

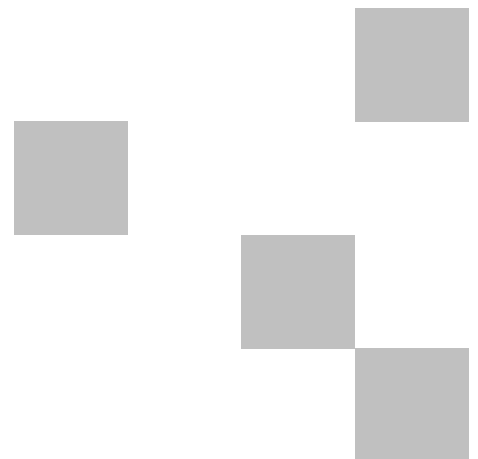


Transport
Roads & Maritime
Services

GIANT BARRED FROG MANAGEMENT PLAN

Warrell Creek to Urunga upgrade

FEBRUARY 2013



PACIFIC HIGHWAY UPGRADE:

WARRELL CREEK TO URUNGA

GIANT BARRED FROG (*Mixophyes iteratus*)

MANAGEMENT STRATEGY



FEBRUARY 2013

PREPARED FOR THE ROADS AND MARITIME SERVICES BY:

LEWIS ECOLOGICAL SURVEYS

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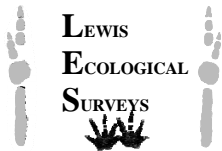
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Adrian Vannisse (GeoView) – GIS map production.

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Belinda Bock (Roads and Maritime Services) – Project management and logistics.

Brett Hoffman (Roads and Maritime Services) – Project manager and logistics.

Photography - Lewis Ecological Surveys © else stated

Top – The endangered Giant Barred Frog (*Mixophyes iteratus*) recorded from ch.42565 Upper Warrell Creek.

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* in response to additional investigations within the Nambucca Investigation Area between ch. 49265 and ch.56865

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1.0 INTRODUCTION

1.1 Background

Lewis Ecological Surveys (LES) has been contracted by Roads and Maritime Services (RMS) to prepare a management strategy for a population of Giant Barred Frog (*Mixophyes iteratus*) recorded during targeted frog surveys for the Warrell Creek to Urunga Pacific Highway Upgrade project (Lewis in prep). This species is currently listed as an endangered species pursuant to the NSW *Threatened Species Conservation Act* (1995) and Commonwealth *Environment Protection and Biodiversity Conservation Act* (1999) given that it has disappeared from much of its historic range (see Cogger 1995). Remnant populations of Giant Barred Frog face a number of threats including:

- Chytrid fungal disease;
- Vegetation clearance;
- Reduction in water quality, from sedimentation or pollution;
- Changes in water flow patterns, either increased or decreased flows;
- Reduction of leaf-litter and fallen log cover through burning;
- Timber harvesting and other forestry practices;
- Predation on eggs and tadpoles by introduced fish;
- Weed spraying close to streams; and (see Mahony 1993; Mahony *et al.* 1997; NPWS 1998; Berger *et al.* 1999; Hines *et al.* 1999; Lemckert 1999; Lemckert and Brassil 2000; Lewis and Rohweder 2005).

The Environmental Assessment (EA) prepared for the Warrell Creek to Urunga Pacific Highway Upgrade project identified potential habitat for the Giant Barred Frog at several creeks and drainage lines in the northern half of the study area, through Nambucca, Little Newry and Newry State Forests (SKM 2010). The EA identified the proposal as having the potential to impact on this species as it would directly traverse streams and rivers across the study area.

During targeted surveys between December 2011 and October 2012 (i.e. summer/spring) a population of Giant Barred Frogs was recorded at Upper Warrell Creek at ch. 42565 with 1 adult female (Snout-vent 120 mm) recorded ~30 m downstream of the RMS project boundary (Figure 1-1; Lewis in prep). The individual was completely exposed above the leaf litter and sitting close to vegetative groundcover. Suitable habitat was also identified at nearby Butchers Creek (Ch. 43365) and further north within the Nambucca Heads to Urunga section of the upgrade at Boggy Creek (Ch. 62765) and McGraths Creek (Ch. 71965). The remaining creeks were considered less likely to contain Giant barred Frogs and the rivers (i.e. Kalang, Nambucca) and some creeks (i.e. Deep Creek) are saline and do not represent frog habitat.

