The Final Determination to reject this population will be published on the NSW Legislation website on 17th August, 2018.

Notice of and reasons for the Final Determination

The NSW Threatened Species Scientific Committee, established under the *Biodiversity Conservation Act 2016* (the Act), has made a Final Determination to REJECT a proposal to list a population of the Koala *Phascolarctos cinereus* (Goldfuss, 1817) in the Port Stephens area (north of the Hunter River, east of the Pacific Highway and south of Nelson Bay/Karuah River) as an endangered population as populations of threatened species are ineligible to be listed under the Act.

The Scientific Committee has found that:

1. The Koala population located in the Port Stephens area (north of the Hunter River, east of the Pacific Highway and south of Nelson Bay/Karuah River) is the subject of this determination. This population consists of three sub-populations – Tomaree, Medowie-Tilligerry and Ferodale-Karuah. The first two of these sub-populations provide most records of the species in the region (in part due to greater survey effort), showing a concentration of Koala records from Heatherbrae/Raymond Terrace in the west to Shoal Bay in the east, particularly in the Tomaree and Medowie-Tilligerry areas (Knott *et al.* 1998; OEH *in litt*. June 2016). Primary Koala habitat is present in other areas of the Port Stephens area (*e.g.* Williamtown, Tomago, Kings Hill) but these areas have not been as comprehensively surveyed. Land clearing patterns and topography have resulted in the Tomaree Peninsula population becoming relatively isolated, limiting both emigration and immigration movement of individuals (Knott *et al.* 1998). Recent Koala records for the third sub-population (Feroday-Karuah) which extends north from the other two towards Limeburners Creek, are very limited (Knott *et al.* 1998; OEH *in litt*. June 2016). Port Stephens Council (2002) defined the following Koala management units (KMU) relevant to this determination: Tilligerry Peninsula KMU; Tomaree Peninsula KMU; Raymond Terrace KMU; Medowie KMU; Tomago Sandbeds KMU; Karuah/Ferodale KMU and Fullerton Cove/Stockton Bight KMU. More recently, Biolink (2017) defined seven Koala "hubs" east of the Pacific Highway: Anna Bay/Soldiers Point, Tilligerry, Medowie, Williamtown East, Williamtown West, Tomago/Heatherbraeand Grahamstown West.

2. Prior to European settlement the Port Stephens area contained a substantial area of contiguous Koala habitat covering approximately 70% of the Port Stephens local government area (LGA) (Knott *et al.* 1998). During the last two centuries, this has been severely modified with habitat becoming highly fragmented due to clearing for agriculture, housing, sand mining and roads (Knott *et al.* 1998). Clearing began on fertile and well-watered land along the banks of the Lower Hunter and Williams Rivers and progressed to the east (Knott *et al.* 1998). Lunney *et al.* (1998) has suggested that some habitat in the Port Stephens area no longer supports extant Koala populations, most notably in the western and northern parts of the Port Stephens area. A small but increasing population is known to occur west of the Pacific Highway in the Port Stephens LGA (Biolink 2016, 2017). Prior to clearing, fertile riverbanks and flats habitat would have supported higher densities of Koalas than those areas where Koalas remain extant in the Port Stephens area (Knott *et al.* 1998). The Pacific Highway appears to have restricted movements of Koalas and areas to its west had not been recolonised in the late 1990s (Knott *et al.* 1998).) Declines in Koala distribution and abundance within the Port Stephens area have previously

been noted and concern for the species' long-term persistence has been expressed for some decades (Lunney and Reed 1990; Phillips *et al.* 1996; Knott *et al.* 1998; Lunney *et al.* 1998).

3. The Koala population in the Port Stephens area (north of the Hunter River, east of the Pacific Highway and south of Nelson Bay/Karuah River) can be considered disjunct due to the interaction between natural and anthropogenic barriers to movement. The rivers that form the northern and southern boundaries are more than 150 m wide at their narrowest points (and Nelson Bay in the north and the Hunter estuary in the south are much wider), and preferred Koala habitat is generally not found on either side of these rivers due, in part, to past clearing (Knott *et al.* 1998; OEH *in litt*. 29 June 2016). While Koalas will move through habitat that is unsuitable for occupation (Moon 1990; Ramsay 1999), and there are occasional observations of individuals swimming across rivers >100 m wide, rivers >50 m wide are considered to be a barrier to demographic connectivity (NSW Scientific Committee 2005). The Pacific Highway, a four-lane dual carriageway, represents the western boundary of the population. Major roads are considered a significant barrier to the movement of Koalas, functioning both as a substantial habitat gap that resident Koalas are reluctant to cross and as a significant source of mortality (Dique *et al*. 2003a, 2003b; NSW Scientific Committee 2005; Lassau *et al.* 2008; Rhodes *et al.* 2014). Although there are several fauna underpasses in the region (at the Raymond Terrace and Karuah bypasses) which have been monitored, there is only scant or anecdotal evidence of their use by Koalas (SMH 2004; RTA 2006; RMS 2015). In a similar landscape further north, Phillips *et al.* (2011) found negligible use of under- and over-passes by Koalas, while Taylor and Goldingay (2003) found Koalas only infrequently used culverts beneath the Pacific Highway in northeastern NSW. Koalas also appear to avoid using rope bridges across roads (Goldingay and Taylor 2016).

