

LEDA Manorstead Pty. Ltd.  
Attn: Mr. Reg van Rij  
Suite 14, Level 1  
46 Cavill Avenue  
Surfers Paradise Qld 4217

23<sup>rd</sup> October, 2015

Dear Reg

I refer to your e-mail and associated attachments of the 15<sup>th</sup> October requesting further advice on structural and fauna movement/management issues related to provision of the 50 m wide dual purpose (i.e. drainage/fauna movement) corridor on the Cobaki site.

Upon consideration of the information that was provided four matters arise as follows:

1. Limitations imposed by the already approved underpass structure at the extreme eastern end of the corridor,
2. The plant species to be used in the re-creation of a facsimile Scribbly Gum Woodland within the corridor,
3. The issue of fencing in the context of a need to effectively contain the movement of wildlife that may make use of the corridor in the longer term, and
4. Requirements to facilitate under-road fauna movement at each of the envisioned road crossings to the west.

In terms of 1 above I reiterate the principles of my earlier advice (correspondence 17/03/2014 refers) that in my opinion the greatest number of corridor entry opportunities should be provided at the interface with adjoining habitat areas at the eastern and western ends respectively. For this reason and notwithstanding the existing approval/consent in so far as it relates to the eastern interface, I support consideration of any modification/change to the already approved installation that will optimize the potential for utility by wildlife. In terms of any possible modification/change I draw your attention to the proposed design solutions for the 'upstream' areas that involve 2 x 2.4 m x 1.8m ledged RCBCs at either side of a centrally located linking slab. While I acknowledge that the design is drainage focused, I also regard it as wildlife-friendly and in the context of any modification/change would thus support installation of such a structure at the eastern corridor easement habitat interface. As I have previously advocated, a further modification to both approved and proposed structures involves the installation (by way of retro-fitting) of timber shelves and associated access ramps. Based on the work of Jones *et al* (2012) such shelves are intended to ensure year-round dry access through RCBCs for wildlife species that may otherwise be deterred by

the presence of water. While aspirations to regular underpass maintenance are often espoused in management documents, such necessary actions are rarely (if ever) undertaken and even more difficult to monitor and enforce. The use of shelves thus ensures that the potential for all-year round dry access through underpass structures can be maximized. For your information I have attached a drawing of the intended outcome as recently implemented by Port Macquarie Hastings Council.

In terms of the second matter (revegetation strategy within the proposed corridor) I note the intent is to recreate a facsimile Scribbly Gum Woodland with an associated specification for the tallest-stratum vegetation canopy cover to be less than 30% for fire management purposes. To this end I support the intention to use Swamp Mahogany as a component of the over-storey revegetation strategy in addition to the creation of dense understory of native shrubs and groundcovers. Swamp Mahogany, in addition to being a tree species known to be preferred by koalas, is also a locally and regionally significant biodiversity asset because of its flowering phenology.

The issue of fencing does not appear have been detailed or annotated in the attachments I received. Nonetheless, fencing is a fundamental consideration because of a need to create a barrier between the wildlife habitat within the corridor and that of the adjoining development precincts. The intent of fencing should be to contain wildlife movement within the designated corridor while at the same time restricting access to the corridor by people and domestic animals. This barrier effect could be achieved by way of a standard floppy-top design typically deployed on road upgrades. However, a recent review we completed for NSW Roads & Maritime Services (Phillips and Fitzgerald 2014), some aspects of which I presented at the recent ANET conference in Coffs Harbour, provides *de facto* support for acceptance of a broader range of fence types being recognised as capable of influencing/impeding wildlife movement. This knowledge has allowed us to promote less expensive designs that are capable of achieving the same end result. By example, the fencing standard we have recommended for purposes of the Ocean Drive Road Corridor Koala Management Framework (Phillips *et al* 2014) comprises 1800 mm x 50 mm x 50 mm galvanised mesh supported above ground by 1500 mm high 60mm galvanised pipe uprights at 3m intervals (Note: the 300mm difference in the width of the mesh and the height of the uprights is deliberate, the intent to facilitate a floppy-top effect to the fence as an additional deterrent). Locally, a similarly informed specification based on ongoing liaison with NSW Roads & Maritime and which have resulted in a shorter floppy-top component is currently being retro-fitted to two Pacific Highway interchanges between Brunswick Heads and Tyagarah in the Byron LGA.