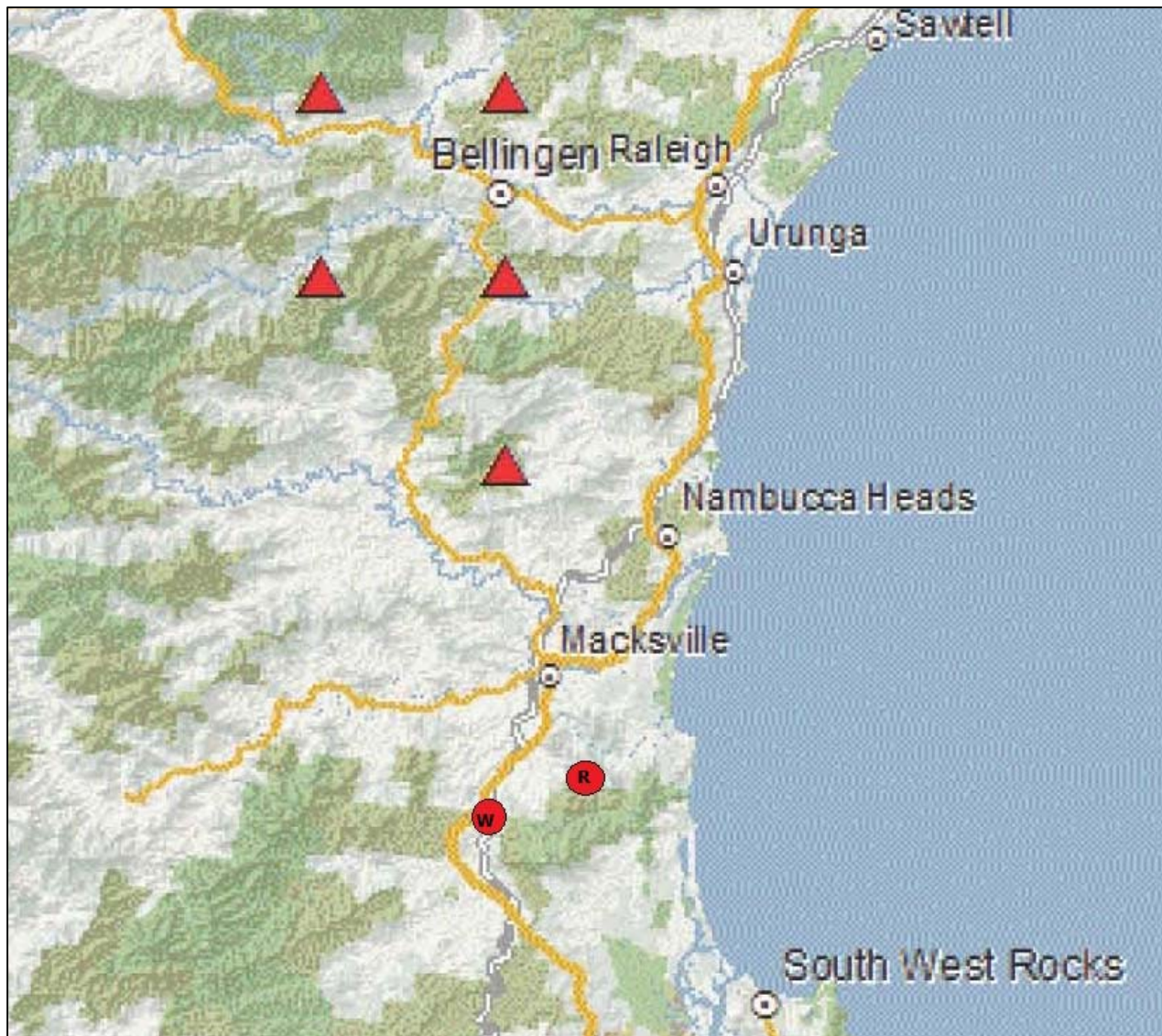


Figure 1-1. Regional historic distribution (red triangles) of Giant Barred Frog (*Mixophyes iteratus*) in the Warrell Creek to Urunga including the Warrell Creek (W) and reference site (R) record (red circles) from the field survey of Lewis (in prep). Source: Wildlife Atlas April 2012 www.bionet.nsw.gov.au/

2.0 MANAGEMENT PROCEDURE

Six management strategies have been proposed as a means to avoid, minimise and mitigate impacts to the Giant Barred Frog. They include:

1. Identification of Giant Barred Frog habitat;
2. Further surveys at Butchers Creek, Boggy Creek and McGraths Creek to finalise presence/absence (Figures 2-1; 2-2; 2-3),
3. Protection of known Giant Barred Frog habitat;
4. Pre-clearing Surveys to be implemented in three stages of:
 - a. Early works when establishing site controls (i.e. clearing limits for clearing and grubbing);
 - b. Pre-clearing survey within 5 days of commencing the clearing and grubbing program;
 - c. Clearing supervision during the clearing and grubbing program; and
 - d. De-watering procedures within areas identified as Giant Barred Frog habitat.
5. Frog fencing in areas of Giant Barred Frog habitat considered in the context of:
 - a. Temporary frog fencing; and
 - b. Permanent frog fencing.
6. An unexpected finds procedure to address instances where Giant Barred Frogs are detected during routine pre-clearing surveys or at other times during the project.

2.1 Identification of known and Potential Giant Barred Frog Habitat

Giant Barred Frog is known to occur at Upper Warrell Creek at ch. 42565 (Lewis in prep; Figure 2-1). Suitable or likely habitat was identified at nearby Butchers Creek (Ch. 43365) and further north within the Nambucca Heads to Urunga section of the upgrade at Boggy Creek (Ch. 62765) and McGraths Creek (Ch. 71965; Figures 2-1; 2-2; 2-3). The following section provides an opportunity for RMS to address the status of Giant Barred Frogs at those three sites identified as 'likely' habitat.

2.2 Further Surveys (Contractor)

The contractor (or RMS if contract has not been awarded) will perform further surveys at Butchers Creek, Boggy Creek and McGraths Creek (Figures 2-1; 2-2; 2-3). The survey program at each site will be as follows:

- 1 km transect with 450 m either side of the construction footprint (100 m represents construction footprint);
- The duration for this transect should be set at 2 person hours;
- Surveyed on two non-consecutive nights in spring¹ and two in summer. Combined with the earlier works performed by SKM (2010) and more recently Lewis Ecological Surveys (Lewis in prep) each of these sites will have been surveyed over a number of years and seasons.

The outcome of these surveys should provide a confidence interval capable of stating presence or absence for Giant Barred Frogs at the site. If the frogs are deemed to be absent then Giant Barred Frog management strategies will not be required at those sites. If Giant Barred Frogs are recorded then these surveys should transform immediately into a monitoring event as per Section 3.0 of this management strategy. This management strategy would then be updated accordingly.

¹ RMS to do this if the contract has not been awarded.

