



Our Ref: AM/97017/Lw1

1st February 2023

Department of Planning, Industry and Environment
Regional Assessments
GPO Box 39
Sydney NSW 2001

Attention: Jane Flanagan

Via email: jane.flanagan@planning.nsw.gov.au

Dear Jane,

RE: KINGS FOREST - ADAPTIVE MANAGEMENT REQUEST: PROPOSED AMENDED EXCLUSION FENCE DESIGN

I refer to the Kings Forest project, and in particular the requirement to provide permanent fauna exclusion fencing. Kings Forest Estates Pty Ltd (formerly Project 28 Pty Ltd) wish to amend the approved permanent exclusion fence design to bring it into line with current best practice exclusion fence design. Whilst the design of the approved exclusion fence was to the standards of the time when first developed, current best practice designs have now changed and Kings Forest Estates Pty Ltd wishes to ensure that the exclusion fencing design remains contemporary for the future. As the exclusion fencing is a critical path item to allow the commencement and progression of the project it is proposed that amendments to the exclusion fencing design are undertaken using the Adaptive Management Approach.

The approved Management Plans prepared for the Kings Forest project contained guidelines for an Adaptive Management Approach which was subsequently endorsed by the Australian Department of Agriculture, Water and the Environment (DAWE), NSW Department of Planning, Infrastructure and Environment (DPI&E), Biodiversity Conservation Division (BCD) of the DPI&E and Tweed Shire Council (TSC). Adaptive management is an approach that involves continually monitoring a process to evaluate its effectiveness, an improving the process based on this evaluation. As the project evolves, it has been acknowledged by NSW DPI&E, BCD and TSC that conflicts between management plans may be identified during the management plan approval process. In addition, changes to site conditions and the results of monitoring (i.e. rehabilitation monitoring) may require amendments to the management actions anticipated in the approved Management Plans.

Each relevant approved Management Plan included a specific section outlining the relevant adaptive management approaches to be utilised to manage conflicts between management plans and to respond to issues identified during routine monitoring. The endorsed Adaptive

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Management Approach requires that a log of changes to each management plan will be updated monthly and published on the project website. In addition, a copy of the adaptive management log will be included in the relevant Annual Monitoring Report/s. The log shall include (as a minimum), the date, the title of the plan affected, an explanation of the inconsistency and update made, and confirmation that TSC, BCD or any relevant agencies support the amendment.

In accordance with the requirements for the Adaptive Management Approach, this letter outlines the proposed changes to allow relevant agencies to provide written confirmation of the proposed Adaptive Management Approach. This written confirmation can then be attached to the Adaptive Management Log as evidence of agency support.

Proposed Changes

The current approved design for permanent exclusion fencing is detailed in various management plans and allows for the following design features:

- 1.5 m high floppy top fencing with an attached 60 cm wide metal sheeting along the bottom of the fence; and
- A galvanised steel overhang (lip) to discourage frogs from climbing over the fence.

The proposed amended exclusion fence design will involve the following three (3) main changes:

- Removal of the floppy top to be replaced with a straight 1.5 m vertical fence;
- Replacement of the 60 cm wide metal sheeting with 60 cm wide anti-climb UV resistant hard plastic panelling to increase their longevity; and
- Removal of the galvanised steel lip (overhang) which was to discourage frogs from scaling the fence.

The proposed amended exclusion fence will utilise two (2) design variations characterised by the above features over different sections of the Kings Forest estate. The use of the design variations will be determined by ground conditions:

- Non-wetland areas - The exclusion fencing will have the anti-climb panels sitting approximately 10 cm above the ground. This fence type is only designed to stop Koala movements. Tweed Shire Council have requested that the panels be raised off the ground so as to increase their longevity.
- Wetland/wallum sedge frog habitat areas - The exclusion fencing will have the panels sitting into the ground by 5 cm so as to stop Wallum sedge frog and Koala movements. No vehicular or pedestrian access gates will be included in permanent fauna exclusion fencing adjoining Wallum sedge frog habitat. Tweed Shire Council are accepting of the panels sitting in the ground due to the need to stop frog movements.

An example of the proposed amended exclusion fence is provided in **PLATE 1** below. The proposed amended exclusion fence designs are provided in **ATTACHMENT 1**.

Koala escape mechanisms are still proposed to be strategically placed at 100 m intervals along the road corridor side of any permanent koala-proof fencing that occurs beside a road to allow koalas to climb over the fence if they inadvertently enter the road corridor as per the original approved management plans.



PLATE 1 - example of the proposed amended exclusion fence (Note: anti-climb panels proposed along bottom of fence)

It should be noted that no changes to temporary exclusion fencing requirements or to the location or timing for installation of the permanent exclusion fence is proposed as part of this Adaptive Management Request.

Expert koala and wallum sedge frog reports from suitably qualified experts in support of the amended koala and wallum sedge frog exclusion fence design have also been prepared and are provided. Dr. Stephen Phillips has completed the koala report (**ATTACHMENT 2**) and Dr. Arthur White has completed the wallum sedge frog report (**ATTACHMENT 3**).

Please don't hesitate to contact me if you require any further information.