The last issue relates to the matter of facilitating the movement of wildlife underneath the two locations where other components of the internal road network are proposed to cross the corridor. I am aware that this issue has been a matter of ongoing discussions between LEDA and Council and presume that it has now been resolved. Again and subject to the qualifications I have expressed above regarding the potential bottleneck created by only a single 2.4 m x 1.8 m RCBC at the Cobaki Parkway end, I consider the centrally located linking

slab with RCBCs either side to be well suited and further adaptable in terms of optimising use by wildlife.

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

Yours sincerely

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

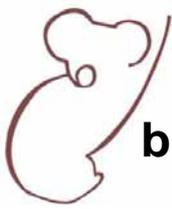
Steve Phillips B.Sc.(Hons), Ph.D.  
Managing Director.

References:

Jones *et al.* 2012. *Koala Retrofit Works Program – Evaluation and Monitoring Report*. Report to Dept. of Transport and Main Roads. Prepared by Applied Road Ecology Group, Environmental Futures Centre, Griffith University, Brisbane, QLD

Phillips, S., and Fitzgerald, M. 2014. *A review of koala road-kill data and issues relating to underpass use by koalas: Pacific Highway upgrades from Chinderah to Ewingsdale, NSW*. Final Report to NSW Roads & Maritime Services.

Phillips, S., Weatherstone, C., and Coburn, D. 2014. *Ocean Drive Road Corridor Koala Management Framework*. Report to Port Macquarie Hastings Council.



LEDA Manorstead Pty. Ltd.  
Attn: Mr. Reg van Rij  
Suite 14, Level 1  
46 Cavill Avenue  
Surfers Paradise Qld 4217

17<sup>th</sup> day of March, 2014

Dear Mr. van Rij

I refer to your request for independent advice regarding the efficacy and potentially utility of underpass configurations currently being considered in the context of Condition 63 of the development consent for the proposed Cobaki residential estate in the Tweed Local Government Area of northern NSW.

For the purposes of preparing what follows I have examined the following documentation:

**(i)** pages 97 – 99 of the Agenda, (Tweed Shire Council) Planning Committee Meeting, Thursday 6th March, 2014 in so far as these pages relate to Condition 63 (Fauna Crossing);

**(ii)** An annotated figure titled “*Scope of Works and Key Sheet Plan*” - Drawing No: YC0229-1E1-D03, Revision E, prepared by Yeats Consulting Engineers and

**(iii)** E-mail advice from Mr. Craig Siganto to yourself dated 13<sup>th</sup> March, 2014 regarding modelled water levels and ledge inundation times arising from a peak storm event in Precinct 6 (the area of interest to this advice – the annotated figure referred to in 2 above refers).

In addition to the above I have also relied upon my particular experience and ecological expertise in the arena of roads, underpasses and the issue of accommodating fauna movement, some aspects of which include but are not limited to:

**(iv)** advice to Tweed Shire Council regarding koala movement, underpass use and associated dimensions in association with the 1998 upgrading of Old Bogangar Road (Callaghan & Phillips 1998 and associated reports);

**(v)** advice to Lismore City Council regarding koala movement, underpass use, fencing and grid standards in association with the 2004 upgrading of Skyline Road, aspects of which included a 6 year *post-upgrade* monitoring program (Biolink Ecological Consultants 2009 and associated reports);

(vi) advice to what is now NSW Roads and Maritime Services regarding underpass dimensions and use of same by wildlife in association with various Highway upgrades;

(vii) advice to other consultancy firms, Local Government Authorities, State and Federal Government agencies regarding issues of road construction standards, amelioration measures and the maintenance of fauna connectivity.

In the context of the above I further advise that I am a member of the Australasian Network for Ecology and Transportation (ANET) under the auspices of which in 2013 I was part of an expert working group comprising researchers, road engineers and planners that examined underpass design and associated fauna connectivity issues along the east coast between Tweed Heads and Coffs Harbour. ANET has been established specifically to further the research, design and advancement of environmentally-sensitive linear infrastructure such as roads and corridor easements.