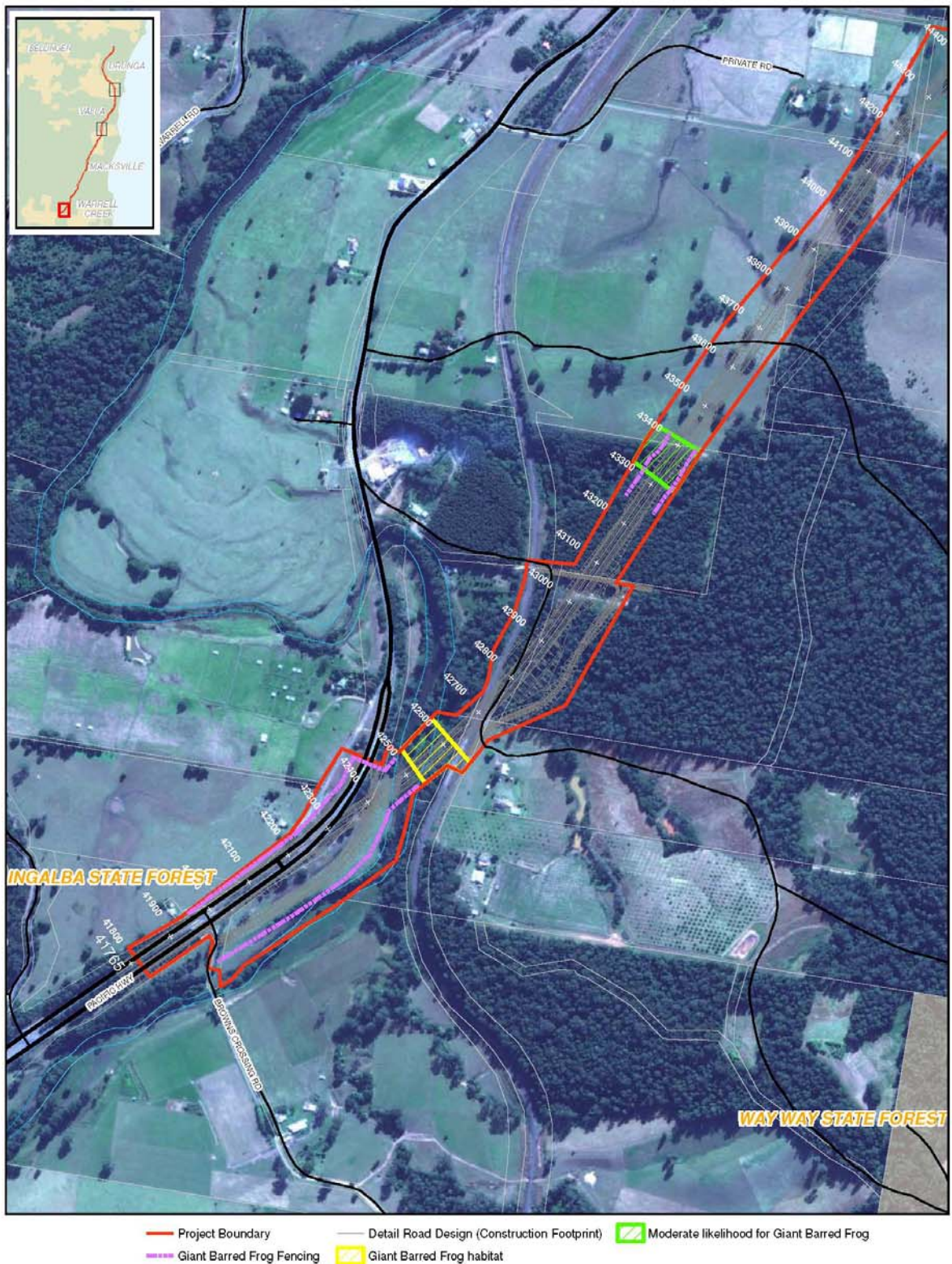


Figure 2 : **GIANT BARRED FROG MANAGEMENT STRATEGY**

Cadastral: Roads and Traffic Authority 2007 Giant Barred Frog Survey: Lewis Ecological Survey 2012 Roads: Geoscience Australia 2009 Aerial Image: Bing Aerial (date unknown)	Highway Design (footprint): RTA 2011 Project Boundary: RTA 2011 Drainage: Geoscience Australia 2009 State Forests: NSW DPI 2008	0 100 200 300 400 500 Meters A4 Scale 1:10,000	Lewis ECOLOGICAL SURVEYS	File: figure_2a_giant_barred_frog_management_00102a.mxd Title: 20-07-2012 www.gisview.com.au geoview
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Figure 2-1. Giant Barred Frog known habitat at Warrell Creek and potential habitat at Butchers Creek.

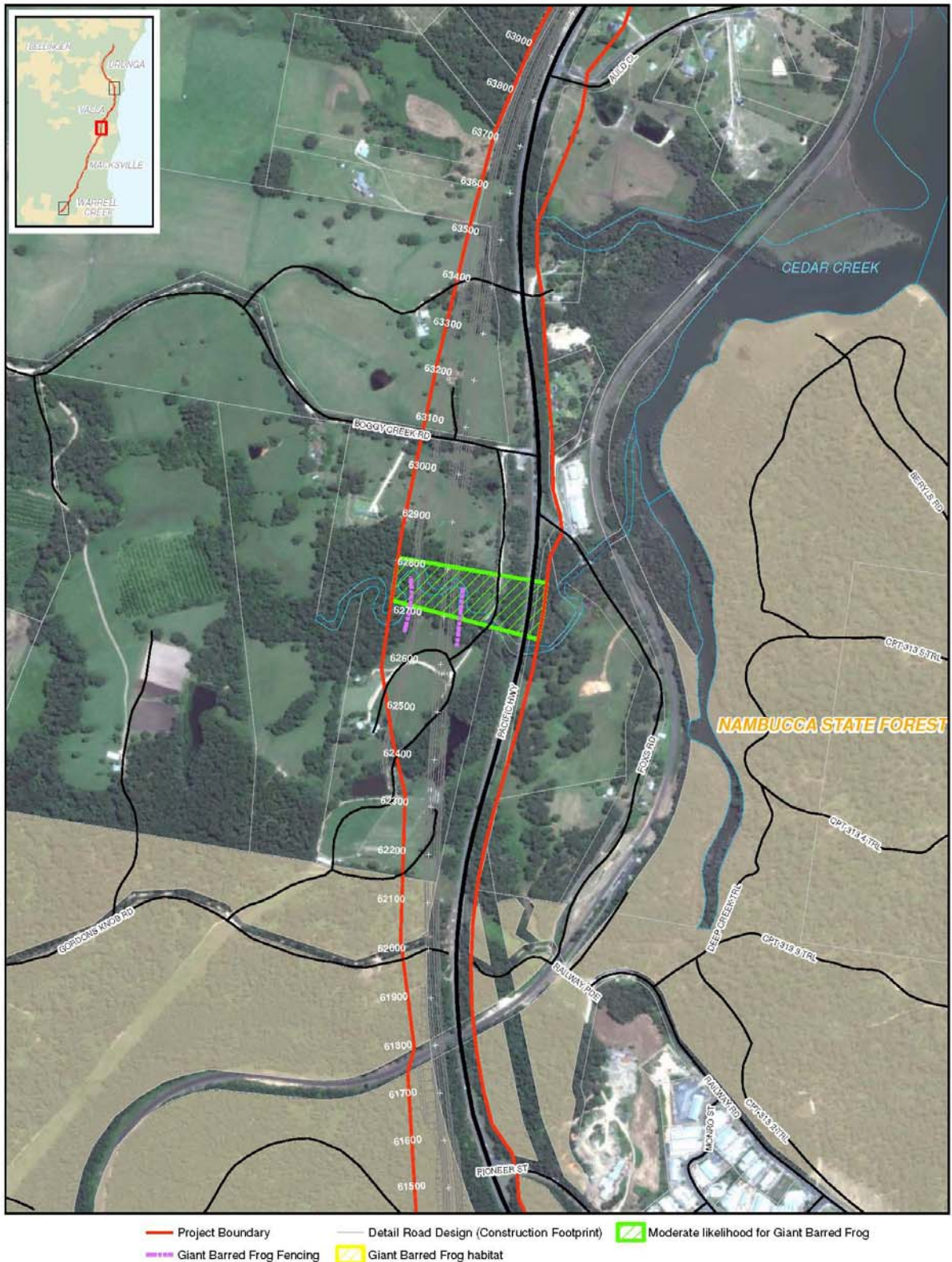


Figure 3 : GIANT BARRED FROG MANAGEMENT STRATEGY

Cadastre: Roads and Traffic Authority 2007 Giant Barred Frog Survey: Lewis Ecological Survey 2012 Roads: Geoscience Australia 2009 Aerial Image: Bing Aerial (date unknown)	Highway Design (Footprint): RTA 2011 Project Boundary: RTA 2011 Drainage: Geoscience Australia 2000 State Forests: NSW DPI 2008	0 100 200 300 400 500 Metres A4 Scale 1:10,000	Lewes ECOLOGICAL SURVEYS 	Ref: Figure 3-1_GiantBarredFrogManagement_00701.mxd Date: 28-07-2012 www.geoview.com.au GEVIEW 9140 Macquarie Drive Byron Bay, NSW, 2481 T: 61 6 439 401147 E: info@geoview.com.au W: www.geoview.com.au
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Figure 2-2. Potential Giant Barred Frog habitat at Boggy Creek.