Yours faithfully,
JWA Pty Ltd



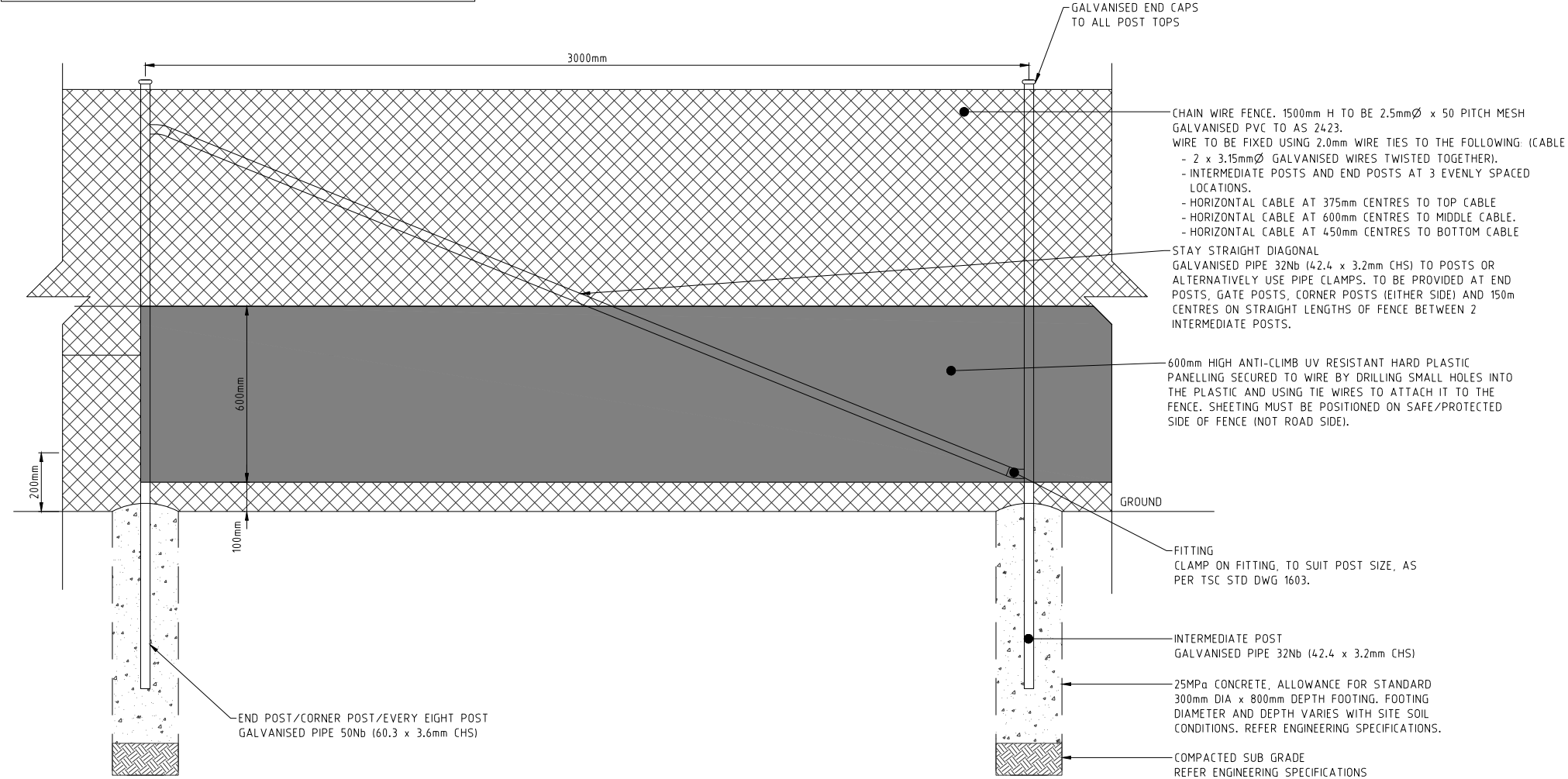
Adam McArthur
Director / Principal Ecologist

ATTACHMENT 1 - PROPOSED AMENDED EXCLUSION FENCE DESIGN

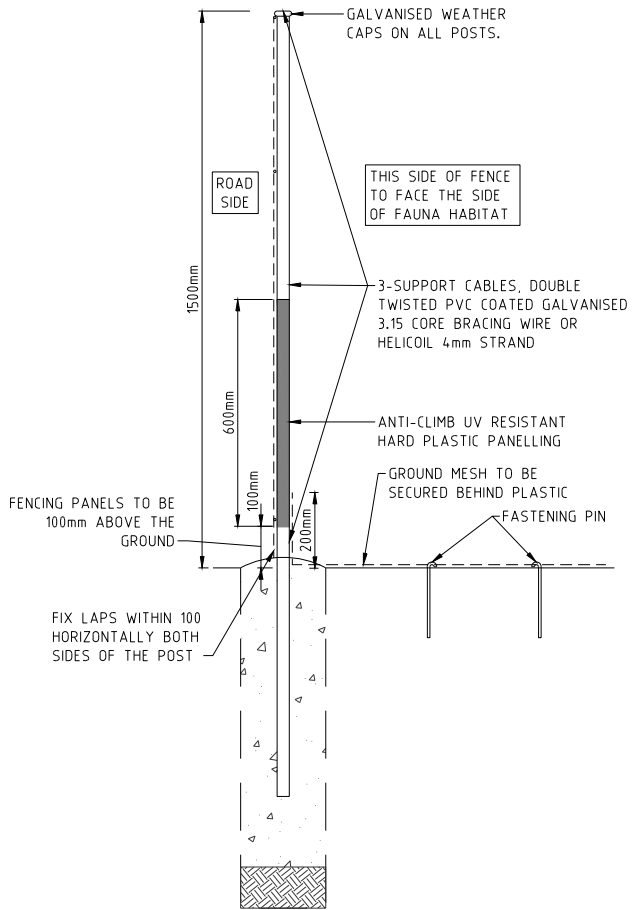
NOTE:
THE FENCE IS NOT APPLICABLE FOR PROVIDING EDGE PROTECTION WHERE THERE IS RISK OF INJURY FROM A FALL THAT IS GREATER THAN 1.0m, THIS INCLUDES CULVERTS, BRIDGE CROSSING AND RETAINING WALLS.