On the basis of information contained in the Planning Committee Agenda referred to in 1 above, I understand that there are differences of opinion between LEDA and the Tweed Shire Council regarding how best to make provision for fauna movement across Precinct 6 of the Cobaki development site, specifically relating to the number and dimensions of Reinforced Concrete Box Culverts (RCBCs) that are required to facilitate the safe under-road passage of fauna and hence effective use of a proposed east-west wildlife corridor.

On the basis of the preceding information I offer the following without prejudice commentary and advice for your consideration.

### **1. Purpose & rationale of the proposed corridor**

It is my understanding that the corridor easement is intended to serve a dual purpose of accommodating drainage requirements and over the longer term theoretically facilitate the movement of fauna from lower lying areas of the site to more elevated areas in the vicinity of the NSW – Queensland border to the west. I use the word “longer-term” in the preceding sentence simply because as it currently stands the corridor is conceptual only, any longer term use by fauna remains entirely aspirational because necessary habitat elements are not yet in place.

I further understand that the proposed corridor easement is 50m, while the length of the required under-road traverses required to be serviced by the underpasses (measured by distance between tops of headwalls on both sides of road) I have estimated from the drawings to be ~ 20m.

### **2. Use of proposed corridor and potential utility of underpasses by fauna, including focal species**

While the envisaged corridor easement and associated underpasses can be expected over the longer-term to service a variety of common fauna species, on the Cobaki site particular consideration needs to be given to focal species such as Long-nosed Potoroo *Potorous tridactylus* and (potentially) the koala *Phascolarctos cinereus*, the former known to occur immediately to the north-east, the latter currently not known to be represented by a resident population on the development site or adjacent habitat areas. As I have already alluded to above, use of the proposed corridor easement area by both of these species will be contingent upon creation of suitable habitat: a dense lower stratum in the case of Long-nosed Potoroos, the presence of scattered koala food trees in the latter.

Aforementioned considerations aside, it is important to note that Long-nosed Potoroos have previously been documented as using 2.4m x 1.2m RCBCs (AMBS 2001) while underpass dimensions of 2.4 – 3.0m x 1.8m were also specifically recommended for Long-nosed Potoroo use on the Cobaki site by Lewis and Firestone (2009). Elsewhere and in the case of koalas (and indeed a wide range of other wildlife species including macropods, possums, bandicoots, reptiles and amphibians) it can be demonstrated that use of 1.2 x 1.2m RCBCs up to a maximum under-road traverses of up to 36m will readily occur (Callaghan and Phillips 1998; Biolink Ecological Consultants 2009).

### **3. Issues of inundation**

The use of underpasses by wildlife can be impeded by hydrologically related issues such as poor drainage and/or sedimentation associated with storm events. Ideally, planning for the optimal use of underpasses by terrestrial fauna thus requires year-round, dry access to be afforded. For these reasons there is an obvious advantage in having elevated ledges and/or other structures that enable use of the underpasses to continue under adverse conditions.

Modelling advice from your engineering consultants indicates that in the event of a peak storm event the ledges as currently depicted in the drawing referred to in (ii) above would likely to be covered for less than 1 hour. While there could be some discussion as to whether the amount of water over the ledge during a peak storm event would be actually be sufficient to deter fauna movement, I regard the modeled time period of less than 1 hour as acceptable outcome and a minimal constraint in the context of providing year-round access. However, even were the modeling incorrect by one or more orders of magnitude (and I have no reason to believe this is the case), recent work by Darryl Jones and colleagues from Griffith University (Jones *et al.* 2012) has demonstrated that the provision of all year round dry access can be readily achieved even in wet underpasses by way of retro-fitting timber ramps and shelves to the sides of culverts. In my opinion this should be an acceptable modification to underpass configurations on this site and elsewhere if monitoring establishes longer than modeled inundation times do occur and/or other circumstances prevail to render the ground unsuitable for traverses by terrestrial mammals.

### **4. Other Considerations**

As a general planning principle, the greatest number of corridor easement entry opportunities should be provided at the interface with adjoining habitat areas. In this regard it is important to be aware that use of any structure at the interface will likely be at low frequency and restricted to animals that have large home range areas, other species with home range areas in the immediate vicinity, and dispersing animals from other areas. There is adequate data from long term monitoring studies such as I have alluded to above (point (v) refers) to support this assertion, the important consideration being that the number of fauna movement events in such areas will be low in number rather than high. In the case of long corridor easements such as are envisaged in this instance, movements will be more sporadic and fewer because they will primarily be a function of the number of individuals able to enter the corridor easement at the interface and thereafter establish home range areas within the easement rather than moving in a linear fashion along and through it.