4. The geographic distribution of the Koala in the Port Stephens area (north of the Hunter River, east of the Pacific Highway and south of Nelson Bay/Karuah River) is highly restricted. The extent of occurrence (EOO) is estimated to be 703–742 km^2. The EOO estimate is based on the method of assessment recommended by IUCN (2016). The area of occupancy (AOO) was estimated to be 488–608 km^2, based on 122–152 2 x 2 km grid cells, the scale recommended for assessing AOO by the IUCN (2016). The EOO and AOO were estimated using Koala records from Bionet (accessed 12 April 2017) of variable spatial accuracy. The lower estimates were obtained when including only recent records (1997–2015) and the higher estimates were obtained when all records were included.

5. The estimated total number of mature individuals of Koalas in the population in the Port Stephens LGA is considered to be about 800 individuals, with the majority of the population contained within the area north of the Hunter River, east of the Pacific Highway and south of Nelson Bay/Karuah River) (Biolink 2016, 2017; Port Stephens Council *in litt.* October 2017). A small but increasing population (not the focus of this determination although it is included in the above population estimate) occurs west of the Pacific Highway (Biolink 2016, 2017). Given recent fire history, with large fires in 2013 and 2016, and an ongoing decline of koalas in this area this may be an overestimate of the current population. Prior to recent declines, Lunney *et al.* (2007) used a population estimate of 800 animals in a population viability analysis within the Port Stephens area (which includes disjunct areas west of the Pacific Highway). Earlier estimates by Phillips *et al.* (1996) report the population to be in the order of 300–500 animals although differences in methodologies between population estimates limit the ability to make accurate comparisons over time. Recent surveys have suggested much lower numbers of Koalas are present compared with historical estimates, commensurate with recent evidence of

decline (see Paragraphs 6–11). Recent estimates are based on habitat assessment and field survey, individual road surveys, hospitalisation rates and from intensive surveys by the Hunter Koala Protection Society (now Port Stephens Koalas) and these suggest the largest sub-population, the Tomaree sub-population may currently contain 125–200 animals (C. McLean *in litt.* May 2016; D Paull *in litt.* July 2016), compared with the estimate of 595 for the period 1998–2015 (Biolink 2016). A Generational Persistence Assessment by Biolink (2017) detected a reduction in the extent of habitat being occupied by koalas across eastern parts of the Port Stephens LGA, most acutely at Raymond Terrace, and also in parts of the Tomago Sandbeds and Tilligerry Peninsula. Biolink (2016) reports a recent apparent loss of populations from localities such as Raymond Terrace and Karuah.

6. The number of mature Koalas Port Stephens LGA is estimated to be approximately 800 individuals (Port Stephens Council *in litt.* October 2017). The majority of these comprise the population described in this Determination, while a small proportion occurs west of the Pacific Highway and is disjunct from the population (Biolink 2016, 2017). Given recent fire history, with large fires in 2013 and 2016, and the ongoing decline of Koalas in this area, this may be an overestimate of the current population size. Prior to recent declines, Lunney *et al.* (2007) used a population estimate of 800 animals in a population viability analysis within the Port Stephens area (which includes disjunct areas west of the Pacific Highway). Earlier estimates by Phillips *et al.* (1996) report the population to be in the order of 300–500 animals although differences in methodologies between population estimates limit the ability to make accurate comparisons over time. Recent surveys have suggested much lower numbers of Koalas are present compared with historical estimates, commensurate with recent evidence of decline. Recent estimates are based on habitat assessment and field survey, individual road surveys, hospitalisation rates and from intensive surveys by the Hunter Koala Protection Society (now Port Stephens Koalas). These suggest the largest sub-population, the Tomaree sub-population, may currently contain 125–200 animals (C. McLean *in litt.* May 2016; D Paull *in litt.* July 2016), compared with the estimate of 595 for the period 1998–2015 (Biolink 2016). Generational Persistence Assessment by Biolink (2017) detected a reduction in the extent of habitat being occupied by Koalas across eastern parts of the Port Stephens LGA, most acutely at Raymond Terrace, and also in parts of the Tomago Sandbeds and Tilligerry Peninsula. Biolink (2016) reports a recent apparent loss of populations from localities such as Raymond Terrace and Karuah.