ALL GALVANISED STEEL PIPE TO AS 1074

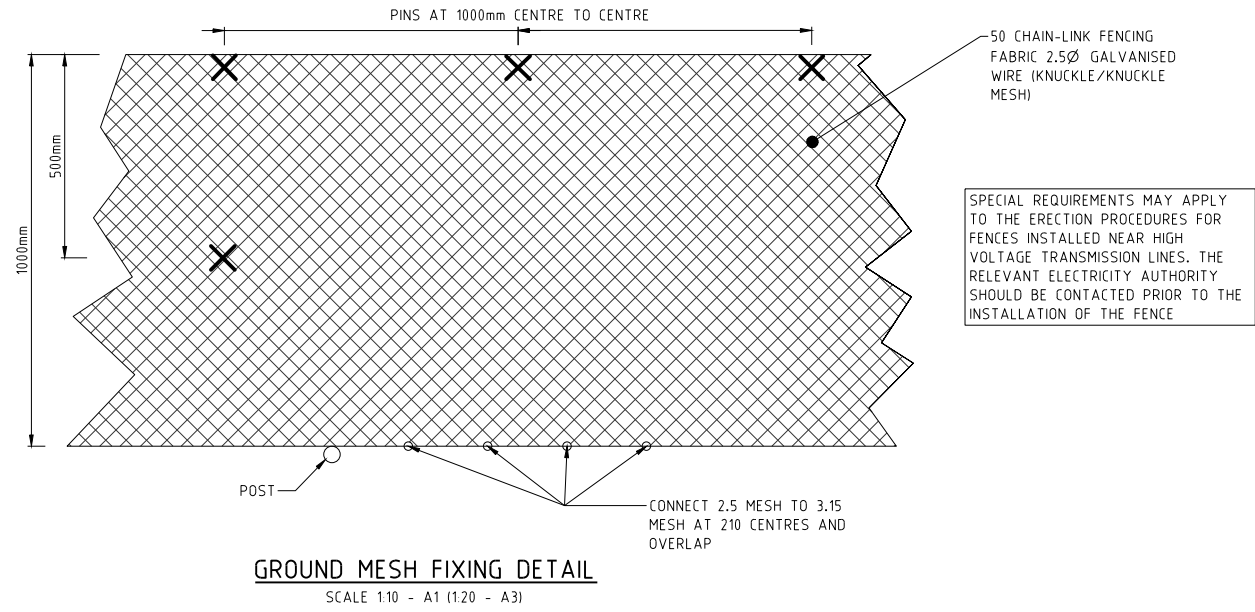
ALL CHAIN AND SUPPORT CABLES TO BE GREEN (DETERMINED BY SITE). POSTS TO BE STANDARD GALVANISED.



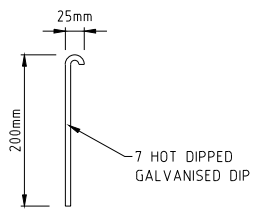
KOALA EXCLUSION FENCE
SCALE 1:10 - A1 (1:20 - A3)



**KOALA EXCLUSION FENCE
IN GENERAL AREAS**
SCALE 1:10 - A1 (1:20 - A3)



GROUND MESH FIXING DETAIL
SCALE 1:10 - A1 (1:20 - A3)



NOTE: FOR LOOSE OR SANDY SOILS 350 (MIN) GALVANISED FASTENING PINS MUST BE USED.

FASTENING PIN DETAIL
SCALE 1:50 - A1 (1:100 - A3)

NOTE:

- CHS SHALL BE GRADE C250, OR AS NOTED ON THE DRAWING, TO AS1074. ALL BOLTS, WASHERS AND NUTS SHALL BE HOT DIPPED GALVANISED TO AS1214. ALL STEEL WORK SHALL BE HOT DIPPED GALVANISED TO AS/NZS4680. PRIOR TO GALVANISING, ALL WELD SPLATTER AND WELDING SLAG SHALL BE REMOVED.
- ALL DIMENSIONS ARE IN MILLIMETERS.