Hence the primary controlling element influencing utility is the initial access point at the habitat interface; this has even greater relevance at the Cobaki site because for much of its envisaged length the adjoining landscape will be in the form of housing. In this case the fact that there is an already approved 2.4m x 1.8m RCBC to be provided for the eastern end of the easement at its junction with the envisaged

Cobaki Parkway is clearly relevant. As I have indicated above, a variety of wildlife species including potential focal species such as Long-nosed Potoroos and Koalas will readily use of an underpass of this dimension. In an ecological context I am thus comfortable that a 2.4m x 1.8m RCBC should thus serve as the standard for connectivity along the length of the corridor easement and reiterate that it already exceeds the minimum already known to be suitable for the majority of wildlife species likely to use it.

### **5. Concluding comments**

I am reluctant to directly engage the difference of opinion that apparently exists between LEDA and Tweed Shire Council in this instance, instead proposing that a means of resolution may already be evident in the information and advice I have provided herein. Moreover, so long as the design standard and specifications are based on sound ecological advice I do not see why such plans might additionally need to be submitted for approval of the General Manager or his delegate.

On the basis of the above I consider that the current underpass configuration and associated dimensions as detailed in the drawing by Yeats Consulting are more than adequate for the envisaged corridor easement and clearly exceed what might otherwise be expected on the basis of available standards adopted elsewhere.

On ecological grounds I have seen nothing in the Agenda report referred to in (i) above that serves to justify an increase in the number of culverts from that proposed in the diagram by Yeats Consulting; indeed I regard LEDA's intended design that would place 2 x 2.4m x 1.8m ledged RCBCs at either side of a linking slab as an innovative design development with broader application beyond this particular development site. Were it possible, I would even advocate such an installation be installed at the corridor easement habitat interface under the Cobaki Parkway in exchange for single 2.4m x 1.8m RCBCs (with ledges or shelves) at the two road crossings in Precinct 6.

Do not hesitate to contact the undersigned if you require further information. Please be aware that the references I have detailed over the page represent only those I have referred to in this correspondence; there is a rapidly growing literature on underpass use and corridor easement utility by wildlife that can be drawn upon if required to further support the matters I have discussed herein.

Yours sincerely



Steve Phillips B.Sc.(Hons), Ph.D.  
Managing Director/Principal Ecologist.