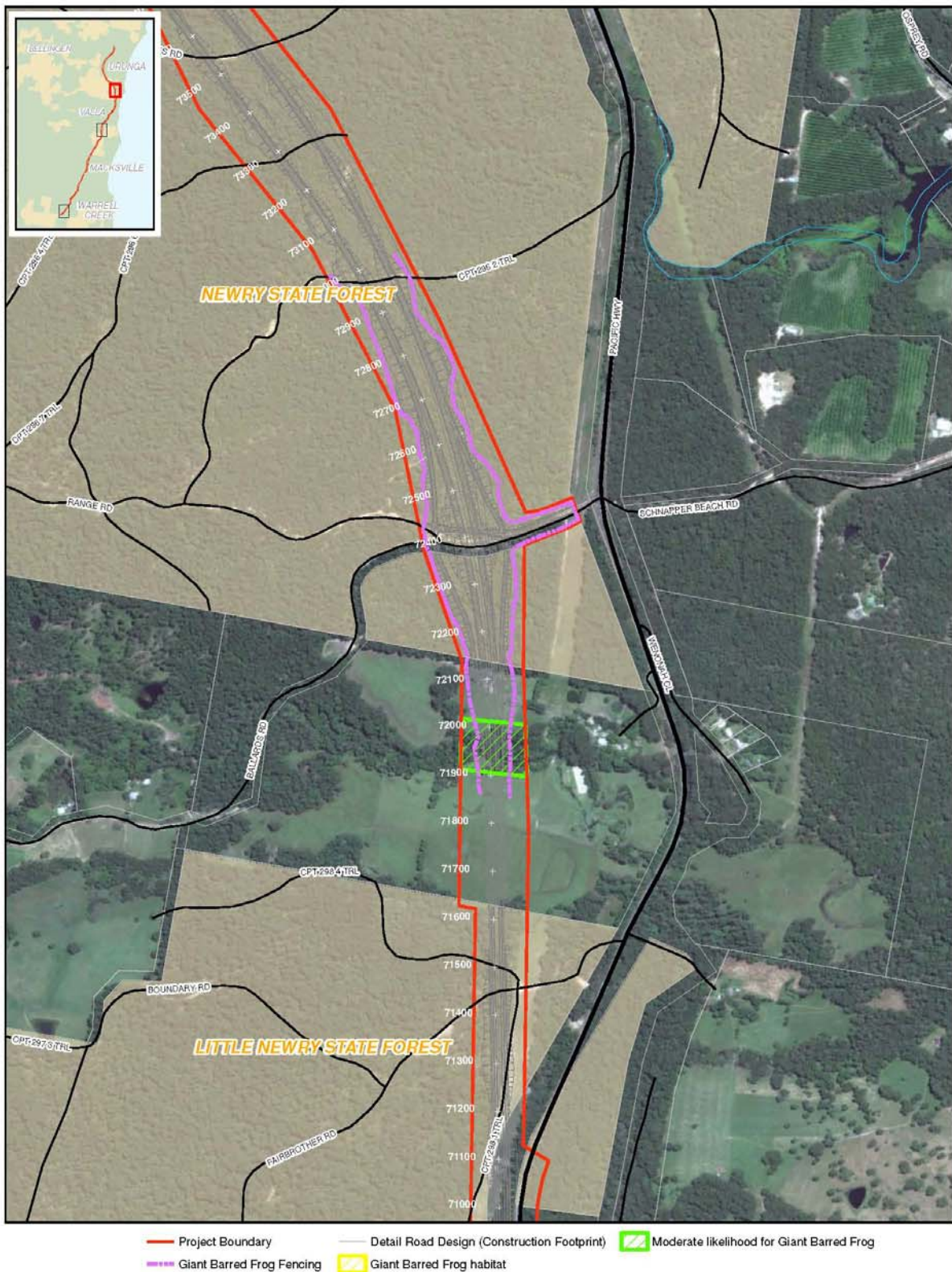


Figure 4 : GIANT BARRED FROG MANAGEMENT STRATEGY

Collector: Roads and Traffic Authority 2007 Giant Barred Frog Survey: Lewis Ecological Survey 2012 Roads: Geoscience Australia 2009 Aerial Image: Bing Aerial (date unknown)	Highway Design (Footprint): RTA 2011 Project Boundary: RTA 2011 Drainage: Geoscience Australia 2000 State Forests: NSW DPI 2008	<p>A4 Scale 1:10,000</p>
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GEOVIEW E: 618 430 61142 3748 Jacaranda Drive P: info@geoview.com.au Byron Bay, NSW, 2481 W: www.geoview.com.au		

Figure 2-3. Potential Giant Barred Frog habitat at McGraths Creek.

2.3 Protection of Existing Habitat

Following the identification of Giant Barred Frog habitat (see Section 2.1 and 2.2 above), these areas (Upper Warrell Creek at ch. 42565, Butchers Creek at ch.43365, Boggy Creek at ch. 62765 and McGraths Creek at ch. 71965) should be protected from construction related works other than what is considered essential. The locating of access tracks, utilities redistribution, car parking facilities and other ancillary works including topsoil stock piles, lay down areas, wash down bays, site shedding and compound sites should not be located in these areas. This approach will be in accordance with MCoA:

C1. The Proponent shall employ all feasible and reasonable measures to minimise the clearing of native vegetation to the greatest extent practicable during the construction of the project

C27 Unless otherwise approved by the Director General in accordance with this condition, the sites for ancillary facilities associated with the construction of the project shall (c) be located in areas of low ecological significance and require minimal clearing of native vegetation (not beyond that already required by the project).

The protection of the identified areas should include the demarcation of clearing limits and signage identifying these areas as 'no go' zones.

2.4 Pre-clearing surveys

Pre-clearing surveys will provide an additional safeguard to reduce direct mortality to individual frogs during the clearing and grubbing phase of the project. At the four identified sites (see Section 2-1) the following pre-clearing survey procedure will be performed.