7. Koala populations throughout NSW are subject to several ongoing threats including habitat loss and degradation, increased mortality due to high frequency of wildfire, dog attacks, vehicle strike and disease (DECC 2008; Phillips *et al.* 2011). Human population growth is linked with extinction risk, habitat loss and degradation (Harte 2007) and in NSW the human population is projected to increase by 48% in the period 2007–2056 (ABS 2016). Port Stephens LGA is projected to increase in population by 37.9% between 2011 and 2036 (Planning NSW 2016). Development pressures continue in the Port Stephens area. Several developments are under consideration as of January 2016, including more than 500 ha of preferred Koala habitat and over 700 ha of supplementary habitat (OEH *in litt*. Jun 2016). Habitat loss and fragmentation also have the potential to further impede dispersal and recruitment between sub-populations and are associated with increased risks of vehicle strike and domestic dog attack (McAlpine *et al.* 2006; Phillips *et al*. 2011). 'Clearing of native vegetation' is listed as a Key Threatening Process under the Act.

8. Inappropriate fire regimes, particularly high intensity or high frequency wildfires, also represent a significant threat to Koala populations east of the Pacific Highway (Phillips *et al*. 2011; Hopkins and Phillips 2012). Fires impact Koalas directly through mortality of animals and habitat fragmentation reduces the ability of animals to subsequently recolonise burnt areas. A population viability analysis of the Tomaree Koalas has highlighted the significance of fire-related mortality and predicted that at the current estimated mortality rate the population would decline to extinction within a decade (C. McLean *in litt.* May 2016). An extensive wildfire in the Medowie area in 2016/2017 burnt a large area of Koala habitat. In the Medowie-Tilligerry sub-population high frequency of wildfire has been associated with a long-term decline in the sub-population (OEH *in litt*. June 2016). Habitat loss from wildfire can be short term for Koalas provided they can recolonise the burnt forest and can maintain home ranges within sites regenerating from fire (Matthews *et al*. 2016). This may no longer be the case at Port Stephens due to the reduced size and restricted nature of this population, making it vulnerable to a single fire event affecting a large proportion of the population. Increased wildfire frequency may reduce quality of Koala habitat and has the potential to exacerbate population decline, especially where Koala habitat is fragmented (Starr 1990; Melzer *et al*. 2000; Lunney *et al*. 2007). Frequent wildfires are also thought to have led to the near complete loss of the once abundant Billinudgel Nature Reserve Koala population in the Byron LGA (Hopkins and Phillips 2012; NSW Scientific Committee 2016). This reserve was almost completely burnt in 2004 following two other fires with inter-fire intervals of only three and nine years (Hopkins and Phillips 2012). 'High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as a Key Threatening Process under the Act.

9. Natural mortality is also exacerbated by vehicle strikes. The total number of Koala deaths from vehicle strike is likely to be larger than that reported and the risk of vehicle strike can be expected to rise with increased urbanisation and human population growth. The long-term viability of Koala populations can be particularly sensitive to slight changes in mortality rates. For example, Phillips *et al*. (2007) concluded, based on a population viability analysis, that a small increase in the mortality rate of 2–3 % (as a function of total population size) from road mortality would lead to population decline in an otherwise demographically stable Koala population in south-eastern Queensland.

10. Chlamydial disease and the Koala Retrovirus (KoRV) are common in Koala populations in eastern Australia (CoA 2011) and are present in the Koala population east of the Pacific Highway, north of the Hunter River and south of Nelson Bay/Karuah River (D. Paull *in litt.* 15 March 2015). Chlamydia can cause blindness, infertility and pneumonia (Polkinghorne *et al*. 2013) while KoRV has been linked to some cancers and suppression of the immune system (Denner and Young 2013). Both diseases impact the general health of populations and can exacerbate the effect of other environmental stressors.

11. The Koala population in the Port Stephens area (north of the Hunter River, east of the Pacific Highway and south of Nelson Bay/Karuah River) is threatened by mortality due to dog attack (Lunney *et al.* 2007; DECC 2008). In the period 1988–1998, 125 Koalas were admitted to Koala hospitals as a result of dog attack and the mortality rate was 62% (Port Stephen Council 2002). More recently, in 2014, 7% (of 29) of mortalities detected by the Hunter Koala Protection Society (now Port Stephens Koalas) resulted from dog attacks. On the mid-north coast of NSW, attacks by dogs are the cause of *c.*15% of admissions to the Port Macquarie Koala Hospital (Phillips *et al*. 2011).

