# King Forest

## Review of Revised (2017) Koala Plan of Management

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# Abbreviations

| Abbreviation | Description |
|---|---|
| BC Act | NSW *Biodiversity Conservation Act 2016* |
| CKPoM | Comprehensive Koala Plan of Management |
| DoEE | Commonwealth Department of the Environment and Energy |
| DPE | Department of Planning and Environment |
| KPoM | Koala Plan of Management |
| OEH | Office of Environment and Heritage |
| TSC Act | NSW *Threatened Species Conservation Act 1995* |

# Executive Summary

This report presents the results of a review by Eco Logical Australia of a revised Koala Plan of Management (KPoM), which was lodged with the Department of Planning and Environment (DPE) for review and consideration as part of a modification request (number 4) to DPE to amend the Stage 1 Kings Forest residential approval. The KPoM and various other relevant material was reviewed, key issues identified, and recommendations made. This included approval from the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the revised KPoM.

It is noted that the Kings Forest site has already received previous approvals. There has been changes in legislation since the Kings Forest Concept Plan was approved, including, in particular, the listing of the koala as an Endangered Population under the NSW *Threatened Species Conservation Act 1995* (TSC Act) between the Tweed and Brunswick Rivers east of the Pacific Highway on 22 April 2016.

A number of key matters pertinent to the long-term persistence of koalas on the Kings Forest site were identified through the review. In summary, it is considered that there are substantive issues with the approach taken in the revised KPoM to some matters, and that changes are warranted. It is considered that without changes to the KPoM, in particular on the approach taken to koala corridors, fencing, and koala road crossings that the koala population on the Kings Forest site is likely to decline substantially. This would place the Tweed Coast Koala Endangered Population under further pressure and risk that this population will not persist in the long term.

A total of 17 recommendations have been made with regards to the proposed modification of topics of:

- Quantum and type of koala offset,
- Tree species selection for koala offset planting areas,
- Commencement of koala offset works and standards for achievement,
- Corridor(s) for koala movements (as per condition B4 of the Kings Forest Concept Plan and Condition 45 of the Kings Forest Project Approval),
- Road Crossings and Fencing,
- Proposed monitoring,
- Contingency strategy,
- Planning approval.

# 1 Introduction

## 1.1 Background and Scope of this Review

The Kings Forest concept plan residential development was approved on 19 August 2010. Since that time a number of modifications to the concept plan and Stage 1 approval have been lodged. A subsequent Project application for Stage 1 of the development was approved on 11 August 2013 and comprised subdivision and bulk earthworks.

A modification request (number 4) was lodged with the Department of Planning and Environment (DPE) to amend the Stage 1 approval. This modification request included the clearing of koala habitat additional to that previously approved, and also sought changes to the koala offsets. A revised Koala Plan of Management (KPoM) was lodged with DPE for review and consideration.

Due to the technical nature of the documentation, Eco Logical Australia was engaged to undertake a review of the revised Koala Plan of Management (JWA Ecological Consultants 2017). This report provides a written summary of the outcomes of this review, identification of key matters, and recommendations. The review was desktop in nature, with no site visit conducted.

For context, it is noted that prior to seeking modification approval from DPE, the proponent had lodged and obtained a modification with regards to Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval. The material submitted to the Commonwealth was reviewed for context, but this review does not consider whether EPBC Act approval should have been granted. It is further noted that Commonwealth and NSW approvals are separate and under different jurisdictions and Acts.

## 1.2 Material Reviewed

The following documents were reviewed:

1. Conditions of approval
2. Kings Forest Koala Plan of Management (Carrick 2009)
3. Koala Plan of Management (James Warren & Associates 2012)
4. Revised Koala Plan of Management (JWA Ecological Consultants 2017)
5. Draft Wallum Sedge Frog Management Plan (for consistency with the submitted KPoM)
6. Concept Plan & amended project approvals
7. Final Response Report relating to Matters of NES (Wallum Sedge Frog & Koala) (JWA Ecological Consultants 2015)
8. Modification request to NSW Department of Planning
9. Scientific Committee Final Determination to list the koala population between the Tweed and Brunswick Rivers east of the Pacific Highway as an Endangered Population (NSW Scientific Committee 2016)
10. Tweed Coast Comprehensive Koala Plan of Management Tweed Shire Council (2014)

In addition to review of technical material, telephone or face-to-face discussions were held with the following:

- Tweed Shire Council
- Office of Environment and Heritage (OEH)
- Commonwealth Department of the Environment and Energy (DoEE)

- Project 28 Pty Ltd (the proponent)

### 1.2.1 Relevant Conditions of Consent

The following consolidated conditions of consent (from Annexure B of Annexure A of the Modification 4 documentation) were considered to be directly relevant to koala management at Kings Forest:

Concept Plan Approval

*B1 Koala Plan of Management – Ongoing Review*

*The Koala Plan of Management, and the measures contained therein to offset the impact of the development on existing and future koala populations, shall be updated at each stage of development so that these measures remain relevant and effective and based on contemporary scientific data throughout the development of the Project the subject of this concept plan.*

*Each stage update shall be prepared in accordance with the requirements in C2 and subject to independent review by a suitably qualified person/s to the satisfaction of the Director General.*

*B2 Annual Flora and Fauna Monitoring Report*

*Within 12 months of this approval, or as otherwise determined by the Director-General, the Proponent shall prepare a draft outline of an Annual Flora and Fauna Monitoring Report to the satisfaction of the Director-General. The aim of the report is to collate all monitoring and reporting requirements from relevant documents listed in A3 and to identify any required corrective actions. A baseline Monitoring Report is to be provided prior to construction commencing. The Annual Flora and Fauna Monitoring Report shall be prepared on an annual basis from the date of commencement of construction or as otherwise determined by the Director-General.*

*The Annual Flora and Fauna Monitoring Report shall be prepared by a suitably qualified person/s and include but not be limited to:*
*(1) The aims, objectives and methodology for the report;*
*(2) Baseline monitoring data focusing on existing populations of threatened species, including Wallum frog species and koalas;*
*(3) Performance criteria against which the effectiveness of the various separate management plans dealing with management of koalas, threatened species, buffers, weeds, vegetation and feral animals can be measured;*
*(4) Monitoring and reporting of fauna usage within Environmental Protection zones, ecological buffers and the golf course;*
*(5) Adaptive management procedures to ensure that the various separate management plans remain relevant and effective; and*
*(6) Monitoring and reporting of injuries or mortalities to koalas.*
*(7) Specific monitoring to measure any impact of the development on the adjacent Cudgen Nature Reserve and adaptive management procedures to ensure any impacts are minimised.*

*B4 East-West Wildlife Corridors*

*As identified in the Koala Plan of Management, an east west wildlife corridor of up to 100 metres wide (with a minimum of 50 metres at any one point) must be established. The corridor should be established to provide for habitat and the movement of threatened native fauna that inhabit the site.*
*Prior to the determination of Stage 1, the Proponent shall also demonstrate the practicality or need for establishing a further east west 50 metre wide corridor along the southern boundary of the site.*

*The details of this modification, including regeneration/revegetation of the corridor, the preferred long term protection mechanism, and the practicality of a new southern east west corridor are to be submitted to the satisfaction of the Director-General prior to determination of Stage 1.*

*C2 Management Plans*

*All future applications are to include stage-specific management plan updates providing where relevant details on timelines for implementation of recommended works including maintenance periods; measurable performance and completion criteria; and monitoring, reporting and adaptive management procedures (results to be provided according to B2).*

***Koala Plan of Management***

*For each stage of development an update to the KPoM shall be provided to the satisfaction of the Director-General, confirming that the measures identified and proposed in the KPoM to offset the impact of the development on existing and future Koala populations are adequate.*

*(1) The update should take into account:*

*(a) contemporary data/literature on koala management;*

*(b) the results of the monitoring of management measures operating as part any approved stage/s, in accordance with B2;*

*(c) the role of additional koala habitat created in protecting koala numbers, and*

*(d) the provision of any additional koala management measures, specifically those relating to dogs.*

*(2) The update should include, but not be limited to:*

*(a) the identification of dog breeds known to present a significant threat to koalas; and*

*(b) measures to effectively mitigate the threat posed to koalas by dogs. Such measures may include prohibitions/restrictions on particular breeds; limitations on the number of dogs per property; and specifications on the way dogs are to be housed from dusk to dawn.*

*(3) The update must provide stage specific detail on the following:*

*(a) revegetation and rehabilitation measures;*

*(b) measures to ensure that no identified koala food trees are removed within adjacent ecological buffers or identified core koala habitat within adjacent Environmental Protection zoned land;*

*(c) all obligations regarding the keeping of dogs, including regulatory and enforcement measures;*

*(d) specific road design, lighting and signage requirements aimed at protecting koalas and maintaining their safe passage between habitat areas. These requirements shall include fencing to road verges, fauna underpasses and like measures;*

*(e) detail of procedures to be adopted in the event that koalas are sighted within construction zones or the urban areas;*

*(f) specifications for any off-leash dog exercise areas to ensure appropriate separation from koala habitat;*

*(g) the detail of the location and construction specification of dog exclusion fencing to any adjacent Environmental Protection Zones and the timing of its completion;*

*(h) the detail, content and distribution of koala education and awareness measures aimed in particular at contractors and staff engaged in construction and at future residents of that stage; and*

*(i) a protocol for the reporting of any deaths or injuries to any koala within Kings Forest including collection and recording procedures and where necessary post-mortem procedures or laboratory tests to identify the cause of death to any koala.*

*C8 Traffic and Wildlife Protection Measures*

*All future development applications are to demonstrate that:*

*(1) Provision has been made to maintain the safe passage of wildlife between habitat areas through specific road design, lighting and signage requirements and, where considered appropriate, fencing to road verges, fauna underpasses and like measures; and*

*(2) Road crossings of waterways maintain existing fish passage.*

Project Approval

*A12*

*(5), This approval does not approve any bulk earthworks within ecological buffers across all precincts as depicted on Drawing No. 12301-ALL-041 Revision B, with the exception of minor encroachments into the Precinct 5 ecological buffer for the construction of stormwater management areas (bioinfiltration and vegetated swales), placement of Koala fencing, and construction of Road No. 9 in the south western corner of Precinct 5 for an area of 686m2 as contained within the Proponent's Preferred Project Report 2012 and shown on the Precinct 5 Swale Sections Plan (Drawing No.12301-SK-044 Amendment C dated 15 August 2012) and Road Reserve / Buffer Interface Plan (Drawing No.12301-SK-046 Amendment A dated 17 August 2012).*

*Bushfire Risk Management Plan*

*34. The Bushfire Risk Management Plan (BRMP) shall be amended to address the following:*
*1) Co-operative relations between neighbours to minimise the potential for wildfires and work towards fire frequencies and intensities that do not impact on Koala populations*

*2) Management actions required for future ongoing fire related Koala management in environmental protection zones.*

*3) The revised BRMP shall be endorsed by OEH prior to the issue of a construction certificate for civil works.*

*Baseline Monitoring*
*37.*

*1) Prior to the issue of the first Construction Certificate, the proponent must demonstrate to the satisfaction of the Department that sufficient baseline monitoring has commenced in accordance with the relevant Environmental Management Plans, including the following:*
*a. Flora and Fauna Monitoring Report;*

*Environmental Management Plans*
*39.*

*1) All Environmental Management Plans shall be revised to address management actions to be undertaken throughout the life of the project as relevant to the development precincts that the plan covers. This includes a detailed set of agreed establishment and maintenance phase performance completion criteria, ongoing monitoring and an annual maintenance schedule of works following the initial establishment period. This includes the following plans:*
*a. Flora and Fauna Monitoring Report*
*b. Buffer Management Plan*
*c. Vegetation Management Plan*
*d. Koala Plan of Management*
*e. Feral Animal Management Plan*
*f. Weed Management Plan*
*g. Threatened Species Management Plan*

