

Appendix F – Assessments of significance

Assessments of significance have been carried out for threatened species listed under the BC Act which have been recorded or are considered to have a 'high' or 'moderate' likelihood of occurrence within the study area.

Assessments of significance have been prepared for the threatened entities outlined in Table Error! No text of specified style in document.-1.

Table Error! No text of specified style in document.-1 Threatened entities listed under the BC Act for which Assessments of Significance have been carried out

Scientific name	Common Name	Status under BC Act	Potential occurrence
FLORA			
<i>Callistemon linearifolius</i>	Netted Bottlebrush	V	Moderate. Species not identified during flora surveys across the study area. Study area supports potential habitat for the species.
<i>Corybas dowlingii</i>	Red Helmet Orchid	E	Moderate. Study area supports potential habitat for the species and there are recent records nearby – RPS (2019) have recorded a population of this species in the Kings Hill Development proposal footprint.
<i>Maundia triglochinosides</i>	-	V	Moderate. Species not identified during flora surveys across the study area. Study area supports some small areas of potential habitat for the species in drainage soaks and at the edge of Grahamstown Dam. There are recent records nearby – RPS (2019) have recorded a population of this species in the Kings Hill Development proposal footprint.
<i>Pterostylis chaetophora</i>	-	V	High. Species not identified during flora surveys across the study area, however targeted seasonal surveys for this species were not conducted across the entire study area. Study area supports potential habitat for the species and there are recent records nearby – RPS (2019) have recorded a population of this species in the Kings Hill Development proposal footprint, and there is another population to the east and north-east in the Grahamstown Dam catchment.

Scientific name	Common Name	Status under BC Act	Potential occurrence
FAUNA			
Diurnal raptors			
<i>Circus assimilis</i>	Spotted Harrier	V	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present..
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present..
<i>Lophoictinia isura</i>	Square-tailed Kite	V	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present..
Large forest owls			
<i>Ninox strenua</i>	Powerful Owl	V	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present..
<i>Tyto novaehollandiae</i>	Masked Owl	V	Recorded This species has previously been identified as roadkill in proximity to Irrawang Spillway by PEA Consulting. Additional recent records from the locality and suitable habitat present.
Cockatoos			
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	High. Not recorded during surveys. Recent records from the locality and suitable habitat present.
Nectivorous birds			
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present.
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	Recorded. Recorded during current surveys by Arcadis. Additional recent records from the locality and suitable habitat present..

Scientific name	Common Name	Status under BC Act	Potential occurrence
<i>Lathamus discolor</i>	Swift Parrot	E	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present.
Insectivorous birds			
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present.
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present.
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	High. Not recorded during surveys. Recent records from the locality and suitable habitat present.
<i>Petroica boodang</i>	Scarlet Robin	V	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present.
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V	High Recorded by PEA Consulting near the study area Study area offers potential habitat and recent records from the locality
Large arboreal mammals			
<i>Phascolarctos cinereus</i>	Koala	V	Recorded. Koala sighting by Arcadis during 2019 surveys. Koala scats recorded at several locations during surveys by Arcadis and PEA Consulting. Additional recent records from the locality and suitable habitat present.
Small scansorial/arboreal mammals			
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	High Recorded by PEA Consulting to the west of the study area Study area offers potential habitat and recent records from the locality

Scientific name	Common Name	Status under BC Act	Potential occurrence
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	High Recorded by PEA Consulting near the study area Study area offers potential habitat and recent records from the locality
Microchiropteran bats (microbats)			
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	Recorded. Recorded previously by PEA Consulting Study area offers suitable habitat and recent records from the locality
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	Recorded. Recorded previously by PEA Consulting Study area offers suitable habitat and recent records from the locality
<i>Miniopterus australis</i>	Little Bent-winged Bat	V	Recorded. Recorded previously by PEA Consulting Study area offers suitable foraging habitat and recent records from the locality
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	Recorded. Recorded previously by PEA Consulting Study area offers suitable foraging habitat and recent records from the locality
<i>Myotis macropus</i>	Southern Myotis	V	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	Moderate. Not recorded during surveys. Recent records from the locality and suitable habitat present..
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	Recorded. Recorded previously by PEA Consulting Study area offers suitable habitat and recent records from the locality
Megachiropteran bats (Flying-foxes)			

Scientific name	Common Name	Status under BC Act	Potential occurrence
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	Recorded This species was observed foraging in the canopy of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest by Arcadis during the April/May 2017 survey period. Study area offers foraging habitat No roosting or breeding habitat present within the study area. Nearest known camp is at Raymond Terrace.

Callistemon linearifolius (Netted Bottlebrush)

Callistemon linearifolius is listed as Vulnerable under the BC Act. In NSW it has been recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area. The species was more widespread in the past, and there are reportedly only five to six populations currently remaining from the 22 populations historically recorded in the Sydney area (OEH 2019). Three of the remaining populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve and Spectacle Island Nature Reserve. The species has also been recorded from Yengo National Park.

Callistemon linearifolius grows in dry sclerophyll forest on the coast and adjacent ranges. It flowers spring to summer.

The species has a moderate likelihood of occurrence within the study area. It was not identified during flora surveys across the study area, however the study area supports potential habitat for the species. Hunter Water provided Arcadis with the location of a recent (undated) record of this species to the east of the study area, located over 600 metres away from the study area boundary.

(a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Callistemon linearifolius is a highly conspicuous shrub to 3-4 metres in height. Multiple targeted surveys of the species during the known flowering period have not detected *Callistemon linearifolius* within the study area. As such, if the species is present, it is unlikely to persist in great numbers within the study area and would form only a small proportion of the local population. The proposal would remove 18 hectares Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590) which is known to be associated with the species. The removal of this extent of potential habitat is unlikely to place a local viable population of the species at risk of extinction.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. *Callistemon linearifolius* is a threatened species.

(c) In relation to a habitat of a threatened species, population or ecological community:

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The proposal will involve the clearing of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590) which, as a dry sclerophyll forest may represent suitable habitat for *Callistemon linearifolius*.

Although the proposal will increase the edge effect on some areas of potential habitat for *Callistemon linearifolius*, it will not result in further fragmentation or isolation of any identified local population of *Callistemon linearifolius*.

Given the broad range of PCTs in which *Callistemon linearifolius* is known to be associated with in the locality, it is not expected that 18 hectares of potential habitat is of high importance to the long-term survival of the species or local population.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for *Callistemon linearifolius*.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of, a key threatening process.

Of the key threatening processes listed in Schedule 4 of the BC Act, the following are relevant to the potential impacts of the proposal on *Callistemon linearifolius*:

- Clearing of native vegetation

Approximately 18 hectares of native vegetation that contains potential habitat would be cleared. This does not represent a significant area of this species' habitat in the locality.

- Invasion of native plant communities by exotic perennial grasses

Perennial exotic grass species occur within the study area, mainly in disturbed road verge habitats and cleared areas. The proposal may exacerbate this KTP by facilitating the spread of seeds or fragments of plant to areas where weeds are not present, via plant or contaminated topsoil. The impacts of this KTP can be reduced through appropriate controls and applications of weed management mitigation measures during and after construction.

- Invasion, establishment and spread of *Lantana camara*

Lantana camara is present in various patches throughout the study area, particularly in the disturbed vegetation types. This KTP may result in overshadowing by shrubs which has been identified as a potential threat to the viability of *Callistemon linearifolius* populations. As per the above point for invasive grasses, the proposal may exacerbate this KTP, however, the impacts of this KTP can be reduced through appropriate controls and applications of weed management mitigation measures during and after construction.

Conclusion

The proposal would require the removal of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590). This vegetation provides potential habitat for *Callistemon linearifolius*.

The 18 hectares of potential habitat to be cleared is not considered to be a significant area of habitat or of importance to the long-term survival of *Callistemon linearifolius* in the locality. As a result, it is considered unlikely that the proposal represents a significant impact to this vulnerable species. A Species Impact Statement is not required for this species.

Corybas dowlingii (Red Helmet Orchid)

Corybas dowlingii is listed as Endangered under the BC Act. This species is restricted to the central coast and Hunter regions of NSW, where it has been recorded from the Port Stephens, Bulahdelah, Lake Macquarie and Freemans Waterhole areas (OEH 2019).

Corybas dowlingii forms clonal colonies, typically growing in gullies in tall open forest on well-drained gravelly soils at elevations of 10 to 200 metres (OEH 2019).

The species has a moderate likelihood of occurrence within the study area. It was not identified during flora surveys across the study area, including targeted seasonal surveys, however the study area supports potential habitat for *Corybas dowlingii*. RPS (2019) recorded a population of *Corybas dowlingii* in the Kings Hill Development study area; this population is located about 500 metres to the west of the study area.

It should be noted that recent genetic research on *Corybas dowlingii* is likely to result in taxonomic changes, as discussed in RPS (2019), and once published it is expected that *Corybas dowlingii* will no longer be recognised as a specific taxon. The population recorded at Kings Hill is likely to be ascribed to the taxon *Corybas barbarae*, which is not listed as threatened under the BC Act (RPS 2019). As this research has not yet been published, the species is still considered to be Endangered under the BC Act and has been assessed as such.

(a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Little is known about the life cycle of *Corybas dowlingii*; the species is pollinated by flies, and flowering occurs from June to August (OEH 2019).

The proposal would remove 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590), of which about 13.51 hectares at most may form potential habitat for *Corybas dowlingii*. Multiple targeted surveys of the species during the known flowering period of the species in 2013 did not detect *Corybas dowlingii* within the study area; the closest record is located about 500 metres west of the study area. There is currently no evidence that a viable local population of the species occurs in the study area, and populations in the locality are unlikely to be indirectly affected by the proposal. As such, it is considered unlikely that the proposal would have an adverse effect on the life cycle of *Corybas dowlingii* such that a viable local population is likely to be placed at risk of extinction.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. *Corybas dowlingii* is a threatened species.

(c) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposal will involve the clearing of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590), some of which may represent suitable habitat for *Corybas dowlingii*. Although this PCT is not listed as an associated vegetation type for *Corybas dowlingii* in the TBDC (OEH 2019), the species was recorded in PCT 1590 in the Kings Hill Development study area. The more disturbed zones of PCT 1590 within the study area are unlikely to represent suitable habitat for the species; at most, 13.51 hectares of the total area of the PCT impacted may form suitable habitat for *Corybas dowlingii*.

Although the proposal will increase the edge effects within some retained areas of potential habitat for *Corybas dowlingii*, it will not result in further fragmentation or isolation of any local population of the species.

The area of potential habitat for *Corybas dowlingii* to be cleared comprises linear strips of vegetation with existing edge effects. It is not expected that the 13.51 hectares of potential habitat is of high importance to the long-term survival of the species or local population.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for *Corybas dowlingii*.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of, a key threatening process.

Of the key threatening processes listed in Schedule 4 of the BC Act, the following are relevant to the potential impacts of the proposal on *Corybas dowlingii*:

- Clearing of native vegetation

Approximately 13.51 hectares of native vegetation that contains potential habitat would be cleared. This does not represent a significant area of this species' habitat in the locality.

- Invasion of native plant communities by exotic perennial grasses

Perennial exotic grass species occur within the study area, mainly in disturbed road verge habitats and cleared areas. The proposal may exacerbate this KTP by facilitating the spread of seeds or fragments of plant to areas where weeds are not present, via plant or contaminated topsoil. The impacts of this KTP can be reduced through appropriate controls and applications of weed management mitigation measures during and after construction.

- Invasion, establishment and spread of *Lantana camara*

Lantana camara is present in various patches throughout the study area, particularly in the disturbed vegetation types. This KTP may result in overshadowing by shrubs. As per the above point for invasive grasses, the proposal may exacerbate this KTP, however, the impacts of this KTP can be reduced through appropriate controls and applications of weed management mitigation measures during and after construction.

Conclusion

The proposal would require the removal of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590). Of this, about 13.51 hectares may provide potential habitat for *Corybas dowlingii*.

The 13.51 hectares of potential habitat to be cleared is not considered to be a significant area of habitat or of importance to the long-term survival of *Corybas dowlingii* in the locality. As a result, it is considered unlikely that the proposal represents a significant impact to this endangered species. A Species Impact Statement is not required for this species.

Maundia triglochinoides

Maundia triglochinoides is listed as Vulnerable under the BC Act. The species is largely restricted to coastal NSW and its current distribution extends from Wyong in the south to southern Queensland in the north. Habitat for *Maundia triglochinoides* occurs in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay with low nutrients. Populations of the species may expand during flood events and contract to more permanent wetlands in times of low rainfall.

The species has a moderate likelihood of occurrence within the study area. It was not identified during flora surveys across the study area, including targeted seasonal surveys, however the study area supports some small areas of potential habitat for *Maundia triglochinoides* within drainage soaks and channels and at the edge of Grahamstown Dam. RPS (2019) recorded a population of *Maundia triglochinoides* in the Kings Hill Development study area; this population is located about two kilometres to the west of the study area.

(a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The following is known about the life cycle of *Maundia triglochinoides* (OEH 2019, Benson and McDougall 2002, LES 2013):

- Flowering occurs during warmer months, between November and January.
- The species is probably wind-pollinated.
- Dispersal is likely to be via water, which would disperse both seeds and root tubers. Dispersal may also be facilitated through transport of propagules via machinery, or ingestion of seeds by livestock or waterfowl; Purple Swamphen (*Porphyrio porphyria*) has been observed foraging on the seed heads of this species.
- The plant bears a smooth shiny dehiscent capsule, with each capsule containing a few hard seeds. The hard seed coat may be adapted for periods of prolonged dormancy in the soil.
- *Maundia triglochinoides* also spreads vegetatively, with tufts of leaves arising along a rhizome. Populations may expand following flood events and contract to more permanent wetlands in drier times. The species may have a 'boom and bust' life cycle that is likely to be linked to the El Niño - Southern Oscillation (ENSO) cycle (LES 2013).

The proposal would require the removal of some small areas of potential habitat for *Maundia triglochinoides*. The species has not been identified in the study area over multiple years of survey; the closest record of *Maundia triglochinoides* is located two kilometres to the west of the study area. There is currently no evidence that a viable local population of the species occurs in the study area, nor that populations in the locality would be indirectly affected by the proposal. As such, it is considered unlikely that the proposal would have an adverse effect on the life cycle of *Maundia triglochinoides* such that a viable local population is likely to be placed at risk of extinction.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. *Maundia triglochinoides* is a threatened species.

(c) In relation to a habitat of a threatened species, population or ecological community:

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

The study area contains some small areas of potential habitat for *Maundia triglochinoides* within drainage soaks and channels, mainly to the west of the Pacific Highway, and at the edge of Grahamstown Dam. Although the extent of potential habitat for the species has not been measured, it is likely to comprise less than a hectare. All of this potential habitat would be removed as a result of the proposal.

Although the proposal will increase the edge effects within some retained areas of potential habitat for *Maundia triglochinoides*, it will not result in further fragmentation or isolation of any identified local population of the species.

The area of potential habitat for *Maundia triglochinoides* to be cleared mainly comprises small areas of permanent and ephemeral drainage lines within cleared and modified areas. It is not expected that the less than one hectares of potential habitat is of high importance to the long-term survival of the species in the locality.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for *Maundia triglochinoides*.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of, a key threatening process.

