



Our ref: DOC20/1029388

Senders ref: SSI-8862

Belinda Scott  
Planning and Assessment Group  
Department of Planning, Industry and Environment  
4 Parramatta Square, 12 Darcy Street  
PARRAMATTA NSW 2150

Dear Ms Scott

**Subject: EES comments on Environmental Impact Statement for Beaches Link and Gore Hill Freeway connection – SSI-8862 - twin motorway tunnels across Middle Harbour from Warringah Freeway and Gore Hill Freeway to Balgowlah and Killarney Heights - surface upgrade of Wakehurst Parkway from Seaforth to Frenchs Forest and works to connect to the Gore Hill Freeway at Artarmon**

Thank you for your email of 9 December 2020 requesting advice on the Environmental Impact Statement (EIS) for this critical State significant infrastructure project.

The Environment, Energy and Science Group (EES) appreciates the Planning and Assessment Group giving it an extension in which to provide its comments. EES has reviewed the EIS and provides its recommendations and comments at Attachment A.

If you have any queries regarding this matter, please do not hesitate to contact Janne Grose, Senior Conservation Planning Officer on 02 8837 6017 or at [janne.grose@environment.nsw.gov.au](mailto:janne.grose@environment.nsw.gov.au)

Yours sincerely

A handwritten signature in black ink that reads 'S. Harrison'.

03/03/21

Susan Harrison

**Senior Team Leader Planning  
Greater Sydney Branch  
Environment, Energy and Science**

**Subject: EES comments on Environmental Impact Statement for Beaches Link and Gore Hill Freeway connection – SSI-8862**

The Environment, Energy and Science Group (EES) has reviewed the following documents:

- Beaches Link and Gore Hill Freeway Connection Environmental Impact Statement (EIS) - December 2020
- Appendix N - Groundwater
- Appendix O - Surface Water Quality and Hydrology
- Appendix R - Flooding Technical working paper: Flooding - by Lyall and Associates - December 2020
- Appendix S - Biodiversity Development Assessment Report (BDAR)
- Appendix W – Arboricultural impact assessment
- Draft peer review report of the EIS surface water assessment - by University of NSW's Water Research Laboratory – 18 Feb 2021<sup>(?1)</sup>('WRL review')
- Draft peer review report of the EIS groundwater assessment - by Groundwater Solutions Inc, for WRL - 16 Feb 2021

and provides its comments below.

EES has three key issues with this SSI. The first two relate to prescribed impacts of the project:

- 1) the uncertainty of the groundwater assessment in the model parameters which directly leads to significant uncertainty in model predictions and the groundwater impacts to assess risk. This means that the predicted impact upon groundwater dependent ecosystems (GDEs) is also highly uncertain
- 2) fragmentation and connectivity issues associated with the Wakehurst Parkway upgrade and widening and the lack of evidence that the proposed fauna crossings will be effective to mitigate impacts on threatened species and other native fauna

The third key issue relates to:

- 3) the indirect impacts of the project on Duffys Forest ecological community which is a Serious and Irreversible Impact (SII candidate).

## **Biodiversity**

### Direct impacts

#### *Clearing of vegetation, including native vegetation, and the habitats of threatened flora and fauna species habitat*

The BDAR assesses that direct impacts on biodiversity will occur as a result of clearing a total of approximately 20.92 hectares of vegetation within the subject land for the project, primarily in locations adjacent to the Wakehurst Parkway, within the Flat Rock Drive construction support site (BL2), Balgowlah Golf Course construction support site (BL10), Wakehurst Parkway south construction support site (BL12) and Wakehurst Parkway east construction support site (BL13) (section 5.1.3, page 192). This vegetation consists of:

- 14.15 hectares of native vegetation that meets the definition of one or more NSW plant community types (PCT), of which one (1.38 hectares in extent) is consistent with the definition of a threatened ecological community (TEC), being the Duffys Forest Ecological Community in the Sydney Basin Bioregion, listed as endangered under the *Biodiversity Conservation Act* (BC Act) (section 5.1.1, Table 5.1, page 190)
- 6.77 hectares of other vegetation, including:
  - 1.29 hectares of native revegetation
  - 0.36 hectares of native plantings

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<sup>1</sup> actually dated 18 Feb 2022

- 4.89 hectares of urban exotic/native plantings
- 0.23 hectares of weeds and exotics (section 5.1.3, page 192).

This vegetation is also considered to comprise or contribute to the habitats of numerous threatened species of fauna and flora, including one threatened flora species and 11 threatened fauna species that were either recorded during surveys or otherwise considered highly likely to occur in the subject land, as detailed in sections 3.6.1 and section 3.6.2. The BDAR assesses that direct impacts on biodiversity will occur as a result of clearing of the abovementioned approximately 20.92 hectares of habitat of these threatened species.

EES notes that vegetation removal including the clearing of native vegetation and fauna habitat would be further minimised during further design development and detailed construction planning, where feasible and reasonable (page 190).

#### *Offsets for clearing of native vegetation and the habitats of threatened flora and fauna species habitat*

Under the Biodiversity Offsets Scheme:

- the assessed impacts from clearing of vegetation attributed to PCTs and on ecosystem species' habitat are required to be offset by ecosystem biodiversity credits. The calculated required ecosystem credits are tabulated in Table 7.3.
- the assessed impacts from clearing of habitats of one flora species credit species (*Syzygium paniculatum*) and three fauna species credit species (Red-crowned Toadlet, Rosenberg's Goanna and Large-eared Pied Bat) are required to be offset by species biodiversity credits. The calculated required species credits are tabulated in Table 7.3.

EES recommends that offsetting be required through the purchase and retirement of like-for-like biodiversity credits and that this be completed *prior* to the commencement of construction.

#### Duffys Forest endangered ecological community

Of the seven NSW plant community types (PCTs) identified within the subject site one, PCT 1786, constitutes a threatened ecological community (TEC) under the BC Act, being the Duffys Forest Ecological Community in the Sydney Basin Bioregion ('Duffys Forest'), which is listed as an endangered ecological community (EEC). This TEC is also identified as an entity at risk of a serious and irreversible impact (SAIL) ([www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/biodiversity-offsets-scheme/serious-and-irreversible-impacts](http://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/biodiversity-offsets-scheme/serious-and-irreversible-impacts)). The approval authority is required to consider whether a serious and irreversible impact is likely to occur. The BDAR has provided information in section 5.3/Table 5.10 to assist this decision.