2.4.1 Early Works – Establishing Site Controls (Temporary Frog Fencing)

- a) The works area for the temporary fencing is inspected/searched by Project Ecologist immediately prior to installing the temporary fencing. The search should use active techniques such as raking the leaf litter, call broadcast (this species will readily call during the day) and inspections around tussocks (i.e. *Lomandra* clumps in particular) and logs.
- b) Temporary frog fencing installed for up to 200 m either side of the stream (minimum 900 mm high above ground and buried to a depth of 50-100 mm)². Where the terrestrial habitat bordering the stream is cleared land (i.e. Upper Warrell Creek ch. 700) this may be reduced to 100 m. In each instance a return wing (5 m in length) will be installed to reduce frogs breaching the fence.
- c) Fencing to be installed and inspected/signed off by an ecologist with sufficient frog expertise. This procedure should form part of the pre clearing/ground disturbance checklist/permit.
- d) Fencing will be installed at least 5 days prior to the scheduled clearing date so that active searches can be performed within the clearing footprint (see below).
- e) All this is to be in place within 5 days of nominated clearing start date.

² It is acknowledged that installation of the fence itself will represent ground/vegetation disturbance and as such it should be subject to a pre clearing active search survey and the works supervised by the Project Ecologist.

2.4.2 Pre-clearing Survey for Frogs

- a) Within 5 days of scheduled clearing/ground disturbance operations, the Project Ecologist will perform pre-clearing surveys over a minimum of two non-consecutive nights (i.e. before clearing commences).
- b) Surveys to last 1 person hour per hectare of habitat to be disturbed/removed and involve the use of call broadcast, spotlighting and active searches of litter, debris and logs.
- c) All Giant Barred Frogs captured will be relocated to the nearest side of the clearing limit with information collected on sex, breeding condition and snout-vent length. Alternative relocation sites may be considered provided they occur within the same drainage. As a general rule frogs should not be relocated further than 300 m from the capture site which should theoretically remain within an individual's home range.
- d) Frogs with a snout-vent length >40 mm will be PIT³ tagged to document the performance measure of this as a suitable relocation strategy. Juvenile/sub adult frogs may be marked in accordance with the animal care and ethics licence of the Project Ecologist or frog expert. Toe-clipping is one possible method, however, not all animal care and ethics committees support this approach.
- e) A frog hygiene protocol will be adopted at sites with Giant Barred Frog. This protocol will be in accordance with Department of Environment and Climate Change DECC (now EPA) Hygiene protocol for the control of disease in frogs Information Circular Number 6.

2.4.3 Clearing Supervision

- a) At the four identified sites the clearing and grubbing activities will be supervised by the Project Ecologist until such a time they are confident no Giant Barred Frogs remain within the work site.
- b) Captured frogs will be treated as per 2.4.2 c) and 2.4.2 d).
- c) The need to perform additional night time surveys will be at the discretion of the Project Ecologist. For example, only part of the site may have been cleared or more suitable weather conditions present an increased opportunity to detect frogs.

2.4.4 Dewatering Procedures in Giant Barred Frog areas

- a) The dewatering process will be conducted in accordance with an Environmental Work Method Statement (EWMS) and the DECC (2008) hygiene protocol for the control of disease in frogs. All waterways and dams within those areas identified as Giant Barred Frog habitat will be subject to this dewatering process.
- b) Where the water body is to be pumped dry the intake pipe must be positioned in the deepest section.
- c) Screening of the pump intake (5mm mesh size) will be installed to prevent tadpole entrainment.

³ Passive Integrated Transponder (i.e. microchip as used to mark and identify domestic animals).

- d) Once the remaining water body is shallow enough to be effectively waded through by field personnel intensive dip netting will be undertaken to remove as many aquatic fauna as practical.
- e) All tadpoles will be identified and sorted by species and/or genus and placed into separate holding containers. The size of these containers will be left to the discretion of the Project Ecologist.
- f) All tadpoles will be released into permanent/semi-permanent pools in adjacent habitats. Tadpoles will be first acclimatised to the recipient sites water temperature by immersing bags or aquaria in the release pools to allow a gradual equilibrium of water temperature prior to release.
- g) In stances where there are numerous tadpoles from a wide range of species, preferential treatment will be given to Giant Barred Frog tadpoles due to their legislative status as an endangered species. The release of predatory species (i.e. eels) will not occur in areas where Giant Barred Frog tadpoles are being released. This will reduce the risk of predation and/or competition.

2.5 Permanent Frog Fencing

- a) Frog fencing must be installed in areas where the presence of Giant Barred Frogs has been confirmed and there is a 'high' risk of frogs accessing the carriageway. A high risk has been defined as earth embankments/batters within 200 m of the stream.
- b) The fence must provide the required protection for between 100-200 m either side of the stream. Based on the concept design frog fencing may be required at the following chainages:
 - i. Ch. 41965-42515 (southern/western side of Upper Warrell Creek);
 - ii. Ch. 43265-43415 (Butchers Creek);
 - iii. Ch. 62665-62855 (Boggy Creek); and
 - iv. Ch. 71865-73015 (McGraths Creek).

Design wise, the frog fencing must be a standalone fence positioned between the floppy top fauna fence or boundary fence and the carriageway (i.e. toe of the batter). From a design perspective, the fence is a larger version of the design used at a number of Green-thighed Frog locations. It will stand at least 900 mm in height and comprise neoprene rubber sheeting including a small rubber return of not less 100 mm on the ground. The fence hot dip galvanized pressed sheet metal or powder coated aluminum pressed sheet mounted on a galvanized star picket (Figure 2-4). This design is about to be installed for the Kempsey Bypass Project and has the support of EPA (Lewis 2011). An alternative option may be to retrofit a similar design described above to any proposed floppy top fauna fencing.

The success of this design will be based on the absence of Giant Barred Frog fence breaches⁴. As part of the monitoring procedures for measuring the effectiveness of the frog fencing, some monitoring of fence breaches must be undertaken by a suitable qualified zoologist at certain times of the year (i.e. when population monitoring occurs). This monitoring program will involve

⁴ This will also be detailed in the EMS required for the project.

surveys for Giant Barred Frog on both sides of the frog fence as this data will clearly show whether the frog fence is effective at excluding frogs.

