



Transport for
New South Wales

Warrell Creek to Nambucca Heads

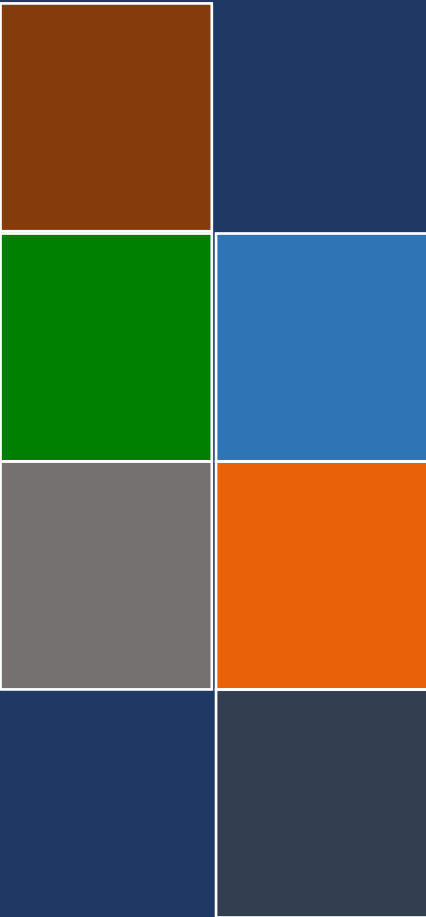
Interim Giant Barred Frog Monitoring Report –spring
year five operational phase (2022-2023)

Transport for New South Wales | April 2023 |



Pacific Highway upgrade: Warrell Creek to Nambucca Heads (WC2NH)

Giant Barred Frog – operational phase Year
Five (2022-2023)



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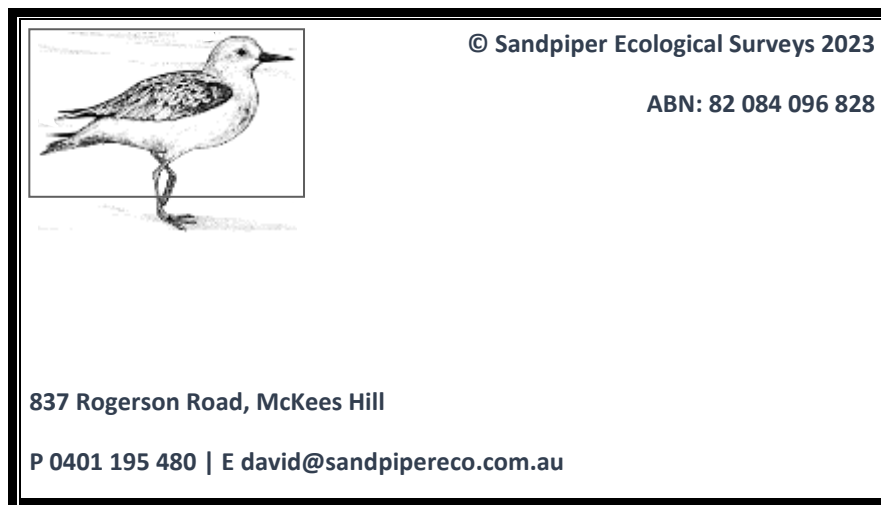
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1. Introduction

In 2015, Transport for New South Wales, in conjunction with Acciona Ferrovia Joint Venture (AFJV), commenced the upgrade of the Pacific Highway between Warrell Creek and Nambucca Heads (WC2NH). The WC2NH project was opened to traffic in two stages:

- Stage 2a - 13.5km section from Lower Warrell Creek Bridge to Nambucca Heads opened on 18 December 2017; and
- Stage 2b - 6.25km section from the southern end of the project to the Lower Warrell Creek bridge opened in late June 2018.

Approvals for the WC2NH upgrade required monitoring of several species and mitigation measures during the operational phase. Species monitored include koala (*Phascolarctos cinereus*), yellow-bellied glider (*Petaurus australis*), giant barred frog (*Mixophyes iteratus*), green-thighed frog (*Litoria brevipalmata*) slender marsdenia (*Marsdenia longiloba*), rusty plum (*Niemeyera whitei*) and Floyds grass (*Alexfloydia repens*). Mitigation measures monitored included green-thighed frog breeding ponds, fauna underpasses, vegetated median, and exclusion fence. Sandpiper Ecological Surveys (SES) has been contracted by Transport for NSW (TfNSW) to deliver the WC2NH operational ecological and water quality monitoring program in accordance with the Warrell Creek to Nambucca Heads Operational Ecological and Water Quality Monitoring Brief (the Brief).