Table 5.10 in the BDAR indicates construction of the project would require the removal of 1.38 hectares (ha) of Duffys Forest TEC, while an additional area of 1.36 ha would be subject to indirect impacts through 'edge effects' (page 207), for upgrade of the Wakehurst Parkway from Seaforth Oval north to Warringah Road (page iii).

EES has reviewed this information in Table 5.10 and considers that it is deficient with respect to the following:

- The information from "OEH (2016)"<sup>2</sup> relied on for the *current* total area of Duffys Forest EEC within the Pittwater IBRA subregion stated in Table 5.10 is in fact based on interpretation of *pre-2009* aerial photography and does not take into account the cumulative

<sup>2</sup> **The native vegetation of the Sydney metropolitan area** (<https://www.environment.nsw.gov.au/surveys/VegetationSydMetro.htm>). Originally drafted in 2009 and considerably revised and published in 2013 (version 2.0), the vegetation maps and reports for the Sydney metropolitan area were updated in 2016 (version 3.0), but only with respect to the designation of **biometric vegetation types (BVTs)** and **plant community types (PCTs)** for each of the 79 identified vegetation communities, however no changes were made to the vegetation classification, community descriptions or areal extent of the communities documented in the version 2.0 reports and maps.

losses from subsequent actual or approved developments (other than the Northern Beaches Hospital road upgrade project) and unauthorised clearing of this ecological community in the 10–11 years since. These include the approved clearing of approximately 3.07 ha for the Mona Vale Road East Upgrade project by Transport for NSW. Other developments approved since 2009 by Northern Beaches Council or Part 5 authorities are also likely to have resulted in clearing of this EEC.

In addition, more detailed vegetation assessment undertaken on behalf of Transport for NSW's for its species impact statement (SIS) and submissions report for the Mona Vale Road West Upgrade project identified different extents of communities to those identified by OEH (2016) and concluded that there was actually a *smaller area* of Duffys Forest vegetation in that study area than mapped by OEH.

Furthermore, much of the remaining amount is highly fragmented, in small unconnected patches and is consequently subject to degradation from human disturbances, weeds, and other processes.

- Table 5.10 of the BDAR also indicates the project may result in water table drawdown beneath patches of Duffys Forest TEC adjoining the Wakehurst Parkway to the east and south of Seaforth Oval. It states "Groundwater modelling for the project has predicted up to three to five metres of water table drawdown beneath these patches of Duffys Forest (by 2027 and 2126 respectively) (Jacobs, 2020b)" but it is not clear from where in Appendix N this is derived. While the BDAR considers that Duffys Forest TEC is not a groundwater dependent ecosystem and would likely only draw on groundwater opportunistically during periods of low rainfall, EES considers the groundwater assessment to be deficient in a number of respects, as described in later comments.

EES recommends that:

- the extent of this ecological community as mapped by OEH (2013, minor update 2016 as version 3) be reviewed against recent aerial imagery, information from the Mona Vale Road West Upgrade SIS, and Northern Beaches Council to determine the actual extant distribution within the Pittwater IBRA subregion
- as a consequence, the BDAR be revised and resubmitted with updated information SAIL to support the assessment.

The EIS indicates Wakehurst Parkway north construction support site (BL14) would be the same site that was used as the main construction support site for the Northern Beaches Hospital road upgrade project. It notes revegetation works were carried out at this site, including planting with species consistent with the Duffys Forest endangered ecological community within the eastern section of the site (section 19.3.1, page 19.10). It confirms this revegetated area would remain fenced off and protected from disturbance and that during further design development and construction planning the temporary construction support site layout would be refined to show the revegetation area, to ensure it is avoided and protected during construction. EES recommends the protection and ongoing management of the planted Duffys Forest is included as a condition of consent.

#### Indirect impacts on vegetation, including native vegetation and threatened flora and fauna species habitat

Relevant indirect impacts of the construction or operation of the project on native vegetation, TECs and threatened species habitat adjoining or outside the subject land are identified and considered in section 5.2 of the BDAR. One of these impacts – the reduced viability of adjacent habitat due to edge effects along new edges – which is particularly relevant where the realignment and upgrade of Wakehurst Parkway would result in additional edge effects in some areas through the creation of new edges in previously undisturbed vegetation (section 5.2.2, page 198). For the Wakehurst Parkway section of the project the BDAR has endeavoured to quantify this impact, based on collection of data from 10 vegetation condition transects assessing the extent of existing edge

effects in adjoining native vegetation. This assessment found that edge impacts such as increased weed cover and reduced native ground and shrub cover are largely limited to the area within 20 metres of the road edge.

Consequently, an analysis of the native vegetation within a 20-metres buffer from the edge of the subject land was made (Table 5.5 and Figure 5-2). This estimated:

- 0.23 ha would be subject to increased edge effects to the extent they would become unviable due to the small size and isolation of the remaining patches
- 8.20 ha would be subject to increased edge effects as a result of the project due to the creation of one or more new edges within previously unfragmented vegetation. Of this about 1.36 ha meet the criteria for the BC Act-listed Duffys Forest EEC.

These areas of affected native vegetation are further broken down by PCT in Table 5.6 (page 202).

Under the BAM, indirect impacts on vegetation attributed to PCTs (including PCT 1786) and on ecosystem species' habitat are *not* required to be offset by ecosystem biodiversity credits, although the approval authority has the discretion to do so. The proponent has estimated the impacts of these indirect impacts in terms of ecosystem biodiversity credits, as tabulated in Table 7.2, and suggested an additional 50 ecosystem credits as a means to offset indirect impacts at the discretion of the Minister for Planning and Public Spaces. EES recommends that this be accepted and made a condition of approval.