*2) Performance criteria for all management plans are reviewed to ensure they are specific to each precinct and action, measurable, achievable, relevant and timely*

*3) The implementation schedule of all Environmental Management Plans shall be revised to include the following details as relevant to the precincts that the plan covers:*
*a. Actions that are specific to the precinct for which they are addressing*
*b. Specific map references to identify locations of works for all actions*
*c. Total areas to be planted (m2)*
*d. Planting density (per m2)*
*e. Number of permanent signs to be erected and maintained*
*f. Total areas for weed management activities (m2)*
*g. Length of any fencing (temporary and permanent)*
*h. Total areas for heath regeneration and revegetation (m2)*

*i. Locations and areas (m2) of proposed threatened species habitat*
*j. Timing and frequency of actions*
*k. Monitoring requirements (frequency) that are specific to the action*

*Buffer Management Plans*
*41.*

*1) Figures 10 and 10A to 10L shall be revised as necessary to ensure that spatial overlap of heath revegetation, Koala food tree planting and Wallum Sedge Frog compensatory habitat is minimised.*

*2) Tree plantings are to be minimised in areas that are identified as naturally regenerating.*

*3) The final Buffer Management Plans shall be prepared in consultation with Council and submitted to the Secretary for approval within 6 months of the date of determination of the application (No. 2012/2328) mad under sections 130(1) and 133 of the Commonwealth Environmental Protection and Biodiversity Conservation Act of this approval or prior to issue of any construction certificate, whichever occurs first.*

*45. Koala Plan of Management. The Koala Plan of Management shall be revised as follows:*

*1) A revised offset strategy for the loss of Koala food trees incorporating the following:*

*a. the restoration and planting of Koala food trees offsite (a 27ha area of land has been nominated by OEH and identified in Map 1. (attached))*

*b. planting of Koala food trees in the new east-west corridor as required by Term B4 of the Concept Plan approval.*

*c. planting of Koala food trees in other suitable locations across the site within each relevant precinct of the development in general accordance with the plan titled "Proposed Koala Compensatory Habitat Area Staging Plan, Condition 45, Figure 1, JWA Pty Ltd, 29 April 2014", and as modified by any approval of the revised Koala Plan of Management under this condition. The timing of plantings shall be in accordance with the approved revised Koala Plan of Management required by Condition 45(2).*
REPORT NOTE: A copy of this plan has been included in Appendix B of this report.

*d. Koala food tree plantings are to be minimised in areas that are identified as naturally regenerating.*

*2) The revised KPoM approval shall include details of the Koala food tree planting schedule with numbers and staging and be prepared in consultation with Council and submitted to the Secretary for approval within 6 months of the date of determination of the application (No. 2012/2328) made under sections 130(1) and 133 of the Commonwealth Environmental Protection and Biodiversity Conservation Act or prior to issue of any construction certificate, whichever occurs first.*

*3) The amended KPoM shall have regard to any determination of the NSW Scientific Committee established by the Threatened Species conservation Act 1995.*


Map 1: Location of ex-Banana Land, nominated by OEH as potential land for Koala food tree planting (condition 45).

**Figure 1: Map of 27ha of offsite land within Cudgen Nature Reserve for koala habitat planting.**

*46. Koala Infrastructure*

*1) Any roads through the environmental areas of the site must include:*

*a. fencing on both sides of the road of a design that will prevent the crossing by dogs and koalas;*

*b. fauna underpasses installed at intervals sufficient to allow unimpeded movement by wildlife including koalas across roads. Such fencing and underpasses within Environmental Protection Areas are to be constructed prior to the commencement of bulk earthworks in the southern and/or western development precincts.*

*2) Precinct 1 and 5 Fauna exclusion fencing must be integrated with fencing at Tweed Coast Road. Such fencing is to be constructed at the completion of bulk earthworks.*

*3) The design and precise location of fauna exclusion fencing must ensure that the buffer area available to fauna is maximised and makes provision for a functional maintenance zone each side of the fencing in order to allow sufficient room for replacement and maintenance of the infrastructure.*

*4) Precinct 1 fauna exclusion fencing should be sited at the outer edge of the 50m ecological buffer.*

*5) Signage shall be erected in strategic locations within Precincts 1, 2, 3, 4 and 5, such as in the public open space areas within Precinct 5 and at fauna underpasses, advising residents that Koalas are active in the area and dogs should be kept on a leash at all times and encourage residents to keep dogs in enclosed yards between the hours of 6pm and 6am.*

*6) Erection of permanent vandal proof signs shall be erected at regular intervals to inform people about the purpose of the Koala exclusion fencing and the importance of maintaining the fence.*

*Flora and Fauna Monitoring Report*

*47. The Flora and Fauna Monitoring Report (FFMR) should be revised to the satisfaction of OEH as follows:*

*1) The FFMR framework should be revised to ensure that monitoring of impacts in relation to threatened wetland bird species (black-necked stork, black bittern) takes suitable account of any measures proposed in relation to drainage maintenance of Blacks Creek.*

*2) Table 4 – Threatened Fauna shall include the requirement to report fauna monitoring results to Council and OEH*

*3) The discussion of methodology in relation to monitoring of Koala should be more fully developed than that provided in Table 5 and Section 5.3, to the satisfaction of OEH*

*4) The monitoring of impacts in relation to threatened wetland bird species (Table 12) should take suitable account of any measures proposed in relation to drainage maintenance of Blacks Creek, and be consistent with actions specified in the Drain Maintenance Management Plan and Threatened Species Management Plans.*

*5) The results of all monitoring of feral animals (Table 13) shall be additionally reported to OEH to assist in efforts to co-manage any feral animal problems on and adjacent to the site.*

*6) The final Flora and Fauna Monitoring Report shall be prepared in consultation with Council and submitted to the Secretary for approval within 6 months of the date of determination of the application (No. 2012/2328) made under sections 130(1) and 133 of the Commonwealth Environmental Protection and Biodiversity Conservation Act or prior to issue of any construction certificate, whichever occurs first.*

*50. Bond for Environmental Restoration and Maintenance Works*

*a) Prior to commencement of bulk earth works for each precinct a cash bond or bank guarantee shall be lodged with Council to ensure that the relevant environmental management plans for the associated Potential Council Land (as outlined by the Potential Council Land Plan detailed in condition B5 of the concept plan) is implemented. The amount of such bond will be based on 135% of the cost of the environmental works (repair and/or enhancement) for the associated precinct/Potential Council Land for the establishment period specified in the approved environmental management plans. Two written quotes from suitably experienced and qualified contractors must be submitted to the Council which detail the cost of all works required. The cash bond or bank guarantee will be refunded, following the written approval from the Secretary of the environmental audit for the associated Potential Council Land as per condition 49(1).*

*b) Once the establishment period has been completed, every 2 years the Proponent shall lodge a cash bond or bank guarantee with Council to ensure that the relevant environmental management plans for the Potential Council Land are implemented for that 2 year maintenance period. The amount of such bond will be based on 135% of the cost of the environmental maintenance works for the associated precinct/Potential Council Land (as outlined by the Potential Council Land Plan detailed in condition B5 of the concept plan) for that 2 year period, or until the completion criteria specified in the environmental management plans are met as required by Condition 39, and the land is transferred to public ownership. Two written quotes from suitably experienced and qualified contractors must be submitted to the Council which detail the cost of all works required in the relevant 2 year maintenance period.*

*c) The cash bond or bank guarantee will be refunded at the end of each two year maintenance period subject to the Audit Report confirming that the requirements of the approved environmental management plans have been implemented by the Proponent.*

*d) Monitoring of the effectiveness of the environmental works (repair, enhancement and/or maintenance) is to be undertaken in accordance with Condition 49. Any supplementary or*

*approved adaptive management works deemed necessary by the independent contractor shall be promptly undertaken once the need is identified.*

*e) Bi-annual bonding will no longer be required following the Proponent providing evidence to the Secretary that the final audit has been conducted in accordance with Condition 49 which demonstrates that the relevant works have been completed and written evidence is provided to the Secretary that the lands have been transferred into public ownership.*

*121. Koala Plan of Management*

*1) All Koala exclusion fencing must:*

*a. be installed along the eastern and northern boundary of the service station/food and drink premises as identified in 'Proposed Site Plan' prepared by Push (ref: Job No. 738.12, Drawing 1000, Issue P3, dated December 2016); and*

*b. be constructed in accordance with the with the revised Koala Plan of Management approved by the Secretary in accordance with MP06_0318 Condition C2 and MP08_0194 Condition 45.*

*2) The Koala fence must be constructed and functional prior to the issue of an Occupation Certificate for any building in Precinct 1. Evidence must be obtained from a suitably qualified ecological professional that certifies management measures have been constructed in accordance with the approved Koala Plan of Management.*

*148. Koala Plan of Management.*

*All necessary management measures relevant to Precinct 5 (exclusion fencing, road grids, traffic calming devices, underpasses etc) required by the approved Koala Plan of Management prepared by James Warren and Associates dated August 2012, must be constructed and functional prior to the release of a Subdivision Certificate for the first stage of the subdivision in Precinct 5. Evidence is to be obtained from a suitably qualified ecological professional that certifies management measures have been constructed in accordance with the approved Koala Plan of Management, and submitted to the Secretary for approval.*

### 1.3 Details of Reviewers

Dr Steven Ward reviewed the documentation, undertook discussions with agencies and Project 28 Pty Ltd, and prepared the review report. Steven has a PhD in koala ecology, and 14 years of experience as an ecological consultant.

Dr Meredith Henderson undertook quality assurance review of the review report.

Copies of CV's for these two staff are provided in Appendix A.

# 2 Key Matters Identified and Discussion

This section identifies various matters that have been identified as being key matters, either by submissions from Tweed Shire Council, OEH, or by the reviewers. Table 1 identifies the matter, the approach taken with regards to that topic in the original KPoM (Carrick 2009), the Stage 1 KPoM (James Warren & Associates 2012), and the revised KPoM (JWA Ecological Consultants 2017) which is the subject of this review. Commentary on that matter is also provided by the reviewers. Recommendations as a result of the review are provided in section 3 of this report.