12. Inferences of population decline are rendered uncertain by the absence of a consistent survey program in the region. A 43% reduction in the AOO has been demonstrated by an analysis of NSW Wildlife Atlas records for the periods 2003–2009 and 2009–2015 (D. Paull *in litt.* March 2015). Atlas records in each period comprise a similar number of records (1,118 vs 1,037), although with different spatial distributions in space and different survey methods were employed by different observers. Biolink (2016) estimate that 54% of available habitat was occupied over the last three generations (1998–2015) and field surveys in 2017 found a similar rate of occupancy, indicating occupancy was not in decline during this period (Biolink 2017). Biolink (2016) also found no appreciable decline in EOO between 1920–2015. Recent spot-lighting surveys at 70 sites on the Tomaree Peninsula revealed an occupancy rate of 31%, though faecal pellets, which can persist for some time, were recorded on 68% of sites (C. McLean *in litt*. May 2017). Most Port Stephens residents who responded to community surveys reported that Koala populations were either declining or static in 1992 and again in 2006 (Predavec *et al.* 2016). Continuing decline is anticipated as only 36% of preferred Koala habitat in the area is found within reserved lands and there is increasing pressure for suburban development which is likely to cause habitat loss and increased mortality from vehicle collision and dog attack. Population viability analysis by Lunney *et al.* (2007) in the Port Stephens area suggested a population of 800 Koalas would decline to 20 by 2050 and more recent population viability analysis for the Tomaree sub-population suggested that 200 individuals would decline to zero in 20 years (C. McLean *in litt*. May 2017). Elsewhere, an isolated population of Koalas on the Iluka peninsula declined to extinction due to the effects of fire on its adjacent source population (Lunney *et al.* 2002; DoE 2017). The estimated rate of decline for Koalas in NSW was 33% between 1990 and 2010 (DoE 2017).

13. The NSW Scientific Committee established under the *Threatened Species Conservation Act 1995* made a Preliminary Determination to support a proposal to list a population of the Koala *Phascolarctos cinereus* (Goldfuss, 1817) in the Port Stephens area (north of the Hunter River, east of the Pacific Highway and south of Nelson Bay/Karuah River) as an endangered population as, in the opinion of the NSW Scientific Committee, the population is facing a very high risk of extinction in NSW in the near future as determined in accordance with Clauses 11, 13 and 14 of the *Threatened Species Conservation Regulation 2010*.

14. The Preliminary Determination was placed on public exhibition for comment from 18th August, 2017 to 13th October, 2017.

15. On 25th August, 2017 the *Threatened Species Conservation Act 1995* was repealed and replaced by the *Biodiversity Conservation Act 2016*.

16. Under Clause 4.1(5) of the *Biodiversity Conservation Regulation 2017* a population of a species is not eligible to be listed as threatened if the species is separately listed as a threatened species under the *Biodiversity Conservation Act 2016*.

17. Under section 4.14 of the *Biodiversity Conservation Act 2016* the NSW Threatened Species Scientific Committee is required to consider the assessment criteria and procedures under a common assessment method agreed between the Commonwealth, State and Territories.

18. Under clause 2.2 of the Intergovernmental memorandum of understanding relating to the agreement on a common assessment method for listing of threatened species and threatened ecological communities (CAM MOU 2015), a population of a species is not eligible to be listed

as threatened if the species is separately listed as a threatened species under the *Environment Protection and Biodiversity Conservation Act 1999.*

19. The Koala is listed as a Vulnerable species in New South Wales under the *Biodiversity Conservation Act 2016.*

20. The Koala is listed as a Vulnerable species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

21. As the Koala is listed as a threatened species under the *Biodiversity Conservation Act 2016* and the *Environment Protection and Biodiversity Conservation Act 1999* the population of the Koala *Phascolarctos cinereus* (Goldfuss, 1817) in the Port Stephens area (north of the Hunter River, east of the Pacific Highway and south of Nelson Bay/Karuah River) is ineligible to be listed under the *Biodiversity Conservation Act 2016*.

Dr Marco Duretto
Chairperson
NSW Threatened Species Scientific Committee

Exhibition period: 08/12/17 – 02/02/18
Exhibition period: 17/08/18 – 12/10/18 Proposed Publication date: 17/08/18

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