KOALA PROOF FENCE

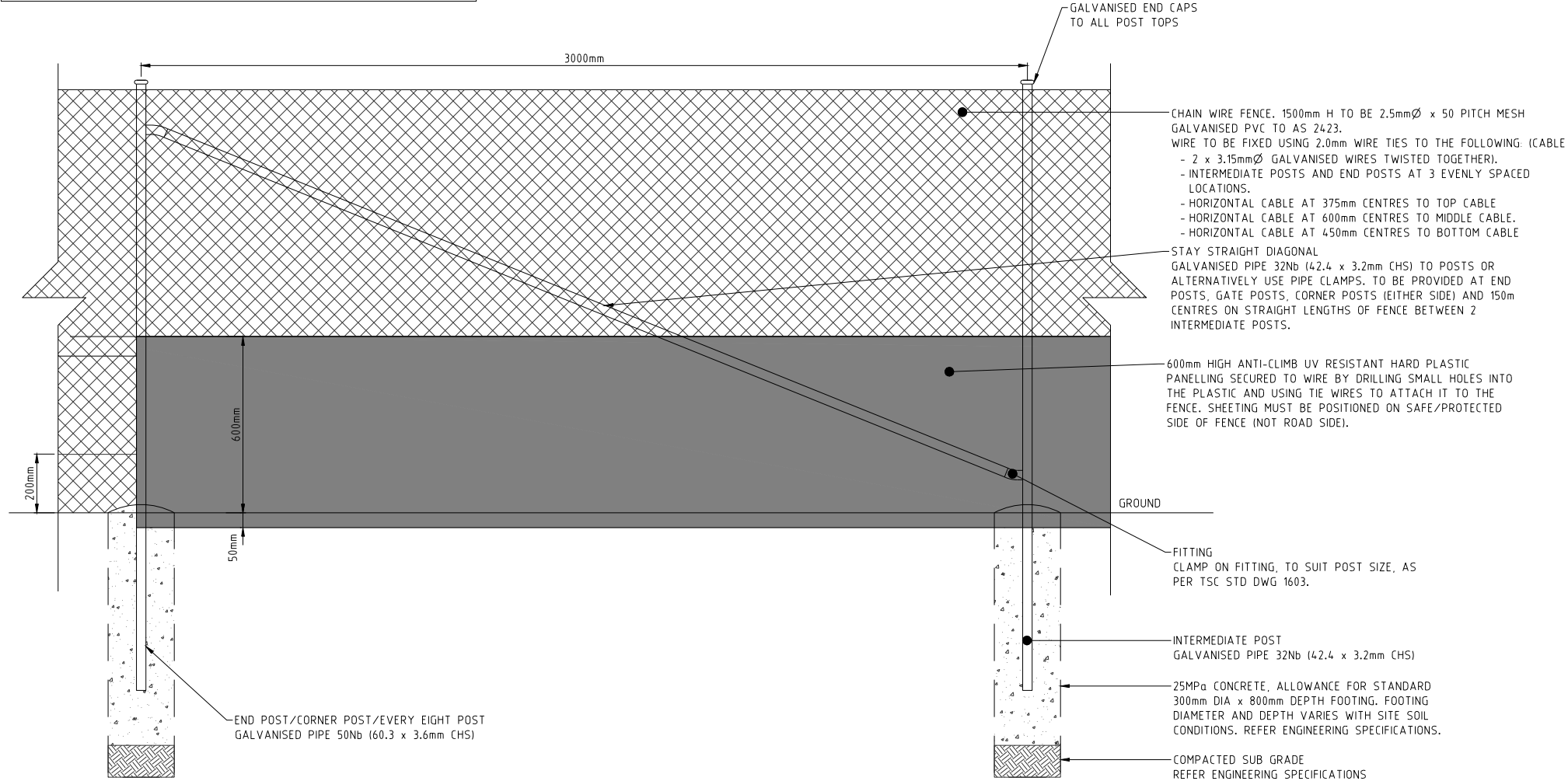
- TIE/LACING WIRE SHALL BE GREEN PVC COATED GALVANISED WIRE UNLESS SPECIFIED OTHERWISE.

SOURCE: Mortons Urban Solutions - Koala Exclusion Fence (Ref: 12301-ALL-SK140-142.pdf Rev C dated 04/08/22) SCALE: Not to Scale JWA PTY LTD Ecological Consultants	CLIENT Project 28 Pty Ltd PROJECT Koala Plan of Management Kings Forest Melaleuca Drive, Duranbah, NSW Shire of Tweed	FIGURE 19A PREPARED: BW DATE: 15 August 2022 FILE: N97017_Design Fencing.cdr	TITLE PERMANENT EXCLUSION FENCING DESIGN - GENERAL PANEL
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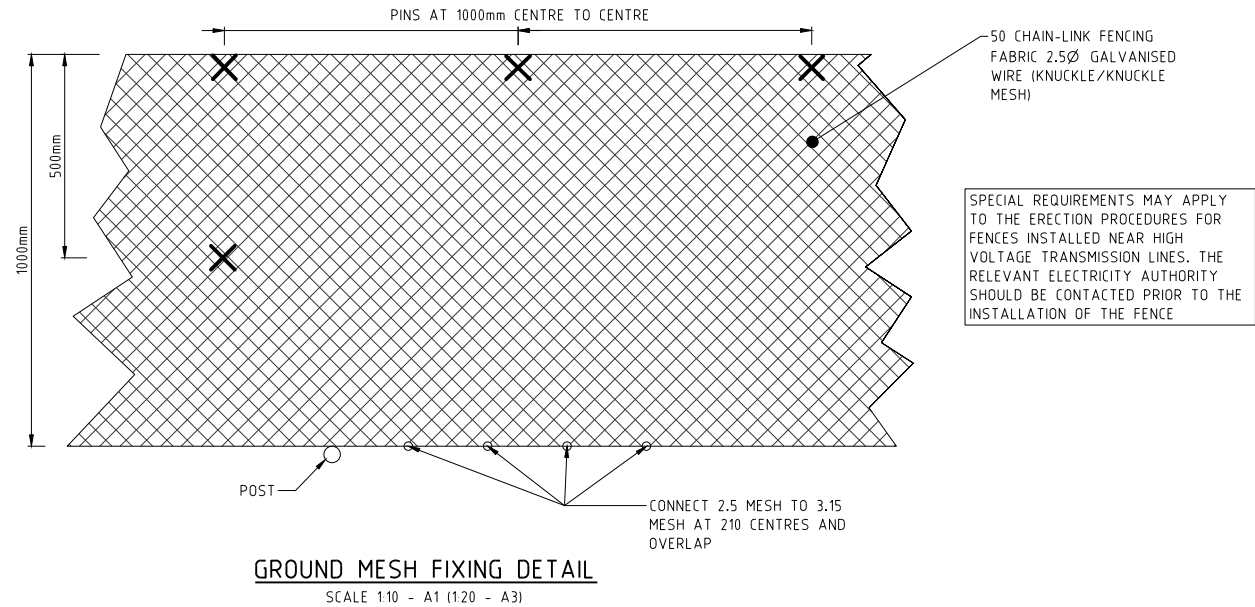
NOTE:
THE FENCE IS NOT APPLICABLE FOR PROVIDING EDGE PROTECTION WHERE THERE IS RISK OF INJURY FROM A FALL THAT IS GREATER THAN 1.0m. THIS INCLUDES CULVERTS, BRIDGE CROSSING AND RETAINING WALLS.

ALL GALVANISED STEEL PIPE TO AS 1074

ALL CHAIN AND SUPPORT CABLES TO BE GREEN (DETERMINED BY SITE). POSTS TO BE STANDARD GALVANISED.