Of the key threatening processes listed in Schedule 4 of the BC Act, the following are relevant to the potential impacts of the proposal on *Maundia triglochinoides*:

- Clearing of native vegetation

Less than one hectare of potential habitat would be cleared. This does not represent a significant area of this species' habitat in the locality.

- Invasion of native plant communities by exotic perennial grasses

Perennial exotic grass species occur within the study area, mainly in disturbed road verge habitats and cleared areas, including areas of potential habitat for *Maundia triglochinoides*. The proposal may exacerbate this KTP by facilitating the spread of seeds or fragments of plant to areas where weeds are not present, via plant or contaminated topsoil. The impacts of this KTP can be reduced through appropriate controls and applications of weed management mitigation measures during and after construction.

Conclusion

The proposal would require the removal of less than a hectare of potential habitat for *Maundia triglochinoides*. This area of potential habitat is not considered to be a significant area of habitat or of importance to the long-term survival of *Maundia triglochinoides* in the locality. As a result, it is considered unlikely that the proposal represents a significant impact to this vulnerable species. A Species Impact Statement is not required for this species.

Pterostylis chaetophora

Pterostylis chaetophora is listed as Vulnerable under the BC Act. This species is currently known from 18 scattered locations between Taree and Kurri Kurri, with additional records near Denman and Wingen (OEH 2019).

Preferred habitat for *Pterostylis chaetophora* is seasonally moist, dry sclerophyll forest with a grass and shrub understorey (OEH 2019).

The study area supports potential habitat for *Pterostylis chaetophora*. RPS (2019) recorded a population of *Pterostylis chaetophora* in the Kings Hill Development study area; this population is located about 50 metres to the west of the study area. There is another record of the species in the OEH BioNet database to the east of the study area, located about 90 metres away in vegetation adjoining Grahamstown Dam. This record is dated from 2017.

The species has a high likelihood of occurrence within the study area. It was not identified during flora surveys across the study area; targeted surveys for *Pterostylis chaetophora* were conducted by RPS (2019) within the portion of the study area to the west of the Pacific Highway. Targeted surveys for this species have not been undertaken within the portion of the study area to the east of the Pacific Highway; previous targeted surveys conducted within this area did not specifically target *Pterostylis chaetophora*, and only one day of targeted orchid survey within the known flowering period of September to early November has been conducted, on 13 September 2012. Most records of *Pterostylis chaetophora* in the OEH Bionet database are dated between late September and late October.

(a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The following is known about the life cycle of *Pterostylis chaetophora* (OEH 2019):

- The species flowers from September to November.
- Vegetative reproduction is not common in this group of Greenhoods, but some species may form more than one dropper annually.
- The species fails to flower in dry seasons.
- Plants are deciduous and die back to the large, underground tubers after seed release.
- New rosettes are produced following soaking autumn and winter rains.

The proposal would remove 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590), of which about 13.51 hectares forms potential habitat for *Pterostylis chaetophora*. The closest record of the species is located about 50 metres to the west of the study area, however this occurrence of the species is likely to be removed as part of the Kings Hill Development. The next closest record is about 90 metres to the east in the Grahamstown Dam catchment. RPS (2019) states that the known population of *Pterostylis chaetophora* in the Grahamstown Lake Catchment Area contains 'hundreds of plants', although most are known from a patch of about 100 m².

Multiple surveys of the study area between 2012 and 2019 did not detect *Pterostylis chaetophora* in the study area, however to date the species has not been subject to targeted searches within the study area during the known flowering period. As such, a conclusion on whether the proposal would have an adverse effect on the life cycle of *Pterostylis chaetophora* such that a viable local population is likely to be placed at risk of extinction cannot be made until further seasonal targeted surveys for the species are conducted.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. *Pterostylis chaetophora* is a threatened species.

(c) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposal will involve the clearing of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590), some of which represents suitable habitat for *Pterostylis chaetophora*. The more disturbed zones of PCT 1590 within the study area are unlikely to represent suitable habitat for the species; as such, 13.51 hectares of the total area of the PCT impacted is considered to form suitable habitat for *Pterostylis chaetophora*.

The proposal may increase the edge effects within some retained areas of known habitat for *Pterostylis chaetophora* to the east of the study area; although the cleared edge is about 90 metres away from the record, it is not known how far this population extends. The proposal, along with the larger Kings Hill Development, would also result in further fragmentation of potential habitat and may increase the isolation of the local population of the species, particularly to the south-west of the known record where existing potential habitat for the species would be cleared, and across the Pacific Highway to the west where individuals would be cleared as part of the Kings Hill Development.

The area of potential habitat for *Pterostylis chaetophora* to be cleared comprises linear strips of vegetation with existing edge effects. The importance of the 13.51 hectares of potential habitat that would be impacted to the long-term survival of the species in the locality is not clear without determining the presence of the species in the study area, and, if present, the size and extent of the population. Given the existence of a population of the species within the Grahamstown Lake Catchment Area adjoining the study area, and another in Columbey National Park about 13 kilometres to the north-west of the study area, unless there is a large population of the species in the study area then the potential habitat present is unlikely to be of high importance to the long-term survival of the species in the locality.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for *Pterostylis chaetophora*.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of, a key threatening process.

Of the key threatening processes listed in Schedule 4 of the BC Act, the following are relevant to the potential impacts of the proposal on *Pterostylis chaetophora*:

- Clearing of native vegetation

Approximately 13.51 hectares of native vegetation that contains potential habitat would be cleared. This does not represent a significant area of this species' habitat in the locality.

- Invasion of native plant communities by exotic perennial grasses

Perennial exotic grass species occur within the study area, mainly in disturbed road verge habitats and cleared areas. The proposal may exacerbate this KTP by facilitating the spread of seeds or fragments of plant to areas where weeds are not present, via plant or contaminated topsoil. The impacts of this KTP can be reduced through appropriate controls and applications of weed management mitigation measures during and after construction.

- Invasion, establishment and spread of *Lantana camara*

Lantana camara is present in various patches throughout the study area, particularly in the disturbed vegetation types. This KTP may result in overshadowing by shrubs. As per the above point for invasive grasses, the proposal may exacerbate this KTP, however, the impacts of this KTP can be reduced through appropriate controls and applications of weed management mitigation measures during and after construction.

Conclusion

The proposal would require the removal of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (PCT 1590). Of this, about 13.51 hectares forms potential habitat for *Pterostylis chaetophora*. There are records of the species about 50 metres to the west and about 90 metres to the east. Hundreds of plants of *Pterostylis chaetophora* are reported to be present in the Grahamstown Lake Catchment Area (RPS 2019).

Multiple surveys of the study area between 2012 and 2019 did not detect *Pterostylis chaetophora* in the study area, however to date the species has not been subject to targeted searches within the portion of the study area to the east of the Pacific Highway during the known flowering period. As such, a conclusion on whether the proposal would have a significant impact on *Pterostylis chaetophora* cannot be determined without determining the presence of the species in the study area, and, if present, the size and extent of the population. This assessment therefore cannot be finalised until further seasonal targeted surveys for the species are conducted.

Diurnal raptors

Potential impacts on the following threatened diurnal raptor species have been assessed in accordance with the five factors set out in Section 7.3 of the BC Act:

- Spotted Harrier (*Circus assimilis*) – Vulnerable
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*) – Vulnerable
- Square-tailed Kite (*Lophoictinia isura*) – Vulnerable

No Spotted Harrier, White-bellied Sea-Eagle or Square-tailed Kite were recorded in the study area during field surveys. The OEH BioNet database shows recent records for all of these species from within 10 kilometres of the study area, and the study area provides suitable habitat for all three of these diurnal raptors. All three of these diurnal raptors are therefore considered to have a 'moderate' likelihood of occurrence within the study area.

Due to broad similarities in habitat requirements and ecology, impacts to these species have been considered as a single assessment of significance.

Distribution, habitat and ecology

The Spotted Harrier is listed as Vulnerable under the BC Act. The species occurs throughout the Australian mainland, except for in densely forested or wooded habitats along the coastline, escarpment and ranges. In NSW, it is widespread and comprises a single population. The species predominantly occurs in grassy open woodland, inland riparian woodland, grassland and shrub steppe. Most commonly, it is observed in native grassland, but has also been recorded in agricultural land foraging over open habitats and along riparian edges. The Spotted Harrier builds stick nests in trees and lays eggs in Spring (sometimes Autumn), with young remaining in the nest for several months. The species preys on terrestrial mammals (e.g. bandicoots, bettongs and rodents), birds and reptiles. The Spotted Harrier occasionally forages on insects, and rarely preys on carrion.

The White-bellied Sea-Eagle is listed as Vulnerable under the BC Act. The species is distributed around the Australian coastline, as well as inland along rivers and wetlands of the Murray Darling Basin. In NSW, it is widespread along the east coast and all major inland rivers and waterways. It inhabits coastal dunes, tidal flats, grassland, heathland, woodland and forest, and occurs at sites near the sea, or within the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Breeding habitat consists of mature tall open forest, woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches. Eggs are laid in late Winter, with young remaining in the nest for 65-70 days. The White-bellied Sea-Eagle preys on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion.

The Square-tailed Kite is listed as Vulnerable under the BC Act. The species ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, there are scattered records although records indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. In the south-east and along the NSW south coast, the species is a summer breeding migrant, arriving in September and leaving by March. The species is found in a variety of timbered habitats including dry woodlands and open forests. In particular, the Square-tailed Kite preference timbered watercourses and appear to occupy hunting ranges of more than 100km². Breeding occurs from July to February, with nest sites generally located on or within proximity to watercourses. Nests are usually located in a fork or on large horizontal tree limbs. The Square-tailed Kite is a specialist hunter of passerines, especially honeyeaters. The species will target nestlings in particular, picking most prey items from the outer foliage of the tree canopy.

- (a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,**

No diurnal raptor nests were observed in the study area. Vegetation proposed for removal would not be suitable as nesting trees and given the fidelity of all three diurnal raptor species to nest sites, it is unlikely that they would nest within the study area in the future. Due to the small area of potential foraging habitat to be impacted (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest and 3 hectares of foraging habitat along the dam foreshore for White-bellied Sea-Eagle), and the low potential of occurrence of breeding, it is unlikely that the proposal would impact the life cycle of the Spotted Harrier, White-bellied Sea-Eagle and Square-tailed Kite. Consequently, viable local populations for all three species are unlikely to be placed at risk of extinction.

- (b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable. The Spotted Harrier, White-bellied Sea-Eagle and Square-tailed Kite are threatened species.

- (c) in relation to the habitat of a threatened species or ecological community:**

- (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

The proposed works at Kings Hill would require the removal of 18 hectares of potential foraging and roosting habitat for the Spotted Harrier, White-bellied Sea-Eagle and Square-tailed Kite. In addition, 3 hectares of foraging habitat along the dam foreshore for White-bellied Sea-Eagle will be removed. The extent of habitat to be removed is minor given the availability of substantial areas of good condition, suitable habitat, such as riparian zones surrounding the Hunter and Williams Rivers, Medowie State Conservation Area and Tilligerry State Conservation Area, in nearby areas.

The removal of 18 hectares (and an additional 3 hectares for White-bellied Sea-Eagle) of potential habitat would not result in a significant reduction of habitat connectivity in the region. Similar habitat surrounding the study area is unlikely to become isolated or fragmented as a result of clearing for the proposal.

The small area of potential habitat to be removed in the study area is not likely to be important to the long-term survival of the Spotted Harrier, White-bellied Sea-Eagle and Square-tailed Kite in the locality.

- (d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for the Spotted Harrier, White-bellied Sea-Eagle and Square-tailed Kite.

- (e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

Schedule 4 of the BC Act provides a list of the 'key threatening processes' (KTPs). Of the KTPs listed in Schedule 4 of the BC Act, several are applicable to the proposed works at Kings Hill. Of those, the following are relevant to the Spotted Harrier, White-bellied Sea-Eagle and Square-tailed Kite:

- Clearing of native vegetation

Native vegetation will be cleared for the proposed works at Kings Hill. Vegetation proposed for removal contains potential foraging habitat for all three diurnal raptor species. However, the extent of vegetation to be removed is minor given the availability of suitable habitat in nearby areas.

- Removal of dead wood and dead trees

Dead wood and dead trees may be removed as a result of the proposed works at Kings Hill. The White-bellied Sea-Eagle is known to occasionally construct nests in large dead trees. However, it is unlikely that dead trees within the study area provide suitable nesting habitat for any of the three diurnal raptor species.

Conclusion

In light of the consideration of the above five factors, the proposed works at Kings Hill are unlikely to have a significant impact on the Spotted Harrier, White-bellied Sea-Eagle and Square-tailed Kite in the study area, or wider locality, as a result of the proposed actions as:

- The proposed works would not adversely affect the lifecycle of the species such that viable local populations are likely to be placed at risk of extinction;
- The proposed works would not substantially fragment habitat for the species and;
- The proposed works are unlikely to exacerbate any KTPs, and do not comprise a significant area of habitat for any of the three diurnal raptor species.

Consequently, preparation of a Species Impact Statement (SIS) is not required.

Large forest owls

Potential impacts on the following threatened large forest owl species have been assessed in accordance with the five factors set out in Section 7.3 of the BC Act:

- Powerful Owl (*Ninox strenua*) – Vulnerable
- Masked Owl (*Tyto novaehollandiae*) – Vulnerable

The Powerful Owl and Masked Owl was not recorded in the study area during field surveys. One deceased Masked Owl was recorded by PEA Consulting in the southern extent of the study area. The OEH BioNet database shows recent records for both owl species from within 10 kilometres of the study area, and the study area provides suitable habitat for both the Powerful Owl and Masked Owl. The Masked Owl is therefore 'recorded', and the Powerful Owl considered to have a 'moderate' likelihood of occurrence within the study area.

Due to broad similarities in habitat requirements and ecology, impacts to these species have been considered as a single assessment of significance.

Distribution, habitat and ecology

The Powerful Owl (*Ninox strenua*) is listed as Vulnerable under the BC Act. The species is endemic to eastern and south-eastern Australia, predominantly occurring on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout forested habitats, however inland populations have collapsed due to land clearing. The Powerful Owl inhabits a range of vegetation types from woodland and open sclerophyll forest to tall open wet forest and rainforest. Large areas of habitat are required; however, the species can occur in fragmented landscapes. Dense vegetation is used for diurnal roosting, while forests and

woodlands are used for foraging and breeding. The Powerful Owl mainly preys on medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. Prey can vary regionally, with Ringtail Possum making up the bulk of diet for Powerful Owls in southern NSW. Breeding pairs demonstrate high fidelity to territories with territory size varying with habitat quality. The species nests in large tree hollows (at least 0.5m deep) and at least 150 years old. Powerful Owls are monogamous and mate for life. Nesting occurs from late Autumn to mid-Winter. Clutches consist of two dull white eggs and incubation lasts approximately 38 days.

The Masked Owl (*Tyto novaehollandiae*) is listed as Vulnerable under the BC Act. Distribution of the Masked Owl throughout Australia is sparse, with 90% of records occurring in NSW. In NSW, the species is widespread within and east of the Great Dividing Range, from Murwillumbah on the north coast to Ben Boyd National Park in the south. Scattered records of the species have been made west of the Great Dividing Range, as far west as Fowlers Gap. The species inhabits dry eucalypt forests and woodlands from sea level up to 1100m that contain tall or dense mature trees that support hollows suitable for nesting and roosting. Although a forest owl, the species will often hunt along forest and roadside edges. The typical diet consists of tree-dwelling and ground mammals, especially rats. Masked Owl roost and breed in moist eucalypt forested gullies, utilising large tree hollows or sometimes caves for nesting. This species has previously been identified as roadkill in proximity to Irrawang Spillway by PEA Consulting.