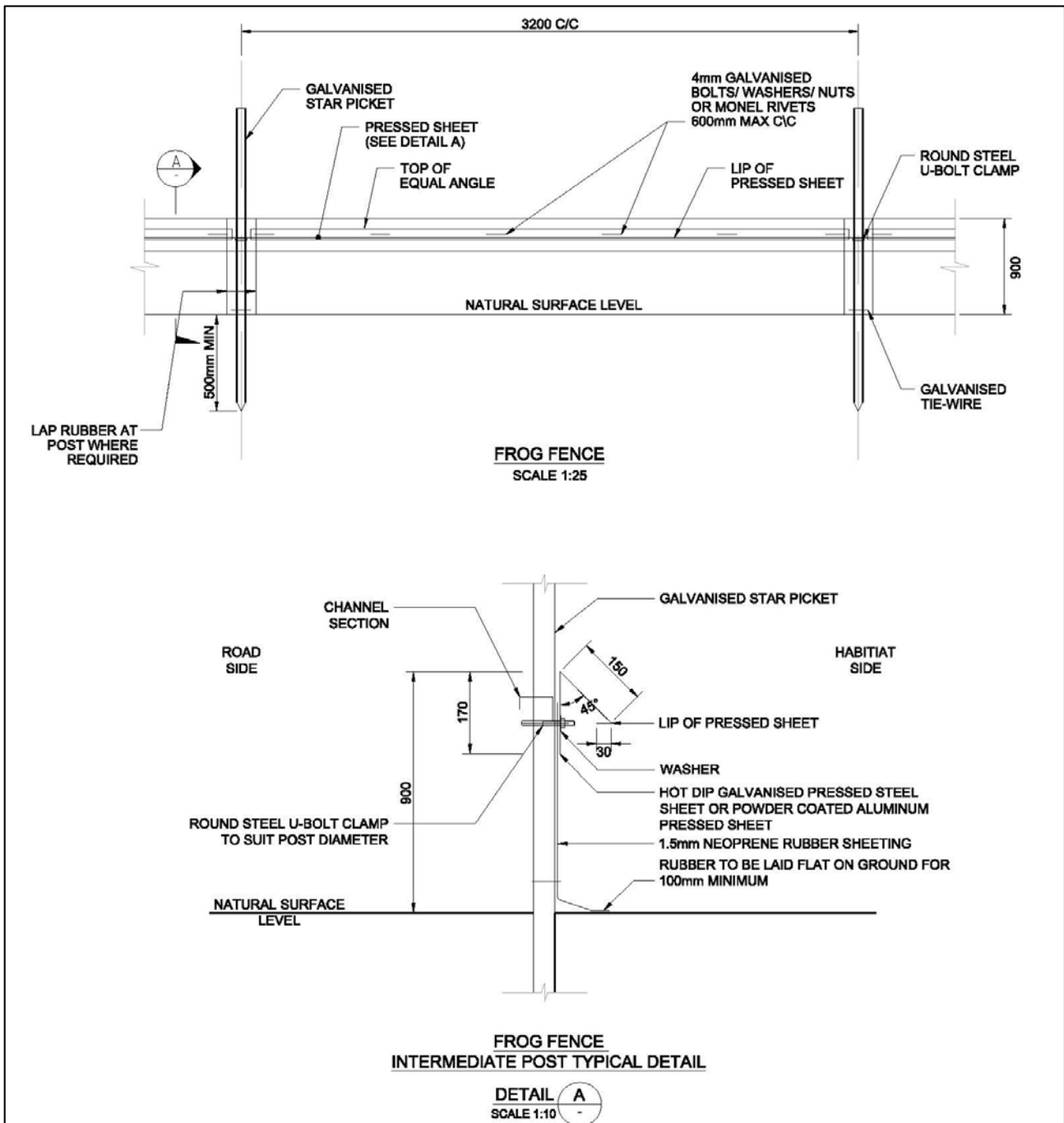


Figure 2-4. Example of a frog fence design for Warrell Creek to Urunga.

2.6 Unexpected Finds Process

An unexpected finds process has been developed to manage instances where Giant Barred Frog may be detected during pre-clearing surveys, clearing operations or dewatering works for the upgrade. This is in response to field surveys not being exhaustive (<3 surveys at any given site) and the ability of Giant Barred Frogs to move relatively large distances in short time periods. For example, hundreds of metres when the clearing footprint will rarely extend beyond 120 m.

In an unexpected finds instance the management strategies outlined in this plan will be adopted and include:

1. Protection of Giant Barred Frog habitat including provisions for its protection from ancillary areas and their associated impacts consistent with MCoA C1 and C27;
2. Temporary and if required permanent frog fencing;
3. Additional pre-clearing surveys as deemed appropriate by the Project Ecologist or frog specialist;
4. Implementation of the monitoring program in accordance with Section 3.2 and the performance measures outlined in Section 4.0 of this management strategy.

3.0 MONITORING OF THE MANAGEMENT STRATEGIES

There are three concerns with the Giant Barred Frog and the Pacific Highway Upgrade program between Warrell Creek and Urunga. They include:

1. Direct mortality of frogs resulting in further population declines;
2. Deterioration of habitat quality in the receiving or adjacent environment (i.e. habitat degradation);
3. Population connectivity with the construction footprint severing habitat; and
4. The potential introduction or spread of the chytrid fungus.

Whilst this management strategy demonstrates how the project will minimise these impacts there is a need to demonstrate how successful this has been during the delivery of the project. The following monitoring program provides this and outlines the performance measures associated with the program of works and corrective actions therein.

3.1 Monitoring Sites

At present the monitoring program will be limited to Upper Warrell Creek in the southern part of the project corridor. Opportunity is provided for the adoption of additional sites depending on the outcomes of Section 2.2, 2.4 and 2.6. No reference site will be incorporated into this monitoring program as a means to manage chytrid fungus.

3.2 Monitoring Survey

3.2.1 Frog Surveys

- 1 km transect with 450 m either side of the construction footprint (100 m represents construction footprint);
- The duration for this transect should be set at 2 person hours;
- Baseline data will be collected prior to construction and consist of one survey in spring, summer and autumn (i.e. three surveys). If this is not possible for the Nambucca to Urunga section of the project (i.e. last minute discovery of population) then surveys may be amalgamated into multiple surveys (3) at 6 week intervals. In either instance this approach will provide cues on habitat use within and adjacent to the road corridor leading up to construction.
- Each field survey will entail a meandering transect on both sides of the creek bank with all frogs marked via a PIT tag (i.e. micro-chipped). The objective of PIT tagging is to individually mark each frog with a unique alphanumeric identifier (i.e. code) which can be read via a bar code scanner. Juvenile/sub adult frogs (<40 mm snout vent length) may be marked in accordance with the animal care and ethics licence of the Project Ecologist or frog expert. Toe-clipping is one possible method, however, not all animal care and ethics committees support this approach.
- For each frog the following information will be collected:
 - Location according to demarcated survey zone;

- Sex (male, female, unknown);
- Breeding condition with:
 - males assessed on the colouration of their nuptial pads (i.e. no colour, light, moderate, dark);
 - females based on whether they are gravid or not gravid (egg bearing).
- Snout-vent length (mm);
- Weight (gms); and
- General condition of the frog (i.e. signs of chytrid).

3.2.2 Tadpole Surveys

Tadpole surveys provide an additional means to assess population structure and as to whether frogs are breeding at the site. The survey procedure will be as follows:

- The 1 km transect is divided up into 100 m zones which will equate to 4-5 zones downstream corridor, one zone within the corridor (i.e. construction site) and 4-5 zones upstream of the road corridor.
- Two bait traps (~300 mm x 200 mm) per 100 m of stream (as described above) and left operating for 3 hrs. This equates to 20 bait traps and 60 hrs of survey effort.
- Tadpole dip-netting to be undertaken opportunistically but the survey effort recorded.