KOALA EXCLUSION FENCE
SCALE 1:10 - A1 (1:20 - A3)

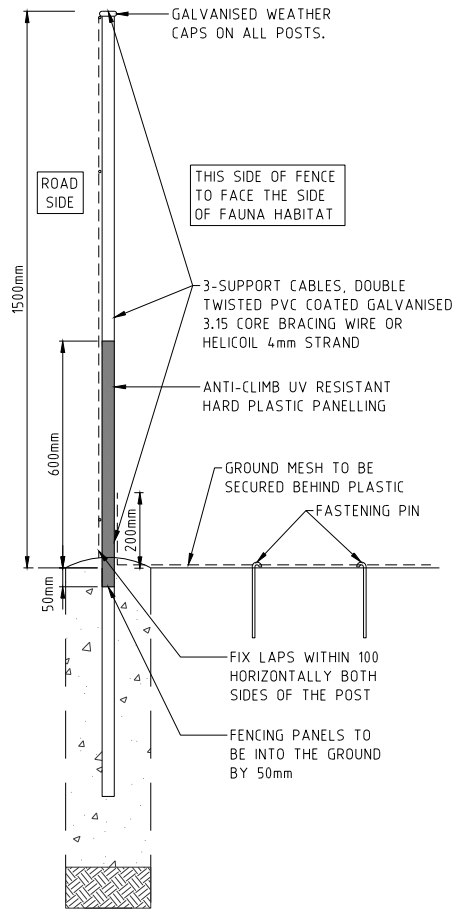


NOTE:

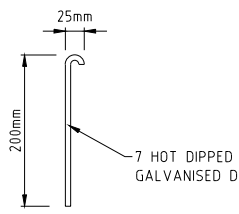
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- ALL DIMENSIONS ARE IN MILLIMETERS.

KOALA PROOF FENCE

- TIE/LACING WIRE SHALL BE GREEN PVC COATED GALVANISED WIRE UNLESS SPECIFIED OTHERWISE.



**KOALA EXCLUSION FENCE
IN WETLAND/WSF HABITAT AREA**
SCALE 1:10 - A1 (1:20 - A3)



NOTE: FOR LOOSE OR SANDY SOILS 350 (MIN) GALVANISED FASTENING PINS MUST BE USED.

FASTENING PIN DETAIL
SCALE 1:50 - A1 (1:100 - A3)

SOURCE: Mortons Urban Solutions - Koala Exclusion Fence (Ref: 12301-ALL-SK140-142.pdf Rev C dated 04/08/22) SCALE: Not to Scale JWA PTY LTD Ecological Consultants	CLIENT Project 28 Pty Ltd PROJECT Koala Plan of Management Kings Forest Melaleuca Drive, Duranbah, NSW Shire of Tweed	FIGURE 19B	TITLE PERMANENT EXCLUSION FENCING DESIGN - WSF AREAS PANEL
		PREPARED: BW DATE: 15 August 2022 FILE: N97017_Design Fencing.cdr	

ATTACHMENT 2 - LETTER FROM DR STEPHEN PHILLIPS



Mr. James Warren
(Managing Director)
James Warren and Associates
(P) 0419 232 580 | (E) james@warren.com.au

4th July 2022

Dear James,

I refer to your request for expert advice regarding the design of koala/frog exclusion fencing proposed for use at Kings Forest. This fencing is intended to assist in the prevention of movement of Wallum sedge frogs (*Litoria olongburensis*) and Koalas (*Phascolarctos cinereus*) from habitat areas into developed areas.

A fence design which has previously been developed in collaboration with Leda Holdings is shown in Figure 1 of this letter and a revised design is shown in Figure 2. Both fences are constructed of chain-link wire mesh of galvanised steel, feature a 60 cm anti-climb / metal scratch panel at the base of the fence on the side facing habitat areas and have diagonal galvanised posts between end posts, gate posts and corner posts. The major features that differ in the revised design are:

- the removal of the floppy top, resulting in a straight vertical fence; and
- the removal of the steel lip (overhang) which was to prevent frogs from breaching the fence.

There are further differences including that the distance between uprights posts is 4 m in the approved design compared to 3 m in the proposed design and the vertical height in the approved design is 1.16 m (excluding floppy-top for which the height is not defined) compared to 1.5 m in the proposed design.

It is my understanding from information provided by yourself that Dr. Arthur White (expert advisor on matters relating to the Wallum sedge frog) has agreed with removal of the steel lip and recommended:

- the inclusion of UV resistant hard slippery plastic panels in place of the metal panels;

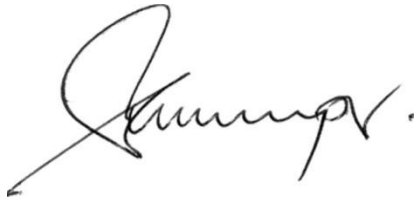
- the bottom of the plastic panels to be placed at least 5 cm into the ground around the wetland areas; and
- the fence around the wetland areas to be placed at a higher elevation than the wetland areas it surrounds.

In reviewing the likely effectiveness for preventing koala movement of the revised design as shown in Figure 2 and the inclusion of recommendations by Dr. White, I draw on data evidencing that a variety of fencing standards successfully influence the movement of koalas (Phillips and Fitzgerald 2014). Current informed and best practice fencing standard implies the use of 1.5 m – 1.8 m chain mesh wire at 3 – 5 m interval panels. This could make the revised design more appropriate, given its presumed greater vertical height. There may be an argument that ‘the higher the better’ and the revised design height (1.5 m) is at the lower end of what best practice would suggest, especially if the fence was also intended to impede human passage. Something that is not clear from either fencing design is the matter of how fence end issues are addressed. If relevant, this would be best addressed by continuing fencing to a substantive natural barrier to koala movement. There is also the matter of potential entry nodes that may allow koalas to access the fenced exclusion zone such as might be presented by roads / driveways for construction vehicles. This seems to have addressed in the gate designs presented in the second and third parts of Figure 2 but efficacy will be dependent on whether gates will be appropriately secured. For this reason, exclusion fencing should ideally be used in conjunction with appropriate ‘koala-grids’ if gates cannot be consistently secured and monitored. This will embody best-practice design principals that enforce the exclusion principal (Biolink 2003 - 2009).