- (a) *in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,***

Several trees were identified within the study area with large hollows suitably sized for nesting large forest owls. Stag-watch surveys were undertaken at these trees and no owls were recorded exiting hollows. As such, it is unlikely that these species are breeding on the study area. Due to the small area of potential foraging habitat to be impacted (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest), and the low potential of occurrence of breeding, it is unlikely that the proposal would impact the life cycle of the Powerful Owl and Masked Owl. Consequently, viable local populations for both species are unlikely to be placed at risk of extinction.

- (b) *in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:***

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
(ii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

Not applicable. The Powerful Owl and Masked Owl are threatened species.

- (c) *in relation to the habitat of a threatened species or ecological community:***

- (i) *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and***

- (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and***

- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,***

The proposed works at Kings Hill would require the removal of 18 hectares of potential foraging and roosting habitat for the Powerful Owl and Masked Owl. In addition, the removal of up to 41 hollow-bearing trees would likely reduce prey density in the broader area and may contain hollows suitable for nesting. However, the extent of habitat to be removed is minor given the availability of substantial areas of good condition, suitable habitat, such as riparian zones surrounding the Hunter

and Williams Rivers, Meadowie State Conservation Area and Tilligerry State Conservation Area, in nearby areas.

The removal of 18 hectares of potential habitat would not result in a significant reduction of habitat connectivity in the region. The habitat is already highly fragmented from the Pacific Highway, rural land and access easements. Similar habitat surrounding the study area is unlikely to become isolated or fragmented as a result of clearing for the proposal.

Given the lack of species presence and breeding pairs identified in the potential nest trees to be impacted, the small area of potential foraging habitat to be removed in the study area is not likely to be important to the long-term survival of the Powerful Owl and Masked Owl in the locality.

(d) *whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),*

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for the Powerful Owl or Masked Owl.

(e) *whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.*

Schedule 4 of the BC Act provides a list of the 'key threatening processes' (KTPs). Of the KTPs listed in Schedule 4 of the BC Act, several are applicable to the proposed works at Kings Hill. Of those, the following are relevant to the Powerful Owl and Masked Owl:

- Clearing of native vegetation

Native vegetation will be cleared for the proposed works at Kings Hill. Vegetation proposed for removal contains potential foraging habitat for both large forest owl species. However, the extent of vegetation to be removed is minor given the availability of suitable habitat in nearby areas.

- Removal of tree hollows

Up to 41 hollow-bearing trees are proposed to be removed as a result of works at Kings Hill. Hollow-bearing trees proposed for removal may support large tree hollows suitable for nesting large forest owls. Hollow-bearing trees also provide habitat for preferred prey species. However, the extent of hollow-bearing trees to be removed is minor given the availability of suitable habitat in nearby areas.

Conclusion

In light of the consideration of the above five factors, the proposed works at Kings Hill are unlikely to have a significant impact on the Powerful Owl and Masked Owl in the study area, or wider locality, as a result of the proposed actions as:

- The proposed works would not adversely affect the lifecycle of the species such that viable local populations are likely to be placed at risk of extinction;
- The proposed works would not substantially fragment habitat for the species and;
- The proposed works are unlikely to exacerbate any KTPs, and do not comprise a significant area of habitat for either of the two large forest owl species.

Consequently, preparation of a Species Impact Statement (SIS) is not required.

Cockatoos

Potential impacts on the following threatened cockatoo species has been assessed in accordance with the five factors set out in Section 7.3 of the BC Act:

- Glossy Black-Cockatoo (*Calyptorhynchus lathami*) – Vulnerable

The Glossy Black-Cockatoo was not recorded in the study area during field surveys. However, previous surveys have recorded chewed seed cones within the study area, and flocks of the species have been observed in the wider area. Further, the OEH BioNet database shows recent records for the species from within 10 kilometres of the study area. Suitable habitat for the Glossy Black-Cockatoo is present within the study area. The Glossy Black-Cockatoo is therefore considered to have a 'high' likelihood of occurrence within the study area.

Distribution, habitat and ecology

The Glossy Black-Cockatoo is listed as Vulnerable under the BC Act. The species is uncommon although widespread throughout suitable forest and woodland habitats from along the central Queensland coastline to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW. An isolated population also exists on Kangaroo Island, South Australia. The Glossy Black-Cockatoo inhabits open forest and woodlands of the coast and Great Dividing Range where stands of sheoak occur. In the locality of the study area the Glossy Black-Cockatoo feeds almost exclusively on seeds extracted from the wooden cones of *Allocasuarinas*, particularly *Allocasuarina littoralis* and *A. torulosa*. Inland populations may feed on a greater variety of *Allocasuarina* species. The species typically targets mature trees that are 2m – 10m tall. The Glossy Black-Cockatoo is dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.

The Glossy Black-Cockatoo was not recorded in the study area during field surveys. Evidence of feeding by the Glossy Black-Cockatoo (chewed *Allocasuarina* sp. cones) were recorded near the western boundary of the study area during surveys undertaken for the Kings Hill Development SIS (RPS 2019). The OEH BioNet database shows recent records for this species from within 10 kilometres of the study area, and the study area provides suitable habitat for this species. The Glossy Black-Cockatoo is therefore considered to have a 'high likelihood of occurrence within the study area.

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The study area offers potential foraging and nesting habitat for the Glossy Black-Cockatoo. *Allocasuarina littoralis* occurs commonly in the southern extent of the study area, predominantly within disturbed roadside vegetation and as isolated trees within exotic grassland and on the eastern side of the Pacific Highway. Several trees were identified within the study area with large hollows suitably sized for nesting Glossy Black-Cockatoo. However, no Glossy Black-Cockatoo, including potential breeding pairs, were recorded within the study area.

Due to the small area of potential foraging habitat to be impacted (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest), and the low potential of breeding, it is unlikely that the proposal would impact the life cycle of the Glossy Black-Cockatoo. Consequently, viable local populations for both species are unlikely to be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable. The Glossy Black-Cockatoo is a threatened species.

- (c) *in relation to the habitat of a threatened species or ecological community:*
- (i) *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*
- (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*
- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,*

The proposed works at Kings Hill would require the removal of 18 hectares of vegetation, which represents potential foraging and roosting habitat for the Glossy Black-Cockatoo. In addition, the removal of up to 41 hollow-bearing trees of which a small number are suitable for nesting. However, the extent of habitat to be removed is minor given the availability of substantial areas of good condition, suitable habitat, such as riparian zones surrounding the Hunter and Williams Rivers, Medowie State Conservation Area and Tilligerry State Conservation Area, in nearby areas.

The removal of 18 hectares of vegetation would not result in a significant reduction of habitat connectivity in the region. The habitat is already highly fragmented from the Pacific Highway, rural land and access easements. Similar habitat surrounding the study area is unlikely to become isolated or fragmented as a result of clearing for the proposal.

Given the lack of species presence and breeding pairs identified in the potential nest trees to be impacted, the small area of potential habitat to be removed in the study area is not likely to be important to the long-term survival of the Glossy Black-Cockatoo in the locality.

- (d) *whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),*

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for the Glossy Black-Cockatoo.

- (e) *whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.*

Schedule 4 of the BC Act provides a list of the 'key threatening processes' (KTPs). Of the KTPs listed in Schedule 4 of the BC Act, several are applicable to the proposed works at Kings Hill. Of those, the following are relevant to the Glossy Black-Cockatoo:

- Clearing of native vegetation

Native vegetation will be cleared for the proposed works at Kings Hill. Vegetation proposed for removal contains potential foraging habitat for the Glossy Black-Cockatoo. However, the extent of vegetation to be removed is minor given the availability of suitable habitat in nearby areas.

- Removal of tree hollows

Up to 41 hollow-bearing trees are proposed to be removed as a result of works at Kings Hill. A small number of hollow-bearing trees proposed for removal support large tree hollows that may be suitable for nesting Glossy Black-Cockatoo. However, the extent of hollow-bearing trees to be removed is minor given the availability of suitable habitat in nearby areas.

Conclusion

In light of the consideration of the above five factors, the proposed works at Kings Hill are unlikely to have a significant impact on the Glossy Black-Cockatoo in the study area, or wider locality, as a result of the proposed actions as:

- The proposed works would not adversely affect the lifecycle of the species such that viable local populations are likely to be placed at risk of extinction;

- The proposed works would not substantially fragment habitat for the species and;
- The proposed works are unlikely to exacerbate any KTPs, and do not comprise a significant area of habitat for the Glossy Black-Cockatoo.

Consequently, preparation of a Species Impact Statement (SIS) is not required.

Nectivorous birds

Potential impacts on the following threatened nectivorous bird species have been assessed in accordance with the five factors set out in Section 7.3 of the BC Act:

- Regent Honeyeater (*Anthochaera phrygia*) – Critically Endangered
- Little Lorikeet (*Glossopsitta pusilla*) – Vulnerable
- Swift Parrot (*Lathamus discolor*) – Endangered

The Regent Honeyeater and Swift Parrot were not recorded in the study area during field surveys. The Little Lorikeet was recorded during field surveys. Further, the OEH BioNet database shows recent records for all three nectivorous bird species from within 10 kilometres of the study area and suitable habitat for all three nectivorous species is present within the study area. The Little Lorikeet is therefore 'recorded', and the Regent Honeyeater and Swift Parrot considered to have a 'moderate' likelihood of occurrence within the study area.

Due to broad similarities in habitat requirements and ecology, impacts to these species have been considered as a single assessment of significance.

Distribution, habitat and ecology

The Regent Honeyeater is listed as Critically Endangered under the BC Act. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. The range of the Regent Honeyeater has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW, the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some year's flocks converge on flowering coastal woodlands and forests (e.g. Swamp Mahogany and Spotted Gum), particularly on the central coast and occasionally on the upper north coast. In NSW, the species breeds between July and January in Box-Ironbark and temperate woodlands, and riparian gallery forest dominated by River Sheoak in the Capertee Valley and Bundarra-Barraba regions. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks, as well as in *Mistletoe haustoria*. The species lays two or three eggs which are incubated by the female for 14 days.

The Little Lorikeet is listed as Vulnerable under the BC Act. The species is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. There is evidence that the species make nomadic movements, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs. The Little Lorikeet forages on nectar and pollen primarily in the canopy of open *Eucalyptus* forest and woodland, yet also finds food in a range of isolated flowering trees. Riparian habitats are particularly used, due to higher soil fertility and greater productivity. The species nests in hollows within proximity to foraging areas. Hollows generally have small entrances (~3cm) and are 2m – 15m off the ground. The species shows high fidelity to nest sites and breeds between May and September. In prolific flowering years, the species may breed twice, producing 3 – 4 eggs per attempt. Several small flocks

(between two and five birds) of the Little Lorikeet were recorded during field surveys by Arcadis in July/August 2019.

The Swift Parrot is listed as Endangered under the BC Act. The species breeds in Tasmania during Spring and Summer, migrating in the Autumn and Winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW the species mostly occurs on the coast and south west slopes. On the mainland, the species targets areas of profuse flowering of eucalypts, or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Forest Red Gum *E. tereticornis*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana*, Blackbutt *E. pilularis*, and Yellow Box *E. melliodora*. There is evidence that Swift Parrot return to foraging sites on a cyclic basis depending on food availability.

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The study area offers potential foraging and nesting habitat for the Little Lorikeet. No breeding sites for the Regent Honeyeater occur in the study area, and the Swift Parrot breeds in Tasmania. As such, only potential foraging habitat exists for these species within the study area.

Several trees were identified within the study area with hollows suitably sized for nesting Little Lorikeet. However, no Little Lorikeet were recorded breeding within the study area during numerous surveys over several years. There is a low likelihood that the Little Lorikeet may infrequently use small tree hollows within the study area for breeding, however it is unlikely that the study area supports breeding habitat for a large proportion of the population of this species.

Due to the small area of potential foraging habitat to be impacted (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest), low potential of occurrence of breeding for Little Lorikeet, and no suitable breeding habitat for Regent Honeyeater or Swift Parrot, it is unlikely that the proposal would impact the life cycle of these three nectivorous species. Consequently, viable local populations for the Regent Honeyeater, Little Lorikeet and Swift Parrot are unlikely to be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable. The Regent Honeyeater, Little Lorikeet and Swift Parrot are threatened species.

(c) in relation to the habitat of a threatened species or ecological community:

- (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,**

The proposed works at Kings Hill would require the removal of 18 hectares of potential foraging and roosting habitat for the Regent Honeyeater, Little Lorikeet and Swift Parrot. In addition, the removal of up to 41 hollow-bearing trees may contain hollows suitable for nesting Little Lorikeet.

However, the extent of habitat to be removed is minor given the availability of substantial areas of good condition, suitable habitat, such as riparian zones surrounding the Hunter and Williams Rivers, Medowie State Conservation Area and Tilligerry State Conservation Area, in nearby areas.

The removal of 18 hectares of potential habitat would not result in a significant reduction of habitat connectivity in the region. The habitat is already highly fragmented from the Pacific Highway, rural land and access easements. Similar habitat surrounding the study area is unlikely to become isolated or fragmented as a result of clearing for the proposal.

Given the lack of species presence and breeding pairs of Little Lorikeet identified in the potential nest trees to be impacted, the small area of potential habitat to be removed in the study area is not likely to be important to the long-term survival of the Regent Honeyeater, Little Lorikeet and Swift Parrot in the locality.

(d) *whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),*

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for the Regent Honeyeater, Little Lorikeet and Swift Parrot.

(e) *whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.*

Schedule 4 of the BC Act provides a list of the 'key threatening processes' (KTPs). Of the KTPs listed in Schedule 4 of the BC Act, several are applicable to the proposed works at Kings Hill. Of those, the following are relevant to the Regent Honeyeater, Little Lorikeet and Swift Parrot:

- Clearing of native vegetation

Native vegetation will be cleared for the proposed works at Kings Hill. Vegetation proposed for removal contains potential foraging habitat for all three nectarivorous species. However, the extent of vegetation to be removed is minor given the availability of suitable habitat in nearby areas.

- Removal of tree hollows

Up to 41 hollow-bearing trees are proposed to be removed as a result of works at Kings Hill. Hollow-bearing trees proposed for removal may support tree hollows suitable for nesting Little Lorikeet. However, the extent of hollow-bearing trees to be removed is minor given the availability of suitable habitat in nearby areas.

Conclusion

In light of the consideration of the above five factors, the proposed works at Kings Hill are unlikely to have a significant impact on the Regent Honeyeater, Little Lorikeet and Swift Parrot in the study area, or wider locality, as a result of the proposed actions as:

- The proposed works would not adversely affect the lifecycle of the species such that viable local populations are likely to be placed at risk of extinction;
- The proposed works would not substantially fragment habitat for the species and;
- The proposed works are unlikely to exacerbate any KTPs, and do not comprise a significant area of habitat for either of the three nectarivorous bird species.

Consequently, preparation of a Species Impact Statement (SIS) is not required.

