MEMO

Date: 17 March 2021
To: Adam Smith
From: Mark Aitkens
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Regarding: PR130430 Kings Hill: Response to WWF Koala Report

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Response to the findings of the WWF report on Port Stephens Koala Study

The WWF Port Stephens Koala Study report that was recently released and supplied to the Regional Planning Panel by Port Stephens Koalas, is an updated version of the same study commissioned by Kingshill Developments (KHD) as published in the Kings Hill Species Impact Statement (SIS) (Appendix H) in July 2020. The KHD commissioned Port Stephens wide Koala genetics study was based on the same knowledge on Koala genetics to understand Koala population structuring in the Port Stephens LGA. This investigation formed an important and integral role in the preparation of the SIS by:

- Improving the definition for the local population; and
- Understanding habitat connectedness and/ or movement barriers.

Mark Aitkens of RPS is acknowledged in the WWF report for reasons relating to his role in initiating, defining the scope/ purpose and project managing the production/ publication of the genetic studies performed by OWAD Environmental for the SIS. Accordingly, an earlier version of the WWF report can be viewed in Appendix H of the SIS.

This genetic study greatly informed the SIS by reducing the uncertainty in the assessment and providing important insight on possible mitigation strategies to aid the conservation of the local Koala population Key findings of the KHD commissioned Port Stephens LGA wide Koala genetics study is listed below:

1. Kings Hill Koalas ('inland Koalas') are genetically separate from Tilligerry – Tomaree Koalas (i.e. 'peninsular' Koalas). The genetic separation has given rise to population structuring with genetic bottlenecking of significant conservation concern evident in the peninsular Koala population.

2. Inland Koalas are genetically linked to Koalas north from Kings Hill (i.e. Booral, Clarence Town, Barrington Tops and Port Macquarie). Genetic evidence supports the inclusion of Kings Hill Koalas in the Wang Wauk State Forest Area of Koala Significance (ARKS).

3. 'High' genetic diversity observed in Kings Hill Koalas is likely a function of effective genetic exchange among the much larger 'inland Koala' population (i.e. Wang Wauk State Forest ARKS Koala population).

4. 'Low' genetic diversity of the 'peninsular' Koala population is a function of poor genetic exchange with the inland Koalas. Significant conservation implications apply to the peninsular Koalas.

In addition to KHDs demonstrated commitment to maintain and conserve effective wildlife connectivity throughout the Kings Hill urban release area and more broadly, this study points to the merits of constructing a fauna underpass across the Pacific Highway at the Old Irrawang Spillway to facilitate the safe movement of the Koala. While KHD and the proposed concept development application is not responsible for genetic disparities of the kind reported in the LGA wide genetic studies, KHD recognises the importance of a broader conservation focus and is supportive of a collaborative approach to the management of these conservation issues as mentioned in Section 7.1.2.1.3 of the SIS.

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Consistency with Earlier Studies

The scope of the two foundational studies presented in the Kings Hill SIS is succinctly described as follows:

- Report 1
  - Provide additional information on Koala activity at the Kings Hill site to supplement prior work performed by BioLink using the SAT method;
  - Identify the number of Koala individuals likely present on the Kings Hill site through genetic profiling and also provide comment on the disease status of these animals; and
- Report 2
  - Perform a broader genetics study to investigate genetic exchange across the Port Stephens LGA to better understand the importance of wildlife corridors for the Koala.

As earlier stated, the WWF report is a third study built on the findings presented in the two foundations studies. To reiterate, the recent WWF report prepared by OWAD Environmental is an expansion on the findings provided in the second report prepared for KHD and published in Appendix H of the SIS.

There is high consistency between the earlier Kings Hill genetics studies and that provided in the WWF report. The WWF report provides additional resolution on population structuring not previously evident in the earlier study. Notably, the WWF report indicates the Pacific Highway is likely to be a substantial barrier disrupting genetic exchange between peninsular and inland Koalas.

The following section provides a more detailed appreciation for the stepwise progression of Koala genetics analysis recently performed in the Port Stephens LGA, its purpose and the conclusions. The reference to PM No.1 Pty Ltd (i.e. KHD) and Mark Aitkens in the WWF report provides some acknowledgement of the foundational roles played by these contributors in the preparation WWF report.