#### *Plant community type identification*

EES has not undertaken a thorough analysis of plant community typing in the BDAR, but does question the identification of PCT 1292 *Coastal Sandstone Riparian Scrub (Water Gum-Coachwood Riparian Scrub Along Sandstone Streams, Sydney Basin)* along Burnt Bridge Creek within the Balgowlah Golf Course construction support site (BL10) (section 3.3, Fig. 3-3, page 86). EES notes that OEH (2016) modelled PCT 1292 as occurring only in the sandstone plateaux south of urban Sydney and the floristics data from plots BB05 and BB07 were not analysed in Table 3.4 against PCT 1780 *Coastal Sandstone Riparian Forest (Sydney Peppermint / Coachwood - Water Gum open forest in protected sandstone gullies around Sydney and the Central Coast)* as a possible choice.

#### Avoid and minimise impacts on native vegetation

Table 19-18 in the EIS includes an Environmental Management Measure (EMM) (B6) that "Vegetation removal including the clearing of native vegetation and fauna habitat will be further minimised during further design development and construction planning, where feasible and reasonable". All attempts should be made for the project to firstly avoid and then minimise impacts on native vegetation and where possible the project should be amended to avoid/minimise vegetation clearing. EES recommends this includes relocating the proposed construction support sites such as:

- the Wakehurst Parkway south construction support site (BL12)
- the Wakehurst Parkway east construction support site (BL13) to reduce impacts on remnant bushland, particularly as the BDAR indicates there are recent Bionet records of Eastern Pygmy-possum (page 146), Large-eared Pied-bat (page 147) and the Large Bent-winged Bat and Little Bent-winged Bat (page 154) on the Wakehurst Parkway east construction support site (BL13).

The RtS needs to clarify if it is possible to relocate the Flat Rock Drive temporary construction support site (BL2) to reduce impacts on the bushland rehabilitation area within Flat Rock Reserve (section 22.4.2 of EIS). The EIS notes BL2 has been located to limit clearing impacts on vegetation re-growth, which was established in 1998. While the BL2 site includes rehabilitated bushland and the impacted portion of the reserve would be revegetated and rehabilitated, it is unclear why this site has been chosen instead of the nearby Flat Rock Creek baseball diamond site to avoid any clearing of the 22 year old rehabilitated bushland, (see Figure 22.9 of EIS), particularly as the BDAR notes Powerful Owls were recorded adjacent to BL2 (see section 3.6.2.4.7, page 151) and



the Large Bent-winged Bat and the Little Bent-winged Bat were recorded adjacent to BL2 during Anabat surveys (section 3.6.2.4.12, page 154).

#### Prescribed biodiversity impacts

*Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range / Impacts of the development on movement of threatened species that maintains their life cycle*

The BDAR indicates prescribed biodiversity impacts specified by the BAM that are applicable to the project include:

- Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
- Impacts of the development on movement of threatened species that maintains their life cycle

It notes the proposal will increase existing fragmentation, mainly where the Wakehurst Parkway would be widened from two lanes to a four-lane dual carriageway (see Table 5.11, page 213).

#### Fauna crossing of Wakehurst Parkway

The BDAR notes the realignment and upgrade of the Wakehurst Parkway would widen the gap between habitat on the eastern and western side of Wakehurst Parkway and potentially adversely affect the movement patterns of a number of native fauna including threatened terrestrial fauna known or likely to occur in the area such as Rosenberg's Goanna, Eastern Pygmy-possum, Red-crowned Toadlet and Southern Brown Bandicoot. The BDAR states "the gap between habitat on the eastern and western side of the Wakehurst Parkway is currently about 12 to 15 metres. This gap would increase to about 35 to 40 metres in the southern portion of the Wakehurst Parkway, and about 18 to 20 metres in the northern portion of the Wakehurst Parkway" (page 220).

The EIS proposes to upgrade/replace or construct fauna exclusion fencing, fauna underpasses and rope crossings to mitigate impacts and facilitate fauna crossing beneath or over the road (section 19.5.2) so as to provide connectivity between Garigal National Park to the west and Manly Dam Reserve to the east .

The EIS indicates new and replacement fauna crossings to be provided over and beneath the Wakehurst Parkway, include

- three new fauna underpasses along the Wakehurst Parkway as shown in Figure 6-28 and Figure 6-29 (section 6.56, page 6.37 of EIS) including
  - two new fauna underpasses about 1000 metres north of Kirkwood Street and 620 metres south of Aquatic Drive. The underpasses would be 1.8 metres high and three metres wide
  - separate fauna underpass would be located about 725 metres north of Kirkwood Street (page 5.49)
- three new rope bridge crossings canopy bridges would be constructed about 910 metres and 1370 metres north of Kirkwood Street and 885 metres south of Aquatic Drive along Wakehurst Parkway (section 6.56, page 6.37 of EIS).

The SSI should ensure that the project improves native fauna connectivity and minimises risks to fauna.

#### *Efficacy of fauna passage structures proposed as mitigation measures for target fauna*

A major issue with this SSI is the lack of data and evidence as to the effectiveness of the various fauna passage structures (underpasses, rope crossings) and fauna exclusion fencing. The last review of fauna passage structures in NSW to EES's knowledge was in 2009 (*Use of fauna passage structures on RTA roads*).

Section 9.3 of the BAM (supported by further detail in section 2.7 of the *BAM Operational Manual Stage 2*) includes requirements that the BDAR must: document mitigation measures proposed to manage impacts, including proposed techniques, timing, frequency and responsibility for implementing each measure; identify any measures for which there is risk of failure; evaluate the risk and consequence; and document any adaptive management strategy.

EES considers the BDAR and EIS lacks any demonstration of the likely efficacy of the proposed fauna passage structures in providing migration passage for the of threatened fauna species suggested. In fact, for some of the target species for which these measures are proposed is the BDAR acknowledges that their effectiveness is unknown and/or not demonstrated, for example in relation to the use of the proposed rope canopy bridges by the Eastern Pygmy-possum the BDAR states “to date this species has not been known to use rope bridges” (Table 5.16, page 221).

In comments in 2017 on similar-sized culverts proposed for the Mona Vale Road West project by Transport for NSW / RMS, EES indicated that there was also no evidence to substantiate their use by the Eastern Pygmy-possum, and EES is not aware of any such use since.

The EIS states the fauna exclusion fencing, fauna underpasses and rope crossings will “facilitate the safe crossing of fauna beneath or over the road” (section 19.5.2, page 19.60 ) and mitigation measures such as fauna exclusion fencing, fauna underpasses and rope crossings would be implemented to minimise impacts (see Table 19.5, page 19.61). While acknowledging that provision of these measures is a significant investment by TfNSW, TfNSW has not provided any evidence that the proposed rope crossings and underpass structures would be successful for some of the target species, particularly the Eastern Pygmy-possum (see comments below).