The following interim report details the methods and results of the spring year five operational phase giant barred frog population monitoring. The objective of giant barred frog monitoring, as outlined in the Giant Barred Frog Management Strategy (GBFMS), is “to demonstrate through the life of the project that mitigation has maintained or improved population sizes and habitat of giant barred frog. The use of preconstruction, during construction and post-construction monitoring to measure frog distribution, abundance, and habitat quality with defined thresholds will be used to measure the overall performance of the mitigation” (Lewis 2014b).

1.1 Background

The giant barred frog is listed as ‘Endangered’ under both the NSW *Biodiversity Conservation Act 2016* (BC Act) and Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The impact of the upgrade on giant barred frog was assessed in the Project Environmental Assessment (Sinclair Knight Merz [SKM] 2010). Following identification of potential giant barred frog habitat during the Project environmental assessment, Lewis Ecological conducted targeted surveys in November 2011 and January/February 2013 (Lewis 2014a). A population of giant barred frog was subsequently confirmed at Upper Warrell Creek and a management strategy prepared (see Lewis 2014b).

Measures proposed to manage impacts on giant barred frogs included: population monitoring, pre-clearing surveys, temporary frog fencing during construction, clearing supervision, dewatering procedures (tadpole surveys) and permanent frog exclusion fence. Population monitoring was recommended to occur within a 1km transect, extending either side of the upgrade alignment, in spring, summer and autumn of Year 1 and 3 of the construction phase and years 1, 3 and 5 of the operational phase using the methods applied during preconstruction baseline surveys.

Preconstruction baseline surveys for giant barred frog were conducted between 20 September 2013 and 2 April 2014. The baseline surveys recorded 47 individuals, including 22 adults (11 females & 11 males), 8 sub-adults, and 8 juveniles. Based on these results, the population of giant barred frogs at the Upper Warrell Creek

site was calculated as 45 adults (with a 1:1 sex ratio), 19 sub-adults, and 16 juveniles (Lewis Ecological 2014b). Geolink (2018) recalculated population size for baseline, year 1 and year 3 construction phase samples and obtained population estimates of 41 (2013/14), 7 (2015/16), and 8 (2017/18), respectively. The results suggest a substantial decline in population between 2013/14 and 2015/16.

During early construction work *Mixophyes* spp. tadpoles were recorded at Butchers Creek (Geolink 2015). There was some conjecture about the identification of tadpoles and targeted surveys for adult frogs and further consultation with frog specialists was undertaken in an attempt to confirm the identification. The final consensus was that the tadpoles were great barred frog (*Mixophyes fasciolatus*) and the giant barred frog was unlikely to occur at Butchers Creek (see Geolink 2015; Lewis 2015). Nonetheless, a precautionary approach was adopted and the Butchers Creek site was included in population monitoring (Geolink 2016). No giant barred frogs were recorded at Butchers Creek during the construction phase (Geolink 2018).

2. Methodology

2.1 Study area

The WC2NH project covers a total length of 19.75km and extends from Warrell Creek in the south to Nambucca Heads in the north (Figure 1). The alignment bypasses the town of Macksville and the northern section traverses Nambucca State Forest. The two sample sites, Butchers Creek and Upper Warrell Creek, are situated near the southern end of the alignment (Figure 1). Following completion of the spring year 3 operational phase survey it was agreed with TfNSW that future monitoring at Butchers Creek be discontinued following refused entry from the landowner in response to severe flooding that had increased the risk of tree-fall at the site in combination to the absence of giant barred frog records during construction and operational surveys. As such, monitoring in year 5 spring survey was focused at Upper Warrell Creek along a 1km transect, extending either side of the upgrade alignment divided into 21 zones per baseline monitoring (Figure 2).