**Table 1: Key matters for koala management, approach taken in KPoM's, and review commentary**

| Matter | Approach taken in various KPoM's | Review Commentary |
|---|---|---|
| Impact on koala habitat | The original KPoM (Carrick 2009, p4) did not anticipate any clearance of 'core koala habitat' (as defined under SEPP44).<br>Stage 1 of Kings Forest received approval for clearing of 7.49 ha of koala habitat, of which 0.81ha was identified as primary and 6.68ha as secondary habitat (James Warren & Associates 2012, Figure 6).<br>The revised KPoM identifies a total of 14.92 ha of koala habitat would be removed (1.24 ha primary and 13.68ha secondary habitat) (JWA Ecological Consultants 2017, Table 3). This is an increase of 7.43 ha (0.43 ha primary and 7.00 ha secondary habitat). It is understood that the increase is primarily due to revision of koala habitat mapping. | The development footprint has already received approval under the concept plan. The conditions of consent (as identified in section 1.2.1 of this report) are the relevant controls relevant to the implementation of the development.<br>The revised KPoM (JWA Ecological Consultants 2017) seeks revisions to the quantum and type of koala offsets which is discussed below, as well as setting out proposed koala management on the site. Given that it is understood that the future development will be within the approved footprint, this matter is not considered further in this report. |
| Quantum and type of koala offset | The original Concept Plan KPoM (Carrick 2009, Action 3 page 20 and Figure 1) identified 69 ha of land available on site for revegetation/rehabilitation to improve koala habitat values. In addition, 56 ha of 'core koala habitat' was also identified within the 150 ha parcel of land adjacent to Cudgen Nature Reserve proposed to be transferred to public ownership.<br>The Stage 1 KPoM proposed planting koala food trees across 71.12 ha (James Warren & Associates 2012, section 7.9.2 and Table 4). It is noted that this proposal included overlap with proposed 39.3 ha of | Both OEH and Tweed Shire Council have raised concerns with regards to the proposed changes to the koala offset(s). OEH seeks that the conditions of consent with regards to delivery of koala offsets as per the stage 1 approval be retained.<br>In addition Tweed Shire Council has raised concerns about the areas proposed for planting in the current KPoM. Their submission identified a total of 19.8 ha which are proposed for koala planting in the current KPoM, but which have been mapped by the proponent as currently being native vegetation, rather than cleared areas for new plantings (Figure 2). ELA has |

| Matter | Approach taken in various KPoM's | Review Commentary |
|---|---|---|
| | Wallum sedge frog compensatory habitat. Nevertheless, the proposal proposed planting of one koala food tree per 25m2 where there was no overlap with Wallum Sedge Frog habitat, and planting of one koala food tree per 50m2 where there was overlap. In total this gave 20,588 trees proposed for planting (half to be koala food trees and half non-koala food trees).<br><br>The conditions of consent for Stage 1 under 45(1) required: (a) restoration and planting of Koala food trees offsite on a 27ha area of land, (b) planting of Koala food trees in the new east-west corridor as required by Term B4 of the Concept Plan approval, (c) planting in accordance with a plan in the 2014 KPoM, and (d) that koala food tree plantings in areas naturally regenerating be minimised (refer to section 1.2.1 of this report for full details). T<br><br>With regards to the part c, this condition was also previously modified and the condition refers to: "…*planting of Koala food trees in other suitable locations across the site within each relevant precinct of the development in general accordance with the plan titled "Proposed Koala Compensatory Habitat Area Staging Plan, Condition 45, Figure 1, JWA Pty Ltd, 29 April 2014"*. A copy of this plan has been included in Appendix B of this report. This plan proposed planting across 54.88 ha of land to be planted out with koala food trees (25.83 ha for stage1, 20.29 ha for stage 2, and 8.76 ha for stage 3).<br><br>It is understood that the revised KPoM has sought to remove overlaps with Wallum sedge frog offsets, and proposes a total of 56.71 ha of compensatory habitat planting (JWA Ecological Consultants 2017, Figure 17). A total of 22,184 trees are proposed for planting (Table 2 of Appendix 6). | reviewed the revised KPoM proposed planting areas (JWA Ecological Consultants 2017, Figure 17) against the previous vegetation mapping (James Warren & Associates 2012, Figure 13), and notes that larges areas in the southern and eastern portion of the site were previously mapped as regenerating forest (of various types). Given that these areas are already regenerating, a number of regions proposed as offsets for koala tree planting do not meet the requirements of the current conditions of consent. Further, the revised KPoM in Figure 18 shows the inclusion of part of the east-west corridor as counting towards the area required under condition of consent 45(1)c. It is noted that this area is already required to be planted out with koala food trees under clause b of this condition, and thus should not, in the view of the reviewers, be counted towards the area required to meet clause c.<br><br>It is also not clear to ELA how the various areas proposed for koala tree planting were selected, with multiple small polygons or irregular shapes scattered across the site. It is noted that there is a need to avoid overlap with the Wallum sedge frog offset areas, but the rationale for the areas selected is not set out in the revised KPoM. In particular it is noted that many parts of the "buffer" lands do not appear to have been utilised.<br><br>It is also noted from an regulatory perspective, that the multiple areas would be very difficult to monitor and enforce effectively, as it could be difficult to ascertain on the ground precisely whether an area had previously been vegetated (and of what type), or was an offset area for planting.<br><br>The revised KPoM splits the proposed koala compensatory habitat into 5 categories (wet / dry, and primary / secondary koala habitat). The logic behind these zones is not clear, especially as the first two tree species listed for "West secondary koala habitat" is "*Eucalyptus robusta* +/- *Eucalyptus tereticornis*" (JWA Ecological Consultants 2017, Table 1 of Appendix 6), both of which are associated with primary koala habitat. Further, *Eucalyptus robusta* (Swamp Mahogany) is listed for planting under |

| Matter | Approach taken in various KPoM's | Review Commentary |
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| | | "dry" koala habitat, whereas this species favours moister areas, and similarly *Eucalyptus tereticornis* (Forest Red Gum) is listed for planting under "wet" koala habitat, whereas this species is unlikely to tolerate 'wet' areas. The KPoM also does not specify a minimum number of the planted trees which are to be koala food trees.<br><br>It is understood that the proponents seek to have the koala offsets reduced from the previous conditions of consent, despite an increase in the amount of koala habitat to be impacted. Given that the proponent seeks this condition to be amended, ELA has briefly reviewed what offset would be required for the additional 7.43 ha and total 14.92 ha of impact upon koala habitat, based on current relevant policies.<br><br>Although Tweed CKPoM (Tweed Shire Council 2014) does not apply to this proposal (as it was not in force when the original KPoM was approved), nonetheless it provides useful context and was reviewed with regards to koala offset provisions. Appendix C contains offset provisions. It is noted that the additional impact would not be approved under this CKPoM. Nonetheless, if the CKPoM was applied, the project would be required to offset the koala habitat cleared at an offset ratio on-site of 15:1, or if offsite at 20:1. Thus, offset provision for the additional impact would be 111.45ha of koala habitat onsite, or 142.6 ha offsite, and total impact would require 223.8 ha onsite or 298.4 ha offsite.<br><br>The Framework for Biodiversity Assessment and Major Project Offset Policy applies to major projects (noted that this will change with the introduction of *the Biodiversity Conservation Act 2016*). The number of Tweed Endangered Population koala credits that would have been required was calculated based on the koala's Tg score of 0.375, with the number of credits = Area impacted x species multiplier (1 / Tg) x 10 = 7.43 or 14.92 ha / 0.375 x 10 = 198 (additional) and 398 (total) credits. Under the Biobanking 2014 methodology the number of koala species credits generated at a Biobanking conservation site would be 7.1 credits per hectare. Thus, the |

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| | | total offset area in terms of koala habitat for the Tweed population at Biobanking site(s) required would equal 198 / 398 credits divided by 7.1, which would give an area of 27.9 ha required for additional impact, or 56.04 for total impact.<br>It is the view of reviewers that a reasonable argument for modification of the current conditions of consent has not been put forward by the proponent, which has sought the removal or reduction of offsets. That the Commonwealth require a lower offset amount to satisfy their policies does not mean that the quantum of offset required should be modified. It is also understood from discussion with OEH that adequate land is available on NPWS estate for the 27 ha of required offsite planting. Various different policies and methods will give different offset volumes. ELA is aware that the level of listing is a key factor for the quantum of offset required under the Commonwealth offset policy, and as the koala is listed as Vulnerable, the quantum of offset required is relatively low. There are other species, particularly those listed as Critically Endangered, where the quantum of offset required under the Commonwealth policy could be much higher than that required under NSW policies. It would also be highly unusual to approve the clearing of additional habitat, and yet to lower the amount of compensatory offset, which is what the proponent is seeking in this instance.<br>Thus, in this instance, it is considered appropriate that the project comply with the current offset obligations. |
| Tree species selection for koala offset planting areas | The original KPoM (Carrick 2009) did not identify particular tree species to be used for revegetation.<br>Stage 1 KPoM (James Warren & Associates 2012, section 7.9.2) proposed the planting of 10,284 koala food trees, and 10,294 of other endemic Sclerophyll Forest species, but did not identify specific species.<br>The revised KPoM (JWA Ecological Consultants 2017), splits the proposed planting areas up into 5 different proposed types, and | The earlier KPoM's provided little detail on the plantings proposed. The revised KPoM does provide greater detail including regeneration approaches, plant species, and number of plants to be planted.<br>Tweed Shire Council has commented that in their view the two primary koala food tree species for planting are *Eucalyptus robusta* or *Eucalyptus tereticornis.* |

| Matter | Approach taken in various KPoM's | Review Commentary |
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| | Appendix 6 provides a list of tree species to be used for selection of trees for planting, and in Table 2 in this Appendix identifies the number of plants proposed for planting. A total of 22,184 trees are identified for planting across the entire site according to this schedule. However, Appendix 6 does not identify what proportion of the trees planted will be koala food trees.<br>There are also discrepancies between the material provided by the proponent to the Commonwealth and the revised KPoM. The Commonwealth submission stated that 43.45 ha of land suitable for planting koala habitat trees (JWA Ecological Consultants 2015, p4), consisting of:<br>• 1.66 ha of land suitable for Wet Secondary (Paperbark forest) koala habitat: 0 to 0.2m depth to groundwater;<br>• 10.43 ha of land suitable for Wet Primary (Swamp mahogany forest) and Secondary (Paperbark forest) koala habitat including Wet heath: 0.2 to 1.0m depth to groundwater;<br>• 30.21 ha of land suitable for Dry Secondary (Scribbly gum forest) koala habitat including Dry heath: 1.0 to 2.0m depth to groundwater; and<br>• 1.15 ha of land considered to be suitable for Secondary koala habitat: outside the limit of the groundwater model.<br>The revised KPoM (JWA Ecological Consultants 2015, Figure 18) now proposes:<br>• 20.61ha of Dry Primary Koala Habitat (this is a new category so increase of 20.61ha)<br>• 7.46 ha of Dry secondary Koala habitat plus dry heath (reduction of 22.75ha)<br>• 21.79ha of Wet primary and secondary Koala habitat (increase of 11.36ha) | The reason for changes in the planting of koala food tree categories proposed from the Commonwealth submission material to the revised KPoM is unclear, and not discussed in the revised KPoM. It is also unclear what the proposed vegetation planting will provide, both in terms of the end vegetation communities that the planting will seek to approximate (if any), and the number of koala food trees that will be delivered in each proposed 'type' of koala compensatory habitat.<br>It is considered highly desirable that the KPoM:<br>1. Identify a minimum number of 10,294 koala food trees or greater to be delivered (rather just number of trees per se). This minimum number is taken from that proposed in the Stage 1 KPoM, and<br>2. Describe the characteristics of the various proposed 'types' of koala compensatory habitat. This could be done in a tabular form and provide<br>a. Area<br>b. Depth to groundwater (as a range)<br>c. Vegetation community plant community type to be approximated via plantings<br>d. Broad structure of the vegetation type to be created via plantings<br>e. Minimum total number of koala food trees (either *Eucalyptus robusta* or *Eucalyptus tereticornis*) to be planted<br>f. Other trees, shrubs, or groundcover plant species to be planted<br>It is noted that some of the attributes referred to under dot point 2 are already provided in Table 1 of Appendix 6 of the revised KPoM, but this will provide greater clarity. |