EES considers that the proposed structures are not “proven successful” for the target fauna species. Furthermore, independent reviews by Niche Environmental (2014) of fauna underpasses proposed for the Warrell Creek to Nambucca/Urunga section of the Pacific Highway upgrade, support EES’s views that there is little evidence to support their success, both in general and for amphibian species.

There is no reference in the BDAR on the lengths of the proposed underpasses, a factor which can have a large influence on their use by fauna species.

There is no commitment in the BDAR to carry out pre-, during- and post-approval monitoring of these mitigation measures and local populations or to consult with EES, LLS and Northern Beaches Council in preparation of a monitoring plan that will consider remedial actions in responses to declines over the period of monitoring in the local population following construction.

#### *Target Species*

It is important the SSI identifies which native species (threatened and non-threatened species) are specifically targeted to use the underpasses and rope crossings. Table 19-18 in the EIS includes an Environmental Management Measures (EMM) that connectivity measures will be designed during further design development and consider measures to facilitate the crossing of native fauna species including the Eastern Pygmy possum, Red-crowned Toadlet, Southern Brown Bandicoot and Rosenbergs Goanna. Table 5.16 in the BDAR includes a list of target species which *may use* the crossing structures but it appears there is no certainty that some of the species listed will use the crossings, such as the Eastern Pygmy Possum (page 221) as noted above.

This lack of evidence to support the use of underpasses by amphibians, as noted above is an issue for the threatened Red-crowned Toadlet, as the BDAR states it “is considered highly likely to occur in the northern extent of the subject land” and “this species is assumed to be present in areas of suitable habitat adjoining the Wakehurst Parkway” (see Section 5.4.5.2.1, page 230). It is unclear if the Red-crowned Toadlet is likely to use the fauna underpasses (see comments below).

The BDAR does not identify the koala as a target species that may potentially use the underpasses (see Table 5.16). While Table 3.29 in the BDAR indicates that koalas have been recorded within 1.5 km of the subject land, page 141) and Annexure A notes that large tracts of native vegetation within and adjoining the northern extent of the subject land offer potential habitat to the koala (see page A-88), both Table 3.29 and Annexure A assign koalas as a Low likelihood of occurrence.

Since the BDAR was undertaken new BioNet records have been submitted in December 2020 of koala calls having recently been heard in 2017 and 2019 in the locality. EES is aware that a koala was observed in 1979 in what part of the Garigal National Park and this information was recorded in Aus Zoologist Vol 26 (3) Sept 1990. EES recommends the BDAR is revised to include consideration of this new information as the BDAR has discounted the koala as a candidate species by the BAM credit calculator (section 3.6.2.3 of BDAR).

Further, EES notes there are inconsistencies between how the BDAR has treated the likelihood of occurrence of the koala compared to the Southern Brown Bandicoot (*Isoodon obesulusobesulus*). Table 3.29 in the BDAR indicates that Southern Brown Bandicoots have also been recorded within 1.5 km of the subject land but unlike to koala Table 3.29 assigns this species as a High likelihood of occurrence (page 142). Similarly Annexure A also notes large tracts of native vegetation within and adjoining the northern extent of the subject land offer potential habitat to this species but unlike the koala it assigns the Southern Brown Bandicoot as a high likelihood of occurrence (see page A-82). While Table 3.30 states “this species was not identified in the subject land during targeted surveys” (page 143) the EIS states “it has previously been recorded in proximity to the construction footprint next to the Wakehurst Parkway” (Table 19.7, page 19-32) and the BDAR lists the Southern Brown Bandicoot as a target species that may use the crossing structure. Due to the recent BioNet records of koalas in the locality, the RtS needs to consider the likelihood of koalas using the underpasses and it should include details on specific underpass design features that are known to be required for koala use.

Targeted research needs to be undertaken to gain an awareness of the conditions and populations adjacent to the fauna crossings.

Once a list of target species is identified (threatened and non-threatened), the proposed locations and design of the crossings needs to be appropriate for these species, such as whether the proposed height, width and length of the underpass is adequate.

The crossing should be located as close as possible to existing fauna pathways and at locations with highest rates of road kill (see Queensland Fauna Sensitive Road Design Manual (Chapter 6 of Vol 2, page 46)). “The Fauna Fencing should account for repetitive pathway behaviour, as many species are averse to changing paths and will try to use the same path even if it is blocked” (Queensland Fauna Sensitive Road Design Manual, Chapter 6 of Vol 2, page 67).

It is recommended the fauna crossings are designed in consultation with experts on the target fauna species so the crossing structures are effective. A condition of consent should be included to this effect:

- ***The fauna crossings (including underpasses and rope crossings) must be designed in consultation with experts on the target fauna species that may potentially use the crossings and experts in fauna crossings***

The BDAR notes the design of underpasses and rope crossings would ensure the minimum requirements for fauna crossings would be met in accordance with *Wildlife Connectivity Guidelines: Managing wildlife connectivity of road projects (draft)* (Roads and Maritime, 2011) (page 221). EES has been advised:

- the RMS guidelines on fauna crossing structures and their dimensions differ markedly from those of other states, for example the Queensland Department of Transport and Main Roads Fauna Sensitive Road Design Manual – June 2010 - Volume 2 (hereafter referred to as the Queensland Fauna Sensitive Road Design Manual) which is available at the following link:



- In almost all details the RMS specifications are well below those considered acceptable in other states. The RMS guidelines are allegedly based on the *minimum* specifications under which a single animal of the subject species has used a structure on a single occasion.

It is recommended the project also refers to the Queensland Fauna Sensitive Road Design Manual or Victorian *VicRoads Fauna Sensitive Road Design Guidelines* (Rev.0, Aug 2012) when considering appropriate specifications for road crossing structures, assuming that comparable species are available for consideration.