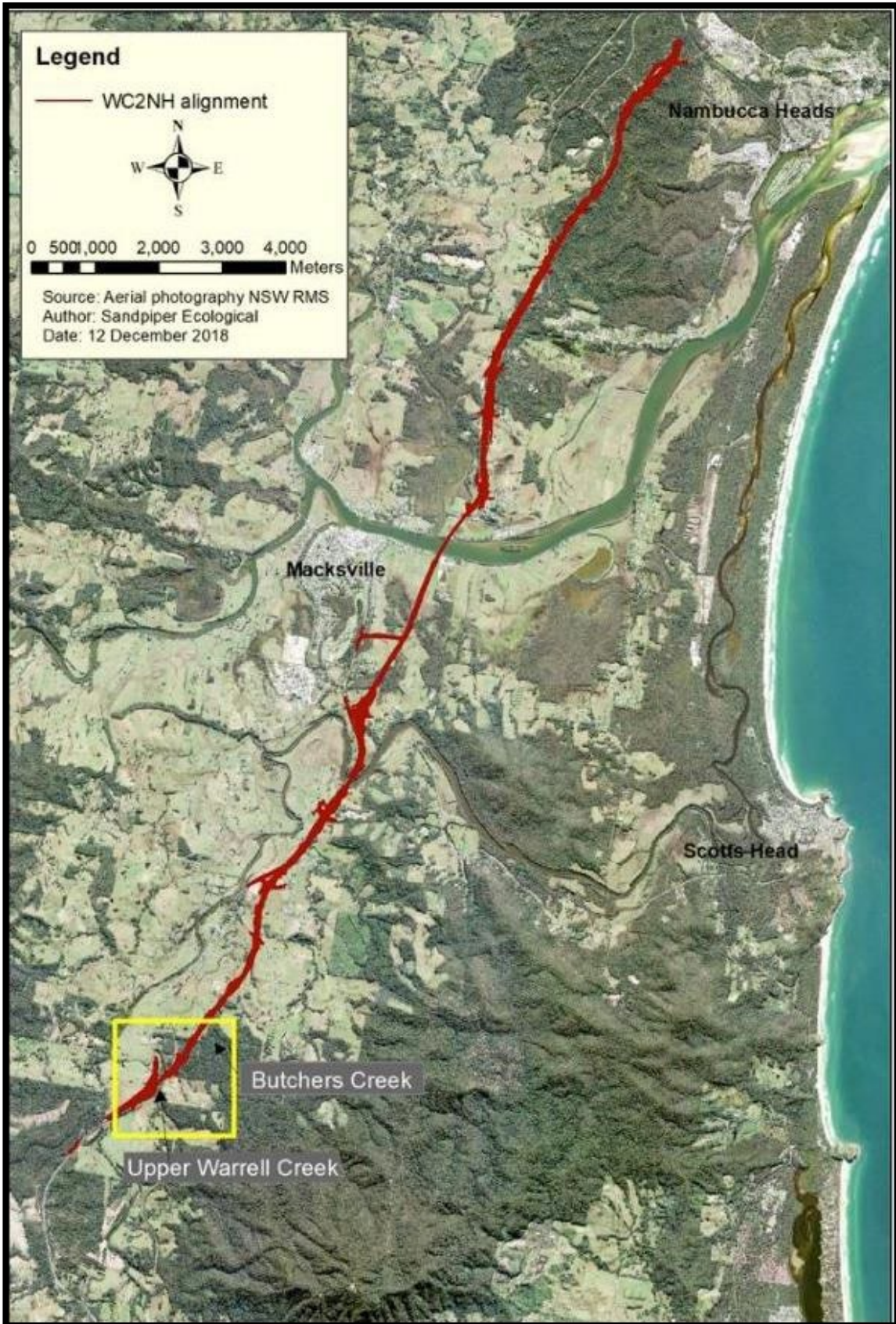


Figure 1: Location of giant barred frog sample sites in relation to the WC2NH alignment.

