. Fleay's Barred Frogs were calling or responded to call-playback during the three surveys in October 2018 that were undertaken during ideal conditions for a call survey. The maximum and average (±1 standard deviation) total number of frogs detected during the three surveys conducted in ideal conditions were 10 and 7.0±4.4 frogs on the 250m strip-transect upstream of the proposed crossing point and 5 and 4.0±1.0 frogs on the 200m strip-transect downstream of the proposed crossing point. The locations of all Fleay's Barred Frog detections at Blackfellow Creek are shown in **Figure 3.1**, with detailed location data provided in **Appendix A**.

Figure 3.1

Table 3.1 Summary of total Fleay's Barred Frogs detected upstream and downstream of the proposed new trail crossing of Blackfellow Creek. The number of calling frogs is reported in parentheses.

Date	Upstream (250m)	Downstream (200m)	Comments
20 March 2017	7 (0)	0 (0)	No frogs calling or responded to call-playback; high stream flow.
4 October 2018	10 (3)	5 (4)	Frogs calling independently and responded to call-playback.
5 October 2018	2 (0)	3 (2)	Frogs not calling independently but some responded to call-playback.
7 October 2018	9 (7)	4 (1)	Frogs calling independently and responded to call-playback.
Maximums	***10 (7)***	***5 (4)***	
Average total ±1SD during ideal conditions	***7.0 ± 4.4***	***4.0 ± 1.0***	

Dip-netting on 21 March 2017 and 25 October 2018 confirmed that Fleay's Frog tadpoles occurred relatively abundantly in all the small pools along the length of the creek surveyed, both above and below the proposed creek crossing point. The average (±1 standard deviation) number of Fleay's Frog tadpoles captured per dip-net sweep was 6.9±8.7 (range 0 to 30) in pools upstream of the proposed crossing point and 7.3±5.0 (range 1 to 15), in pools downstream of the proposed crossing point. These data confirm the suitability of the creek for Fleay's Barred Frog breeding.

Photo 3.1 Fleay's Barred Frog foraging on an open bank of Blackfellow Creek.

Photo 3.2 Suitable habitat for Fleay's Barred Frog and Mountain Frog on Blackfellow Creek.

3.3.2 Dalrymple Creek Section

No frogs were heard calling or responded to call-playback during the nocturnal spotlighting survey of 21 March 2017. However, this survey was undertaken soon after heavy rain and in conditions of high stream flow; therefore, frogs were not expected to be calling or responding to call-playback. Despite survey conditions being ideal for detecting frogs foraging, no Fleay's Barred Frogs were detected above the proposed crossing point and only two Fleay's Barred Frogs were detected below the proposed crossing point (**Photo 3.3**). Fleay's Barred Frogs were very active during the survey of 4 October 2018 following light showers that broke a dry spell, with frogs detected both foraging and calling. Fleay's Barred Frogs were calling or responded to call-playback during the three surveys in October 2018 that were undertaken during ideal conditions for a call survey. The maximum and average (±1 standard deviation) total number of frogs detected during the three surveys conducted in ideal conditions were 16 and 9.7±6.5 frogs on the 200m strip-transect upstream of the proposed crossing point and 17 and 10.3±6.5 frogs on the 100m strip-transect downstream of the proposed crossing point (**Table 3.2**).

Figure 3.2

The locations of all Fleay's Barred Frog detections at Dalrymple Creek are shown in **Figure 3.2**, with detailed location data provided in **Appendix A**.

Table 3.2 Summary of total Fleay's Barred Frogs detected upstream and downstream of the proposed new trail crossing of Dalrymple Creek. The number of calling frogs is reported in parentheses.