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| | • 1.60ha of Wet secondary koala habitat (reduction of 0.06ha)<br>• 5.25 ha of Secondary Koala habitat (increase of 4.1ha) | The modelled pre and post groundwater depths were also reviewed (Appendix 4, JWA Ecological Consultants 2015) with regards to the proposed koala vegetation planting (Figure 18, JWA Ecological Consultants 2017). It is noted that it was extremely difficult to accurately combine the different information sources due to the scales of the figures, and because there are many small areas. Nonetheless, the majority of the areas proposed for planting seemed to be consistent with the predicted post-development groundwater levels, with the exception of three locations where 'Dry Primary Koala Habitat' is proposed for planting, but where the post-development groundwater levels appear to be very high, and often modelled as being above surface level (refer to marked up figure in Appendix C for locations). |
| Commencement of koala offset works and standards for achievement | The original KPoM (Carrick 2009, page 20) required that revegetation of "about 64 ha") commence within 180 days of approval of a Project Application in respect of the first stage of the Kings Forest development. The revegetation for the gold course of "about 5 ha" to commence as soon as possible after approval of a Project Application in respect of the bulk earthworks required for the golf course.<br>Stage 1 KPoM (James Warren & Associates 2012) conditions of consent for Kings Forest effectively deferred timing of planting works to the revised KPoM.<br>The revised KPoM (JWA Ecological Consultants 2017) proposes planting in a staged approach across the precincts. This will result in a slower delivery of the koala offsets compared to the original KPoM. Proposed targets for revegetation planting are provided in Table 1 of Appendix 7 of the revised KPoM, and include >90% survival of all planted stock during all monitoring events; >60% native canopy cover after 3 years, >80% after 5 years, weed control to <1% cover during all monitoring events, and "*Fully structured vegetation communities (with* | Both OEH and Tweed Shire Council have raised concerns with regards to the proposed changes to the timing of commencement of koala offset(s). OEH raised concerns with regards to the technical definition of 'commencement of works', however this is technical planning matter and thus there is no comment by the reviewers on this aspect.<br>With regards to the performance measures, it is considered that:<br>• >90% survival of plantings is appropriate, but that this should be made specific to tree plantings, rather than for all plants,<br>• Whilst achieving high canopy cover within 3 or 5 years would be desirable, this will not be possible within the timeframes via plantings, as the tree plantings would still be in the understorey layer compared to mature vegetation. Nonetheless, it is understood that the intent is to measure the success of the plantings, which is supported. However, to make this key measure more relevant, it would be better to tie this to the canopy cover above a particular height, so that what is actually being measured is clearer. |

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| | *reference to appropriate benchmarks) are provided through assisted regeneration and revegetation plantings'*. | • Weed control to <1% cover (across all strata) is supported,<br>• Achieving fully structured vegetation communities with reference to appropriate benchmarks is supported, but it is unclear how this will be assessed and measured, and what benchmarks will be used. |
| Corridor(s) for koala movements (condition B4 of the Kings Forest Concept Plan and Condition 45 of the Kings Forest Project Approval) | The original KPoM (Carrick 2009, pages 21 - 23) identified the importance of koala movement and connectivity with other areas, and in Figure 1 identified a number of proposed areas for koala (and fauna more broadly) connectivity. This KPoM also noted the importance of connecting the site to "*a major piece of environmental infrastructure in the form of a significant land bridge constructed across the alignment of the Pacific Motorway*", and that "*the development proposal adopts the responsible, precautionary approach of considering the possibility that at a time in the future some native vegetation may be restored to connect with this Western side of the fauna overpass to improve its functionality*". There was little detail on exactly what the east-west koala connectivity would comprise of, but the condition of consent B4 required: *'an east west wildlife corridor of up to 100 metres wide (with a minimum of 50 metres at any one point) must be established',* and that '*Prior to the determination of Stage 1, the Proponent shall also demonstrate the practicality or need for establishing a further east west 50 metre wide corridor along the southern boundary of the site'.* A koala corridor to the south across the golf course was also identified (Carrick 2009, Figure 2).<br>The Stage 1 KPoM (James Warren & Associates 2012) proposed to remove the east-west corridor that was previously proposed, arguing that connectivity with the fauna overpass would not be practical. However, the revised conditions of consent under 45-1(b) still required the delivery and planting out of an east-west corridor. A koala corridor to the south across the golf course was also identified (James Warren & Associates 2012, Figure 8). | Corridors and koala movement and connection both within the site, and external to the site is considered, in the opinion of the reviewers, to be crucial to the long-term survival of koalas on the Kings Forest site. In this regard facilitating koala movements through appropriate corridors and facilities to overcome movement barriers such as roads (see next matter), are considered to be crucial. Without connectivity the koala population will become isolated and fragmented, especially with urban development and fencing koala into the conservation areas. Although koalas may persist over the short to medium term, they are not likely to persist in the longer term without connection to the broader Tweed populations.<br>In the opinion of the reviewers, there is merit in the establishment of an east-west corridor on the site. The reviewers are not convinced that the argument put forward that the only effective connections with koala habitat outside of the site will be to the south or southwest. Irrespective of the outcome of this item, there are areas of koala habitat in the western portion of the site proposed to be retained. These areas merit being connected to vegetation in the rest of the site, particularly when koala tree planting works are proposed. The proposal to plant out a 50 m wide area covering only part of this connection, with permanent fencing around it is considered to be inadequate in terms of achieving condition B4 from the Concept Plan approval.<br>It is also noted that Figure 22 of the revised KPoM omits the previous connection through the proposed golf south in the south of the site. It is |

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| | The revised KPoM (JWA Ecological Consultants 2017) discusses connectivity in section 5, and notes that koala radiotracking on the site has found that koalas have utilised corridors within and outside of the site. It also argues that the only effective connections with koala habitat outside of the site will be to the south or southwest. The revised KPoM thus effectively proposes to remove the east-west corridor as required under condition of consent B4. However, although the revised KPoM argues for koala connectivity to the south, the KPoM does not show, or appear to provide for, koala connectivity across the golf course in the south of the site (James Warren & Associates 2012, Figure 22). It is noted that the material submitted to the Commonwealth showed a 'koala linkage' across the golf course area (JWA Ecological Consultants 2015, Overlay Map 2B), | unclear why this has been omitted, especially as plantings in this area was part of previously approved koala offset planting areas. |
| Road Crossings and Fencing | The original KPoM did not discussed that koala vehicle mortality can be a key cause of decline in some populations, and that the vast majority occur where traffic move at speeds of 60km/hr or greater. The KPoM noted a lack of evidence that koalas use underpasses. It is noted by the authors of this review, and in the revised KPoM, that there is now data that supports that koalas will use underpasses (when situated correctly and designed appropriately). The original KPoM therefore proposed the use of "traffic calming" approaches, with an underpass as a failsafe adjacent to the main intersection of the linkage with the main entrance road. Action 7 of the original KPoM proposed a maximum speed of 60km/hr on the distributor road, and 50km/he on residential roads.<br>For road crossings the Stage 1 KPoM proposed that reinforced concrete box culverts (RCBC) would be installed that would be a minimum of 1.2m high and 1.2m wide, and less than 40m long (James Warren & Associates 2012, page 7-24). Fencing was also proposed to direct | As discussed under the corridors matter above, connectivity for the koala across the site is considered to be crucial to the long-term persistence of the koala, in particular given that substantial fencing of habitat to be retained or enhanced is proposed.<br>In the opinion of the reviewers, there are multiple concerns with the proposed road crossings:<br>1. Entrance road crossing. The crossing proposed around main entrance road (Figure 26A of revised KPoM). Fencing is shown the south of the southern entrance / exit of this culvert, which means that koalas to the south will not be able to access the culvert, and koalas from the north would exit in the road corridor, and be a high risk of fatality. Further, what may be some form of drainage channel is located close to the northern entrance/exit. Therefore koalas attempting to move from the northern side of the entrance road to the south would likely encounter the drainage culvert first, and not move on the intended koala movement culvert. It is also |

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| | koalas to the road crossings, and to prevent koalas accessing development areas.<br><br>The revised KPoM proposes '*the location and design of Koala fencing combined with the use of grids and underpasses… will allow for unimpeded Koala movements between Environmental Protection Zones, proposed golf course compensatory habitat areas and adjacent vegetated properties*' (JWA Ecological Consultants 2017, p45, Figure 26A and 26B). Figure 26A appears to show one crossing culvert around the linkage with the main entrance road. It is unclear if other culverts are proposed - no others are show on Figure 26A, but Figure 31 shows an underpass for precinct 6. A diagram showing a grid design is shown in Figure 27, but it is not clear where these are proposed to be located. Figures 29 - 37 show some locations within individual precincts, but it is difficult to understand how these will operate across the site as a whole to facilitate koala movements.<br><br>Various fencing, both 'temporary' and permanent is proposed in the revised KPoM. The reason for the use of temporary fencing, and the locations where it is proposed is not clearly articulated in the revised KPoM. It is assumed that the intent is to prevent koala's accessing in the process of being developed. Either permanent or temporary fencing is shown along both sides of access roads for precincts 6, 7, 11, and 12-14. For the golf course (precinct 14), permanent fencing is shown to both the north and south of the golf course, which would prevent koala movements through this area, which was identified in both the original and Stage 1 KPoM's as a koala movement corridor. Fencing is proposed to be inspected twice a year, with any damage repaired within 2 days of discovery. An area of 'Primary Koala habitat to remain after development' for Precinct 14 is shown as being located on the 'development' side of the proposed permanent fence. | unclear whether the culvert will have standing groundwater, particularly as the groundwater table on the site is close to the surface in many locations. Figure 26B of the revised KPoM appears to show that the entrance road will be raised to a height of approximately twice the height of the koala movement culvert. Based on a culvert height of 1.8 m from Figure 26A, this would appear to mean that the entrance road will be raised by approximately 4 m in height from the ground level. It is not clear if the road design has allowed for raising of the road by this height.<br><br>2. Grids. It is not clear to the reviewers how the grids would permit '*unimpeded koala movements*' as stated in the KPoM. How the grids will allow koalas to achieve crossings is not illustrated. Further, it would appear that the intent would be to allow vehicular traffic to flow unimpeded. As identified in the original KPoM this would permit high vehicle speeds, which would significantly increase the chance of koala mortality. The reviewers are also concerned that the grids would not prohibit dogs accessing conservation areas, and thus causing koala mortality. Although the grids may prohibit koala crossings, many dogs, particularly larger breeds which are a greater threat to koalas, are likely to be able to traverse these.<br><br>3. Crossing point locations. It is difficult to understand where structures are proposed to be located to facilitate koala movements across the site as a whole. However, Figure 37 (for precincts 12 - 14) has been reviewed. This precinct has multiple roads through koala habitat or other conservation areas. A total of one grid appears to be proposed in the north-eastern portion of this precinct. It is unclear how this one grid would allow koala movements to proceed, and for koalas to avoid vehicular strikes and fatalities. The KPoM appears to be substantially deficient in |

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| | | this regard, particularly given the importance of allowing continuing koala movements both during construction periods, and once development is complete. Consideration should be given to including additional koala crossing culverts, and detailed design of these is required to demonstrate that they will function with the road design and groundwater levels (so that the crossing is not inundated).<br>4. Fencing. The design of the fencing proposed to be utilised is supported. However, in the view of the reviewers, the locations where fencing is proposed requires various amendments. This includes, but is not limited to:<br>a. Fencing to be designed in detail for koala crossing culverts so that koalas can access both entrances / exits,<br>b. The installation of permanent and/or temporary fencing along both sides of access roads for precincts 6, 7, 11, and 12-14 to be reviewed. Fencing both sides of the access road may be supported where adequate koala crossing culverts are installed. However, if none are installed, then access roads must incorporate 'traffic calming' adequate to slows vehicles to a maximum speed of 60km/hr for the entire length where the road passes through conservation areas. For clarity, koala crossing culverts are the option with a significant preference by the reviewers,<br>c. Location of fencing for precinct 14 to be amended so that primary koala habitat proposed to be retained, is not on the 'development' side. |