3.2.3. Other Data

Abiotic variables collected during each survey will include:

- Rainfall measured in four scales:
 - During the survey;
 - Within past 24 hrs;
 - Within past 7 days;
 - With past 30 days.
- Relative humidity measured with wet/dry bulb thermometer at the start and finish of the frog survey;
- Air temperature measured with a thermometer at the start and finish of the frog survey;
- Wind speed measured in subjective scale (0= no wind, 1 = light rustles of leaves on trees, 2 = leaves and branches moving and 3 = whole canopy moving);
- Water level measured with a permanently installed water staff or an electronic device if available from the Bureau of Meteorology (BOM).

Anecdotal information including the presence of exotic fish will also be recorded.

Table 3-1. Timing of key actions, responsibilities and documentation requirements for the Giant Barred Frog monitoring.

Management Action/Year Number	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Responsibility	Documentation Requirements
Pre Construction										
Prepare Giant Barred Frog Management Strategy	√								RMS	Construction Environmental Management Plan
Construction										
Habitat Protection		√	√	√					Contractor	Ecological Monitoring Program
Additional/Further Surveys		√							Contractor or RMS if contract has not been awarded	Giant Barred Frog Management Strategy (updated) Ecological Monitoring Program
Pre-clearing Surveys		√	√						Contractor	Ecological Monitoring Program Post Clearing report Giant Barred Frog Management Strategy (updated)
Temporary Frog Fencing		√	√						Contractor	Construction Environmental Management Plan
Permanent Frog Fencing			√	√					Contractor	Ecological Monitoring Program
Unexpected Finds Procedure		√	√	√					Contractor	Giant Barred Frog Management Strategy (updated) Ecological Monitoring Program
Post Construction/Operation										
Monitoring effectiveness of mitigation				√	√	√	√	√	Contractor	Ecological Monitoring Program - Annual reporting

4.0 PERFORMANCE MEASURES

4.1 Ways to Assess Successful Performance of the Management Strategy

Performance indicators of success will be based on either the:

- Continued presence of Giant Barred Frog along any part of the 1 km transect. This approach compensates for the mobile habitats of this species and the shifting patterns of seasonal habitat use;
- The recapture of one or more Giant Barred Frog following their relocation from the clearing footprint (if this occurs); or
- The presence of tadpoles, metamorphs or juveniles frogs during follow up surveys post construction.

4.2 Ways to Assess Unsuccessful Performance of the Management Strategy

Signs of the management strategy being unsuccessful will be based on the following six parameters:

1. Absence of Giant Barred Frog from the monitoring transect once construction has started.

Corrective Action – To employ more broad-scale surveys to determine presence of Giant Barred Frogs further upstream or downstream.

2. Giant Barred Frog injured or dying during the clearing and grubbing program.

Corrective Action – Review the clearing procedures and if necessary the performance of the Project Ecologist or frog specialist undertaken the works. Review the temporary frog fence structure and the need to implement additional controls and/or surveys.

3. Giant Barred Frog being struck by vehicles during either the construction or operational phase of the project.

Corrective Action – Review the integrity of the fence, its design, its extent for either the temporary or permanent fencing.

4. Procedures not being implemented as per the approved Giant Barred Frog management strategy unless the change or adoption of different techniques can be substantiated by a frog expert familiar with the ecology and behaviour of this species.

Corrective Action – Review the procedures that have been implemented. Seek advice from Environmental Protection Authority to demonstrate transparency.

5. The detection of chytrid fungus 'sick and dying' frogs.

Corrective Action – Seek advice from Environmental Protection Authority for current best practise.

5.0 REPORTING COMMITMENTS

The contractor will submit an annual monitoring report to Roads and Maritimes Services for review. Roads and Maritime Services will then provide a final copy of the report for information purposes to the Environmental Protection Agency and the Department of Planning and Infrastructure. For Nambucca Heads to Warrell Creek, the Year 1 report will be a final assessment of Boggy Creek and McGraths Creek implementing the survey strategy outlined in section 2.2 of this document. If the contract has not been awarded by Spring then RMS will perform this task. The absence of Giant Barred Frogs at this point will represent a final close out document unless this species is discovered in accordance with routine pre-clearing surveys (section 2.4) and/or the unexpected finds procedure (section 2.6).

For the Warrell Creek to Nambucca Heads upgrade, the baseline survey report will be submitted prior to the clearing and grubbing program commencing anywhere within 500 m of either Upper Warrell Creek or Butchers Creek. This should represent a 'hold point' for this stage of the Warrell Creek to Nambucca Heads Upgrade but it should not prevent clearing and grubbing from other parts of the project corridor.

The subsequent monitoring reports will provide an assessment on the performance of the management strategies as per section 4.0 of this report.

6.0 REFERENCES

- Anstis, M., (2002). *Tadpoles of south-eastern Australia: A guide with keys*. Reed New Holland, Sydney, Australia.
- Berger, L., Speare, R., Daszak, P., Green, D.E., Cunningham, A.A., Goggin, C.L., Slocombe, R., Ragan, M.A., Hyatt, A.D., McDonald, K.R., Hines, H.B., Lips, K.R., Marantelli, G. and Parkes, H., (1998). Chytridiomycosis causes amphibian mortality associated with population declines in the rain forests of Australia and Central America. *USA Proceedings National Academy Science* **95**: 9031-9036.
- Bionet Wildlife Atlas (2012). Wildlife Atlas Search: Giant Barred Frog *Mixophyes iteratus* 5th April 2012. www.bionet.nsw.gov.au/
- Cogger, H.G. (1995). Reptiles and Amphibians of Australia. 5th edition. Reed Books, Sydney, NSW.
- Hines, H., Mahony, M. and McDonald, K., (1999). An assessment of frog declines in wet subtropical Australia. Pp. 44-63 *in* Declines and Disappearances of Australian frogs ed by A. Campbell. National Heritage Trust, Environment Australia, ACT.
- Lemckert, F., (1999). Impacts of selective logging on frogs in a forested area of northern New South Wales. *Biological Conservation* **89**: 321-28.
- Lemckert, F. and Brassil, T., (2000). Movements and habitat use of the endangered giant barred river frog (*Mixophyes iteratus*) and the implications for its conservation in timber production forests. *Biological Conservation* **96**: 177-184.
- Lewis, B.D (in prep). Warrell Creek to Urunga: Giant Barred Frog (*Mixophyes iteratus*) Field Survey. Report prepared for Roads and Maritime Services by Lewis Ecological Surveys. ©
- Lewis, B.D. (2011). Kempsey to Eungai: Green-thighed Frog Breeding Pond Site Selection & Design. Report prepared for Kempsey Bypass Alliance by Lewis Ecological Surveys.
- Lewis, B.D. & Rohweder, D.A. (2005) Distribution, habitat, and conservation status of the giant barred frog (*Mixophyes iteratus*) in the Bungawalbin Catchment. *Pacific Conservation Biology* **11**(3): 189-197.
- Mahony, M.J., (1993). The status of frogs in the Watagan Mountains area of the central coast of New South Wales. Pp. 257-64. *in* Herpetology in Australia: a Diverse Discipline ed by D. Lunney and D. Ayers. Royal Zoological Society of New South Wales, Mosman, NSW.
- Mahony, M., Knowles, R. and Pattinson, L., (1997). Stuttering Barred Frog. Pp 66-71 *in* Threatened Frogs of New South Wales: Habitats, Status and Conservation ed by H. Ehmann. Frog and Tadpole Study Group of NSW Inc, PO Box A2405, Sydney South.
- Mahony, M., (2000). Prevalence of chytrid in populations of frogs in eastern New South Wales. Abstract presented at Getting the Jump on Amphibian Diseases: Conference and Workshop Compendium, Cairns.
- Sinclair Knight Merz (SKM). 2010. Upgrading the Pacific Highway Warrell Creek to Urunga Environmental Assessment. Report prepared for Roads and Traffic Authority, NSW.