## References

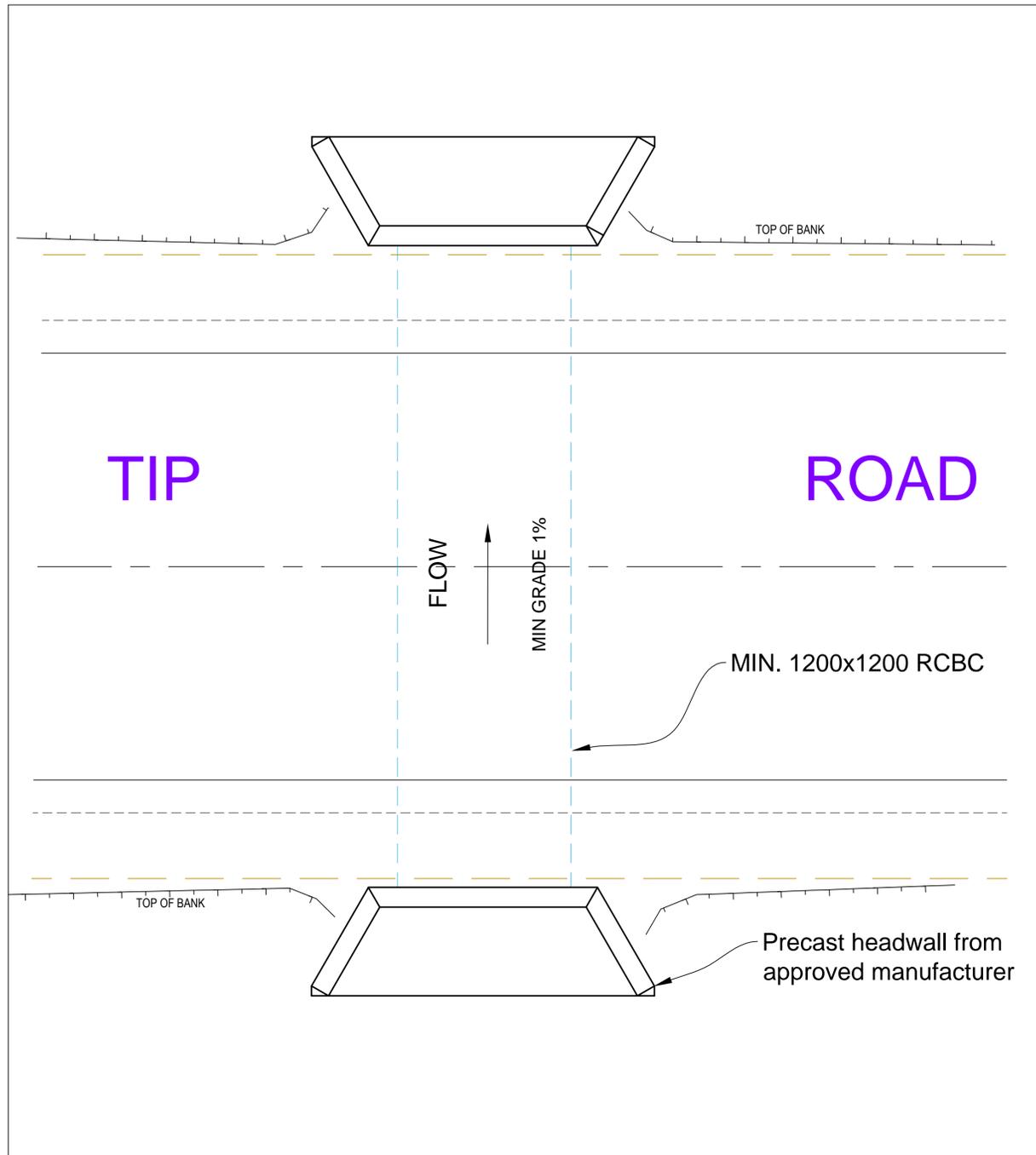
Australian Museum Business Services (AMBS). 2001. Fauna Underpass Monitoring: Stage 1 Final Report – Brunswick Heads. Report to NSW Roads & Traffic Authority.

Biolink Ecological Consultants. 2009. Koala Monitoring Report No. 6 – Skyline Road Upgrade, Lismore, NSW. Report to Lismore City Council.

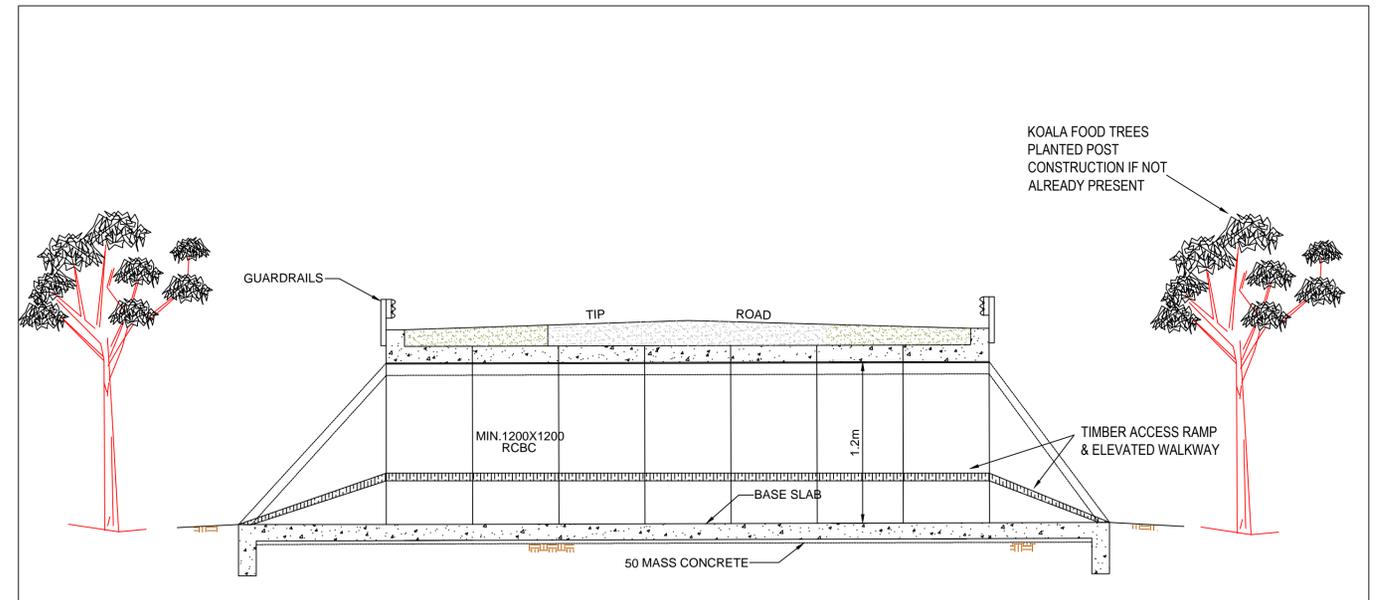
Callaghan, J., and Phillips, S. 1998. Interim Report on Monitoring of impacts on koalas associated with the upgrading and (part) realignment of Old Bogangar Road. Report to Tweed Shire Council. Australian Koala Foundation.