In summary, we support the revised fence design, as presented in Figure 2, with the suggestion to increase the height of this fence if practicable, qualified by the need for clarification regarding potential fence-end issues and the enforcement of gate security. We have attached an image of a fence-end – koala-grid interface installation that resulted from the recommendations of Phillips and Fitzgerald (2014) (Figure 3).

Please don’t hesitate to contact Dr. Amanda Lane if you require any further information.

Regards,

A handwritten signature in black ink, appearing to read 'Stephen Phillips', with a long horizontal stroke extending to the left.

Dr. Stephen Phillips

Biolink Ecological Consultants / Austicon Consulting

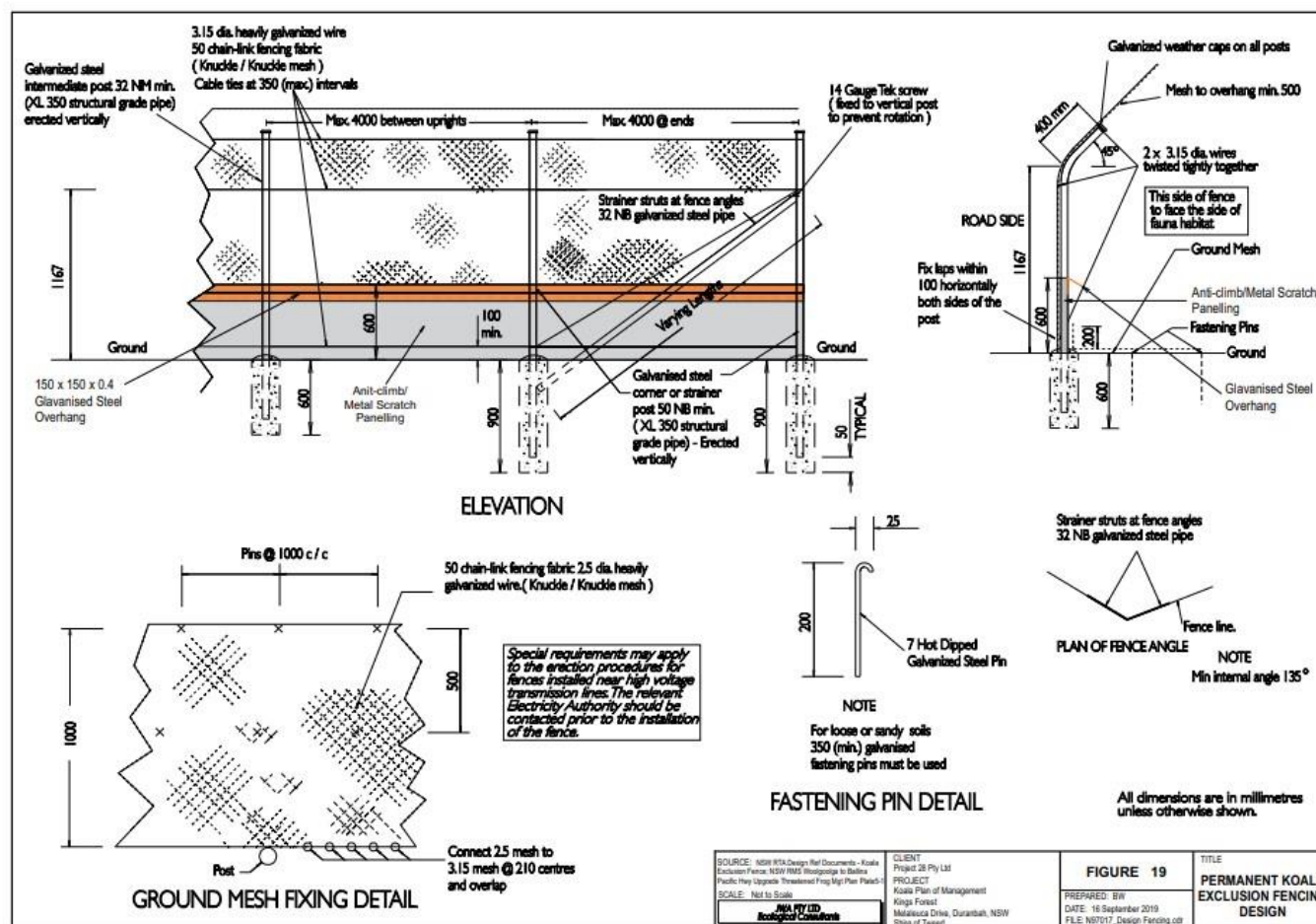


Figure 1: Approved fence design.