Insectivorous birds

Potential impacts on the following threatened insectivorous bird species have been assessed in accordance with the five factors set out in Section 7.3 of the BC Act:

- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) – Vulnerable

- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) – Vulnerable
- Varied Sittella (*Daphoenositta chrysoptera*) – Vulnerable
- Scarlet Robin (*Petroica boodang*) – Vulnerable
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) – Vulnerable

The Dusky Woodswallow, Brown Treecreeper, Varied Sittella and Scarlet Robin were not recorded during field surveys. The Grey-crowned Babbler was recorded adjacent to the study area during field surveys by PEA Consulting. Further, the OEH BioNet database shows recent records for all five insectivorous bird species from within 10 kilometres of the study area and suitable habitat for all five insectivorous species is present within the study area. The Grey-crowned Babbler and the Varied Sittella have a 'high' likelihood of occurrence in the study area. Dusky Woodswallow, Brown Treecreeper and Scarlet Robin are considered to have a 'moderate' likelihood of occurrence within the study area.

Due to broad similarities in habitat requirements and ecology, impacts to these species have been considered as a single assessment of significance.

Distribution, habitat and ecology

The Dusky Woodswallow is listed as Vulnerable under the BC Act. Dusky Woodswallow are widespread in eastern, southern and south-western Australia. The species occurs throughout most of NSW, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. Dusky Woodswallow primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands, farmland, woodland edges and very occasionally in moist forest or rainforest. In NSW, after breeding, birds migrate to the north of the state and south-eastern Queensland. The species nests in an open, cup-shape nest made of twigs, grass, fibrous rootlets and occasionally *Casuarina* needles. Generally, nests occur in shrubs or low trees in forks, in hollow stumps or logs, behind loose bark or in fence posts.

The Brown Treecreeper is listed as Vulnerable under the BC Act. The eastern subspecies lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands such as the Snowy River Valley, Cumberland Plains, Hunter Valley and parts of the Richmond and Clarence Valleys. The population density of this subspecies has been greatly reduced over much of its range, with major declines recorded in central NSW and the northern and southern tablelands. Declines have occurred in remnant vegetation fragments smaller than 300 hectares, that have been isolated or fragmented for more than 50 years. The Brown Treecreeper mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey. It usually is not found in areas with dense shrub. Fallen timber is an important habitat component for foraging; the species pecking and probing for insects, mostly ants, amongst leaf litter, tussocks, fallen timber and along trunks and lateral branches. The species breeds in pairs or co-operatively in territories which range in size from 1.1 to 10.7 ha (mean = 4.4 ha). Each group is composed of a breeding pair with retained male offspring and, rarely, retained female offspring. Often in pairs or cooperatively breeding groups of two to five birds.

The Varied Sittella is listed as Vulnerable under the BC Act. The species is sedentary and inhabits most of mainland Australia except for treeless deserts and open grasslands. In NSW, the Varied Sittella has a continuous distribution from the coast to the far west. The species predominantly inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. Varied Sittella feed on arthropods gleaned from crevices in bark and trees. The species builds a cup-shaped nest

of plant fibres and cobwebs in an upright tree fork high in the living tree canopy. Varied Sittella often reuse the same fork or tree in successive years.

The Scarlet Robin is listed as Vulnerable under the BC Act. The Scarlet Robin is found from south east Queensland to south east South Australia. The species is also found in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. The species inhabits dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. Logs and fallen timber are an important habitat components for the species as they forage for insects and invertebrates on the ground. In Autumn and Winter, the species may live in open grassy woodlands and grasslands or grazed paddocks with scattered trees. The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. Scarlet Robin pairs defend a breeding territory and mainly breed between the months of July and January; they may raise two or three broods in each season. This species' nest is an open cup made of plant fibres and cobwebs and is built in the fork of tree usually more than 2m above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub.

The Grey-crowned Babbler is listed as Vulnerable under the BC Act. The eastern subspecies (*temporalis*) occurs from Cape York south through Queensland, NSW and Victoria and formerly to the south east of South Australia. This subspecies also occurs in the Trans-Fly Region in southern New Guinea. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. The species inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions. Grey-crowned Babbler live in family groups that consist of a breeding pair and young from previous breeding seasons. The species feeds on invertebrates by foraging in trees or on the ground, digging and probing amongst leaf litter and tussock grasses. The species build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Nests are maintained year round, and old nests are often dismantled to build new ones. Grey-crowned Babbler breed between July and February. Usually two to three eggs are laid and incubated by the female. During incubation, the adult male and several helpers in the group may feed the female as she sits on the nest. Young birds are fed by all other members of the group. Territories range from one to fifty hectares (usually around 10 hectares) and are defended all year. Territorial disputes with neighbouring groups are frequent and may last up to several hours, with much calling, chasing and occasional fighting.

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The study area offers potential foraging and nesting habitat for all five insectivorous bird species. Up to 41 hollow-bearing trees will be removed for the proposal, some of which may contain small hollows suitable for nesting Brown Treecreepers and Dusky Woodswallows. The remaining species build nests and could be using resources available within the study area for breeding. However, none of these species were observed to be present or breeding within the study area during the current surveys. Due to the small area of potential foraging habitat to be impacted (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest), the absence of records during surveys, the low potential of occurrence of breeding and the small area of potential breeding habitat present, it is unlikely that the proposal would impact the life cycle of these five insectivorous bird species. Consequently, viable local populations for the Dusky Woodswallow, Brown Treecreeper, Varied Sittella, Scarlet Robin and Grey-crowned Babbler are unlikely to be placed at risk of extinction.

- (b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**
- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable. The Dusky Woodswallow, Brown Treecreeper, Varied Sittella, Scarlet Robin and Grey-crowned Babbler are threatened species.

- (c) in relation to the habitat of a threatened species or ecological community:**
- (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,**

The proposed works at Kings Hill would require the removal of 18 hectares of potential foraging, roosting and breeding habitat for the Dusky Woodswallow, Brown Treecreeper, Varied Sittella, Scarlet Robin and Grey-crowned Babbler. The proposal would also require removal of up to 41 hollow-bearing trees that may provide suitable breeding resources for the Brown Treecreeper and the Dusky Woodswallow. However, the extent of habitat to be removed is minor given the availability of substantial areas of good condition, suitable habitat, such as riparian zones surrounding the Hunter and Williams Rivers, Medowie State Conservation Area and Tilligerry State Conservation Area, in nearby areas.

The removal of 18 hectares of potential habitat would not result in a significant reduction of habitat connectivity in the region. The habitat is already highly fragmented from the Pacific Highway, rural land and access easements. Similar habitat surrounding the study area is unlikely to become isolated or fragmented as a result of clearing for the proposal.

Given the absence of records from within the study area and the narrow, linear shape and small area of potential habitat to be removed in the study area is not likely to be important to the long-term survival of the Dusky Woodswallow, Brown Treecreeper, Varied Sittella, Scarlet Robin and Grey-crowned Babbler in the locality.

- (d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),**

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for the Dusky Woodswallow, Brown Treecreeper, Varied Sittella, Scarlet Robin and Grey-crowned Babbler.

- (e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.**

Schedule 4 of the BC Act provides a list of the 'key threatening processes' (KTPs). Of the KTPs listed in Schedule 4 of the BC Act, several are applicable to the proposed works at Kings Hill. Of those, the following are relevant to the Dusky Woodswallow, Brown Treecreeper, Varied Sittella, Scarlet Robin and Grey-crowned Babbler:

- Clearing of native vegetation

Native vegetation will be cleared for the proposed works at Kings Hill. Vegetation proposed for removal contains foraging, roosting and breeding habitat for the Dusky Woodswallow, Brown

Treecreeper, Varied Sittella, Scarlet Robin and Grey-crowned Babbler. However, the extent of vegetation to be removed is minor given the availability of suitable habitat in nearby areas.

- Removal of tree hollows

Up to 41 hollow-bearing trees are proposed to be removed as a result of works at Kings Hill. Hollow-bearing trees proposed for removal may support tree hollows suitable for nesting Brown Treecreeper and Dusky Woodswallow. However, the extent of hollow-bearing trees to be removed is minor given the availability of suitable habitat in nearby areas.

- Removal of dead wood and dead trees

Dead wood and dead trees may be removed as a result of the proposed works at Kings Hill. Dead wood comprises foraging habitat for all five insectivorous species and is an important habitat component for Brown Treecreeper, Scarlet Robin and Dusky Woodswallow. However, it is unlikely that the dead wood removed within the study area comprises significant habitat and would significantly affect any of the five insectivorous species, given their lack of presence in the study area.

Conclusion

In light of the consideration of the above five factors, the proposed works at Kings Hill are unlikely to have a significant impact on the Dusky Woodswallow, Brown Treecreeper, Varied Sittella, Scarlet Robin and Grey-crowned Babbler in the study area, or wider locality, as a result of the proposed actions as:

- The proposed works would not adversely affect the lifecycle of the species such that viable local populations are likely to be placed at risk of extinction;
- The proposed works would not substantially fragment habitat for the species and;
- The proposed works are unlikely to exacerbate any KTPs, and do not comprise a significant area of habitat for any of the five insectivorous bird species.

Consequently, preparation of a Species Impact Statement (SIS) is not required.

Large arboreal mammals

Potential impacts on the following threatened large arboreal mammal species have been assessed in accordance with the five factors set out in Section 7.3 of the BC Act:

- Koala (*Phascolarctos cinereus*) – Vulnerable

The Koala is 'recorded' within the study area. One Koala was sighted within the study area during surveys by Arcadis in July/August 2019. Koala scats were recorded from three SAT survey locations on the east side of the study area, east of the Pacific Highway, by Arcadis in 2017 and 2019. In addition, Koala surveys carried out by PEA Consulting in 2013 recorded Koala scats and scratches in the study area, however, no individual Koalas were sighted. Koala sightings and scats were recorded from adjacent to the western boundary of the study area during surveys undertaken for the Kings Hill Development Species Impact Statement (RPS 2019).

Bionet database search results (OEH 2019) show that there are 2,301 records of within 10 kilometres of the study area. A large number of records are located within Raymond Terrace township, Medowie State Forest to the north-east of Grahamstown Dam, and in native vegetation on the southern shores of Grahamstown Dam and between Newcastle Airport and Medowie. Few records are located in proximity to the study area or west of Grahamstown Dam.

Distribution, habitat and ecology

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW, Koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range.

Koalas inhabit a range of eucalypt forest and woodland communities, including coastal forests, the woodlands of the tablelands and western slopes, and the riparian communities of the western plains. Koalas are also known to utilise isolated paddock trees. Koalas feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species. The quality of forest and woodland communities as habitat for Koalas is influenced by a range of factors including species and size of trees present, structural diversity of the vegetation, soil nutrients, climate and rainfall and size and disturbance history of the habitat patch.

Koalas are generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. The home range of Koalas varies depending on the quality of the habitat and the number of available food trees; studies in Port Stephens have determined that Koala home ranges vary between 0.2 – 500 hectares, with an average home range of 80 – 90 hectares (DECC 2008).

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

A Koala sighting and scats were recorded from the eastern study area, east of the Pacific Highway. One Koala was sighted within the study area throughout all surveys undertaken by Arcadis in 2017 and 2019, and PEA from 2012 to 2015.

The results of SAT surveys by Arcadis indicate that Koala activity levels are low throughout the study area. Scats were recorded from only three of the 13 Koala SAT locations surveyed by Arcadis in 2017 and 2019. At SAT points where scats were recorded, only one tree with scats was recorded at each of two locations, and seven trees with scats at one location. The SAT survey where seven trees had scats was within a narrow road verge (less than 20 metres wide) along the eastern side of the Pacific Highway between the highway and the Koala fence to the east. It is likely that the comparatively high number of scat trees (7 out of 30) may be atypical for the study area, and may be evidence of one Koala that became temporarily 'trapped' between the highway and Koala fence before moving on to another location.

Koalas were recorded from adjacent to the western boundary of the study area during surveys undertaken for the Kings Hill Development SIS (RPS 2019). A total of 10 individual Koalas were identified to the west of the study area during surveys undertaken for the Kings Hill Development SIS (RPS 2019). Those studies determined that the carrying capacity of land surveyed for the Kings Hill SIS was around 0.5 to 0.75 Koalas per hectare. Population density for the study area is assumed to be considerably lower than the estimated carrying capacity of between 9 and 13.5 Koalas, given the low levels of activity and scarcity of sightings.

The low levels of Koala activity (from SAT surveys) and infrequent sightings indicate that the Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest (PCT 1590) in the eastern portion of the study area is unlikely to support a significant population of Koalas, or to provide significant habitat for resident Koalas. No breeding female (i.e. females with young) and no juvenile Koalas were recorded within the study area. Given the low number of sightings and low levels of activity it is unlikely that the study area provides breeding habitat for the Koala.

Due to the low levels of Koala activity, the small area of Koala habitat to be impacted (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest) and low potential of occurrence of breeding, it is unlikely that the proposal would impact the life cycle of

Koala. Consequently, viable local populations for the Koala are unlikely to be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable. The Koala is a threatened species.

(c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

18 hectares of vegetation (Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest) would be removed for the proposal which provides foraging and movement habitat for the Koala. The low levels of Koala activity and infrequent sightings indicate that the Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation of the study area is unlikely to support a significant population of Koalas, or to provide significant habitat for resident Koalas.

Koala floppy-top fencing has been installed alongside the eastern margin of the Pacific Highway. This fencing aims to prevent Koala (and other terrestrial fauna) access to the highway, thereby reducing mortality resulting from vehicle strikes. However, this fencing also acts as a barrier to fauna movement, preventing the movement of Koalas to habitat west of the Pacific Highway. Koala movement in the eastern portion of the study area is largely restricted to the north/south direction, between the fauna fence and the Grahamstown Dam foreshore.

Native vegetation has been cleared from much of the eastern portion of the study area for the electricity easement (located parallel to the Pacific Highway).

Die-back following permanent inundation resulting from the dam augmentation works has created a 300 metre wide gap between patches of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation occurring to the north and south.

Koalas (sightings and scats) have been recorded within the eastern portion of the study area on both sides of this gap. Koalas are known to be capable of moving large distance (3 to 4km), and it is unlikely that the 300m cleared area would represent an impermeable barrier to Koala movement. Individual Koalas may therefore move infrequently across this gap to access forest vegetation to the north and south.

Koalas that cross this gap may be at greater risk of injury or mortality from dog attacks (dog tracks were recorded in the study area by Arcadis).

A series of 17, 4-metre high Koala refuge poles have been installed along the dam foreshore to mitigate the impact of Koala habitat fragmentation and loss resulting from dieback associated with permanent inundation. Each Koala refuge pole located along the western foreshore of Grahamstown Dam was inspected by Arcadis for signs of Koala use. No scratches were identified on any of the poles, and it is likely that these poles are not currently used by Koalas.

The proposal includes construction of a Koala land bridge to facilitate north-south habitat connectivity and to reduce the potential for dog and fox attacks to Koalas crossing this gap. Once constructed the Koala land bridge will be revegetated using flora species and local progeny from the adjacent Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation. Koala feed trees, particularly *Forest Red Gum* and *Grey Gum*, will be planted along the Koala land bridge. Other canopy tree species will also be planted, and future augmentation planting will be largely dictated by the successful establishment of individual tree species. Revegetation should also be undertaken using pioneer and successional species such as *Acacias* and *Allocasuarinas*. These species will grow quickly and provide short-term refuge for Koalas until dominant canopy species have attained sufficient height to provide refuge for Koalas.