ENVIRONMENT PROTECTION AUTHORITY - COMMENT SHEET

Project:	Pacific Highway Upgrade Warrell Creek to Urunga		
Document title:	Giant Barred Frog Management Strategy		
Revision No.:	October 2012		
Reviewer name:	Craig Harré	Review date:	20/07/12
Response	Ben Lewis	Response date:	19/11/12

Report Reference	EPA Comments	Response
General	Include a commitment to undertake a review of the test of significance if additional individuals/populations are discovered to see if the impacts are consistent with the EA.	Section 2.6 of the management strategy refers to the procedure for unexpected finds in the event that additional individuals/populations are discovered. If additional individuals/populations are discovered after further survey (as required in section 2.2 of the strategy) then the test of significance will be reviewed.
2.1 Identification of known...	Please provide a good map with known locations, proposed locations, fencing and the 'no go' protected areas.	<p>Figures now provided showing known GBF locations, moderate likelihood habitat and fencing. Chainages on the maps have been updated to reflect changes in chainages for WC2U. i.e. 41,765 has been added to the Northbound chainage (WC2U chainage - 19,500) to get the distance from Kempsey.</p> <p>The no go zones will be delineated as part of the clearing limits for the project. They are not considered</p>

Report Reference	EPA Comments	Response
		applicable here for the purposes of mapping exercise.
2.2 Further Surveys	Need a mechanism to update this report following the additional survey results.	Added: This management strategy would then updated accordingly.
2.3 Protection of existing habitat	Is there any overlap of area with the GTF habitat?	No. The species can co-occur but they do not appear to within the RMS project boundary
2.4 Pre-clearing surveys	EPA recommends frog exclusion fencing is a minimum of 9000mm. This height is used successfully on other projects	9000 is a bit much (i.e. 9 m). I suspect you mean 900 mm. Change accepted and amended in relevant frog fencing sections
2.4.2	<p>Concentrated in riparian areas?</p> <p>Searches for GBF on the Bonville Upgrade located a high density of GBF under dry leaf litter on the north west aspect of the creek bank.</p> <p>Under what conditions will it be 'deemed appropriate' to undertake active searches?</p> <p>A lot more effort is required to describe the relocation sites ,i.e. habitat suitability, protection and longevity of pools etc..</p>	<p>Yes searches within the riparian zone which can be broadly defined as up to 100-200 m from the creek. The riparian zones are generally much narrower within this study area.</p> <p>Removed if deemed appropriate to avoid confusion. I was referring to some areas may not contain much leaf litter or log cover and therefore wouldn't require this but other area would.</p> <p>Added - As a general rule frogs should not be relocated further than 300 m from the capture site which should theoretically remain within an individual's home range.</p> <p>If the frogs occur in this area in the first place and combined with a competent Project Ecologist the relocation process and decisions therein should be left to the person in the field (i.e. site conditions can change over a short period of time)</p>

Report Reference	EPA Comments	Response
	Agree with no toe clipping and support hygiene protocol.	Ok.
2.5	<p>Does this include where GBF have been confirmed from prior records?</p> <p>Why not design fence incorporated into fauna exclusion fencing?</p>	<p>There are no prior records of GBF on this project other than the records obtained during field surveys for this management strategy. The previous surveys of the EA did not record this species but identified suitable habitat in the northern part of the project.</p> <p>The frog fencing was an example of a design. I have included a sentence at the bottom of the second paragraph "An alternative option may be to retrofit a similar design described above to any proposed floppy top fauna fencing."</p>
2.6 point 1	Will this include protection from ancillary areas/impacts?	<p>Added the following: Protection of Giant Barred Frog habitat including provisions for its protection from ancillary areas and their associated impacts consistent with MCoA C1 and C27</p>
3.0 Monitoring	Note/ this strategy does not include monitoring success of connectivity strategy and maintenance of population. Is this deliberate?	No. I placed it under the broad concern of 2. Deterioration of habitat quality in the receiving or adjacent environment. To make this clearer ive placed " Population connectivity with the construction footprint severing habitat" as point number 3.
3.1	Chytrid spread can be managed. A reference site will likely be required by the Ecological Monitoring Program.	<p>Given the current circumstances I don't support this approach. The nearest reference site I could find was out in Way Way to the south of Scotts Head Road. This area is close to conservation estate and occurs in a different sub catchment of Warrell Creek.</p> <p>I doubt EPA would support this location as a reference</p>

Report Reference	EPA Comments	Response
		<p>site given the project is a construction project which has a number of risks with machinery being transported in from all over the east coast. I would welcome the introduction of a closer site but I couldn't find one during my field surveys.</p>
<p>Verbal comment to Kristy Harvey from Simone Garwood (EPA)</p>	<p>Strategy has not nominated the frequency or duration (in terms of years) of the monitoring program.</p>	<p>Table 3-1 has now been provided and identifies 5 years of monitoring.</p>
	<p>No detail provided on the Giant Barred Frog picked up in the survey (age, season, habitat extent, location upstream and downstream).</p>	<p>In section 1.0 added: During targeted surveys between December 2011 and February 2012 (i.e. summer) a population of Giant Barred Frogs was recorded at Upper Warrell Creek at ch. 42565 with 1 adult female (Snout-vent 120 mm) recorded ~30 m downstream of the RMS project boundary (Lewis in prep). The individual was completely exposed above the leaf litter and sitting close to vegetative groundcover.</p>