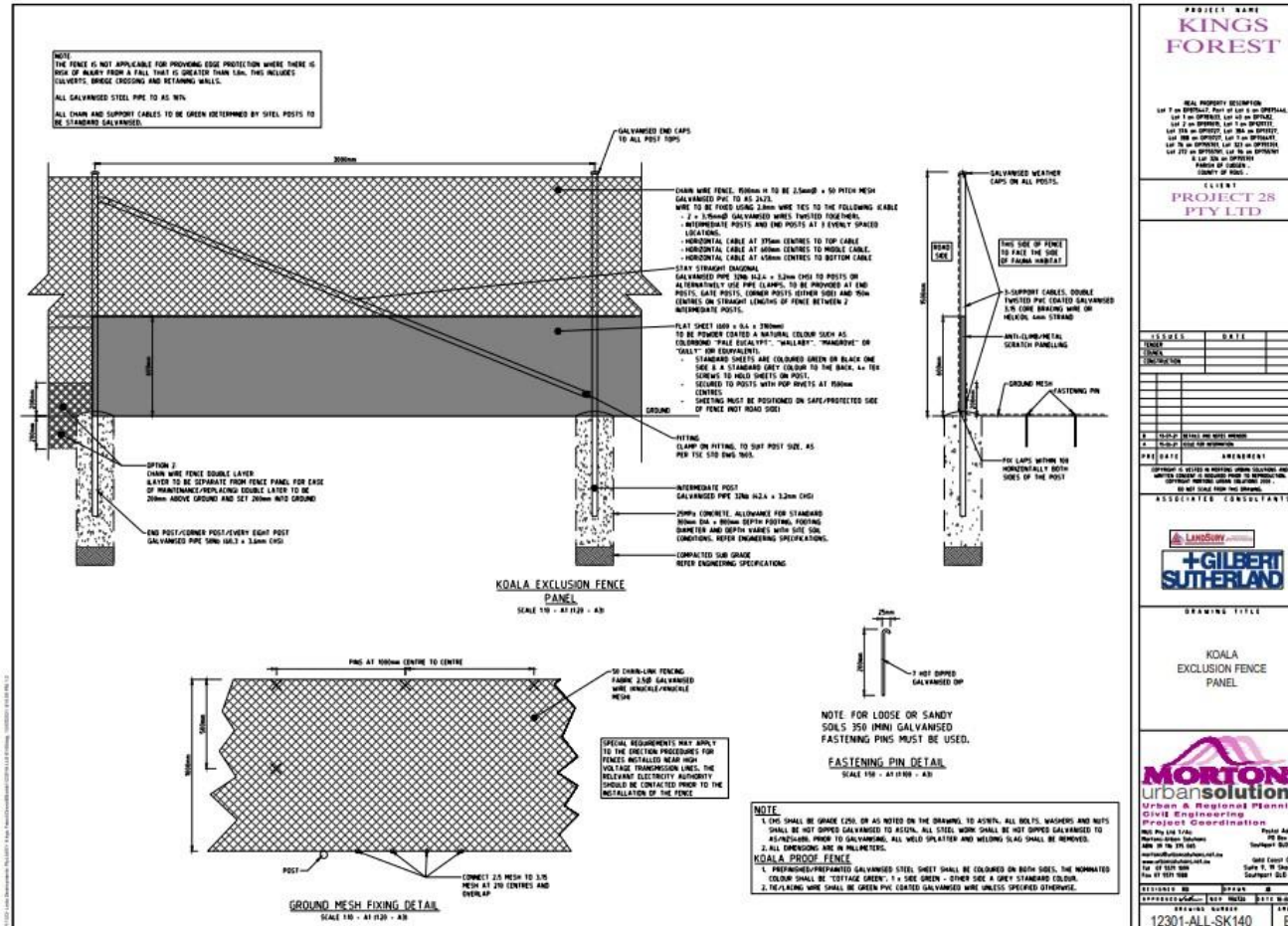




Figure 3: Fence-end – koala-grid interface installation that resulted from the recommendations of Phillips and Fitzgerald (2014).



References

Biolink. (2003 - 2009). *Management of koala issues in conjunctions with the proposed upgrading of Skyline Road*. Various reports for Lismore Council. Biolink Ecological Consultants, Uki, NSW.

Phillips, S. and Fitzgerald, M. (2014). *Review of koala road-kill data and issues associated with underpass use by koalas: Pacific Highway upgrades from Clothiers Creek to Ewingsdale, NSW*. Report to NSW Roads and Maritime Services. Biolink Ecological Consultants, Uki, NSW.

Van der Ree, R., Gagnon, J.W. and Smith, D.J. (2015). *Fencing: a valuable tool for reducing wildlife-vehicle collisions and funnelling fauna to crossing structures*. From Handbook of Road Ecology (eds. R. van der Ree, D.J. Smith and C. Grilo), John Wiley & Sons.

ATTACHMENT 3 - LETTER FROM DR ARTHUR WHITE

Dr Arthur White

(Ecologist)

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The Effective Control of Movement of Wallum Sedge Frogs using Barrier Fences

Introduction

The use of barrier fences to control of movement of threatened frog species in or near development sites has become a standard tool for planners. The style of fence has changed over the years but the basic requirements of the fence has not. The fences are designed to prevent frogs moving into areas that are potentially hazardous to them.

Frog exclusion fences were first used in New South Wales in the 1990s and were particularly developed in the early 1990s for the re-development of the Sydney Olympic Site. One threatened frog species, the Green and Golden Bell frog was widely dispersed across the site and areas of critical habitat were identified and conserved while other areas of new habitat were created. Linking corridors had to be constructed across the landscape and frog exclusion fences were erected to control the movement of a highly mobile frog species and to funnel the species through protected areas (White and Pyke 2001). The fence design for Green and Golden Bell frogs was specific for that species; a species that can climb reasonably well but was capable of particularly long terrestrial journeys (Pyke and White 2001). The requirements for the control of movements of Wallum Sedge Frogs will be somewhat different.

Wallum Sedge Frogs

The biology of Wallum Sedge Frogs is less well studied (Lewis 1996) than Green and Golden Bell frogs, however, there have been enough field studies to allow the effective creation of an effective barrier fence for this species. Wallum Sedge frogs spend most of their time in low undergrowth that ranges from emergent sedges in ponds, to wet heath and Paperbark swamps (Ehmann 1997. Meyer et al. 2006). These frogs will travel along the ground for short distances (eg. to cross a two-lane road: Goldingay and Taylor 2014) but prefer to move through low shrubs at a height of less than 1 metre above ground (Shuker and Hero 2012). Movement occurs at night, particularly during warm, humid nights in spring and summer.