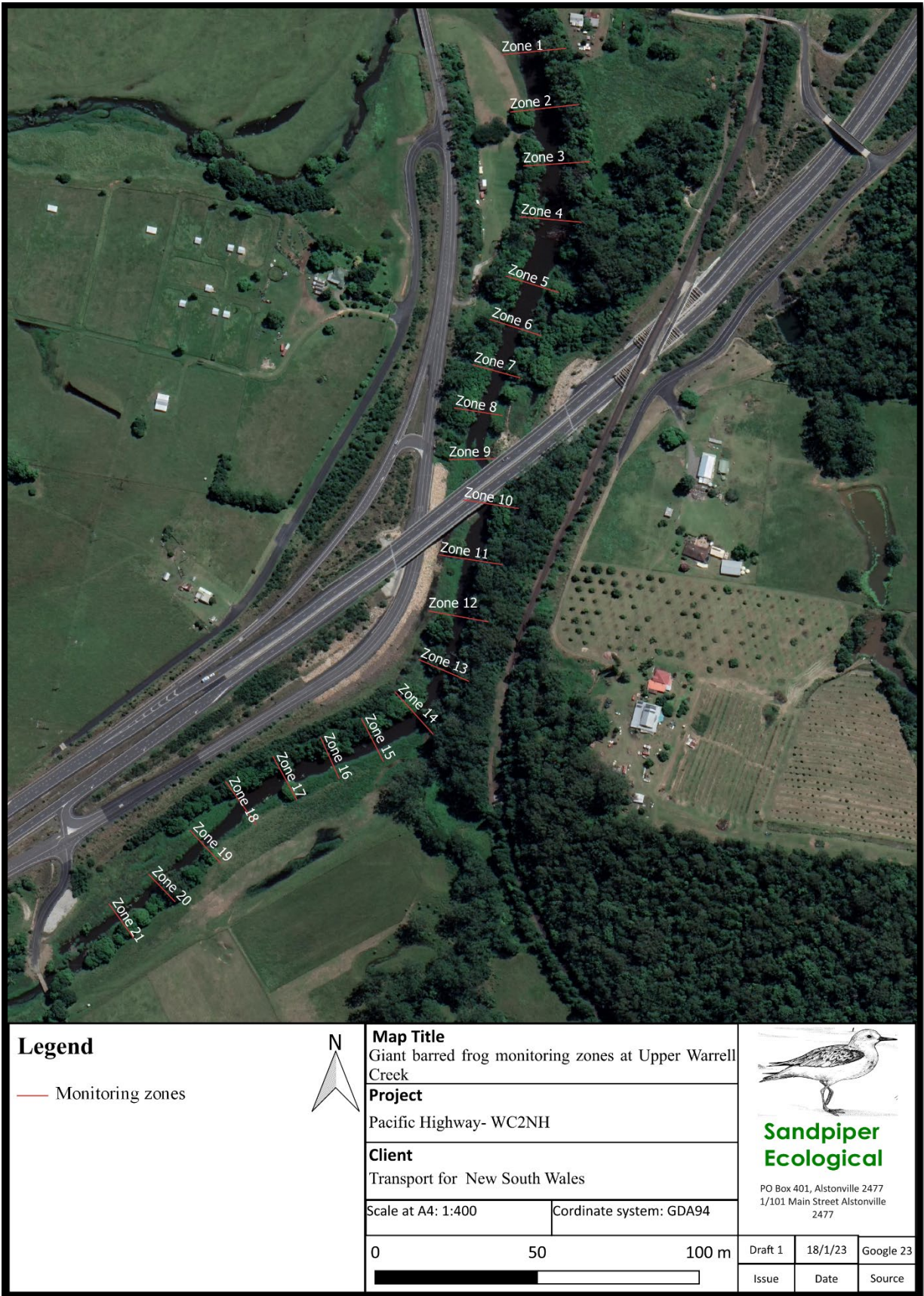


Figure 2: Survey monitoring zones within Upper Warrell Creek.

2.2 Frog surveys

Frog surveys followed the method specified in the Brief and baseline population survey (Lewis 2014). The method involved:

1. Surveys were conducted on 1 and 2 December 2022 (spring survey), with 16 person-hours spent searching for frogs at Upper Warrell Creek. The December 2022 survey was intended to occur in spring and was delayed due an extended dry period where the survey trigger value of >10mm 24hrs prior to the sample was not met (Lewis 2014).
2. Two ecologists conducted a nocturnal meandering foot-based traverse of 40 x 50m survey zones, 20 on each side of the watercourse at Upper Warrell Creek (20/side; Figure 2).
3. Each ecologist was equipped with a 200-700 lumen spotlight and slowly traversed the riparian zone searching for frogs and listening for calls. Giant barred frog calls were broadcast through a 2-watt bluetooth speaker for five minutes within each zone. Both ecologists listened for call responses during and immediately after call broadcast.
4. All captured giant barred frogs were scanned with a Trovan Nanotransponder to determine if that frog had been previously pit-tagged. If the captured individual had not been pit-tagged and was deemed a sub-adult or older (i.e. >40mm snout-vent length) a tag was inserted beneath the skin on the left side and the insertion hole sealed with vet bond. The insertion point was swabbed with disinfectant (Betadine) before the tag was inserted. During operational surveys prior to autumn 2021, only frogs with a SV length greater than 60mm were PIT tagged. In autumn 2021, the size limit was reduced to 40mm to ensure consistency with baseline and construction phase surveys.
5. The dorsal pattern of all captured frogs was photographed during spring. A comparison of dorsal pattern is a way to distinguish individual frogs and was done to identify untagged frogs captured in autumn 2021 and March 2022.
6. Data collected on each captured frog included: Survey zone (20x50m); Distance from the stream edge measured to the nearest 0.1m; Position within the microhabitat (i.e. under litter, above litter, exposed, on rock/log); Sex (male, female, unknown); Age class (adult=>60mm; sub-adult=40-60mm; juvenile=<40mm); Snout-vent length (mm); Weight (grams); Breeding condition:
 - i. males assessed on the colouration of their nuptial pads (i.e. no colour, light, moderate, dark) in accordance with the classification developed by Lewis (2014b);
 - ii. females assessed on whether they are gravid (i.e. egg-bearing, with the typically adult weighing > 100 grams) or not gravid.
 - iii. frogs with a snout-vent length of <60 mm were classified as immature.