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| Fire management | The original KPoM (Carrick 2009, p17) was vague in terms of how bushfire would be managed, and simply identified that fire is managed appropriately, including the use of low intensity controlled burning.<br>Stage 1 KPoM (James Warren & Associates 2012, section 7.8.5) referred to the Stage 1 Bushfire Risk Management Plan and to assess and manage fuel loads via control burns or mechanical means.<br>The revised KPoM (JWA Ecological Consultants 2017, section 8.7) also refers to the Stage 1 Bushfire Risk Management Plan, with the same approach to fire management. One difference is that the golf course is identified as a possible sanctuary. | Koala mortality from bushfire events is considered to be a key issue in the Tweed Shire Council CKPoM (Tweed Shire Council 2017). It is considered that the approach proposed for fire management is appropriate. However, it is noted that the fencing now proposed will exclude koalas from the golf course, so it will not function as a potential sanctuary for koalas unless the fence design is modified. |
| Proposed monitoring and responses | The original KPoM (Carrick 2009) did not identify specific monitoring parameters but identify that home range data is not available for the Tweed Coast area, and an action was:<br>*Action 17: An intensive, 5-year Koala Habitat Monitoring Program (KHMP) will be undertaken:*<br>*The program will be funded by the developer and be conducted by a suitably qualified environmental consultant appointed by the developer with the concurrence of the Director General of the Department of Planning. This is to be a person with a postgraduate qualification in the field of Koala Ecology or Biology and / or who has demonstrated experience and expertise in these fields and / or has published research in these fields in the peer reviewed scientific literature.*<br>• *The purpose of this KHMP will be*<br>*(a) To establish basic ecological benchmarks for monitoring Koalas occupying Kings Forest and its surrounds. These parameters should include definition of Koala home range sizes, density, seasonal dietary patterns, longer term movement patterns, reproductive output, dispersal patterns of juveniles, immigration to the site, genetic* | The monitoring of the regeneration and rehabilitation is considered to be reasonable.<br>The number of monitoring events for fencing per year, appears to be very low, given the importance in the revised KPoM to excluding koalas from the development zones. More frequent monitoring of fencing, at least monthly, would be more appropriate.<br>With regards to understanding how the koala population responds to the development and associated mitigation measures within the KPoM, there has been a significant shift from the monitoring proposed originally. The original approved KPoM proposed collection of significant information about the koala on the site. The method now proposed may collect incidental records of the koala, but now primarily proposes to rely on one day of faecal pellet survey across the entire site to provide both baseline data and information on how the koala is changing. The reviewers note that the rate at which koala faecal pellets break down can vary significantly, depending on the climatic conditions at the time. In particular, heavy rain can accelerate the breakdown rate of the faecal pellets. Also, fire can potentially "bake" faecal pellets and make it harder for faecal pellets to be broken down. These pellets could then persist for some time and increase the |

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| | *structure of the population, parentage analysis, health profile and disease status, etc.*<br>The Stage 1 KPoM (James Warren & Associates 2012, section 7.11) proposed:<br>• Annual flora and fauna monitoring report (including vegetation monitoring),<br>• Annual Koala Monitoring Report,<br>• Monitoring of koala underpass use via sandpits,<br>The revised KPoM (JWA Ecological Consultants 2017) proposes:<br>• Annual Koala Monitoring. A one (1) day diurnal search in spring / summer for koalas by three qualified and/or accredited persons for a faecal pellet search via the 'Spot Assessment Technique' and a Koala Habitat Condition Assessment with 20m by 20m monitoring plots to monitor vegetation condition and phot monitoring,<br>• Koala monitoring after fire (presumably as per the methods for annual koala monitoring),<br>• Sand tray monitoring for underpasses over a 4 day period for 3 or two times per year for 5 years,<br>• Rehabilitation monitoring through 50m transects, 5m by 5m quadrats, and photo points,<br>• Monitoring of fencing twice per year, in combination with signage inspection (section 8.9.3).<br>The revised KPoM in Table 12 provides indicative costings of monitoring and reporting, with a cost of $120,000 per year allocated to each of Precincts 1, 2-5, 6, 7, 8, 11, and 12-14. It is not clear what either the expenditure on individual monitoring line items is. The total anticipated monitoring expenditure across the entire project was roughly estimated by the author of this report based on monitoring in 7 precincts for 5 years | scores for subsequent surveys, even if the number of koalas has actually decreased. Thus there could be fluctuations in the observed faecal pellets which are not due to changes in the koala population, but due to variations in the breakdown rates of the faecal pellets. In the view of the reviewers, due to these reasons, collecting direct data on the koala population present on the site would be preferable.<br>There is also now technology available whereby GPS loggers can be fitted to koala radiocollars. Base station(s) can also be set up such that data can be transmitted to these stations, and then sent via a mobile phone connection. In other words, once the koalas are collared, a significant amount of data on their movements can be downloaded automatically. It is noted that finding and capturing koalas can be labour intensive, and care needs to be taken for animal welfare. In this regard koalas can be captured using a fence and cage trap at the base of the tree that they are in, with periodic checking of the cage trap. Once koalas are captured this would allow tagging of individuals and give additional data to inform estimates of the number of individuals present, the age and sex of koalas presents, and the health of the population. Further, the location data for individual koalas could then be collected remotely as described above, and this would give useful data to inform what habitat koalas are using, portions of the site being utilised and how they move across the site.<br>The sand pad monitoring proposed, can detect koalas, but will only give data for very limited days. A highly effective technique is the use of infrared camera traps. These can be set up so that they will capture movements 24 hours a day, can be solar powered (with the solar panel mounted on a pole nearby to the culvert), and can also transmit the photographs taken via a mobile phone connection to an office. Thus, these are more costly to establish up front, but will give data from throughout the year, and with low staff or maintenance costs if established properly. Given the importance placed on culverts (or other crossing points) minimising impacts, this |

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| | at $120,000 per year, which gives a rough total cost estimate of $4.2 million (based on the information from the revised KPoM and assumptions as stated here), for all monitoring. | monitoring technique would be highly beneficial to understand the degree of use of the crossings by koalas.<br>The cost involved with undertaking capture of koalas, fitting with GPS radiocollars, installing base stations is roughly estimated to be:<br>• About 70 collars with GPS capability at $2,000 per collar = ~$140,000<br>• About 3 base stations at $5,000 station = ~$15,000<br>• Salary cost for set up = ~$30,000<br>• About ~2 weeks of fieldwork per year so as to capture koalas, in two separate sessions of one week each = ~$60,000 per annum<br>• Download of GPS information, home range and population size analysis, and reporting on information gathered = ~$35,000 per annum<br>• Establishment of camera traps at ~$8,000 per culvert for 10 culverts or road crossing points = ~$80,000<br>The key item in the above is the number of years over which monitoring would occur. The revised KPoM has proposed maintenance of the website until 2035, so this has been used to estimate 18 years, which would give a total estimated monitoring cost for the koala capture, GPS radiotracking, and camera traps for crossing points of ~$1.98 million. Of the estimated total monitoring cost of $4.2 million from the revised KPoM, this would leave ~$2.2 million to cover the vegetation, post-fire, and fencing monitoring, which should be more than adequate to cover those monitoring costs. |
| Contingency strategy | The original KPoM (Carrick 2009) did not have any contingency strategy.<br>The Stage 1 KPoM (James Warren & Associates 2012) did not have any contingency strategy. | There are few details on how the contingency would work in practice. In the view of the reviewers this could be dealt with by a requirement to purchase and retire and appropriate number of Tweed Endangered Population koala credits. If the proponent should be unable to source these credits within a 12 month period, to the satisfaction of the approval agencies, then payment |

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| | The revised KPoM (JWA Ecological Consultants 2017, section 11) proposes that a Koala Contingency and Offset Strategy within 12 months of commencement of construction for each precinct. | could be made to the NSW Biodiversity Conservation Trust's fund based on the equivalent number of credits. |

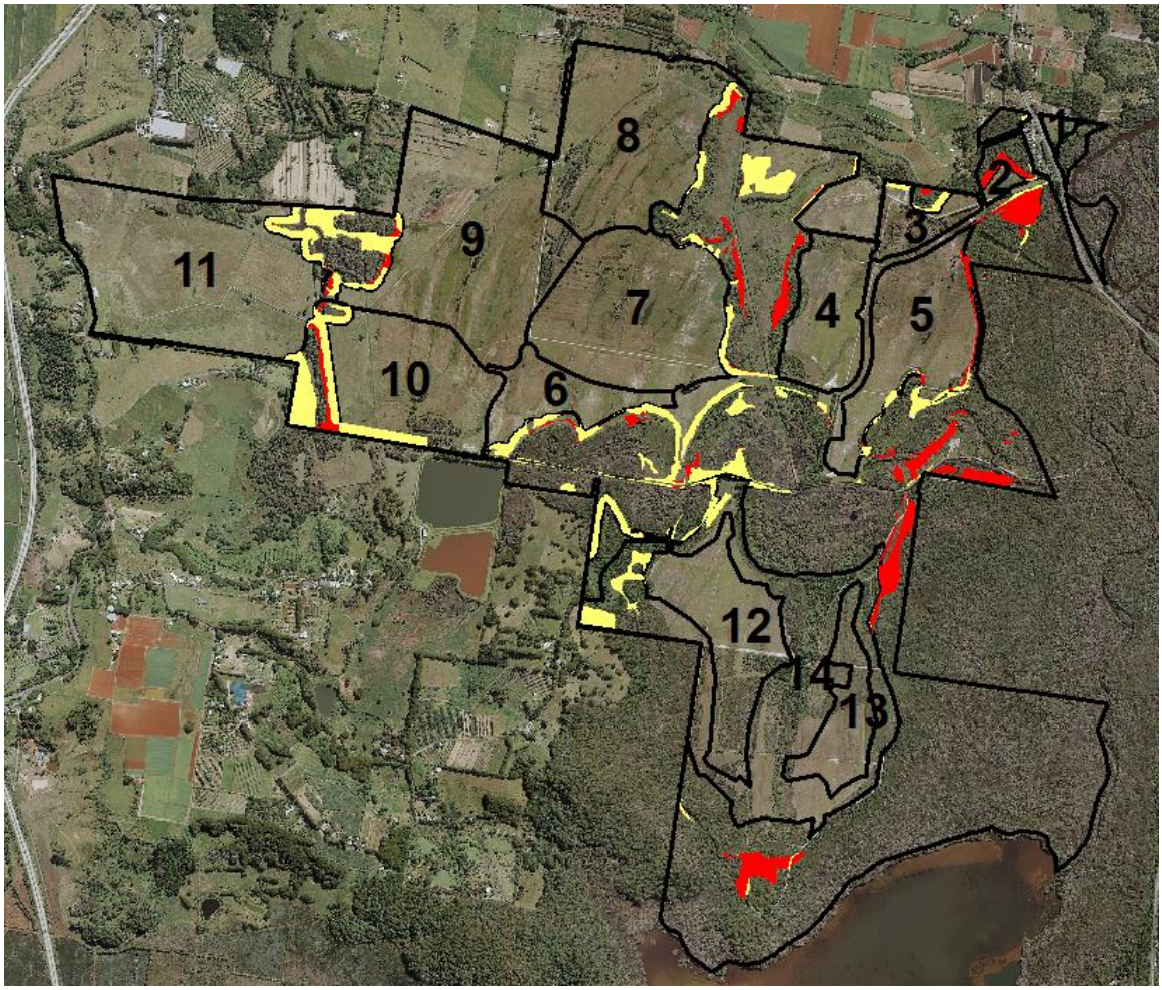



**Figure 2: From Tweed Shire Council report (Figure 6 of that report, titled "*Proposed koala habitat offset areas (56.7ha) showing 19.8ha mapped by the proponent as existing native vegetation (red fill). The pale yellow areas are mapped as cleared or highly disturbed*").**

# 3 Recommendations

The following recommendations are made with regards to outcomes for the koala at the Kings Forest site for each of the key matters discussed in Table 1. The numbering for the recommendations continue from one section to the next so that the recommendations can be more easily tracked.

## 3.1 Impact on koala habitat

No recommendations. *Note: As discussed in Table 1 the development footprint is already approved, and the additional impacts is due to changes in mapping of koala habitat. Therefore, given the previous approval there is no recommendation for this matter, despite the higher impact than stated in previous approval documentation.*

## 3.2 Quantum and type of koala offset recommendations:

1. That the KPoM be revised to provide for offsets consistent with the current conditions of consent. The reviewers believe that the proposed reduction in the koala offsets required is not justified, particularly when the amount of impact identified on koala habitat has effectively doubled. In this regard, it is considered that offsets should constitute:
    a. The restoration and planting of Koala food trees offsite within 27 ha of land (and these lands to be managed in perpetuity for conservation); and,
    b. Planting of Koala food trees in the east-west corridor as required by Term B4 of the Concept Plan approval; and,
    c. Revegetation of at least 54.88 ha in cleared lands across the Kings Forest site for koala food trees (excluding Wallum Sedge Frog and/or heath vegetation areas). The revegetation areas for this component should also not include the east-west corridor in the calculation of total area.