Barrier fences for Wallum Sedge Frogs were using during the construction of the Tugan Bypass in southern Queensland (SMEC 2013), as well as on sections of the upgrade of the Pacific Highway (Lewis 2020). In each case, the barrier fences have consisted of lengths of slippery, mesh fabric (such as fine shade cloth material or durable plastic),

attached to poles or start pickets with longitudinal strand wires providing a base for the attachment of the mesh to the fence. For the Main Roads' projects, the fences have an overhanging lip to prevent any frogs that have climbed the vertical wall of the fence from reaching the top of the fence. These fences were 1 metre high. An important factor in the effectiveness of the fence is that there is a zone of cleared vegetation alongside the fence: this bare zone has two functions; it removes physical routes for climbing frogs to cross over the fence without confronting the barrier fences; and also, it generally discourages the frogs from approaching the fence. Wallum Sedge Frogs rarely will enter open spaces, except during very wet weather.

Barrier Fence Design for Wallum Sedge Frogs

Given that Wallum Sedge Frogs prefer to move in low vegetation or on the ground, an effective barrier must block movement at these two levels. The Main Roads projects addressed these two issues by creating the 1 m high fence with an overhanging lip. Their fence was climbable by Wallum Sedge Frogs and so the overhanging lip was an essential component of the barrier design.

An alternate solution to creating an effective barrier to the movement of these frogs is to erect a non-climbable surface in a vegetation cleared area. If the fence material is non-grip (e.g. polished metal or non-grip plastic), the fence does not need to be as high and also does not need an overhanging lip.

Kings Forest Fence Issues

At Kings Forest, Wallum Sedge Frog barrier fences are to be used in two main areas: firstly, to demarcate the perimeter of the Wallum Sedge Frog habitat areas, and secondly, to be combined with outer fences that also will function as barriers to the movements of koalas.

The original approved fence design for the barrier fences for Wallum Sedge Frogs included a 1500mm high wire floppy fence top and 600 mm high anti-climb panels at the base of the fence. The area either side of the fence would be cleared of vegetation so that frogs (and koalas) cannot bypass the fence using overhanging vegetation.

Tweed Shire Council reviewed the design and expressed concern about the maintenance and upkeep of such a fence design. In particular, there was concern that the anti-climb panel at the base of the fence would deteriorate (especially if it was metal) and the fence's function be compromised. A suggestion was made to reposition the anti-climb panels higher up the fence, but off the ground. While that change would lengthen the life of the panel it would remove the effectiveness of the barrier to Wallum Sedge Frogs on the ground. For Wallum Sedge Frog ground level barriers are the most effective means of restricting the movement of the frogs.

Another possible solution is to not use metal for the anti-climb panels, but a non-grip, highly durable plastic. Plastic fence base barriers have been trialed for other frog species

(eg. the Green and Golden Bell frog) and have been quite effective. There are range of types of plastics that could be used but the cheapest is industrial grade PVC that is UV resistant. The plastic barrier should be 600 mm high and can be secured to a wire support fence by drilling small holes into the plastic and using tie wires to attach it to the fence. The base of the panel should extend into the soil for at least 5 cms.

An issue that arises with the installation of anti-climb panels at the base of frog fence is that the panels may become a barrier to the movement of surface water. Ideally, water should not be pooling close to the fence as this will only attract frogs towards the fence. For the same reason, the base of the fence should not be the lowest point in the local area.

As time proceeds the plastic panels at the base of the fence may become marked or scoured (eg. by over-enthusiatic whipper-snipper operators). The plastic panels can remain in place but be recoated with a non-grip paint if this should happen. The plastic panels if looked after will last at least 25 years in situ (compared to an average of about 10 years for metal sheeting).

Conclusion

Frog barrier fences for Kings Forest do not require an overhanging lip or to be higher than 600 mm. They do require a non-grip vertical wall (preferably of UV resistant plastic) and to be placed at ground level with the base slightly buried. If a 2m vegetation clearance zone is maintained either side of the fence, Wallum Sedge Frogs will be prevented from bypassing the fence and will be forced to approach the fence at ground level.

References Cited

- Ehmann H. 1997. Wallum sedge frog. In 'Threatened Frogs of New South Wales: Habitats, Status and Conservation'. (Ed. H. Ehmann.) pp. 182–187. (FATS Group Publication: Sydney.)
- Goldingay, R.L., and B. Taylor. 2014. How many frogs are killed on a road in North-east New South Wales? *Australian Zoologist* 33 (3): 332–336.
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- Lewis B. D. 1996. A distribution and habitat assessment of three threatened frog species; *Litoria aurea*, *Litoria olongburensis*, *Crinia tinnula* in northern NSW. B.Sc. (Graduate) Thesis, Southern Cross University, Lismore.
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Meyer, E., J.M. Hero, L. Shoo and B. Lewis. 2006. *National recovery plan for the wallum sedgefrog and other wallum-dependent frog species*. Report to Department of the Environment and Water Resources, Canberra. Queensland Parks and Wildlife Service, Brisbane. Available from: <http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-wallum-sedgefrog-and-other-wallum-dependent-frog-species>. In effect under the EPBC Act from 09-May-2007.

Pyke, G.H. and A. W. White. 2001. A Review of the Biology of the Green and Golden Bell Frog *Litoria aurea*. *Aust. Zool.* 31(4): 563-598.

Shuker, J.D. and J-M. Hero. 2012. Perch substrate use by the threatened wallum sedge frog (*Litoria olongburensis*) in wetland habitats of mainland eastern Australia. *Australian Journal of Zoology* 60(4) 219-224 <https://doi.org/10.1071/ZO12030>.

SMEC. 2013. Tugun Bypass, Frog Management Plan, Five Year review. Report prepared for Department of Transport and Main Roads.

Dr Arthur White

29 March 2022