The 17 poles that were installed along the dam foreshore will be reinstated on the Koala land bridge. These poles would be retrofitted with rope coils to increase grip and aid climbing by Koalas. The timing and responsibilities for the removal and reinstatement of Koala refuge poles will be described in the Construction Flora and Fauna Management Plan.

The clearing of native vegetation for the proposal would exacerbate the loss and fragmentation of Koala habitat in Kings Hill. Given the low value of this habitat for movement, particularly east-west movement, impacts would be minor. Further, the installation of a Koala land bridge would improve north-south habitat connectivity for the species.

Studies were undertaken for the Kings Hill Development SIS (RPS 2019) to determine the nutritional values of Koala feed trees. The following trees species that have been recorded from the study area were determined to be 'high' or 'moderate' value feed trees for Koalas:

High value feed trees

- *Eucalyptus tereticornis* (Forest Red Gum)
- *E. punctata* (Grey Gum)

Moderate value feed trees

- *E. moluccana* (Grey Box)
- *E. crebra* (Narrow-leaved Ironbark)
- *E. fibrosa* (Red Ironbark)
- *E. acmenoides* (Broad-leaved Mahogany)

Nutrient analysis and feed tree densities were used to inform habitat mapping across the Kings Hill URA with the following categories:

- Unsuitable. May be used for movement
- Potential habitat: PCT surrogate
- Suitable Koala habitat
- Suitable Koala habitat (high value)

Vegetated areas of the western portion of the study area are mainly 'potential habitat' or 'unsuitable' Koala habitat, with small areas of 'suitable Koala habitat' mapped (RPS 2019). No 'suitable Koala habitat (high value)' was mapped as occurring within or near the study area.

The 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation to be removed contains varying abundances of 'high' and 'moderate' value Koala feed trees. Forest Red Gum and Grey Gum have both been recorded throughout the study area, however vegetation within the study area does not support a high abundance of these tree species. The most commonly occurring 'moderate' value Koala feed tree is Grey Box. Narrow-leaved Ironbark, Red Ironbark and Broad-leaved Mahogany occur in relatively low abundance in the study area.

Given the habitat value and low activity levels of the Koala within the study area, the small area of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest to be removed in the study area is not likely to be important to the long-term survival of the Koala in the locality.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for the Koala.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Schedule 4 of the BC Act provides a list of the 'key threatening processes' (KTPs). Of the KTPs listed in Schedule 4 of the BC Act, several are applicable to the proposed works at Kings Hill. Of those, the following are relevant to the Koala:

- Clearing of native vegetation

18 hectares of native vegetation will be cleared for the proposed works at Kings Hill. Vegetation proposed for removal contains foraging and breeding habitat for the Koala. However, the extent of vegetation to be removed is minor given the availability of suitable habitat in nearby areas.

- Predation by the European Red Fox *Vulpes vulpes* (Linnaeus, 1758)

The European Red Fox was recorded in the study area. European Red Fox can predate on Koalas. The proposal may exacerbate this KTP through the creation of additional edge habitats that may favour the European Red Fox.

Conclusion

In light of the consideration of the above five factors, the proposed works at Kings Hill are unlikely to have a significant impact on Koala in the study area, or wider locality, as a result of the proposed actions as:

- The proposed works would not adversely affect the lifecycle of the species such that viable local populations are likely to be placed at risk of extinction;
- The proposed works would not substantially fragment habitat for the species and;
- The 18 ha of habitat that would be removed for the proposal does not comprise a significant area of habitat for the Koala.

Consequently, preparation of a Species Impact Statement (SIS) is not required.

Small scansorial/arboreal mammals

Potential impacts on the following threatened small scansorial/arboreal species have been assessed in accordance with the five factors set out in Section 7.3 of the BC Act:

- Squirrel Glider (*Petaurus norfolcensis*) – Vulnerable
- Brush-tailed Phascogale (*Phascogale tapoatafa*) – Vulnerable

The Squirrel Glider and Brush-tailed Phascogale were not recorded during field surveys. PEA Consulting has previously recorded the Squirrel Glider in native vegetation west of the study area (i.e. west of the Pacific Highway), and recorded Brush-tailed Phascogale approximately 300 metres north of the study area. Brush-tailed Phascogale were also recorded adjacent to the study area during SIS surveys (RPS 2019). Further, the OEH BioNet database shows recent records for both species from within 10 kilometres of the study area and suitable habitat for both species is also present within the study area. Squirrel Glider and Brush-tailed Phascogale are considered to have a 'high' likelihood of occurrence within the study area.

Due to broad similarities in habitat requirements and ecology, impacts to these species have been considered as a single assessment of significance.

Distribution, habitat and ecology

The Squirrel Glider listed as Vulnerable under the BC Act. The Squirrel Glider is widely distributed in eastern Australia, from northern Queensland to western Victoria. The species inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Squirrel Glider prefer mixed species stands with a shrub or *Acacia* midstorey. The species lives in family groups of a single adult male, one or more adult females and offspring. Squirrel Glider require abundant tree hollows for both refuge, roosting and nest sites. Dens are located in a leaf-lined nest in a tree hollow, used for sheltering and breeding. Their diet varies seasonally and consists of *Acacia* gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein. Home-ranges of the species vary between 0.65 and 8.55 hectares, and nightly movements between 300m and 500m are common. Males disperse from their natal range after 1 year (Strahan 1995, OEH 2012).

The Brush-tailed Phascogale is listed as Vulnerable under the BC Act. The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records in the west. The species prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. They are also known to inhabit heath, swamps, rainforest and wet sclerophyll forest. The Brush-tailed Phascogale is an agile climber, foraging preferentially in rough barked trees of 25cm DBH or greater. The species feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20ha – 40ha, while males have overlapping territories often greater than 100ha. Brush-tailed Phascogale nest and shelter in tree hollows with entrances 2.5cm – 4cm wide and use many different hollows over a short time span. Mating occurs May – July; males die soon after the mating season whereas females can live for up to three years but generally only produce one litter.

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The study area offers potential foraging and breeding habitat for both small scansorial/arboreal species (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest). The diversity of flowering trees, predominantly *Eucalyptus sp.*, *Corymbia sp.*, *Melaleuca sp.* and scattered *Acacia sp.*, recorded within the study area provide foraging habitat for the Squirrel Glider. In addition, the removal of up to 41 hollow-bearing trees may impact potential sheltering and breeding habitat for the Squirrel Glider. Further, Spotted Gum-Ironbark Forest recorded within the study area supports an abundance of rough-barked trees, such as Ironbarks and Grey Boxes, that offer preferred foraging habitat to the Brush-tailed Phascogale. In addition, the removal of up to 41 hollow-bearing trees may impact potential sheltering and breeding habitat for the species.

Neither species were recorded within the study area. Further, due to the small area of potential foraging and breeding habitat to be impacted (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest and up to 41 hollow-bearing trees), and existing disturbances (e.g. located on a highway edge subject to noise and light pollution), it is unlikely that the proposal would impact the life cycle these threatened scansorial/arboreal mammal species. Consequently, viable local populations for the Squirrel Glider and Brush-tailed Phascogale are unlikely to be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable. The Squirrel Glider and Brush-tailed Phascogale are threatened species.

(c) in relation to the habitat of a threatened species or ecological community:

- (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,**

The proposed works at Kings Hill would require the removal of 18 hectares of potential foraging and breeding habitat for the Squirrel Glider and Brush-tailed Phascogale. However, the extent of habitat to be removed is minor given the availability of substantial areas of good condition, suitable habitat, such as riparian zones surrounding the Hunter and Williams Rivers, Medowie State Conservation Area and Tilligerry State Conservation Area, in nearby areas.

The removal of 18 hectares (and up to 41 hollow-bearing trees) of potential habitat would not result in a significant reduction of habitat connectivity in the region. The habitat is already highly fragmented from the Pacific Highway, rural land and access easements. In particular, there is a significant break in north-south habitat connectivity of approximately 300 metres of land due to inundation from the construction of Grahamstown Dam. The proposal includes construction of a land bridge at this location to facilitate north-south habitat connectivity for Koalas. This structure will include planting of understorey and canopy species which will provide north-south habitat connectivity for other species, including the Squirrel Glider and the Brush-tailed Phascogale

Given the lack of species presence, the existing disturbances and fragmentation and the proposed Koala land bridge construction, the small area of potential habitat to be removed in the study area is not likely to be important to the long-term survival of the Squirrel Glider and Brush-tailed Phascogale in the locality.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for the Squirrel Glider and Brush-tailed Phascogale.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Schedule 4 of the BC Act provides a list of the 'key threatening processes' (KTPs). Of the KTPs listed in Schedule 4 of the BC Act, several are applicable to the proposed works at Kings Hill. Of those, the following are relevant to the Squirrel Glider and Brush-tailed Phascogale:

- Clearing of native vegetation

Native vegetation will be cleared for the proposed works at Kings Hill. Vegetation proposed for removal contains foraging and breeding habitat for the Squirrel Glider and Brush-tailed Phascogale. However, the extent of vegetation to be removed is minor given the availability of suitable habitat in nearby areas.

- Removal of tree hollows

Up to 41 hollow-bearing trees are proposed to be removed as a result of works at Kings Hill. Hollow-bearing trees proposed for removal may support tree hollows suitable for Squirrel Glider and Brush-tailed Phascogale. However, the extent of hollow-bearing trees to be removed is minor given the availability of suitable habitat in nearby areas.

Conclusion

In light of the consideration of the above five factors, the proposed works at Kings Hill are unlikely to have a significant impact on the Squirrel Glider and Brush-tailed Phascogale in the study area, or wider locality, as a result of the proposed actions as:

- The proposed works would not adversely affect the lifecycle of the species such that viable local populations are likely to be placed at risk of extinction;
- The proposed works would not substantially fragment habitat for the species and;
- The proposed works do not comprise a significant area of habitat for Squirrel Glider and Brush-tailed Phascogale.

Consequently, preparation of a Species Impact Statement (SIS) is not required.

Microchiropteran bats (microbats)

Potential impacts on the following threatened microbat species have been assessed in accordance with the five factors set out in Section 7.3 of the BC Act:

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) – Vulnerable
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) – Vulnerable
- Little Bent-winged Bat (*Miniopterus australis*) – Vulnerable
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*) – Vulnerable
- Southern Myotis (*Myotis macropus*) – Vulnerable
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) – Vulnerable
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) – Vulnerable

PEA Consulting have recorded five Vulnerable (BC Act) microbat species within the study area: Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat and Greater Broad-nosed Bat. Further, the OEH BioNet database shows recent records for all listed microbat species from within 10 kilometres of the study area and suitable habitat is also present within the study area. Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat and Greater Broad-nosed Bat are 'recorded' within the study area. Southern Myotis and Yellow-bellied Sheath-tail-bat are considered to have a 'moderate' likelihood of occurrence within the study area.

Due to broad similarities in habitat requirements and ecology, impacts to these species have been considered as a single assessment of significance.

Distribution, habitat and ecology

The Eastern False Pipistrelle is listed as Vulnerable under the BC Act. The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. The species prefers moist habitats, with trees taller than 20m. Eastern False Pipistrelle generally roost in eucalypt hollows, but the species has also been found under loose bark on trees or in buildings. They hunt beetles, moths, weevils and other flying insects above or just below the tree canopy. The species hibernates in winter, and females are pregnant in late Spring to early Summer.

The Eastern Coastal Free-tailed Bat is listed as Vulnerable under the BC Act. The Eastern Free-tail-bat is found along the east coast from south Queensland to southern NSW. They occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing

Range. The species roosts mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, likely insectivorous.

The Little Bent-winged Bat is listed as Vulnerable under the BC Act. The Little Bent-winged Bat is distributed along the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. The species prefers moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, *Melaleuca* swamps, dense coastal forests and *Banksia* scrub. It is generally found in well-timbered areas. Little Bent-winged Bat roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Large Bent-winged Bat, and, in Winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Large Bent-winged Bat and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in Spring and birthing occurs in early Summer. Males and juveniles disperse in Summer. Only five nursery sites /maternity colonies are known in Australia.

The Large Bent-winged Bat is listed as Vulnerable under the BC Act. The species occurs along the east and north-west coasts of Australia. Caves are the primary roosting habitat for this species, but they also use derelict mines, storm-water tunnels, buildings and other man-made structures. The Large Bent-winged Bat form discrete populations centred on a maternity cave that is used annually in Spring and Summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can form number from 100 to 150,000 individuals. The species hunt in forested areas, catching moths and other flying insects above the treetops.

The Southern Myotis is listed as Vulnerable under the BC Act. The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100km inland, except along major rivers. The species generally roosts in groups of 10 – 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. The Southern Myotis forages over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.

The Yellow-bellied Sheath-tail-bat is listed as Vulnerable under the BC Act. The Yellow-bellied Sheath-tail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range (most of Victoria, south-western NSW and adjacent South Australia) it is a rare visitor in late Summer and Autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. The species roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, the species flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late Summer and Autumn.

The Greater Broad-nosed Bat is listed as Vulnerable under the BC Act. The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however, it does not occur at altitudes above 500m. The species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. The Greater Broad-nosed Bat forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3m –

6m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.

- (a) *in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,***

The study area offers potential foraging and breeding habitat for microbat species (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest and 3 hectares of foraging habitat along the dam foreshore for Southern Myotis). The Large Bent-winged Bat and Little Bent-winged Bat breed in maternity colonies in caves and therefore would not breed in the study area. Hollow-bearing trees within the study area could offer potential roosting and/or breeding habitat for the remaining microbat species. The removal of up to 41 hollow-bearing trees could disrupt the breeding cycle of one or more of the listed microbat species. Disturbance of hibernating microbats during Winter can result in mortalities due to a lack of foraging resources and limited fat stores during this time (Churchill 2008). Impacts to the breeding cycle could include displacement of females with young or pregnant females. Whether these impacts occur is dependent on the timing of vegetation removal.

Microbats are wide-ranging, highly mobile animals and any microbats roosting in the study area are likely to be part of local populations that extend beyond the study area in connected remnant vegetation, including along the edge of Grahamstown Dam. Clearing of up to 41 hollow-bearing trees for the proposal could result in indirect mortalities or interruption to the breeding cycle, reducing the numbers of local populations. The proposal is likely to impact a small proportion, if any, of microbat populations known to occur in the wider locality (i.e. recorded within 10 kilometres). The proposal is therefore unlikely to lead to the extinction of these populations.

- (b) *in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:***

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
- (ii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,***

Not applicable. The Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Yellow-bellied Sheath-tail-bat and Greater Broad-nosed Bat are threatened species.

- (c) *in relation to the habitat of a threatened species or ecological community:***

- (i) *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and***

- (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and***

- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,***

The proposed works at Kings Hill would require the removal of 18 hectares of potential foraging and breeding habitat for the seven microbat species, and an additional 3 hectares of foraging habitat along the dam foreshore for Southern Myotis. However, the extent of habitat to be removed is minor given the availability of substantial areas of good condition, suitable habitat, such as riparian zones surrounding the Hunter and Williams Rivers, Medowie State Conservation Area and Tilligerry State Conservation Area, in nearby areas.