### Fauna Underpasses

The EIS and the BDAR refer to existing underpasses, for example Table 5.10 in the EIS refers to “retention of the existing fauna underpass north of Aquatic Drive constructed as part of the Northern Beaches Hospital road upgrade project” (page 5.49). It is unclear if any monitoring of these existing fauna underpasses has previously been undertaken, or if the existing underpasses are currently being monitored to determine their effectiveness and if so, which native species have been recorded using the underpasses. The RtS needs to provide details on the existing underpasses, their use by native fauna and any existing monitoring results and findings.

The BDAR notes the underpasses will consist of concrete box culverts and the underpasses would be designed to convey surface water flows as well as facilitate fauna crossings and would include a raised bench on one side of the base of the culvert, to allow for the dry passage of animals during periods of high flow, designed to be dry in a 1 in 10 year Average Recurrence Interval (ARI) and that the dimensions and specifications of fauna underpasses would be refined during further design development (Section 5.4.4, page 220). Table 5.16 in the BDAR indicates for the fauna underpasses 2925 and 3230 that the box culvert will be about 1.8 m high x 3 m wide (page 221) while fauna underpass 4390 will be about 2.4m high x 3 m wide (page 221). It is unclear why one underpass is proposed to be 2.4 m high and not the other two. The RtS should address this.

Table 5.16 indicates that all three underpasses may be used by large terrestrial mammals such as the Swamp Wallaby (*Wallabia bicolor*) (page 221-222 of BDAR). The RtS needs to clarify if the Swamp Wallaby is the largest species potentially using the underpasses.

The height, width and length of the underpass structures should be appropriate for all species that will potentially use the underpasses. The Queensland Fauna Sensitive Road Design Manual states 3 metre x 3 metre box culverts are generally considered suitable to accommodate a wide variety of terrestrial fauna species (including macropods, koalas and flightless birds) but to encourage the passage of a variety of small to large fauna species, a minimum vertical clearance of three to five metres is considered necessary (Chapter 6 of Vol 2, pages 43-44).

The RtS should clarify if large terrestrial mammals are intended to use the raised bench for dry passage. Details are required on the height of the raised bench and whether the underpass height is adequate to incorporate the raised bench plus allow for the dry passage of large terrestrial mammals. The Queensland Fauna Sensitive Road Design Manual states for macropods “dry passage at all times within the culvert must be provided” (Chapter 6 of Vol 2, page 45) and “koalas require a dry passage” (Chapter 6 of Vol 2, page 44).

The Queensland Fauna Sensitive Road Design Manual notes “Long and narrow underpasses deter macropods” (Chapter 6 of Vol 2, page 45) and lengths longer than 20 m have generally lower use (Table 6.6.3, page 46). The RtS needs to include details on the proposed length of the underpasses and evidence of the known use of such underpass lengths by native fauna.

The EIS includes an example of a fauna underpass (see Figure 6.22). EES considers additional fauna habitat needs to be included in and around the fauna underpass to make it more fauna friendly for multiple species including arboreal mammals, invertebrates, reptiles and amphibians. The fauna underpass shown in Figure 6.22 of the EIS could be improved by including for example:

- an earth floor / 'natural floors'
- the placement of logs, rocks, leaf litter on the floor of the underpass for ground-dwelling species refuge
- enough space for larger animals to pass through the underpass
- the openings should lead directly into habitat (not concrete) – i.e. revegetate the entrances to the underpass/culvert crossings with suitable habitat including palatable vegetation).

The underpass entrances should lead to natural habitat on both sides and fauna should have the ability to view habitat on the other side of the road from the culvert entrances (Queensland *Fauna Sensitive Road Design* - Chapter 6 of Vol 2, page 45 ).

The BDAR states “landscaping near the fauna underpasses would be integral to their effectiveness and use by fauna species. Planting of trees and shrubs at fauna underpass approaches would provide connectivity between underpasses and adjacent fauna habitat that has been retained within the subject land. Consideration should be given to planting of feed species for target species, such as banksias for Eastern Pygmy-possum outside of any fauna fencing. Landscaping treatments within underpasses could include the placement of mulch or gravel, rocks and ground timber that offer protection and refuge to some fauna species” (page 222).

The addition of an earth floor is necessary to assist wildlife use of the underpass structures. According to the Queensland Fauna Sensitive Road Design Manual amphibians are unlikely to pass through culverts with a concrete base (Chapter 6 of Vol 2, page 39). There is a need to account for the inclusion of an earth floor when calculating the appropriate height of the underpass and details needs to be provided how an earth floor will be included if the underpasses are also to be designed to convey surface water flows.

It is recommended the RtS includes details on the fauna habitat/ fauna furniture that is to be placed within the culverts and near the underpass entrances to facilitate fauna movement for each native fauna species that may potentially use the underpasses. In addition, a condition of consent should be included which requires the underpasses to incorporate appropriate fauna habitat/fauna furniture within the culverts and near the entrance to the underpasses to facilitate fauna movement.

- ***The fauna underpasses must incorporate appropriate fauna habitat/ fauna furniture within the culverts and near the underpass entrances to facilitate fauna movement for all native species (threatened and no threatened) that will potentially use the underpasses***

#### Culverts for drainage purposes

The BDAR indicates in addition to the specific fauna-crossing structures, a number of culverts would be constructed for drainage purposes and these may offer opportunities for smaller fauna species to cross beneath the road. It indicates these culverts do not specifically provide for fauna passage and may be inundated following rain but smaller terrestrial mammals, reptiles and amphibians may use these culverts on occasion (page 222). Details are required on the number of drainage culverts that are proposed to be installed and their height and width. A plan showing their location and the proposed fauna crossings would be useful.

The RtS needs to clarify whether fauna furniture will be included in the drainage culverts to assist fauna passage and address whether any existing culverts of a similar height, width and length are known to facilitate fauna passage. The use of the drainage culverts by native fauna can't be relied on and should not be considered as a mitigation measure to assist with fauna connectivity.

## Fauna Fencing

### *Suitability for subject species*

The BDAR indicates the Red-crowned Toadlet and Eastern Pygmy Possum are '*Threatened fauna species at highest risk of injury or mortality*' during vegetation clearing and other construction activities and it refers to vehicle strike (Section 5.14 of BDAR and section 19.5.2 of EIS). The RtS needs to clarify if:

- vehicle strike is also an issue for the Red-crowned Toadlet during the operation of the project
- the Red-crowned Toadlet and Eastern Pygmy Possum will be at highest risk of injury or mortality due to vehicle strike during the operation of the project.