Genesis of the Genetic Studies

The SIS prepared for the Concept DA at Kings Hill by RPS on behalf of KHD was initiated in 2018 and has built on an accumulated biodiversity knowledge base obtained over the prior 15 years. Recent and prior works involved numerous field, laboratory and desktop investigations culminating in the preparation of the SIS. Part of these studies included a comprehensive study for the Koala where industry standard and contemporary investigations were used to establish a detailed understanding of the species and its habitat use on the site. These investigations are listed below:

- Spot Assessment Technique or SAT method including activity analysis (see Appendix G of the SIS);
- Spotlighting and diurnal transect/ area searches for Koala individuals (see Section 4 of the SIS and Appendix F of the SIS);
- Dog detection including activity and DNA analysis (see Appendix H of the SIS);
- Foliar nutrient studies and modelling (see Appendix I of the SIS);
- Koala tree mapping (see Section 4.4.24 of the SIS); and
- Refugia analysis from satellite imagery (see Section 4.4.24 of the SIS).

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Mark Aitkens of RPS scoped and the initial dog detection work performed by OWAD Environmental, which was completed in November 2018 and reported in early 2019 (OWAD 2019a). This work represents the first of two reports prepared by OWAD Environment as included in Appendix H the SIS.

The purpose of this work was to obtain further spatial information on Koala presence/ absence, thereby compliment the SAT data collected and analysed by BioLink earlier in the year (BioLink 2019a). This work was performed at a higher resolution than the SAT method and provided additional important insight on Koala activity across the site.

In preparing this work OWAD Environmental was also instructed by Mark Aitkens to obtain fresh Koala scats for DNA analysis. The purpose of this was as follows:

- Identify individual Koalas through DNA profiling, which allowed for the identification of gender and disease status; and
- Analysis of relatedness (i.e. are the Koalas located on site close relations to each other).

The results of this study, as reported in Section 4.4.24 of the SIS and OWAD (2019a) (Appendix H), are summarised as follows:

- 10 Koala individuals were present at Kings Hill in the second half of 2018 comprising four females and six males;
- Four Koalas tested positive for Chlamydia;
- Genetic relatedness test identified two pairs of close relatives and are likely to be parent – offspring pairs; and
- Relatively high allelic richness.

Separate to, and in parallel with the preparation of the SIS, was the preparation of a biodiversity assessment for the Kings Hill – Pacific Highway road interchange and channel project. This assessment work, which was being prepared by Arcadis for TfNSW, is predominantly associated with lands owned by Hunter Water. In preparing this assessment, Arcadis recognised the potential importance of creating a wildlife movement underpass beneath the Pacific Highway at the Old Irrawang Spillway south of the Kings Hill project primary for the benefit of Koala movement. Further, during submissions on this project, Hunter Water identified wildlife connectivity concerns on the eastern side of the Pacific Highway where the channel works may result in the disconnection of Koala habitat where Grahamstown Dam is at its closest to the Pacific Highway. Both these connectivity issues were communicated to RPS (Mark Aitkens) for comment.

In responding on behalf of KHD, Mark Aitkens of RPS recommended the expansion of the genetics work performed on the Kings Hill site to better understand the importance of local wildlife movement corridors (i.e. expand on the results of genetic profiling established for the Kings Hill site to better understand Koala population structuring at the local level). The broader genetics study, which was purposely designed by Mark Aitkens of RPS, included the sites outside the Kings Hill site as indicated in the **Table 1**.

OWAD Environmental was then instructed by Mark Aitkens of RPS to survey these additional sampling sites for the purposes of obtaining additional Koala genetic profiles for inclusion in a population structure analysis. OWAD Environmental successfully obtained an additional 23 unique DNA profiles from this expanded local study, which also included Koala individuals housed in the Port Stephens Koala hospital. Local DNA profiles were increased to 33 unique individuals and, with existing DNA profiles retained by WildDNA for Barrington Tops, Port Macquarie and Booral, were pooled into a population structure analysis.