2.3 Tadpole survey

Tadpole surveys will be undertaken during the summer and autumn surveys of year five monitoring and will be undertaken using the following procedure:

1. Dip-netting by two ecologists within each survey zone. Dip-netting targeting areas of undercut bank and detritus.
2. One bait trap (~300 mm x 200 mm), baited with bread, to be installed within each zone for 2½ -3 hours.
3. The following information is to be collected for each giant barred frog tadpole:
 - a. Species
 - b. Survey zone (20x50m).
 - c. Sex (male, female, unknown).
 - d. Weight (grams).

Tadpoles identified with reference to Anstis (2001, 2017).

2.4 Habitat assessment

Key habitat components in each survey zone are required to be sampled annually (i.e. once/year). Habitat sampling is scheduled to be conducted during the summer sample period. Habitat data recorded in each zone at each site will include:

1. Land use: Description of existing land uses e.g. grazing, dairy, horticulture, conservation, private native forestry.
2. Broad vegetation type within the immediate riparian zone (primary stream bank): Riparian Rainforest, Dry Sclerophyll, Wet Sclerophyll, Sedgeland, Grassland or Cleared Land.
3. In stream physical characteristics including stream width and depth (metres), presence of pools and/or riffles, bed composition (sand, clay, rock, organic or other to be specified), and type of emergent vegetation, if present.
4. Stream bank characteristics including bank profile expressed as steep, benched or a gradual incline from the water's edge.
5. Foliage projective cover of overstorey, midstorey and ground layer vegetation on the stream bank.
6. Groundcover expressed as a percentage of vegetation, leaf litter, soil, and exposed rock.
7. Litter depth - Deep (>100 mm); Moderate (20-100 mm); Shallow (>0-20 mm); or Absent (0 mm).

2.5 Water quality sampling

Water samples and field measurements are to be taken within the sample transect at Upper Warrell Creek during the summer and autumn surveys. Due to a change in property ownership, the sample collection site has been moved approximately 100m upstream. Field physicochemical measurements, including Conductivity, pH, Temperature, dissolved oxygen and turbidity, will be measured using a Horiba Laqua PC110 portable water quality meter.

Water quality parameters to be analysed from the collected sample/s include:

1. Heavy Metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.
2. Nutrients including Nitrogen (as N), Suspended Solids and Total Phosphorus.
3. Hydrocarbons from the following groups:
 - a. Naphthalene group including TRH>C10-C16, TRH>C10-C16 less Naphthalene (F2), TRH>C16-C34, TRH>34-C40, TRH C6-C10 and TRH C6-C10 LESS BTEX (F1).
 - b. BTEX group including Benzene, Ethylbenzene, m&p-Xylenes, o-Xylene, Toluene and Xylenes – total.

3. Results and discussion

3.1 Survey timing weather conditions and effort

Below average rainfall was recorded 30 days before the sample period, with 36 mm falling before 2 December, 17 mm of which was recorded to 9 am on 1 December. Rainfall was present during both spring surveys, with heavy rainfall occurring on 1 December, which may have affected frog activity and detectability (Table 1). The air temperature was slightly cool and ranged between 16.8°C and 18.2°C (Table 1). Overall conditions were not ideal for giant barred frog detection but were considered reasonable. The combined survey effort at Upper Warrell Creek during the spring sample was 15.75 person-hours.