The BDAR notes the Red-crowned Toadlet is unlikely to evade vehicles quickly but they are unlikely to travel large distances from preferred habitat (page 232) it also indicates the underpasses would facilitate the safe crossing of Wakehurst Parkway by the toadlet (page 233). It states, "Connectivity measures will be designed during further design development ... and consider measures to facilitate the crossing of threatened fauna species including the Eastern Pygmy-possum, Red-crowned Toadlet, ...." (page 244).

It is unclear if the Red-crowned Toadlet and Eastern Pygmy Possum are targeted by the fauna exclusion fencing/underpass guidance fencing. In relation to the fauna exclusion fencing/underpass guidance fencing :

- Table 5.18 in the BDAR indicates the fauna exclusion fencing would be designed to facilitate Eastern Pygmy-Possum crossing and to prevent the species from entering to the road but it is not clear from this table if the Red-crowned Toadlet is likely to enter the road, and if so if the fencing is to be designed to prevent the Red-crowned Toadlet's from accessing the road (pages 233-234 )
- Section 5.4.4 of the BDAR indicates the design specifications of the fauna exclusion fence would be developed during further design development, and "consideration would be given to designing the fence to exclude small fauna species such as Eastern Pygmy-possum, from the road corridor" (page 220)
- Table 6.1 of the BDAR (Environmental Management Measures) states "fauna exclusion fencing would be designed to exclude small fauna species from the road such as Eastern-Pygmy-possum..." (page 244)

If the fauna exclusion fencing, underpass guidance fencing and also the underpass structures are to be designed to target the Red-crowned Toadlet and Eastern Pygmy Possum, these small and specialised fauna will require considerable species-specific engineering solutions and a condition of consent should be included to this effect. Neither the Red-crowned Toadlet or Eastern Pygmy Possum are going to respond to a standard chain-mail flop-top fence.

Sydney Olympic Park Authority have installed effective fencing for frogs, and there is evidence for fencing Growling Grass Frog in Victoria. The general limitation is one of constant repairs.

### Underpass Guidance Fencing

The EIS mentions the provision of "fauna exclusion fencing" along the eastern and western edge of the realigned and upgraded Wakehurst Parkway to prevent fauna from accessing the road and being subjected to vehicle strike (page 19-60). The EIS states the fauna exclusion fencing "will be installed for the full extent of the Wakehurst Parkway within the construction footprint" (page 19.74) and the BDAR states "fauna fencing would be provided for the length of Wakehurst Parkway (page 184) and "the fauna exclusion fence would also guide animals to move along the fence toward a number of fauna underpasses that would be provided beneath the Wakehurst Parkway" (page 220, BDAR).

It is assumed the EIS also uses this term to imply "*underpass guidance fencing*", but the two should be considered specifically. The latter is a different purpose and often requires significantly different design, materials etc. For guidance fencing the proponent needs to provide a scaled

diagram of the alignment which identifies where the fence is proposed and where it is proposed to end – the fencing should not push wildlife into a new roadkill hotspot. Also, the fencing design needs to address how it links to the underpass structures. Fencing above the underpass is not useful in directing animals into the underpass. Instead, guidance fencing is required which links with the wall base of the culvert structure, so that the native fauna move seamlessly into the crossing structure.

As noted above, NPWS has identified that the fauna fencing would need to consider fire fighter access with a lockable pedestrian gate every 100 meters so that fire fighters could establish escape routes for this area during fire operations. The SSI should address whether the proposed crossing structures provide an adequate escape route for native fauna to prevent native fauna being trapped by the fence during a fire and whether a enough crossings and spacing between the crossings has been provided.

#### Fauna rope canopy bridges

The BDAR states “three new rope bridges would be provided to facilitate the safe crossing of arboreal fauna above the road and three existing rope bridges would be replaced to allow for the widened road as part of the project (page 221). It is unclear if the proposed replacement of the tree existing fauna rope canopy bridges will be in addition to the three new proposed rope crossings canopy bridges (i.e. will the project result in six rope bridge crossings in total). The RtS needs to confirm this.

The BDAR indicates the rope crossing locations would also be refined during further design development, micrositied for optimum usage by fauna. The RtS needs to clarify if the selected locations for the crossings are based on existing road kill data, monitoring data, suitable habitat availability for target species etc. The RtS should provide details on this and whether three new rope bridges is an adequate number of crossings and whether the distance between the crossings is appropriate.

#### Maintenance of underpasses, fencing, rope crossings

The BDAR states “maintenance of any fencing and underpasses is critical to the efficacy of these measures and would need to be detailed in an Operational Environmental Management Plan or existing Environmental Management System that incorporates the project” (page 221). Details need to be provided on the ongoing maintenance including regular inspection of the fauna exclusion fencing along its entire length, replacement of fauna furniture, removal or replacement of vegetation near the underpass entrances

The RtS needs to identify who will be responsible for maintaining and funding the future maintenance of the underpasses, fencing, rope crossings in perpetuity, and provide details on the funding source. The maintenance of the fauna fencing and fauna crossings in perpetuity should be included as a condition of consent.

#### Monitoring

EES recommends a long-term monitoring program is undertaken to evaluate the effectiveness of the fauna crossings. The monitoring program should be prepared in consultation with EES, the Greater Sydney Local Land Services (LLS) and Northern Beaches Council and a condition of consent is included to this effect.

If monitoring data is not currently available for the existing underpasses and rope crossings, monitoring should commence immediately at the existing crossings to obtain baseline data prior to designing and constructing the proposed fauna crossings.

The monitoring of existing and new crossing should continue during the operation of the crossings and consider:

- target species
- the duration of monitoring and the frequency

- how effective are the wildlife crossing structures at increasing population viability
- the number of species using the crossings and the rate of their detection
- the local species abundance in the habitat within the vicinity of the crossings
- photographic monitoring; monitoring of scats, hair and tracks; road kill data.

The findings of the monitoring should be provided in an annual report to DPIE, EES and LLS and published in scientific literature and made available on line.

*Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and TECs*

The BDAR indicates prescribed biodiversity impacts specified by the BAM that are applicable to the project include:

- impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and TECs.