Table 1: RPS Sampling Design for Port Stephens LGA Koala genetics study

Sample Site	Description	Purpose of Sample Site
Grahamstown Dam West (north)	Habitat east of Kings Hill on Hunter Water lands and north of the point where Grahamstown Dam is at its closest to the Pacific Highway	To test for relatedness between Koala individuals known to occur on the Kings Hill site and individuals located to the south
Grahamstown Dam West (centre)	Habitat south of the point where Grahamstown Dam is at its closest to the Pacific Highway	To test for relatedness between Koala individuals known to occur on the Kings Hill site and individuals located to the south
Mambo Wetlands, Stoney Ridge Reserve, Wanda Wetlands,	Tomaree peninsular Koalas	To test for relatedness between Koala individuals located at Kings Hill and more broadly in the Port Stephens LGA to explore the likely extent of the local population
Boomerang Park and Karuah BioBank	Habitat independent of Kings Hill but not located near the Tomaree peninsular Koalas	To test for relatedness between Koala individuals located at Kings Hill and more broadly in the Port Stephens LGA to explore the likely extent of the local population

WildDNA performed the population structure analysis of the pooled DNA profiles established from the broader local study and their own database. This analysis identified strong population structuring separating Koalas located on the Tomaree peninsular (cluster PS1) from animals located elsewhere including those at Kings Hill and further afield including those at Barrington Tops, Booral and Port Macquarie (cluster PS2). This work is recognised in Section 4.4.24.7 of the SIS with the supporting consultancy report included in Appendix H of the SIS (OWAD 2019b).

A summary of the population structure analysis results provided in Section 4.4.24.7 of the SIS is reproduced below for convenience:

- Two genetic clusters representative of two separate Koala populations referred to as:
  - Port Stephens 1 - Tomaree Peninsula (PS1)
  - Port Stephens 2 – Western Port Stephens (including Kings Hill) (PS2).

  The genetics of PS2 currently show connection to other populations in the greater landscape, including a known population 200km north (Port Macquarie) and at Barrington Tops. Koala samples obtained from Booral and Clarence Town form part of the PS2 genetic cluster and are inferred to form part of that population.
- PS2 has high genetic diversity with relatively greater diversity found at Kings Hill site when compared to Grahamstown Dam West and Karuah. Management should aim to maintain and restore gene flow where possible so as to avoid further possible genetic differentiation within Port Stephens LGA;
- Population cluster PS1 (Tomaree Peninsula) is isolated and has lower genetic diversity than PS2. In the absence of intensive and targeted management measures, this population may be at risk of being lost; and
- Koalas on the Kings Hill site showed the least concerning indicators of all lands assessed whether in terms of genetic indicators or in terms of Koala activity levels detected. Management should aim to minimise and mitigate impacts to Koalas on this land.

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Further details on genetic assessment methods and results referred to in this report are currently being prepared for publication in a peer-reviewed journal.

Closure

The WWF report is the third and most recent publication on Koala genetics in the Port Stephens LGA. It proceeds two earlier genetic studies commissioned by KHD for the Kings Hill project. All studies are consistent with each other and present a progressive knowledge build on Koala genetics in the Port Stephens LGA. Little difference exists between the genetic study published in the Kings Hill SIS and that presented in the WWF report. Both reports indicate the importance of building safe wildlife connectivity paths for the Koala in the local and regional context.

KHD has integrated this knowledge into the SIS by expanding and improving connectivity throughout its part of the urban release area. Further, KHD has recognised the importance of improving cross Pacific Highway connectivity noting the degradation of Koala genetics east of this existing transport corridor. Finally, KHD is of the understanding that the 'high' genetic diversity present on the Kings Hill site is an expected outcome and is a function of healthy genetic exchange with other Koalas that form part of the much larger 'inland Koala' population (e.g. Wang Wauk State Forest ARKS). The inland Koalas population is genetically separated from the Tilligerry – Tomaree population (peninsular population), which is characterised by relatively low genetic diversity. It is the latter finding that is of major conservation significance and should be addressed by all levels of government to remedy the problem.

For any further advice or clarification please do not hesitate to contact the undersigned for more assistance on 0488 224 200.

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References

Biolink (2019a) Kings Hill Koala Habitat Assessment. Report to Kings Hill Developments. Biolink Ecological Consultants, Uki, NSW.

OWAD Environmental (2019a) Raymond Terrace Koala Survey Report. Prepared by OWAD Environmental for PM No.1 Pty Ltd c/o RPS Group.

OWAD Environmental (2019b) Port Stephens LGA Koala Genetic Sampling Report. Prepared by OWAD Environmental for PM No.1 Pty Ltd c/o RPS Group.