The removal of 18 hectares (and up to 41 hollow-bearing trees) of potential habitat would not result in a significant reduction of habitat connectivity in the region. The habitat is already highly fragmented from the Pacific Highway, rural land and access easements. Similar habitat surrounding the study area is unlikely to become isolated or fragmented as a result of clearing for the proposal.

Given the lack of species presence, their high mobility, and existing disturbances and fragmentation, the small area of potential habitat to be removed in the study area is not likely to be important to the long-term survival of the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Yellow-bellied Sheath-tail-bat and Greater Broad-nosed Bat in the locality.

(d) *whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),*

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Yellow-bellied Sheath-tail-bat and Greater Broad-nosed Bat.

(e) *whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.*

Schedule 4 of the BC Act provides a list of the 'key threatening processes' (KTPs). Of the KTPs listed in Schedule 4 of the BC Act, several are applicable to the proposed works at Kings Hill. Of those, the following are relevant to the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Yellow-bellied Sheath-tail-bat and Greater Broad-nosed Bat:

- Clearing of native vegetation

Native vegetation will be cleared for the proposed works at Kings Hill. Vegetation proposed for removal contains foraging habitat for the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Yellow-bellied Sheath-tail-bat and Greater Broad-nosed Bat. However, the extent of vegetation to be removed is minor given the availability of suitable habitat in nearby areas.

- Removal of tree hollows

Up to 41 hollow-bearing trees are proposed to be removed as a result of works at Kings Hill. Hollow-bearing trees proposed for removal may support tree hollows suitable for five microbat species. However, the extent of hollow-bearing trees to be removed is minor given the availability of suitable habitat in nearby areas.

Conclusion

In light of the consideration of the above five factors, the proposed works at Kings Hill are unlikely to have a significant impact on the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Yellow-bellied Sheath-tail-bat and Greater Broad-nosed Bat in the study area, or wider locality, as a result of the proposed actions as:

- The proposed works would not adversely affect the lifecycle of the species such that viable local populations are likely to be placed at risk of extinction;
- The proposed works would not substantially fragment habitat for the species and;
- The proposed works do not comprise a significant area of habitat for Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Southern Myotis, Yellow-bellied Sheath-tail-bat and Greater Broad-nosed Bat.

Consequently, preparation of a Species Impact Statement (SIS) is not required.

Megachiropteran bats (flying-foxes)

Potential impacts on the following threatened megachiropteran bats have been assessed in accordance with the five factors set out in Section 7.3 of the BC Act:

- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable

The Grey-headed Flying-fox was recorded during stag-watching and spotlighting field surveys, foraging in the canopy of flowering eucalypts within the study area. Further, the OEH BioNet database shows recent records for the Grey-headed Flying-fox from within 10 kilometres of the study area and suitable habitat is present within the study area. The Grey-headed Flying-fox is 'recorded' within the study area.

Distribution, habitat and ecology

Grey-headed Flying-foxes are generally found within 200km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. The species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high with some camps having been used for over a century. Grey-headed Flying-fox can travel up to 50km from the camp to forage; commuting distances are more often up to 20km. The species feeds on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia*, and fruits of rainforest trees and vines. The species is also known to forage in cultivated gardens and fruit crops.

- (a) **in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,**

The study area offers potential foraging habitat for the Grey-headed Flying-fox (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest). A diversity of flowering trees, predominantly *Eucalyptus* sp., *Corymbia* sp., and *Melaleuca* sp. were recorded in vegetation within the study area. Feed trees known to be utilised by the Grey-headed Flying-Fox (Eby and Law 2008) that were recorded in the study area are listed below.

Species in the blossom diet of Grey-headed Flying-foxes recorded in the study area	Species in the fruit diet of Grey-headed Flying-foxes recorded in the study area
<i>Angophora costata</i> (Smooth-barked apple): uncommon <i>Corymbia maculata</i> (Spotted Gum): common <i>Eucalyptus moluccana</i> (Grey Box): common <i>Eucalyptus paniculata</i> (Grey Ironbark): common <i>Eucalyptus punctata</i> (Grey Gum): occasional <i>Eucalyptus tereticornis</i> (Forest Red Gum): uncommon <i>Melaleuca quinquenervia</i> (Broad-leaved paperbark)	<i>Pittosporum undulatum</i> (Sweet Pittosporum): uncommon

The study area does not contain any camps (used for roosting and breeding). The nearest Nationally Important Flying-fox camp is mapped by National Flying-fox monitoring viewer (DEE 2019) at Raymond Terrace (Camp ID 625), which has typically supported up to approximately 10,000 Flying-foxes in recent years. Other camps are located at Tenambit (Camp ID 929) (roughly 16km from the study area), Carrington Mangroves (Camp ID 608) (roughly 21km from the study area), Glen William (Camp ID 241) (roughly 16km from the study area), Tocal (Camp ID 521) (roughly 21km from the study area), Blackbutt Reserve (Camp ID 99) (roughly 25km from the study area), East Cessnock (Camp ID 334) (roughly 25km from the study area). Potential foraging resources for the species are available at the study area during critical times of the reproductive cycle. Breeding individuals from any of nearby camps that utilise resources within the study area may be adversely impacted by the removal of foraging habitat. However, vegetation removal, comprising a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, would not significantly diminish the foraging resources elsewhere in the region that would support breeding females. The removal of a total of 18 hectares of foraging habitat as a result of the proposed action is highly unlikely to have an adverse effect on the life cycle of the Grey-headed Flying-Fox such that a viable local population of the species is likely to be placed at risk of extinction.

(b) *in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:*

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
- (ii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,***

Not applicable. The Grey-headed Flying-fox is a threatened species.

(c) *in relation to the habitat of a threatened species or ecological community:*

- (i) *the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and***
- (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and***
- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,***

The proposed works at Kings Hill would require the removal of 18 hectares of potential foraging habitat for the Grey-headed Flying-fox. However, the extent of habitat to be removed is minor given the availability of substantial areas of good condition, suitable habitat, such as riparian zones surrounding the Hunter and Williams Rivers, Medowie State Conservation Area and Tilligerry State Conservation Area, in nearby areas.

The removal of 18 hectares of potential habitat would not result in a significant reduction of habitat connectivity in the region. The habitat is already highly fragmented from the Pacific Highway, rural land and access easements. Similar habitat surrounding the study area is unlikely to become isolated or fragmented as a result of clearing for the proposal.

Given the lack of breeding habitat, existing disturbances and fragmentation, the small area of potential habitat to be removed in the study area is not likely to be important to the long-term survival of the Grey-headed Flying-fox in the locality.

(d) *whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),*

A review of the Register of Declared Areas of Outstanding Biodiversity Value (AOBV) found that no AOBV have been declared for the Grey-headed Flying-fox.

(e) *whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.*

Schedule 4 of the BC Act provides a list of the 'key threatening processes' (KTPs). Of the KTPs listed in Schedule 4 of the BC Act, several are applicable to the proposed works at Kings Hill. Of those, the following are relevant to the Grey-headed Flying-fox:

- Clearing of native vegetation

Native vegetation will be cleared for the proposed works at Kings Hill. Vegetation proposed for removal contains foraging habitat for the Grey-headed Flying-fox. However, the extent of vegetation to be removed is minor given the availability of suitable habitat in nearby areas.

Conclusion

In light of the consideration of the above five factors, the proposed works at Kings Hill are unlikely to have a significant impact on the Grey-headed Flying-fox in the study area, or wider locality, as a result of the proposed actions as:

- The proposed works would not adversely affect the lifecycle of the species such that viable local populations are likely to be placed at risk of extinction;
- The proposed works would not substantially fragment habitat for the species and;
- The proposed works are unlikely to exacerbate any KTPs, and do not comprise a significant area of habitat for the Grey-headed Flying-fox.

Consequently, preparation of a Species Impact Statement (SIS) is not required.

Appendix G – EPBC Significant Impact Assessments

Significant Impact Assessments have been carried out for threatened species listed under the EPBC Act which are known or considered to have a high or moderate likelihood of occurrence within the study area.

Significant Impact Assessments have been prepared for the threatened entities outlined in Table Error! No text of specified style in document.-2.

Table Error! No text of specified style in document.-2 Threatened entities listed under the EPBC Act for which Significant Impact Assessments have been carried out

Scientific name	Common Name	Status under EPBC Act	Potential occurrence
Fauna			
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	Moderate.
<i>Lathamus discolor</i>	Swift Parrot	CE	Moderate.
<i>Phascolarctos cinereus</i>	Koala	V	Recorded.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	Recorded.

Swift Parrot (*Lathamus discolor*)

The Swift Parrot is listed as Critically Endangered under the EPBC Act. This species spends spring and summer in Tasmania during the breeding season and returns as a non-breeding migrant to the mainland to forage during winter. It moves in response to changing food availability returning to some foraging sites regularly.

The study area supports the following tree species that are known foraging resources for the Swift Parrot (Saunders and Tzaros 2011):

- *Eucalyptus tereticornis* (Forest Red Gum) – winter blossom
- *Corymbia maculata* (Spotted Gum) – winter blossom
- *Eucalyptus moluccana* (Coast Grey Box) – lerps

Important habitats for the Swift Parrot (Saunders and Tzaros 2011) include habitats which are used:

- For nesting (Tasmania only)
- By large proportions of the population
- Repeatedly between seasons
- For prolonged periods of time

The criteria listed above are broadly consistent with the criteria used by Birdlife Australia (IUCN 2016) to identify Key Biodiversity Areas (KBAs) (previously 'Important Bird Areas') for the Swift Parrot. The study area is not located within a KBA for the Swift Parrot. The nearest KBAs for the Swift Parrot to the study area (Birds Australia 2019) are:

- Hunter Valley KBA (Swift Parrot and Regent Honeyeater) – approximately 30 kilometres to the south west
- Lake Macquarie KBA (Swift Parrot and Regent Honeyeater) – approximately 35 kilometres to the south

The Swift Parrot occurs as a single population (Saunders and Tzaros 2011). The population was estimated in 2010 to be up to 1,000 pairs (Saunders et al. 2010).

The Swift Parrot was not recorded during surveys of the study area. The most recent Swift Parrot records from within 10 kilometres of the study area are from Wallaroo National Park in 2012, and the closest recent records to the study area are from Raymond Terrace in 2007 (OEH 2019).

Although not recorded during surveys, the species is considered 'moderately' likely to occur within the study area given the presence of suitable foraging habitat and nearby recent records (OEH 2019).

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it would:

Lead to a long-term decrease in the size of a population.

The Swift Parrot occurs as a single population of up to 1,000 pairs. This species is a non-breeding migrant to mainland Australia where it can occur throughout south-eastern Australia where suitable foraging habitat is present. The Swift Parrot has not been recorded from the study area but has been recorded from the locality as recently as 2012.

The study area supports three tree species that are known foraging species for the Swift Parrot. The Swift Parrot may therefore infrequently forage within the study area during non-breeding periods.

The study area does not provide habitat which is used by the Swift Parrot:

- For nesting
- By large proportions of the population
- Repeatedly between seasons
- For prolonged periods of time

Further, the study area does not occur within or near any mapped KBAs for the Swift Parrot. As such the study area is not considered to provide important habitat for this species.

The proposal would not impact breeding habitat for this species. A small area of potential foraging habitat would be removed for the proposal, however much larger areas of better quality potential foraging habitat for the Swift Parrot occur in the locality surrounding the study area, including large areas protected in national parks, nature reserves and state conservation areas. As such, it is unlikely that the proposal would lead to a long-term decrease in the size of the single population of the Swift Parrot.

Reduce the area of occupancy of the species

The area of occupancy of breeding habitat for the Swift Parrot is less than 500 km². Breeding habitat is located wholly within Tasmania, and no breeding of this species has been recorded from the mainland. During the non-breeding period the Swift Parrot may occur throughout south-eastern mainland Australia as far north as southeast Qld. This non-breeding area of occupancy for the Swift Parrot is around 4,000 kilometres². Habitat loss throughout the distribution of the Swift Parrot is likely to have caused a decline in the area of occupancy for this species across its range.

The study area for the proposal is located on mainland Australia and does not support breeding habitat for the Swift Parrot. The Swift Parrot has not been recorded from the study area, however the study area provides limited foraging resources that may be used infrequently by the Swift Parrot during non-breeding periods. Much larger areas of better quality potential foraging habitat for the Swift Parrot occur in the locality surrounding the study area, including large areas protected in national parks, nature reserves and state conservation areas. Important non-breeding habitat for the Swift Parrot occurs in the Hunter Valley KBA 30 kilometres to the south-west, and Lake Macquarie KBA 35 kilometres to the south.

Given the large area of occupancy on mainland Australia, the small area of potential habitat within the study area, the absence of records from the study area and the distance from KBAs it is highly unlikely that the proposal would reduce area of occupancy of the Swift Parrot.

Fragment an existing population into two or more populations

The single population of the Swift Parrot occurs throughout south-eastern mainland Australia as non-breeding migrants. This is a highly mobile species that may occur anywhere throughout its known mainland range (approximately 4,000 kilometres²) where suitable foraging resources are present. The study area supports approximately 40 hectares of potential foraging habitat for the Swift Parrot, of which 18 hectares would be removed for the proposal.

Given the high mobility of this species and the small area of potential foraging habitat to be removed the proposal would not fragment the single population of Swift Parrot into two or more populations.

Adversely affect habitat critical to the survival of a species

No critical habitat has been declared for the Swift Parrot. Areas of 'important habitat' are considered to occur within the Hunter Valley KBA (30 kilometres to the south-west) and Lake

Macquarie KBA (35 kilometres to the south). These KBAs will not be impacted by the proposal. As such the proposal will not adversely affect habitat critical to the survival of the Swift Parrot.

Disrupt the breeding cycle of a population

The Swift Parrot is a non-breeding migrant to mainland Australia. Roosting sites (Saunders and Tzaros 2011) and KBAs may be important for social interactions for the Swift Parrot and, as such, may play a key role in the breeding cycle of this species.

The Swift Parrot was not recorded within the study area. No known roosting sites or areas of 'important habitat' are known to occur near the study area. It is unlikely that the small area of potential habitat to be removed for the proposal would provide significant foraging resources or opportunities for regular social interactions for this species. As such the proposal is highly unlikely to disrupt the breeding cycle of the single population of the Swift Parrot.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Swift Parrot has not been recorded from the study area. Although this species has recently been recorded from the locality (OEH 2019) there is no indication that the Swift Parrot occurs regularly, in large numbers or over a long period of time anywhere in the locality. The nearest 'important habitat' areas for the Swift Parrot occur in the Hunter Valley KBA (30 kilometres to the south-west) and Lake Macquarie KBA (35 kilometres to the south). These areas will not be impacted by the proposal.

The study area supports approximately 40 hectares of potential foraging habitat for the Swift Parrot, of which 18 hectares would be removed for the proposal. Much larger areas of better quality foraging habitat for the Swift Parrot occur in the wider locality, much of which is protected in national parks, nature reserves and state conservation areas. The Swift Parrot is a highly mobile species, and removal of a small area of potential habitat for the proposal is unlikely to isolate remaining habitat for this species.

Only a small area of potential habitat for the highly mobile Swift Parrot will be removed for the proposal. Large areas of potential habitat will remain in the locality, and the locality does not support 'important habitat' for the Swift Parrot. Considering these factors it is highly unlikely that the proposal will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the Swift Parrot is likely to decline.

Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

Sections of the study area are highly disturbed and modified and there is evidence of invasive fauna (ie fox and rabbit) and weed species. Mitigation strategies include the retention of remnant vegetation where possible and weed removal/control. The proposal is unlikely to result in additional invasive species becoming established.

Introduce disease that may cause the species to decline

Beak and feather disease is capable of affecting the Swift Parrot and can result in high nestling mortality. It is spread by the movements of common species carrying the disease. The proposal is unlikely to aid the spread of beak and feather disease.

Interfere with the recovery of the species

The Swift Parrot is a non-breeding migrant to the mainland. This species was not recorded from the study area but has been recorded infrequently from the locality (OEH 2019). A small area (18 hectares) of potential foraging habitat for the Swift Parrot will be removed for the proposal, however the study area and the locality are not considered to provide 'important habitat' for this species.

Given the absence of records from the study area, the infrequency of records from the locality and the absence of important habitat it is considered unlikely that the proposal will interfere with the recovery of the Swift Parrot.

Conclusion

Under the EPBC Act an action requires approval from the Australian Government Minister for the Environment and Energy (DoEE) if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance such as the Swift Parrot. Based on the above assessment, it is concluded that the action would not have a significant impact on the Swift Parrot as it would result in the removal of a relatively small amount of potential foraging habitat which is not likely to be critical to the survival of the species. It is unlikely to introduce diseases or invasive species that would impact this species. As such the action does not require referral to DoEE.

Regent Honeyeater (*Anthochaera phrygia*)

The Regent Honeyeater is listed as Critically Endangered under the EPBC Act. The species has a wide distribution across mainland south-eastern Australia. It predominantly occupies dry open forest and woodland and riparian forests of River Sheoak along the ranges and western slopes of the Great Dividing Range. The Regent Honeyeater also occurs in coastal Swamp Mahogany and Spotted Gum forests (OEH 2019).

The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. The study area supports (or is likely to support) the following plant species that are known foraging (blossom) resources for the Regent Honeyeater (CoA 2016, OEH 2019):

- *Corymbia maculata* (Spotted Gum)
- *Amyema miquelii* (Box Mistletoe)
- *Eucalyptus fibrosa* (Broad-leaved Ironbark, or Red Ironbark)

When nectar is scarce the Regent Honeyeater may also feed on lerps and honeydew. Insects form about 15% of the diet and are particularly important to nestlings (OEH 2019).

Habitat critical to the survival of the Regent Honeyeater (CoA 2016) includes:

- Any breeding or foraging habitat in areas where the species is likely to occur; and
- Any newly discovered breeding and foraging locations.

Birdlife Australia has identified a number of Key Biodiversity Areas (KBAs) (previously 'Important Bird Areas') for the Regent Honeyeater. The study area is not located within a KBA for the Regent Honeyeater. The nearest KBAs for the Regent Honeyeater to the study area (Birdlife Australia 2019) are:

- Hunter Valley KBA (Swift Parrot and Regent Honeyeater) – approximately 30 kilometres to the south west
- Lake Macquarie KBA (Swift Parrot and Regent Honeyeater) – approximately 35 kilometres to the south

The Hunter Valley/Central Coast is the nearest of four areas identified as 'regularly used areas' and 'key breeding areas' in the *National Recovery Plan for the Regent Honeyeater* (CoA 2016). The area mapped as the Hunter Valley KBA for the Regent Honeyeater by Birdlife Australia (2019) is consistent with the 'key breeding area' mapping provided in the recovery plan (CoA 2016).

The Regent Honeyeater occurs as a single population (CoA 2016). The population size was estimated in 2010 to be 350-400 individuals (Garnett et al., 2011; Regent Honeyeater Recovery Team, unpublished data).

The Regent Honeyeater was not recorded during surveys of the study area. The BioNet Wildlife Atlas (OEH 2019) shows the most recent record for this species in the locality at Medowie in 2002. The Regent Honeyeater has been observed more recently at the Hunter Region Botanic Gardens, approximately 10 kilometres to the south of the study area (Carl Corden pers. obs.). Up to six Regent Honeyeaters were reported by several observers at this location between 21 July and 11 August 2018 (Birdline NSW 2019). Birds were observed feeding on insects and nectar from the blossoms of *Eucalyptus pilularis* (Blackbutt) at this location.

Although not recorded during surveys, the species is considered 'moderately' likely to occur within the study area given the presence of potential foraging habitat and nearby recent records (OEH 2019, Birdline NSW 2019, Carl Corden pers. obs.).

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it would:

Lead to a long-term decrease in the size of a population.

The Regent Honeyeater occurs as a single population of 350-400 individuals. This species occurs throughout south-eastern Australia where suitable foraging habitat is present.

The Regent Honeyeater has not been recorded from the study area but has been recorded from the locality as recently as 2018. The study area supports three plant species that are known foraging species for the Regent Honeyeater. The Regent Honeyeater may therefore infrequently forage within the study area during non-breeding periods.

The study area does not occur within or near any mapped KBAs for the Regent Honeyeater. As such the study area is not considered to provide important habitat or key breeding habitat for this species.

A small area of potential foraging habitat would be removed for the proposal, however much larger areas of better quality potential foraging habitat for the Regent Honeyeater occur in the locality surrounding the study area, including large areas protected in national parks, nature reserves and state conservation areas. As such, it is unlikely that the proposal would lead to a long-term decrease in the size of the single population of the Regent Honeyeater.

Reduce the area of occupancy of the species

The Regent Honeyeater occurs throughout south-eastern mainland Australia as far north as southeast Qld. This area of occupancy for the Regent Honeyeater is around 4,000 kilometres². Habitat loss throughout the distribution of the Regent Honeyeater is likely to have caused a decline in the area of occupancy for this species across its range.

The Regent Honeyeater has not been recorded from the study area, however study area provides limited foraging resources that may be used infrequently by the Regent Honeyeaters. Much larger areas of better quality potential foraging habitat for the Regent Honeyeater occur in the locality surrounding the study area, including large areas protected in national parks, nature reserves and state conservation areas. Important habitat for the Regent Honeyeater occurs in the Hunter Valley KBA 30 kilometres to the south-west, and Lake Macquarie KBA 35 kilometres to the south. The Hunter Valley KBA is also identified as a 'key breeding area' for the Regent Honeyeater.

Given the large area of occupancy on mainland Australia, the small area of potential habitat within the study area, the absence of records from the study area and the distance from KBAs it is highly unlikely that the proposal would reduce area of occupancy of the Regent Honeyeater.

Fragment an existing population into two or more populations

The single population of the Regent Honeyeater occurs throughout south-eastern mainland Australia. This is a highly mobile species that may occur anywhere throughout its known mainland range (approximately 4,000 kilometres²) where suitable foraging resources are present. The study area supports approximately 40 hectares of potential foraging habitat for the Regent Honeyeater, of which 18 hectares would be removed for the proposal.

Given the high mobility of this species and the small area of potential foraging habitat to be removed the proposal would not fragment the single population of Regent Honeyeater into two or more populations.

Adversely affect habitat critical to the survival of a species

No critical habitat has been declared for the Regent Honeyeater. 'Habitat critical to the survival of the Regent Honeyeater' (CoA 2016) includes all potential foraging and breeding habitat within the range of the species, and all 'newly discovered breeding and foraging locations'. The Regent

Honeyeater was first recorded foraging at the Hunter Region Botanic Gardens in July 2018. This is a new foraging location and may therefore be considered as habitat critical to the survival of the Regent Honeyeater.

Areas of 'important habitat' are considered to occur within the Hunter Valley KBA (30 kilometres to the south-west) and Lake Macquarie KBA (35 kilometres to the south). These KBAs and 'critical habitat' at Hunter Region Botanic Gardens will not be impacted by the proposal. As such the proposal will not adversely affect habitat critical to the survival of the Regent Honeyeater.

Disrupt the breeding cycle of a population

The Regent Honeyeater has not been recorded breeding in the study area or the locality. The Hunter Valley KBA is a key breeding area for the Regent Honeyeater. The Lake Macquarie KBA and the Hunter Region Botanic Gardens may be important for social interactions for the Regent Honeyeater and, as such, may play a key role in the breeding cycle of this species.

The Regent Honeyeater was not recorded within the study area. No known breeding sites, roosting sites or areas of 'important habitat' are known to occur near the study area. It is unlikely that the small area of potential habitat to be removed for the proposal would provide significant foraging resources or opportunities for regular social interactions for this species. As such the proposal is highly unlikely to disrupt the breeding cycle of the single population of the Regent Honeyeater.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Regent Honeyeater has not been recorded from the study area. Although this species has recently been recorded from the locality (OEH 2019, Birdline NSW 2019, Carl Corden pers. obs.) there is no indication that the Regent Honeyeater occurs regularly, in large numbers or over a long period of time anywhere in the locality. The nearest 'important habitat' areas for the Regent Honeyeater occur in the Hunter Region Botanic Gardens (10 kilometres to the south), the Hunter Valley KBA (30 kilometres to the south-west) and Lake Macquarie KBA (35 kilometres to the south). These areas will not be impacted by the proposal.

The study area supports approximately 40 hectares of potential foraging habitat for the Regent Honeyeater, of which 18 hectares would be removed for the proposal. Much larger areas of better quality foraging habitat for the Regent Honeyeater occur in the wider locality, much of which is protected in national parks, nature reserves and state conservation areas. The Regent Honeyeater is a highly mobile species, and removal of a small area of potential habitat for the proposal is unlikely to isolate remaining habitat for this species.

Only a small area of potential habitat for the highly mobile Regent Honeyeater will be removed for the proposal. Large areas of potential habitat will remain in the locality, and the study area does not support 'important habitat' for the Regent Honeyeater. Considering these factors it is highly unlikely that the proposal will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the Regent Honeyeater is likely to decline.

Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

Sections of the study area are highly disturbed and modified and there is evidence of invasive fauna (ie fox and rabbit) and weed species. Mitigation strategies include the retention of remnant vegetation where possible and weed removal/control. The proposal is unlikely to result in additional invasive species becoming established.

Introduce disease that may cause the species to decline

No diseases have been identified that pose a threat to the Regent Honeyeater. As such the proposal is highly unlikely to introduce disease that may cause the Regent Honeyeater to decline.

Interfere with the recovery of the species

The Regent Honeyeater was not recorded from the study area but has been recorded infrequently from the locality (OEH 2019, Birdline NSW 2019, Carl Corden pers. obs.) A small area (18 hectares) of potential foraging habitat for the Regent Honeyeater will be removed for the proposal, however the study area is not considered to provide 'important habitat' for this species.

Given the absence of records from the study area, the infrequency of records from the locality and the absence of important habitat it is considered unlikely that the proposal will interfere with the recovery of the Regent Honeyeater.

Conclusion

Under the EPBC Act an action requires approval from the Australian Government Minister for the Environment and Energy (DoEE) if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance such as the Regent Honeyeater. Based on the above assessment, it is concluded that the action would not have a significant impact on the Regent Honeyeater as it would result in the removal of a relatively small amount of potential foraging habitat which is not likely to be critical to the survival of the species. It is unlikely to introduce diseases or invasive species that would impact this species. As such the action does not require referral to DoEE.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-Fox is listed as Vulnerable under the EPBC Act. This species was observed during stag-watching and spotlighting surveys, foraging in the canopy of flowering eucalypts within the study area.

The Grey-headed Flying-fox occurs from Bundaberg in Queensland in the north to Melbourne in Victoria to the south, typically between the coast and the western slopes of the Great Dividing Range. The species may be found in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps, while additional foraging is provided by urban gardens and cultivated fruit crops. The Grey-Headed Flying-Fox is a highly mobile species with a nightly feeding range of 20 to 50 kilometres from a roosting camp. Diet typically comprises a wide variety of flowering and fruiting plants (Tidemann 1995, Churchill 1998); non-indigenous and exotic tree species introduced to the urban landscape provide additional foraging habitat for this species.

Grey-headed Flying-foxes roost in large numbers, with up to tens of thousands of flying foxes using individual camps for mating, birth and rearing of young. The study area does not contain a camp (occupied roosting habitat). The nearest Nationally Important Flying Fox camp is mapped by *National Flying-fox monitoring viewer* (DEE 2017a) at Raymond Terrace (Camp ID 265), which has typically supported up to approximately 10,000 flying foxes in recent years. Other camps are located at Carrington Mangroves (Camp ID 608) and Blackbutt Reserve (Camp ID 99), located 21 and 25 kilometres from the study area, respectively.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Lead to a long-term decrease in the size of an important population of a species

Important populations are those that may be identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

The Grey-headed Flying-fox has no separate or distinct populations (DoE 2014a). The species constantly exchanges genetic information between camps throughout its geographic range. The study area does not contain a maternity roost or roosting camp. It is therefore unlikely that the study area contains a population that is a key source of breeding or dispersal or important for maintaining genetic diversity. The study area is not near the limit of the species range. As such, it is not considered to contain an important population. Therefore the proposal would not lead to a long-term decrease in the size of an important population.

Reduce the area of occupancy of an important population

The study area does not support an important population of the Grey-headed Flying-fox. The proposal would result in the removal of 18 hectares of foraging resources. The removal of this potential habitat would have a minimal impact on the area of occupancy of the species.

Fragment an existing important population into two or more populations

The study area does not support an important population of the Grey-headed Flying-fox. The removal of potential foraging habitat from the study area would not fragment the population of the Grey-Headed Flying-Fox into two or more populations.

Adversely affect habitat critical to the survival of a species

While the proposal would result in the removal of potential foraging habitat, this habitat is not likely to be habitat critical to the survival of this species.

Disrupt the breeding cycle of an important population

There is no known maternity roosting camp of Grey-headed Flying-foxes within the study area. The study area provides a potential foraging resource for the species. The study area is unlikely to contain an important population of the species. As such, the proposal is unlikely to disrupt the breeding cycle of an important population.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal would involve the removal of potential foraging habitat for the Grey-Headed Flying-Fox. This foraging resource does not comprise a significant area of foraging habitat within the study area or the locality. The loss of 18 hectares of foraging resources is not likely to be significant to the species such that it is likely to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The action is unlikely to result in the establishment of an invasive species that is harmful to the Grey-Headed Flying-Fox. Known predators of the species include native reptiles and birds; no invasive exotic fauna species are known to predate upon Grey-Headed Flying-Foxes. The action is highly unlikely to result in the establishment of invasive flora species that are harmful to the Grey-Headed Flying-Fox.

Introduce disease that may cause the species to decline, or

The action is highly unlikely to introduce disease that may cause the Grey-Headed Flying-Fox to decline.

Interfere with the recovery of the species

There is currently no approved Recovery Plan in place for the Grey-Headed Flying-Fox. A Draft National Recovery Plan for the Grey-headed Flying-fox was prepared in July 2009 (DECCW 2009). The Draft National Recovery Plan lists 13 specific objectives for the five-year timeframe of the Plan. Of these, two could be considered relevant to the proposal:

- Objective 1: To identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range.
- Objective 2: To protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes.

While the proposal would result in the removal of potential foraging habitat, this habitat is not likely to be key foraging habitat or habitat critical to the survival of this species.

Conclusion

Under the EPBC Act an action requires approval from the Australian Government Minister for the Environment and Energy (DoEE) if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance such as the Grey-Headed Flying-Fox. Based on the above assessment, it is concluded that the action would not have a significant impact on the Grey-Headed Flying-Fox as it would result in the removal of a relatively small amount of potential foraging habitat which is not likely to be critical to the survival of the species. It is unlikely to introduce diseases or invasive species that would impact this species. As such the action does not require referral to DoEE.

Koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory)

The Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) is listed as Vulnerable under the EPBC Act. This species has been recorded within the study area. One Koala was sighted within the study area during surveys by Arcadis in July/August 2019. Koala scats were recorded from three SAT survey locations on the east side of the study area, east of the Pacific Highway, by Arcadis in 2017 and 2019. In addition, Koala surveys carried out by PEA Consulting in 2013 recorded Koala scats and scratches in the study area, however, no individual Koalas were sighted. Koala sightings and scats were recorded from adjacent to the western boundary of the study area during surveys undertaken for the Kings Hill Development Species Impact Statement (RPS 2019).

Bionet database search results (OEH 2019) show that there are 2,301 records of within 10 kilometres of the study area. A large number of records are located within Raymond Terrace township, Medowie State Forest to the north-east of Grahamstown Dam, and in native vegetation on the southern shores of Grahamstown Dam and between Newcastle Airport and Medowie. Few records are located in proximity to the study area or west of Grahamstown Dam.

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW, Koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range.

Koalas inhabit a range of eucalypt forest and woodland communities, including coastal forests, the woodlands of the tablelands and western slopes, and the riparian communities of the western plains. Koalas are also known to utilise isolated paddock trees. Koalas feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species. The quality of forest and woodland communities as habitat for Koalas is influenced by a range of factors including species and size of trees present, structural diversity of the vegetation, soil nutrients, climate and rainfall and size and disturbance history of the habitat patch.

Koalas are generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. The home range of Koalas varies depending on the quality of the habitat and the number of available food trees; studies in Port Stephens have determined that Koala home ranges vary between 0.2 – 500 hectares, with an average home range of 80 – 90 hectares (DECC 2008).

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Lead to a long-term decrease in the size of an important population of a species

A Koala sighting and scats were recorded from the eastern study area, east of the Pacific Highway. One Koala was sighted within the study area throughout all surveys undertaken by Arcadis in 2017 and 2019, and PEA from 2012 to 2015.

The results of SAT surveys by Arcadis indicate that Koala activity levels are low throughout the study area. Scats were recorded from only three of the 13 Koala SAT locations surveyed by Arcadis in 2017 and 2019. At SAT points where scats were recorded, only one tree with scats was recorded at each of two locations, and seven trees with scats at one location. The SAT survey where seven trees had scats was within a narrow road verge (less than 20 metres wide) along the eastern side of the Pacific Highway between the highway and the Koala fence to the east. It is likely that the comparatively high number of scat trees (7 out of 30) may be atypical for the study area, and may be evidence of one Koala that became temporarily 'trapped' between the highway and Koala fence before moving on to another location.

Koalas were recorded from adjacent to the western boundary of the study area during surveys undertaken for the Kings Hill Development SIS (RPS 2019). A total of 10 individual Koalas were identified to the west of the study area during surveys undertaken for the Kings Hill Development SIS (RPS 2019). Those studies determined that the carrying capacity of land surveyed for the Kings Hill SIS was around 0.5 to 0.75 Koalas per hectare. Population density for the study area is assumed to be considerably lower than the estimated carrying capacity of between 9 and 13.5 Koalas, given the low levels of activity and scarcity of sightings.

The low levels of Koala activity (from SAT surveys) and infrequent sightings indicate that the Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest (Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest) in the eastern portion of the study area is unlikely to support a significant population of Koalas, or to provide significant habitat for resident Koalas. No breeding Koalas were recorded within the study area.

'Important populations' of the Koala have not been identified in the referral guidelines for the Koala (CoA 2014). An important population of a species is defined in the MNES significant impact guidelines (CoA 2013) as:

1. Key source populations either for breeding or dispersal
2. Populations that are necessary for maintaining genetic diversity, and/or
3. Populations that are near the limit of the species range

It is uncertain whether Koalas occurring within the study area would conform with category 1 or category 2 above. Koalas within the study area are therefore assumed to be individuals from an important population as a precautionary measure.

Given the low number of sightings and low levels of activity it is unlikely that the study area provides breeding habitat for the Koala.

Due to the low levels of Koala activity, the small area of Koala habitat to be impacted (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest) and low potential of occurrence of breeding, it is unlikely that the proposal would lead to a long-term decrease in the size of an important population of the Koala.

Reduce the area of occupancy of an important population

The removal of a relatively small amount of potential habitat to be removed from the study area would not significantly reduce the area of occupancy of the species. The 18 ha of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation to be removed from the study area does not comprises a significant area of Koala habitat that occurs in the surrounding locality.

Fragment an existing important population into two or more populations

Koala floppy-top fencing has been installed alongside the eastern margin of the Pacific Highway. This fencing aims to prevent Koala (and other terrestrial fauna) access to the highway, thereby reducing mortality resulting from vehicle strikes. However, this fencing also acts as a barrier to fauna movement, preventing the movement of Koalas to habitat west of the Pacific Highway. Koala movement in the eastern portion of the study area is largely restricted to the north/south direction, between the fauna fence and the Grahamstown Dam foreshore.

Native vegetation has been cleared from much of the eastern portion of the study area for the electricity easement (located parallel to the Pacific Highway).

Die-back following permanent inundation resulting from the dam augmentation works has created a 300 metre wide gap between patches of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation occurring to the north and south.

Koalas (sightings and scats) have been recorded within the eastern portion of the study area on both sides of this gap. Koalas are known to be capable of moving large distance (3 to 4km), and it is unlikely that the 300m cleared area would represent an impermeable barrier to Koala movement. Individual Koalas may therefore move infrequently across this gap to access forest vegetation to the north and south.

Koalas that cross this gap may be at greater risk of injury or mortality from dog attacks (dog tracks were recorded in the study area by Arcadis).

A series of 17, 4-metre high Koala refuge poles have been installed along the dam foreshore to mitigate the impact of Koala habitat fragmentation and loss resulting from dieback associated with permanent inundation. Each Koala refuge pole located along the western foreshore of Grahamstown Dam was inspected by Arcadis for signs of Koala use. No scratches were identified on any of the poles, and it is likely that these poles are not currently used by Koalas.

The proposal includes construction of a Koala land bridge to facilitate north-south habitat connectivity and to reduce the potential for dog attacks to Koalas crossing this gap. Once constructed the Koala land bridge will be revegetated using flora species and local progeny from the adjacent Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation. Koala feed trees, particularly *Forest Red Gum* and *Grey Gum*, will be planted along the Koala land bridge. Other canopy tree species will also be planted, and future augmentation planting will be largely dictated by the successful establishment individual tree species. Revegetation should also be undertaken using pioneer and successional species such as Acacias and Allocasuarinas. These species will grow quickly and provide short-term refuge for Koalas until dominant canopy species have attained sufficient height to provide refuge for Koalas.

The 17 poles that were installed along the dam foreshore will be reinstated on the Koala land bridge. These poles may also be retrofitted with rope coils to increase grip

and aid climbing by Koalas. The timing and responsibilities for the removal and reinstatement of Koala refuge poles will be described in the Construction Flora and Fauna Management Plan.

Given that east-west movement for the Koala are currently restricted and north-south movement would be enhanced, the proposal is not likely to fragment an existing important population of the Koala into two or more populations.

Adversely affect habitat critical to the survival of a species

A total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation would be cleared from the study area for the proposal. This does not comprise a significant area of Koala habitat that occurs in the surrounding locality.

The following Koala feed trees are present in the study area:

- Forest Red Gum – ‘high’ value
- Grey Gum – ‘high’ value
- Grey Box – ‘moderate’ value
- Narrow-leaved Ironbark – ‘moderate’ value
- Red Ironbark – ‘moderate’ value
- White Mahogany – ‘moderate’ value

The study supports only a low abundance of the two ‘high’ value feed trees listed above.

Only one Koala was sighted within the study area during surveys. Surveys did not record any evidence of breeding (i.e. females with young or juveniles) or resident Koalas and activity levels identified from SAT surveys were low. Given the low levels of Koala activity recorded and the narrow, linear shape of habitat present, the study area is unlikely to provide significant habitat for a large number of Koalas.

East-west connectivity for Koalas is limited by the Koala fence along the eastern side of the Pacific Highway reducing its value as a corridor.

Given the above factors, it is unlikely that the study area provides significant or important habitat for the Koala considered to be critical to its survival. As such the proposal will not affect habitat critical to the survival of the Koala.

Disrupt the breeding cycle of an important population

Koalas occurring within the study area are assumed as a precautionary measure to be from a larger important population in the wider locality. The low levels of Koala activity (from SAT surveys) and infrequent sightings indicate that the Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest (Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest) in the eastern portion of the study area is unlikely to support a significant population of Koalas, or to provide significant habitat for resident Koalas. No breeding Koalas were recorded within the

study area. Given the low number of sightings and low levels of activity it is unlikely that the study area provides breeding habitat for the Koala.

Due to the low levels of Koala activity, the small area of Koala habitat to be impacted (a total of 18 hectares of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest) and low potential of occurrence of breeding, it is unlikely that the proposal would disrupt the breeding cycle of an important population of the Koala.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The 18 hectares of vegetation (Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest) to be removed for the proposal provides foraging and movement habitat for the Koala. The low levels of Koala activity and infrequent sightings indicate that the Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation of the study area is unlikely to support a significant population of Koalas, or to provide significant habitat for resident Koalas.

Given the low significance of the value of habitat for the Koala in the study area, the removal of 18 hectares for the proposal is not likely to result in the decline of the local Koala population.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The action is unlikely to result in the establishment of an invasive species that is harmful to the Koala.

Introduce disease that may cause the species to decline, or

The action is highly unlikely to introduce disease that may cause the Koala to decline.

Interfere with the recovery of the species

There is an approved Recovery Plan in place for the Koala for NSW (DECC 2008). The Recovery Plan lists seven general objectives and a number of specific objectives and actions under each objective. Of these, one could be considered relevant to the proposal:

- Objective 1b: Assess the impact of habitat loss and fragmentation on Koala populations

The proposal assesses the impact of habitat loss through this Assessment of Significance and is therefore consistent with the objectives of the Recovery Plan for the species.

Conclusion

Under the EPBC Act an action requires referral to the Australian Government Minister for the Environment and Energy (DoEE) if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance such as the Koala. Furthermore, the Commonwealth have prepared *EPBC Act Referral Guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (Commonwealth of Australia, 2014) to assist in determining the need for a referral. The relevant sections of the referral guidelines are assessed in relation to the proposal and the table below. The below assessment does not trigger the need for a referral under the guidelines. Furthermore, the above assessment, has determined that the proposal would result

in the removal of a relatively small amount of potential habitat which is not likely to be critical to the survival of the species nor is it likely to introduce diseases or invasive species that would impact this species. As such, a referral to the DoEE would not be required.

EPBC referral guidelines for the Koala

Flow chart question	Response
Does your impact area contain habitat critical to the survival of the Koala (habitat score ≥ 5)?	The study area has been determined to support Koala habitat with a score of 10 (refer to Table 3-13).
Do the area(s) proposed to be cleared contain known Koala food trees?	Yes. Koala feed trees, predominantly <i>Eucalyptus moluccana</i> (Grey Box), and in low abundances, <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>Eucalyptus punctata</i> (Grey gum) occur within 18 ha of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation that will be cleared.
Are you proposing to clear ≤ 2 ha of habitat containing known Koala food trees in an area with a habitat score of 5?	No. 18 ha Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation will be cleared.
Are you proposing to clear ≥ 20 ha of habitat containing known Koala food trees in an area with a habitat score of ≥ 8 ?	No. 18 ha Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation will be cleared.

Flow chart question	Response
Will your action adversely affect habitat critical to the survival of the Koala?	No. 18 ha of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation to be cleared. from the study area does not comprises a significant area of koala habitat that occurs in the surrounding locality. Koala feed trees present in the study area are: Forest Red Gum – ‘high’ value Grey Gum – ‘high’ value Grey Box – ‘moderate’ value Narrow-leaved Ironbark – ‘moderate’ value Red Ironbark – ‘moderate’ value The study supports only a low abundance of the two ‘high’ value feed trees listed above. Only one Koala was sighted within the study area during surveys. Surveys did not record any evidence of breeding (i.e. females with young or juveniles) or resident Koalas and activity levels identified from SAT surveys were low. Given the low levels of Koala activity recorded and the narrow, linear shape of habitat present, the study area is unlikely to provide significant habitat for a large number of Koalas East-west connectivity for Koalas is limited by the Koala fence along the eastern side of the Pacific Highway reducing its value as a corridor. Given the above factors, it is unlikely that the study area provides significant or important habitat for the Koala considered to be critical to its survival. As such the proposal will not affect habitat critical to the survival of the Koala.

Flow chart question	Response
Could your action interfere substantially with the recovery of the Koala? Impacts which are likely to substantially interfere with the recovery of the Koala may include one or more of the following: 1. Increasing Koala fatalities in habitat critical to the survival of the Koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities. 2. Increasing Koala fatalities in habitat critical to the survival of the Koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities. 3. Facilitating the introduction or spread of disease or pathogens for example <i>Chlamydia</i> or <i>Phytophthora cinnamomi</i>, to habitat critical to the survival of the Koala, that are likely to significantly reduce the reproductive output of Koalas or reduce the carrying capacity of the habitat. 4. Creating a barrier to movement to, between or within habitat critical to the survival of the Koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the Koala. 5. Changing hydrology which degrades habitat critical to the survival of the Koala to the extent that the carrying capacity of the habitat is reduced in the long-term.	The proposal would not interfere substantially with the recovery of the Koala as follows: 1. The proposal will not introduce dogs to the area or facilitate an increase in dog abundance. The project is unlikely to contribute to any increase in Koala mortality due to dog attacks 2. The existing fauna fence will be retained next to the Pacific Highway, which, when properly maintained by the asset owner, restricts Koala access to the highway and prevent vehicle strikes. Therefore the project is unlikely to contribute to an increase in vehicle strikes. 3. Mitigation measures outlined in Section 5 aim to minimise the risk of introducing disease or pathogens to the study area during construction/operation of the project. Therefore the project is unlikely to significantly reduce the reproductive output of Koalas or reduce the carrying capacity of the habitat. 4. The proposal will not increase the gap between patches of habitat located of the north and south of where Grahamstown Dam encroaches the study area. The proposal includes construction of a Koala land bridge to facilitate habitat connectivity and safe egress for Koalas across the existing 300m clearing between patches of Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest vegetation. Creating this vegetated corridor would include the planting of Koala feed trees to encourage use by Koalas between patches of habitat on the eastern side of the Pacific Highway (north-south link). The proposal would not create any barriers to movement. 5. Run-off from the URA would be directed towards and contained within the stormwater channel. Accordingly, habitat adjoining the proposal footprint is unlikely to be subject to increased volume or velocity of run-off. Changes to hydrology are unlikely to degrade habitat.

Flow chart question	Response
Conclusion	As the proposal would not affect habitat critical to the survival of the species and would not substantially interfere with the recovery of the species, The proposal is unlikely to have a significant impact on the Koala in accordance with Figure 1 of the <i>EPBC Act Referral Guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)</i> (Commonwealth of Australia, 2014). An EPBC Referral is not considered necessary.