Jones *et al.* 2012. Koala Retrofit Works Program – Evaluation and Monitoring Report. Report to Department of Transport and Main Roads. Prepared by Applied Road Ecology Group, Environmental Futures Centre, Griffith University, Brisbane, Qld, Australia

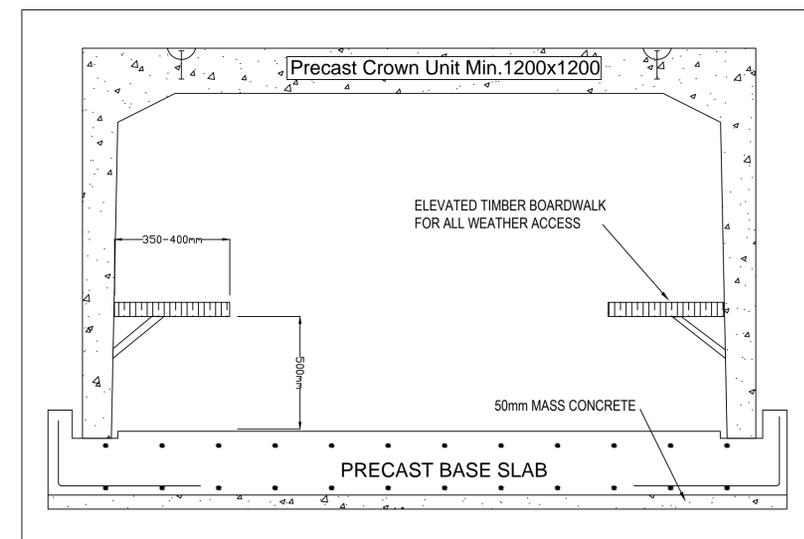
Lewis, B.D and Freestone, C.Z. 2009. *Integrated Plan of Management for the Endangered Long-nosed Potoroo (Potorous tridactylus tridactylus) Population At Cobaki*. Prepared by Lewis Ecological Surveys for PacificLink Alliance.



**PLAN OF KOALA UNDERPASS**  
Not To Scale



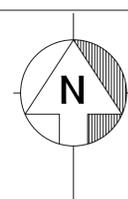
**TYPICAL CROSS-SECTION**  
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**TYPICAL SECTION**  
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Rev.	Date	Description	Approval

Consultant Certification	
Designer	Date
Engineer	Date



Approval	
Principal Design Engineer	Date
Technical Services Manager	Date



Scale
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Drawn:	JE
Surveyed:	NA
Coordinate System:	AHD
Origin of Levels:	NA
File Path/Name:	

DUNBOGAN TIP ROAD UPGRADE KOALA MITIGATION MEASURES TYPICAL UNDERPASS			
Work Order Number:	Drawing Number:	Sheet	Size:
Sheet 1 of 1	Revision:	A1	A1