Impacts on groundwater dependent ecosystems (GDEs)

*Identification of GDEs*

The BDAR (section 3.8) identifies the following ecological entities as groundwater dependent ecosystems (GDEs) in the “locality”:

- terrestrial ecosystems with potential reliance on subsurface groundwater mapped in the *Groundwater Dependent Ecosystems Atlas* ([www.bom.gov.au/water/groundwater/gde](http://www.bom.gov.au/water/groundwater/gde), Bureau of Meteorology 2018), listed in Table 3.33 and mapped at very small scale in Fig. 3-11 of BDAR:
  - vegetation, in upper reaches of Flat Rock Creek at Munro Park, classified as ‘Coastal Sandstone Gully Forest’, ‘Sandstone Riparian Scrub’ and ‘Coastal Sandstone Gully Forest’, which are flagged as GDEs with potential for groundwater interaction ranging from moderate to high
  - vegetation, in lower reaches of Bates Creek, classified as ‘Coastal Sandstone Gully Forest’, ‘Estuarine Mangrove Forest’ and ‘Seagrass Meadow (Zostera)’ which are flagged as GDEs with potential for groundwater interaction ranging from moderate to high
  - vegetation, in Manly Dam Reserve, classified as ‘Coastal Sandstone Gully Forest’ and ‘Coastal Sandstone Plateau Heath’, which are flagged as GDEs with moderate potential for groundwater interaction.
- Areas of PCT 1803 *Coastal Upland Damp Heath Swamp* on the western and eastern sides of Wakehurst Parkway. BDAR section 3.5.2, page 118 discusses this vegetation community as an endangered ecological community, while section 3.8, page 178 acknowledges areas of this community as a GDE, since it “primarily occurs on impermeable sandstone plateaux with shallow groundwater aquifers, in the headwaters and impeded drainage lines of streams, and on sandstone benches with abundant seepage moisture.”

EES makes the following comments in relation to identification of GDEs:

- the term “locality” is not defined in the BDAR, though used throughout in different contexts. It is not explained how the extent of the “locality” was determined for the purposes of identifying GDEs that need to be considered for potential impacts of the project
- for the Flat Rock Creek Reserve/Munro Reserve the BDAR has omitted to include the following GDEs reliant on subsurface presence of groundwater as identified by BoM 2018: vegetation classified as Coastal Sandstone Plateau Heath, Estuarine Fringe Forest and Illawarra Gully Wet Forest
- the PCTs, and if relevant, TECs, pertaining to these vegetation GDEs need to be identified, field verified, and their actual extents mapped at a scale at least as large as the PCTs maps in Figures 3-4 (maps a-e), section 3.3.



- High priority GDEs relate specifically to the *Water Sharing Plan for the Greater Sydney Metropolitan Region: Groundwater Sources* (WSP, DPI 2001) and list a very limited number of GDEs for the purpose of that plan. The absence of such high priority GDEs in the locality of the project does not mean that GDEs or other water dependent ecosystems of high ecological value do not occur within the impact area.
- The BoM 2018 GDE Atlas mapping was the primary source of information used to determine GDEs and the locations of GDE. The BDAR has not used more recent and more detailed spatial information waterways and water dependent ecosystems published by DPIE's Science Division in 2019: '*High Ecological Value Waterways and Water Dependent Ecosystems - GREATER SYDNEY REGION*' (available for each individual local government area on SEED via <https://datasets.seed.nsw.gov.au/dataset/hevwater-greater-sydney-region>).
- These data better identify *water dependent* ecosystems, which may also be *groundwater dependent* – since the local hydrogeology is complex and there is a great deal of uncertainty around this, the precautionary approach should be applied in identifying other possible GDEs. These should include riparian vegetation along any watercourses such as Flat Rock, Quarry, Bates and Burnt Bridge Creeks; the number of unnamed ... "small ephemeral watercourses near Wakehurst Parkway" (section 5.4.5.2; page A-29) and minor seeps throughout the sandstone geology within Garigal National Park and in Manly Dam Reserve that "offer potential habitat to threatened species such as the Red-crowned Toadlet" (5.4.5.2) and Giant Burrowing Frog (page A-29). The latter should also be considered for the same reasons that areas of PCT 1803 have been considered likely to be GDEs.

### *Assessment of impacts on GDEs*

BDAR Section 5.6, page 237, and also Table 5.17, page 228, summarise impacts on GDEs. In examining the impacts of groundwater changes on biodiversity the BDAR relies exclusively on modelled groundwater and base flow changes described in Technical working paper: Groundwater (Appendix N of EIS) and in the following, as 'Jacobs, 2020b'. The following therefore includes comments on both the BDAR and Jacobs 2020b and result from a review by EES Water Science and Greater Sydney Branches, noting that none are hydrogeographers, with the assistance of draft independent reviews of the EIS surface water assessment, by the University of NSW's Water Research Laboratory ('WRL review') and of the EIS groundwater impact assessment, by Groundwater Solutions Inc. on behalf of the WRL ('GSI review'), which were made available to EES.

- The GSI review highlights the uncertainty in model parameters which directly leads to significant uncertainty in model predictions and does not allow for enough exploration of the range and likelihood of plausible groundwater impacts to enable decisionmakers to assess risk. The review further makes the point that due to gaps in data and analysis, the actual groundwater impact of the project is difficult to assess. These mean that the predicted impacts upon groundwater dependent ecosystems will also be highly uncertain.
- The GSI review notes that estimates of baseflow (i.e. groundwater which feeds a watercourse) are based on single water levels and therefore have high uncertainty.
- Baseflow reduction during operation is identified as significant yet it is stated that it is "*unlikely to result in a complete loss of aquatic habitat. Pools would be retained in these waterways and there would still be high flows immediately after rainfall events. Between rainfall events there would still be some (low) flow along the waterways. Outside of the pool areas, substantially reduced flows between rainfall events would be expected to alter assemblages of freshwater biota in these creeks to generally include only those species that are most tolerant to low flows*" (see of BDAR, page 230). The impact to groundwater dependent species is therefore significant. The BDAR notes that the potential operational impacts to Flat Rock Creek are likely to be offset by the Gore Hill Freeway operational wastewater treatment plant discharges to Flat Rock Creek. The impact of the quantity and quality of this water on GDE would need to

be determined. Consultation on this aspect should be undertaken with the EPA and also DPIE's Environment Protection Science Branch.