2. That the KPoM clearly identify both on a map and through provision of georectified GIS shapefile data to approval agencies, the areas proposed for koala habitat planting both onsite, and offsite. The data provided (both in map and GIS formats) should also include associated ancillary information such as modelled post-development groundwater depth. The areas identified for the koala planting should be currently cleared (and not include areas previously mapped as 'regenerating' native vegetation or as heathland), and not include heathland offset areas or Wallum Sedge Frog offset areas. If approved, these offset areas for planting should be clearly marked onsite through survey pegs or other methods of delineating the offset areas.

## 3.3 Tree species selection for koala offset planting areas recommendations:

3. That the KPoM require that a minimum number of 10,294 *Eucalyptus robusta* or *Eucalyptus tereticornis* koala food trees (or greater) will be planted and delivered as part of the onsite Kings Forest revegetation offset works.

4. That the KPoM describe the characteristics of the various proposed 'types' of koala compensatory habitat as suggested in Table 1 of this report.

### 3.4 Commencement of koala offset works and standards for achievement recommendations:

5. That the KPoM require >90% survival of plantings for koala tree plantings, rather than averaged across all plants.

6. That the KPoM require >60% canopy cover of native tree species >1.5 m in height after three years, and >80% canopy cover of native tree species >2.5m in height after five years. If these targets are not achieved then the monitoring (for all monitoring) and maintenance period must be extended until the targets are met.

7. That the KPoM be modified to clearly articulate what appropriate benchmarks are to be utilised for each area (or 'type') of revegetation to determine whether fully structured vegetation communities have been achieved.

### 3.5 Corridor(s) for koala movements (condition B4 of the Kings Forest Concept Plan and Condition 45 of the Kings Forest Project Approval) recommendations:

8. That the KPoM require planting out of the east-west corridor as required by Term B4 of the Concept Plan approval, at a width of 100 m.

9. That the KPoM require the inclusion of the golf course as a koala corridor (and all associated works to deliver this in practice), as identified in previous KPoM's.

### 3.6 Road Crossings and Fencing recommendations:

10. That the KPoM and Kings Forest design allow for additional koala crossing culverts to facilitate koala crossing between areas of habitat bisected by access roads (approximately 10 in total depending on detailed road design). The KPoM to be modified to clearly articulate:
    a. The number of koala crossings proposed (approximately 10 suggested by this review),
    b. The type of crossings (if different types or size of culverts are proposed),
    c. The location of crossings are clearly identified on a plan.
    d. Should it be proposed that any culverts will be below current ground level, then consideration is given with regards to groundwater depth and whether this would result in standing water within the culvert.

11. That should the KPoM continue to propose the use of "grids" that the KPoM make it clear how they permit koalas to achieve road crossings, and '*unimpeded koala movements*' as stated in the KPoM. Further, that it is made clear how inclusion of the grids will prohibit access by dogs to the koala conservation areas.

12. That the KPoM and entrance road koala crossing culvert design be revised and amended so that:
    a. The entrances / exits are not located within the road corridor,
    b. It is clear whether the entrance road will be elevated at this location so that the base of the koala crossing culvert will be located at the current ground level.

13. That fencing proposed in the KPoM is amended such that:
    a. Fencing designed for koala crossings to be clearly set out so that it will 'funnel' koalas to both entrances / exits,
    b. That koalas not be excluded from the golf course by fencing.
    c. The installation of permanent and/or temporary fencing along both sides of access roads for precincts 6, 7, 11, and 12-14 is reviewed. If koala crossing culverts are not proposed at these locations, then it is considered that access roads must incorporate 'traffic calming' adequate to slows vehicles to a maximum speed of 60km/hr for the entire length where the road passes through conservation areas.
    d. Location of fencing for precinct 14 to be amended so that primary koala habitat to be retained, is not within the 'development' side of the fencing.

### 3.7 Fire management recommendations:

No recommendations.

### 3.8 Proposed monitoring and responses recommendations:

14. That the frequency of monitoring for fencing effectiveness in the KPoM be modified to be a monthly event.

15. That the monitoring proposed in the KPoM to consider incorporating the following (to replace the faecal pellet monitoring), in addition to rehabilitation / revegetation monitoring:
    a. Camera traps in or at koala crossing points (or culverts), rather than sand pads.
    b. Consider abandoning the SAT technique for GPS radiotracking of animals across the entire site for the duration of the length of the development. The searches for koalas during capture periods could also be set up to use the OEH spotlighting plot/transect, which could be utilised to provide an ongoing estimate of koala numbers on the site (in conjunction with the known radiocollared koalas).

### 3.9 Contingency strategy recommendations:

16. That the KPoM contain a requirement that purchase and retirement of an appropriate number of Tweed Endangered Population koala credits should the measures proposed be unsuccessful in terms of maintaining the pre-development number of koalas on the site. Further, that if the proponent should be unable to source these credits within a 12 month period, to the satisfaction of the approval agencies, then payment could be made to the NSW trust fund based on the equivalent number of credits.

### 3.10 Planning Approval:

17. That the KPoM (once approved) be considered to be a replacement of the original Concept Plan KPoM.
    *Note: A KPoM was prepared for the original Concept Plan, and is now considered to be out of date. The revised KPoM is considered the most up to date for the site, and thus the most relevant. This change would allow conditions of consent to refer to the revised KPoM for subsequent stages.*

# References

Carrick FN (2009). *Kings Forest Koala Plan of Management*. August 2009

James Warren & Associates (2012). *Koala Plan of Management*. August 2012.

JWA Ecological Consultants (2015). Final response report relating to matters of NES (Wallum Sedge Frog & Koala), February 2015.

JWA Ecological Consultants (2017). *Koala Plan of Management. Lot 76, 272, 323 & 326 DP 755701; Lot 6 DP 875446; Lot 2 DP 819015; Lot 1 DP 706497; Lot 40 DP 7482; Lot 37A DP 13727; Lot 38A DP 13727; Lot 38B DP 13727; Lot 1 DP 129737; Lot 1 DP 781633; Lot 7 DP 8750447. Kings Forest.* Dated 19-5-2017.

NSW Scientific Committee (2016). *Final Determination to list a population of the Koala Phascolarctos cinereus (Goldfuss, 1817) between the Tweed and Brunswick Rivers east of the Pacific Highway as an Endangered Population*, gazetted 22 April 2016.

Tweed Shire Council (2014) *Tweed Coast Comprehensive Koala Plan of Management 2014.* Tweed Shire Council, Murwillumbah, NSW.

# Appendix A CV's of Reviewers

CURRICULUM VITAE

## Dr Steven Ward

**ASSOCIATE AND INFRASTRUCTURE SECTOR LEAD**

### QUALIFICATIONS

- Accredited Biodiversity Banking Assessor, and Course Trainer
- Doctor of Philosophy, Koalas and the Community: a study of low density populations in southern Sydney, University of Western Sydney, 2002.
- Honours, Wollongong University, 1994.
- Bachelor of Science, (Botany / Zoology majors), University of Western Australia, 1992.

Steven's core strength is in attention to detail, and integrating this strength appropriately into the projects he works on. He has expertise in koala ecology, with a PhD in this area where he researched the distribution, density, health, home range size and tree preferences of koalas in the southern Sydney region, but has also worked on multiple projects with other fauna (animal) and flora (plant) species.

Steven is also a leader in terms of expertise in the field of ecological offsets. He has been a trainer of the NSW BioBanking course since its commencement in 2008, as well as being an accredited consultant under this scheme. He has also prepared Operations Manual documentation and a practice note for this scheme, undertaken individual site and larger scale assessments, delivered ecological offsets for projects, undertaken a peer review of the ACT Environmental Offsets Policy, and achieved Commonwealth EPBC Act controlled action approvals and delivery of offsets.

Steven has worked on multiple large-scale projects, including direction and management of other consultants, and providing high-level advice on planning and environmental outcomes. He has also worked on multiple road, rail, water, and power projects, frequently as a project director for the Eco Logical Australia team, and is Eco Logical Australia's lead for projects in the infrastructure sector.

In addition to his technical expertise, Steven has extensive experience in communicating with a wide range of audiences. These communications have included non-technical summaries for clients, as well as high-quality technical reports. He has also presented both spoken papers at a number of conferences, and published eight scientific papers.

### RELEVANT PROJECT EXPERIENCE

**Koala Specialist Projects**

- Kurri Kurri Biodiversity Certification Koala Expert Report
- Appin Biodiversity Certification Koala Expert Report
- Work on Comprehensive Koala Plan of Management for Campbelltown Local Government Area
- Koala Plan of Management - Review of Coffs Harbour Comprehensive Koala Plan of Management, and advice on management of koala habitat, Department of Planning

- Leaf's Gully Koala Assessment - Assessment of vegetation for suitability as koala habitat at Leaf's Gully (south of Campbelltown), and recommendations on design to consider koala habitat and movements.
- Moonee Creek - Assessment of koala habitat, and recommendations regarding environmental protection and sustainable development at Moonee Creek, Coffs Harbour
- Far South Coast Koala Management Framework, NSW Department of Environment and Conservation
- Identification and Mapping of Koala Habitat for Hawks Nest and Tea Gardens Endangered Population
- Hawkesbury Koala Habitat Survey – Multiple plots to assess koala habitat for Hawkesbury City Council
- Koala trapping – Capture of radio-collared koalas for NPWS

**Infrastructure Projects**

- Southlink (in progress) – Project Director for advice on ecological matters for route selection.
- Western Sydney Stadium (in progress) – Project Director for impact assessment under Framework for Biodiversity Assessment.
- Woolgoolga to Ballina Nest box installation and monitoring – Project Director for installation and monitoring over 8 years of >700 nestboxes for Woolgoolga to Ballina (W2B) project (sections 3 – 11).
- TransGrid Bushfire Management - Project Manager. The principle task was a network wide spatial bushfire risk assessment of all TransGrid infrastructure in NSW, including both the risk of assets being impacted by bushfire, and the risk of TransGrid infrastructure resulting in a bushfire event, and the potential implications of such an event.
- Nest box monitoring – Project Manager for audit of 637 nestboxes installed for Manildra to Parkes transmission line upgrade 5 years previously.
- Bungarribee Zoo – Impact and offset assessment under Framework for Biodiversity Assessment, and negotiation with Office of Environment and Heritage, and Department of Planning
- Broken Hill Drought Water Supply EIS – Project Manager for preliminary assessment of ecology values and offset requirements for borefield and desalination plant at Menindee Lakes to supply water to Broken Hill.
- Outer Sydney Orbital (in progress) – ELA Project Director for provision of ecological inputs to scoping of route options.
- M12 – Project Director for provision of ecological inputs to scoping of route options.
- Leader of Eco Logical Australia team for the provision of ecological services to the AECOM / Aurecon Joint Venture (AAJV) under the Sydney Water panel for provision of planning and environmental services. Multiple projects and assessments of various sizes have been delivered.
- Hornsby Quarry Ecological Assessment for disposal of spoil from NorthConnex project
- Southern Access Motorway ecological inputs to route alignment study
- NorthConnex - Project Manager for new freeway road link from M1 to M2 in Sydney's northwest. Works included ecological assessment, Riparian, Groundwater Dependant Ecosystem, and ecology offset assessment.
- Cowan to Teralba rail link embankment flora and fauna assessment
- Oatley to Dapto rail link embankment flora and fauna assessment
- Waterfall rail flora and fauna assessment for replacement of culverts and advice on threatened bat impacts
- North West Rail Link - Project Manager. Works included ecological assessment, EPBC Act, Riparian, and Groundwater Dependant Ecosystem assessment
- Warnervale Rail Station – Statement of Environmental Effects and Species Impact Statement
- Chaffey Dam – Offset strategy (NSW / Commonwealth) for the Booroolong Frog due to dam wall raising. Also preparation of a Conservation Plan for vegetation to be managed as an offset.
- Stroud to Taree ecological constraint assessment for route analysis project

**Planning Assessments**

- Sutherland to Cronulla Active Transport Link REF – Project Director on REF for proposed walking and bike path
- Tench Reserve, Jamiston – Project Director on REF for proposed upgrade of boat ramp, parking, and access for Penrith Council.
- Warnervale Station Statement of Environmental Effects – SEE for proposed new rail station at Warnervale Town Centre.
- Macdonaldtown Part 3A – Part 3A Environmental Assessment and planning advice for the remediation of contaminated land at Macdonaldtown rail yards.