Table 1: Weather conditions and survey effort recorded during the year five spring giant barred frog survey at Upper Warrell Creek. Rainfall data were sourced from the Bellwood weather station. PH = person hours; Wind

categories = 0 - no wind, 1 - rustles leaves, 2 - branches moving, 3 - canopy moving; RH = relative humidity; Rainfall = mm; Temp = °C; Dew Point = °C

Season	Date	Time	Observations	PH	Rainfall	Rainfall (prev 24hr)	Rainfall (prev 7 days)	Rainfall (prev 30 days)	Temp	RH	Dew point	Wind
Spring	1/12/22	2000-2345	LA/AE	7.75	Heavy rain present	0	0	17	16.8	86	14.9	2
	2/12/22	2000-0000	LA/AE	8	Present	19	19	36	18.2	69	14.2	1

3.2 Giant barred frog records and distribution

Four individual giant barred frogs were recorded at Upper Warrell Creek during the year five spring survey (Table 2). Captures included three adults (snout-vent length >60mm), none of which were recaptured and were tagged as new individuals (Table 2). Confirming the sex of non-calling adult frogs is difficult and in the absence of calls, the sex of adult frogs was based on the snout-vent length and weight. Using these criteria, two of the captured individuals (Frog 3 and 4) were deemed male and the larger individual (Frog 1) was deemed female (Table 2). An additional male giant barred frog (Frog 2) was heard calling on the southern bank and was unable to be captured (Table 2). The record of a calling male is encouraging as it provides evidence of breeding in the current population at Upper Warrell Creek.

Giant barred frogs were recorded both downstream and upstream of the alignment (Figure 3). Giant barred frog records were concentrated between zones 6 and 13 (Figure 3) and tended to be within 200m of the alignment, consistent with recent operational monitoring surveys (Sandpiper, 2021 and 2022). Upstream of the alignment, two individuals were captured on the north bank, whilst downstream, two were recorded on the south bank. All captured individuals were positioned within 10m of the stream sitting on leaf litter (Table 2). No recaptures were recorded; hence, no individuals were found to have crossed the alignment.

Table 2: Data recorded for giant barred frogs captured or heard calling during the year 5 spring operational phase monitoring survey at Upper Warrell Creek. HC = Heard call. S = South. N= North. UK= unknown. S/V = snout-vent length.

Frog ID	Season	Date	Zone	Side	Distance to water edge	Position in micro-habitat	Sex	Age	S/V length	Weight	Condition	New or recapture	Microchip ID
1	Spring	1/12/22	8	S	5m	Leaf litter	F	Adult	91	132	Gravid	New	956000011426414
2 (HC)	Spring	1/12/22	6	S	UK	UK	M	Adult	UK	UK	UK	UK	UK
3	Spring	2/12/22	11	N	6m	Leaf litter base of tree	M	Adult	71.5	61	Moderate	New	956000010454481
4	Spring	2/12/22	13	N	10m	Leaf litter	M	Adult	68.4	59	Moderate	New	956000010427117

3.3 Giant barred frog abundance

Adult giant barred frogs continue to persist at Upper Warrell Creek almost five years after completion of construction. Uncertainty remains about whether frogs within the study area have bred in that area or emigrated from upstream (Sandpiper 2022). During year four monitoring, there appeared to be a correlation between declining recaptures, detection of new individuals, and flood frequency (Sandpiper 2022). Movement of frogs into the study area by flood remains likely, and it stands to reason that more frogs will wash into the study area during productive breeding years, such as 2020 and 2021 (Sandpiper 2022). Regarding flood movements, frogs are equally likely to be washed out of the study area. Juvenile frogs may be particularly susceptible to flood transportation due to their small size (Koch & Hero 2007). It appears this trend has continued into year five with no recaptures or juveniles recorded to date, while Bellwood weather station recorded five days of >100mm rainfall, conducive to intense floods at Upper Warrell Creek, since the most recent monitoring in autumn 2022. Further monitoring in year five will assist in determining the status of the giant barred frog population at Upper Warrell Creek and may assist in elucidating population trends associated with flood movements.

4. Recommendations

Table 3: Recommendations based on findings of the spring year four operational phase giant barred frog monitoring program.

Number	Recommendation	Transport for NSW Response
1.	Continue monitoring in summer and autumn to determine the status of the GBF population at WC2NH	Noted.

5. References

Geolink (2018). Annual report – WC2NH giant barred frog population monitoring 2017/2018 – year 3. Report prepared for Pacifico.

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