Date	Upstream (200m)	Downstream (100m)	Comments
21 March 2017	0 (0)	2 (0)	No frogs calling or responded to call-playback; high stream flow.
4 October 2018	16 (8)	17 (4)	Frogs calling independently and responded to call-playback.
5 October 2018	3 (1)	4 (4)	Frogs calling independently and responded to call-playback.
7 October 2018	10 (10)	10 (3)	Frogs calling independently and responded to call-playback.
Maximums	***16 (10)***	***17 (4)***	
Average total ±1SD during ideal conditions	***9.7 ± 6.5***	***10.3 ± 6.5***	

Dip-netting on 21 March 2017 and 25 October 2018 confirmed that Fleay's Frog tadpoles occurred relatively abundantly in all the small pools along the length of the creek surveyed, both above and below the proposed creek crossing point. The average (±1 standard deviation) number of Fleay's Frog tadpoles captured per dip-net sweep was 5.8±2.3 (range 2 to 9) in pools upstream of the proposed crossing point and 9.7±4.5 (range 4 to 18), in pools downstream of the proposed crossing point. Pools were substantially larger and deeper downstream of the proposed crossing point, which likely explains the greater tadpole capture rates in downstream pools. These data confirm the suitability of the creek for Fleay's Barred Frog breeding.

3.3.3 Cascades Circuit Trail

All four surveys for foraging Fleay's Barred Frogs along the 2,700m length of the Cascades Circuit walking trail between the proposed crossing point and the Manna Gum campground downstream of the proposed new crossing point were undertaken during ideal conditions for surveying foraging frogs. During the survey of 21 March 2017, foraging frogs were detected at distances up to 50m from the banks of Dalrymple Creek, whereas during the three surveys in October 2017, most frogs were detected close to the creek at the several points where the public walking trail crosses the creek. Great Barred Frogs (*Mixophyes fasciolatus*) were detected along the lower section of Dalrymple Creek near Manna Gum campground (**Photo 3.4**). The detailed location data for all Mountain Frog detections along the Cascades Circuit trail are provided in **Appendix A**.

Table 3.3 Summary of total Fleay's Barred Frogs and Great Barred Frogs detected foraging along the 2,700m length of the Cascades Circuit walking trail.

Date	Cascades Circuit trail (2,700m)		Comments
	Fleay's Barred Frog	Great Barred Frog	
21 March 2017	42	1	No frogs calling; high stream flow. A few Great Barred Frogs calling intermittently adjacent to the Manna Gum campground.
4 October 2018	32	2	Fleay's Barred Frogs calling sustainedly at scattered locations along the length of Dalrymple Creek.
5 October 2018	12	2	Fleay's Barred Frogs calling intermittently along the length of Dalrymple Creek; Great Barred Frogs calling intermittently along the lower section of Dalrymple Creek near Manna Gum campground.
7 October 2018	16	1	Fleay's Barred Frogs calling intermittently along the length of Dalrymple Creek; Great Barred Frogs calling sustainedly along the lower section of Dalrymple Creek near Manna Gum campground.
Maximum	***42***	***2***	
Average ±1SD	***25.5 ± 14.0***	***1.5 ± 0.6***	

Photo 3.3 Fleay's Barred Frog on Dalrymple Creek.

Photo 3.4 Great Barred Frog on lower Dalrymple Creek close to the Manna Gum campground.

3.4 MOUNTAIN FROG BASELINE SURVEY RESULTS

3.4.1 Blackfellow Creek Section

The maximum and average (±1 standard deviation) total number of frogs detected during the four surveys when Mountain Frogs were actively calling were 4.8±3.0 frogs on the 200m strip-transect upstream of the proposed crossing point and 3.8±2.2 frogs on the 200m strip-transect downstream of the proposed crossing point (**Table 3.4**). The locations of all Mountain Frog detections along the Blackfellow Creek strip-transects are shown in **Figure 3.1**, with detailed location data provided in **Appendix A**.

Table 3.4 Summary of total Mountain Frogs detected calling upstream and downstream of the proposed new trail crossing of Blackfellow Creek.