- Cranebrook Sustainability Assessment – Documentation to meet the Sydney Metro Strategy requirements to be considered for inclusion on the MDP.
- Davy Robinson Reserve Wharf – Preparation of a SEE for replacement of a wharf, Bankstown City Council
- Greater Blue Mountain World Heritage Visitor Centre Architectural Design Competition and REF
- Hammondville Sports Field REF - Preparation of a REF for installation of a new sports oval, Liverpool City Council
- Public wharf at Pleasure Point REF - Preparation of a REF for replacement of a wharf, Liverpool City Council
- Manly Vale, Passmore Reserve - Warringah City Council – REF for new toilet block and associated works

**Conservation Planning / Management**

- Warnervale Heath Wrinklewort Reserve - Plan of Management for conservation reserve within the Warnervale Town Centre, as an offset to impacts on a threatened daisy (Heath Wrinklewort)
- Cranebrook Conservation Planning – Preparation of Conservation Planning document for Cranebrook site.
- Ecological Constraint Assessment, Potts Hill – Identification of Ecological constraints for Potts Hill site
- Menangle Park Local Environmental Study Flora and Fauna Assessment
- Warnervale Town Centre - Assessment, review and consultation to identify ecological values, principles and issues for consideration in the revision of the Warnervale Town Centre Masterplan.
- Campbelltown Biodiversity Study - Designed flora and fauna surveys to fill in knowledge gaps of priority threatened and other significant species in the LGA.
- Yeramba Lagoon Management and Rehabilitation Plan - Development of a management and rehabilitation plan based on an assessment of the ecological condition of Yeramba Lagoon.
- Coronation Estate – Plan for management of ecological values associated with housing development at Wentworth Falls, Blue Mountains

**Review of Assessments**

- Kings Forest – Review of major project assessment for Department of Planning and Infrastructure
- Belrose Road Corridor - Reviewed environmental survey and assessment documents for proposed development in the suburb of Belrose, Warringah Council
- Copacabana - Review to ascertain the adequacy of 8 Part Test for a site in the suburb of Copacabana, in relation to a dispute between a landholder and Gosford Shire Council, P.J. Donnellan & Co Lawyers.
- Shaughnessy Street Subdivision - Independent review of DA and Species Impact Statement (SIS) for proposed development at Shaughnessy Street, Oakhurst, Blacktown City Council
- North Hawks Nest LES – Review of ecological assessment for North Hawks Nest LES

**Due Diligence Assessments**

- Minto – Advice on ecological values, and potential development footprint and pathway for Anglican Retirement Village site in Minto.
- Dapto – Advice on ecological values, and pathway for development of portion of the site, and portion of the site with Illawarra Lowlands grassy Woodland EEC to be retained and managed for conservation.
- Sydney Zoo - Due Diligence assessment of site at Bungarribee in Western Sydney Parklands
- Ninth Ave, Llandilo **-** Due Diligence Assessment of site being considered for residential subdivision
- Charmhaven **-** Due Diligence Assessment of site being considered for residential subdivision
- West Wyong - Due Diligence Assessment of likelihood of gaining access to landlocked site, Landcom
- St Helen's Park - Due Diligence Assessment of land being sold, Landcom
- Chifley - Due Diligence Assessment of development potential of lands which contained some Eastern Suburbs Banksia Scrub, Landcom
- Edmondson Park - Due Diligence Assessment of site being considered for residential subdivision

**Ecological Offset Projects**

- New M5 – Souring of ecosystem credits for contractor CPB Dragados Samsung Joint Venture
- M12 and Northern Road Upgrade – Identify likely vegetation offset requirements and potential threatened species offset requirements for the Northern Road and M12 projects, and identification of potential providers of ecological offsets to provide a 'land bank'.
- Ingleside biodiversity certification (in progress). Project manager for site survey and assessment of rezoning and biodiversity certification the Ingleside release area, in the northern Sydney suburb of Pittwater. Works

performed by ELA included Biodiversity certification strategy, site survey, credits calculations, input to rezoning outcomes, identification of offset sites, targeted survey and advice for *Microtis angusii*.
- Menangle Park - Review of ecological offsets for Lend Lease for lands being considered for purchase and development.
- M5 Ecological Offsets – Identify offset sites and options for M5 upgrade for both threatened vegetation and threatened plant *Acacia pubescens*.
- Moorebank Intermodal – Advice on ecological offsets and potential costs.
- Tomago - Estimate of offset costs for 200km of potential new powerline
- Dubbo former RAAF base biodiversity certification feasibility investigation
- Dubbo City Council – Training to Dubbo Council on ecological offsets and Biodiversity Certification
- Offsets Assessment Guide – various projects – Applying the EPBC Act offsets calculator to multiple projects.
- Shanes Park (in progress) – Project manager for reconsideration request in relation to amendments to conditions associated with the transfer of land (Shanes Park) from Air Services Australia (Commonwealth) to the NSW government, so as to allow future building of Castlereagh Freeway within the identified corridor in the southern portion of the Shanes park site.
- Chaffey Dam – Project management and preparation of an offset strategy for impacts resulting from flooding of known habitat for the Booroolong Frog along the Peel River associated with raising of the Chaffey Dam wall to increase storage capacity. Involved calculation of outcomes under both NSW and Commonwealth offset schemes.
- Project Manager and technical review of ACT Government draft Environmental Offsets Calculator
- Biodiversity Banking Assessor Course Trainer (ongoing)
- Narrabri coal-seam gas field ecological offset investigations
- Conservation Agreement, Potts Hill (Part 3A) – Preparation of a Conservation Agreement at Potts Hill for Sydney Water to allow rezoning and development of surplus lands to proceed
- Trial and Evaluation of the BioCertification Methodology – Mapping, survey and assessment of four separate study areas across NSW in accordance with the draft BioCertification methodology, DECCW.
- RailCorp Offset Strategy – Production of offset strategy for RailCorp activities outside statutory requirements.
- Warnervale Town Centre Biocertification Application, Department of Planning.
- Cranebrook Biobanking Pilot – Trail of biobanking methodology at Cranebrook, IFC Capital
- Delhi Road - Provision of advice on avoiding and offsetting impacts on the EEC Sydney Turpentine Ironbark Forest, resulting from proposed widening of Delhi Road, in the suburb of Macquarie Park.

**Flora and Fauna Impact Assessments**
- Menangle – Project Director for Flora and Fauna assessment of Anglican Retirement Village development
- Gordon – Flora and Fauna assessment for redevelopment of Anglican Retirement Village site, including advice and management for nearby large Grey-headed Flying-fox colony, and Blue Gum High Forest on site.
- Tahmoor – Project Manager for Flora and Fauna assessment proposed rezoning at Tahmoor by Inghams
- Warnervale Rail Station Species Impact Statement
- North Penrith Rezoning – Major project (Part 3A) Flora and Fauna Impact Assessment
- West Dapto Transport Link
- Fairway Drive, Kellyville – Project Manager for Flora and Fauna Impact Assessment for proposed aged car facility, including assessments for threatened bats in road culvert.
- Ecological Assessment, Potts Hill (Part 3A) – Project Management and Flora and Fauna impact assessment
- Eastwood Blue Gum High Forest
- Rydalmere Flora and Fauna Assessment
- Port Kembla Capital Dredging Flora and Fauna Assessment
- African Lion Safari, Silverdale
- Harrington Park Stage 2 and Mater Dei Flora and Fauna Survey
- Hornsby Station Platform 5 and Stabling Project (HSP5SP)
- Lawson Flora and Fauna Assessment
- Penrith Great River Walk
- Flora, Fauna and Bushfire Scoping Study for O'Briens Road, Nareena Hills
- Henry Lawson Drive Pedestrian-cycleway
- Widening of Milperra Drain
- Kentucky Reserve, Bank stabilisation

**EPBC Act Approval**

- Gordon Anglican Retirement Village Redevelopment - Preparation of EPBC Act referral due to being adjacent to Ku-ring-gai Grey-headed Flying-fox colony
- Offsets Assessment Guide – various projects – Applying the EPBC Act offsets calculator to multiple projects.
- North West Rail Link - Project referral and Controlled Activity approval
- Potts Hill (Part 3A) – EPBC Act project referral and approval
- St Marys Rugby Leagues Club - Project referral for proposed new sportsfield

**Other**

- Training of Sydney Water Environmental staff on ecological assessments (one day of material)
- Teaching at University of Technology (UTS) on Land and Environment court case study and BioBanking (2009 – 2013)
- Co-ordinator of Eco Logical Australia's Environmental Management System (July 2010 - June 2012)
- Member of NSW UDIA Sustainability Committee (2008 - 2010)
- Appearing as expert in Land and Environment Court

## SCIENTIFIC PAPERS

Steven is an author of eight published scientific papers:

- Close, R., Ward, S. and Phalen D. (2015). A dangerous idea: that Koala densities can be low without the populations being in danger. *Australian Zoologist*. Online: http://publications.rzsnsw.org.au/doi/10.7882/AZ.2015.001
- Lunney D, Close R, Bryant J, Crowther MS, Shannon I, Madden K, Ward S (2010). Campbelltown's koalas: their place in the natural history of Sydney. In: *Natural History of Sydney*. eds. D Lunney, P Hutchings and D Hochuli, pp319-325. Royal Zoological Society of New South Wales; Sydney.
- Lunney D, Close R, Bryant J, Crowther MS, Shannon I, Madden K, Ward S (2010). The koalas of Campbelltown, south-western Sydney: does their natural history foretell of an unnatural future? In: *Natural History of Sydney*. eds. D Lunney, P Hutchings and D Hochuli, pp339-370. Royal Zoological Society of New South Wales; Sydney.
- Ward S and Close R (2004). Southern Sydney's urban koalas: community research and education at Campbelltown. In: *Urban Wildlife: more than meets the eye*. eds. D Lunney and S Burgin, pp44-54. Royal Zoological Society of New South Wales; Sydney.
- Sluiter AF, Close RL and Ward SJ (2002). Koala feeding and roosting in the Campbelltown area of New South Wales. *Australian Mammalogy* 23: 173-5.
- Ward SJ and Close RL (1998). Community assistance with koala *Phascolarctos cinereus* sightings from a low density population in the southwest Sydney region. In: *Ecology for Everyone: Communicating ecology to scientists, the public and the politicians.* pp97-102. eds. R Wills and R Hobbs, Surrey Beatty & Sons: Chipping Norton, NSW.
- Ellis B, Close R and Ward S (1997). Identification of leaf fragments in koala faecal pellets. In: *A conference on the status of the koala in 1997*. Australian Koala Foundation: Brisbane.
- Whelan RJ, Ward S, Hogbin P and Wasley J (1996). Responses of Heathland Antechinus stuartii to the Royal National Park wildfire in 1994. *Proc. Linn. Soc. NSW*, 116: 97-108.