Date	Upstream (200m)	Downstream (200m)	Comments
4 October 2018 (afternoon)	8	1	Frogs calling independently during warm, dry conditions.
4 October 2018 (evening)	6	6	Frogs calling independently during mild, wet conditions.
5 October 2018 (evening)	1	5	Frogs calling independently and responded to call-playback.
7 October 2018 (evening)	0	0	No response to call-playback.
25 October 2018 (morning)	4	3	Frogs calling independently.
Maximums	***8***	***6***	
Average total ±1SD during activity periods	***4.8 ± 3.0***	***3.8 ± 2.2***	

3.4.2 Dalrymple Creek Section

No Mountain Frogs were detected calling during any diurnal or nocturnal survey upstream or downstream of the proposed Dalrymple Creek crossing, despite abundant suitable habitat along the banks of Dalrymple Creek at these locations. A single Mountain Frog was heard calling on the banks of Dalrymple Creek on the Cascades Circuit approximately 350m downstream of the monitoring sites during the 25 October 2018 survey, confirming that Mountain Frog does occur in Dalrymple Creek. The reduced abundance of Mountain Frog on Dalrymple Creek may result from the lower altitude of this area.

3.4.3 Sylvesters Lookout rock seep

In early October 2018, the rock seep was no longer oozing water after an extended dry spell, and no Mountain Frogs were calling during the diurnal surveys on the 4th and 5th of October 2018. The location of the November 2016 Mountain Frog detection is shown in **Figure 3.3**, with detailed location data provided in **Appendix A**.

3.4.4 Lookout Road creek crossing (a control site)

The maximum and average (±1 standard deviation) total number of frogs detected during surveys were 6.7±6.7 frogs on the 200m strip-transect upstream of the Lookout Road crossing and 8.0±4.2 frogs on the 200m strip-transect downstream of the Lookout Road crossing (**Table 3.5**). The detailed location data for all Mountain Frog detections along the control site strip-transects are provided in **Appendix A**.

Table 3.5 Summary of total Mountain Frogs detected calling upstream and downstream of the Lookout Road creek crossing (a control site).

Date	Upstream (200m)	Downstream (200m)	Comments
4 October 2018 (afternoon)	1	5	Frogs calling independently during warm, dry conditions.
5 October 2018 (morning)	5	11	Frogs calling independently during cool, wet conditions.
25 October 2018 (morning)	14	Not surveyed	Frogs calling independently during partly cloudy and mild conditions.
Maximums	***14***	***11***	
Average total ±1SD	***6.7 ± 6.7***	***8.0 ± 4.2***	

Figure 3.3

3.5 CHYTRID FUNGUS SURVEY RESULTS

Of the five samples collected from tadpoles in Blackfellow Creek, two tested positive for chytrid fungus (all three replicates tested positive), two were equivocal (1 to 2 replicates tested positive) and one tested negative (all three replicates tested negative). Of the five samples collected from tadpoles in Dalrymple Creek and its tributary, one tested positive and four tested negative for chytrid fungus (see **Appendix B** for the laboratory results in their original form). These results confirm the presence of chytrid fungus in both the Blackfellow and Dalrymple catchment systems.

3.6 EXTENT, NATURE, AND SEVERITY OF CURRENT THREATS

Current threats to Fleay's Barred Frog within the areas subject to this assessment include chytrid fungus, feral pigs and domestic cattle. The testing for chytrid fungus confirmed that this pathogen is already present within the Blackfellow Creek and Dalrymple Creek catchments, as originally anticipated. Given the relatively high abundance of adult frogs and tadpoles detected during the surveys, it is likely that Fleay's Barred Frog populations in the Blackfellow Creek and Dalrymple Creek catchments have recovered following the initial impacts of chytrid fungus, as has been documented elsewhere in the range of Fleay's Barred Frogs (Newell *et al.* 2013, Quick *et al.* 2015). The occurrences of feral pigs and domestic cattle within the areas subject to this assessment are described in more detail in a separate report detailing baseline riparian habitat quality and water quality (BAAM 2018b).

4.0 REFERENCES

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APPENDIX A

Frog survey data

APPENDIX B

Chytrid fungus test results