CURRICULUM VITAE

# Dr Meredith Henderson

**PRINCIPAL ECOLOGIST**

**QUALIFICATIONS**

- PhD, Victoria University, Melbourne. Vegetation dynamics in response to fire and slashing in remnants of Western Basalt Plains grasslands and the implications for conservation management.
- Bachelor of Science (Honours), University of Wollongong.
- Accredited BioBanking Assessor BBAM scheme (#155)
- Accredited Person BAM scheme

Meredith is an ecologist with over 24 years of survey and research experience and is Principal Ecologist in Eco Logical Australia's Wollongong Office. Meredith has worked in a range of sectors including state government, University, non-government organisations and the private sector. She has a PhD and Honours degree in terrestrial ecology. Meredith is highly experienced in terrestrial plant ecology and environmental assessment.

She is experienced in the design and completion of ecological surveys, environmental impact assessment, monitoring impacts of land management change, literature reviews and synthesis. Meredith has highly developed skills in government and client liaison.

Meredith has managed many large and complex projects. She is an accredited BioBanking assessor and has been led biodiversity certification projects and application of the major projects assessment and offsetting requirements.

**CAPABILITIES**

**Ecological Survey**

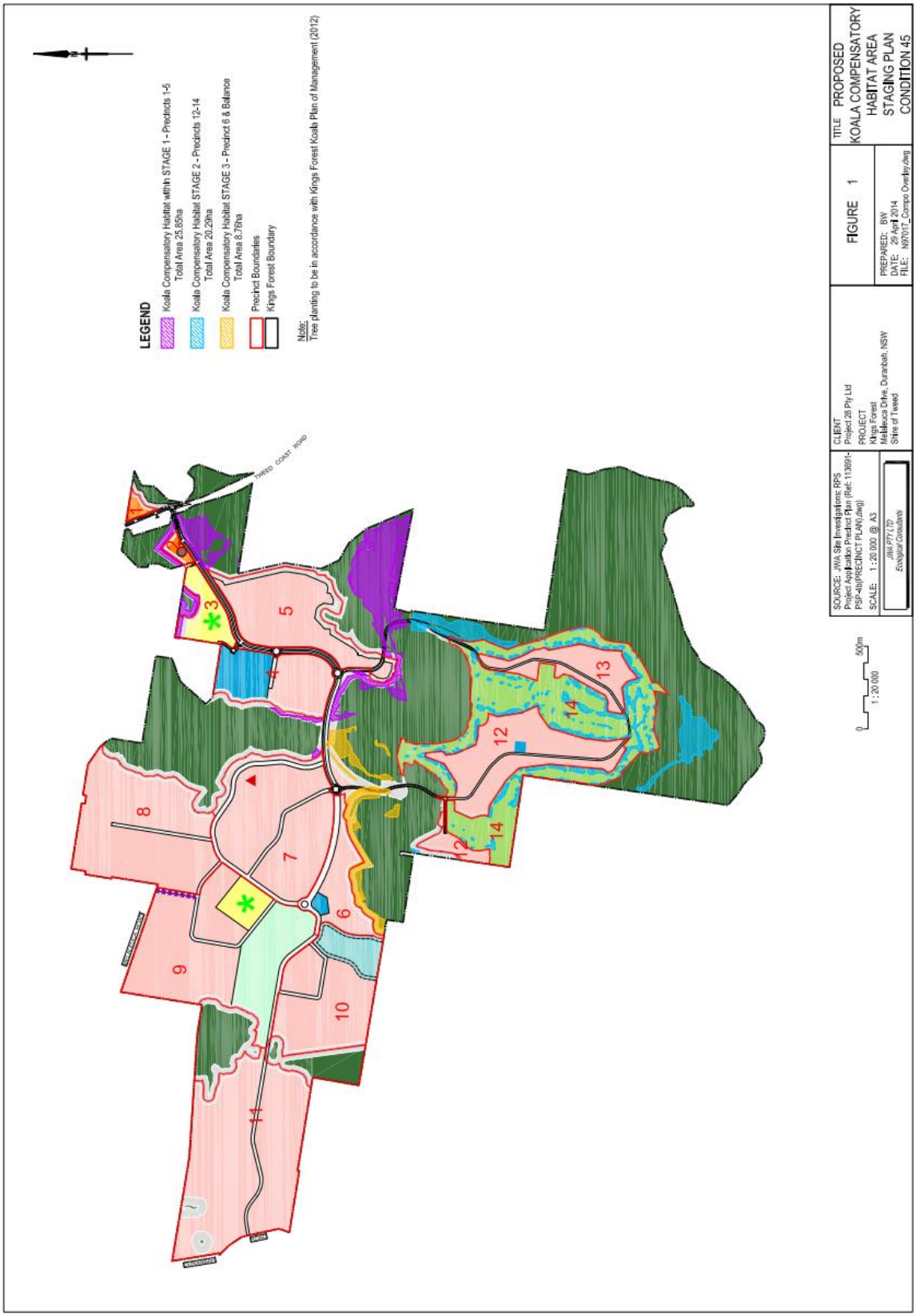
- Full floristics vegetation surveys for vegetation mapping including Bega Valley, Illawarra and South Coast, which contributed to NSW NPWS statewide mapping (NSW NPWS)
- Vegetation mapping of the Holsworthy Military Area (Janet Cosh Herbarium for Department of Defence)
- Camden Council Reserves Vegetation Assessment (Camden Council)
- Preparation of biodiversity inventory for selected reserves in the Hurstville LGA (Hurstville Council)
- Constraints assessment for Mt Keira Summit electricity supply (Wollongong City Council)
- Prepare constraints assessments and flora and fauna assessments for several projects in the Western Sydney Parklands (Western Sydney Parklands Trust)
- Population and vegetation community research in response to grazing and fire in the Guy Fawkes Wilderness Area (NSW NPWS)
- Targeted threatened species surveys (incl. Koala, Green and Golden Bell Frog and number plant species) for a range of infrastructure and residential development clients
- Threatened plant surveys for a range of species for impact assessment, conservation assessment and preparation of NSW Recovery Plans. Species included *Acacia bynoeana*, *Acacia pubescens*, *Acrophyllum australe*, *Chorizema parviflorum* (endangered population), *Darwinia biflora*, *Dillwynia tenuifolia*, *Epacris purpurascens* var. *purpurascens*, *Genoplesium baueri*, *Grevillea juniperina* subsp. *juniperina*, *Grevillea parviflora* subsp. *parviflora*, *Hibbertia superans*, *Melaleuca deanei*, *Micromyrtus minutiflora*, *Persoonia nutans*, *Pomaderris cotoneaster*, *Pomaderris prunifolia* (endangered population), *Pterostylis gibbosa* and *Trachymene saniculifolia*.

**Use of BioBanking and related methods**

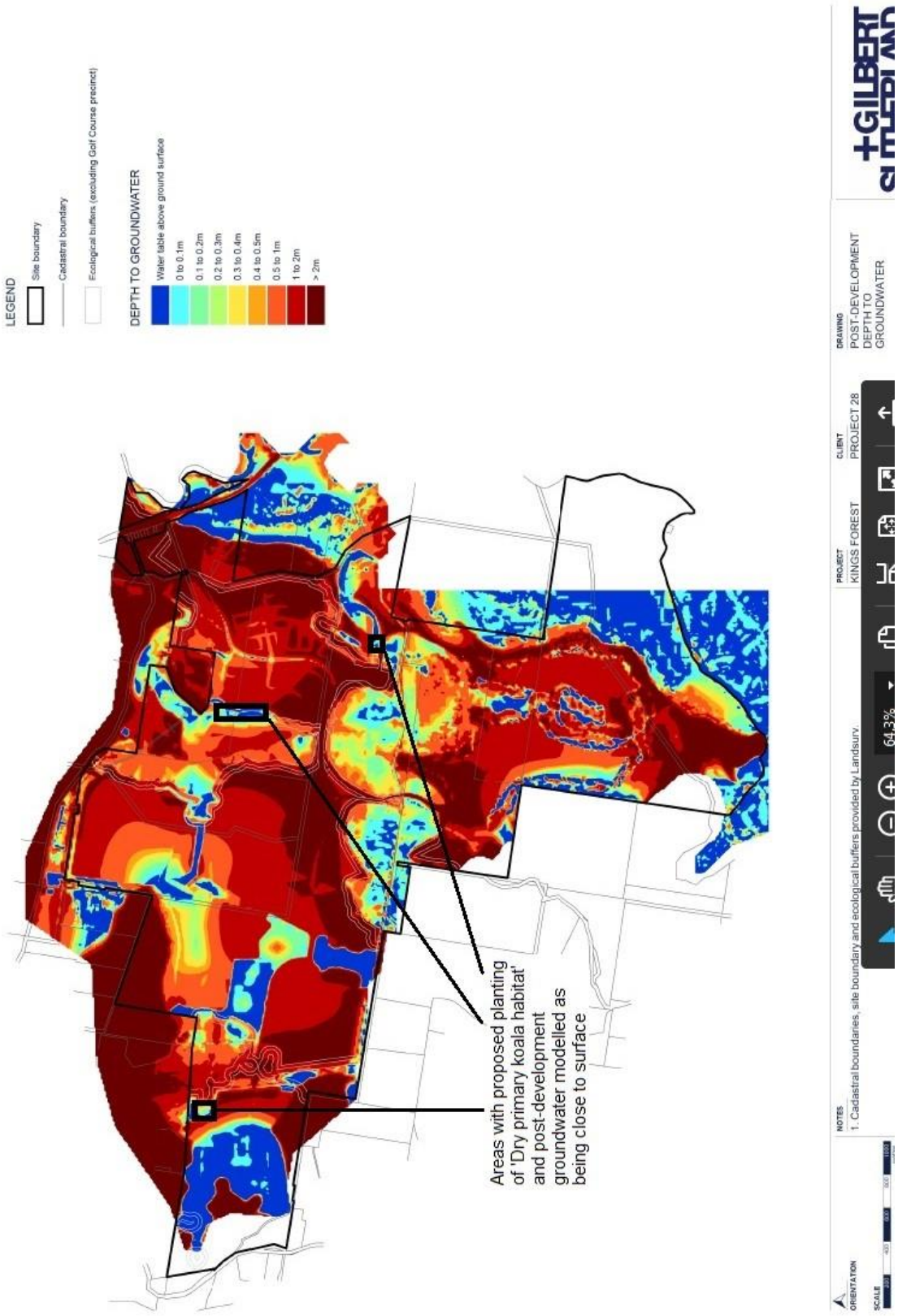
- Conduct field work for BCAM (SouthWest Land Holdings)

- Conduct biobanking plots and vegetation mapping for use in assessing impacts – NorthConnex (Transurban / RMS)
- Conduct biobanking plots, survey and run calculations for additional site for NorthConnex (Transurban / RMS)
- Provide advice to client on biobanking feasibility (Stockland)
- Lead assessor for WestConnex The New M5 using FBA (Roads and Maritime)
- Lead assessor for BCAM in northern Sydney region (Celestino)
- Lead assessor for BioBanking Agreement in the Illawarra (Holcim)
- Conduct field work for proposed major mining project in NSW central tablelands / slopes
- Lead assessor for BCAM at Sydney Science City (Celestino)
- Lead assessor for BCAM at El Caballo, Gledswood and Lakeside (Sekisui House)
- Provide advice on biobanking at Calderwood Valley Stage 3B North (Lendlease Communities)
- Project director and mentor for Biobanking Agreement site at Cawdor (private investors)
- Lead assessor for BioBanking Agreement site at Mundamia (Jemalong Mundamia Pty Ltd)
- Project director and mentor for Biobanking Agreement site at Castlereagh (private investors)
- Accredited Assessor for BioBanking Agreement at Mt Brown (private investors)
- Provide advice to landholder for RMS BioBanking Agreement adequacy (Berry, private landholder)

# Appendix B Koala Food Tree Planting Plan associated with Condition of Consent 45(1c)



# Appendix C Koala Food Tree Planting and Post-Development Groundwater Heights



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