EES supports the recommendation (WRL review page 3) that given that the EIS does not provide predictions of baseflow reductions during extended dry periods or drought it is essential that *"predictions of baseflow reduction should be based on extended timeseries modelling so that flow frequency curves pre and post construction can be assessed on an ecological impact basis for all of the relevant flow facets."*

- EES does not consider acceptable statements such as for Burnt Bridge Creek, for example, that "reductions in flow are unlikely to result in a complete loss of aquatic habitat", and further modelling and assessment is required.
- The Jacob's assessment refers to and provides modelled estimates of both 'water table drawdown' and 'maximum drawdown', but these terms, are neither defined nor the difference between them explained. Furthermore, throughout Jacobs 2020b there appears to be many contradictory values of the quantum of water table drawdown for a given location, e.g. at Flat Rock Creek, under the same scenario (project only or cumulative) and time frame (at end of construction or end of 100 years of operation). For example, estimates in Table 6-8 of "up to 25" metres for project only and cumulative in 2128 do match those in Table 6-10, but do not match those in e.g. Tables 6-9 and 6-10. This also occurs in the BDAR, for example on page 237 it states *"About 10.50 hectares of Coastal Sandstone Gully Forest, Sandstone Riparian Scrub and Coastal Sand Forest is within the area of predicted water table drawdown. The area adjoins Flat Rock Creek and is mapped as having moderate to high potential for groundwater interaction. Water table drawdown beneath this vegetation is predicted to be up to four metres by 2028, and up to 11 metres by 2128 (Jacobs, 2020b)"*, whereas on page D-36 it says *"The drawdown beneath Flat Rock Creek has also been estimated to be up to 28 metres"*. Clarification is required.
- *The level of groundwater dependency of this vegetation is unknown; however, it is likely that it is able to draw on surface water in Flat Rock Creek and soil moisture to prevent drying out of the community, except in dry periods where there is no recharge from rainfall or surface runoff.* It is important to note that:
  - 1) a drawdown of 4 and 11m will result in significant impact to community composition and structure – a drawdown of this magnitude will mean that tree roots will be unable to access groundwater
  - 2) a significant baseflow reduction has been identified in Flat Rock Creek - therefore it is unlikely that this community (and others) will be *"able to draw on surface water in Flat Rock Creek and soil moisture to prevent drying out of the community"*.
- The drawdown beneath Quarry Creek is estimated to be up to eight metres. The drawdown beneath Burnt Bridge Creek is estimated to be up to five metres (see D36 of BDAR). These drawdown estimates would result in substantial impacts to any communities that rely on groundwater for survival <sup>3,4</sup>.
- The BDAR notes that *the extent of groundwater dependence Coastal Upland Swamp (as well as other vegetation identified as groundwater dependent), or their connectivity to other areas of groundwater, is not known and therefore the impacts from water table drawdown are uncertain (Page 237)*. Given this uncertainty how can potential impacts be identified as

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<sup>3</sup> Kuginis, L, Dabovic, J, Byrne G, Raine, A and Hemakumara, H. 2016, *Methods for the identification of high probability groundwater dependent vegetation ecosystems*. NSW Department of Primary Industries

<sup>4</sup> Serov, P, Kuginis, L and Williams, JP. 2012, *Risk Assessment Guidelines for Groundwater Dependent Ecosystems, Volume 1 The Conceptual Framework*. NSW Office of Water and Office of Environment and Heritage. NSW Office of Water (Department of Primary Industries) and Office of Environment and Heritage (Department of Premier and Cabinet)

unlikely. A drawdown of even 1 metre can result in species composition changes for wetlands that are dependent on the surface expression of water.

Table 6.1 (page 244) of the BDAR includes the mitigation measure for water table drawdown impact on GDEs that

*a focussed study will be carried out to confirm potential baseflow reductions at Burnt Bridge Creek, Flat Rock Creek and Quarry Creek due to groundwater drawdown, and whether this might have an increased effect on freshwater ecology in the affected watercourses and nearby groundwater dependent ecosystems. The study will consider how existing site features affect the interaction between surface water and groundwater along the affected reaches of these watercourses, and the hydraulic connectivity in the underlying geology. Where unacceptable ecological impacts are predicted, **feasible and reasonable mitigation** measures to address the impacts will be identified.*

Other than possible lining of parts of the tunnel, it is also unaddressed as to what adaptive management actions might be put in place if the monitoring and modelling show a greater impact than is acceptable. Furthermore, there is no consideration as to what “acceptable” impacts on biota might be.

It is important to note that due to the lag time of groundwater systems unacceptable impacts may be impossible to avoid after groundwater monitoring thresholds have been reached (Currell, 2016), so it is often not possible to manage adverse groundwater impacts through monitoring alone. The GSI groundwater review clearly states that the modelling provides no evidence that adverse groundwater impacts can be mitigated through monitoring and adaptive management.

Despite the large uncertainties, groundwater impacts are proposed to be managed primarily through further monitoring and modelling, with some adaptive (or reactive) management. However, an adaptive management strategy is considered “not applicable” (BDAR, page 12). Section 9.3 of the BAM (supported by further detail in section 2.7 of the *BAM Operational Manual Stage 2*) includes requirements that the BDAR must: document mitigation measures proposed to manage impacts, including proposed techniques, timing, frequency and responsibility for implementing each measure; identify any measures for which there is risk of failure; evaluate the risk and consequence; and document any adaptive management strategy.

EES recommends that:

- the Jacobs Groundwater assessment first be revised in line with the recommendations of the peer review and that
- subsequently the BDAR be revised, including with respect to section 9.3, and resubmitted for review
- both monitoring and adaptive management measures be developed in consultation with the ground and surface water scientists of Department of Regional NSW (from former Department of Primary Industries - Water) and EES. The plan should consider possible scenarios and also be consistent with the advice in section 2.7 (*Management of uncertain impacts*) of the *Biodiversity Assessment Method Operational Manual Stage 2* (DPIE, 2019) and include:
  - relevant baseline data, collected prior to impacts, of variables to be used to monitor changes
  - seasonal changes or relevant impacts to be measured
  - monitoring techniques, intensity and based on best practice (e.g. published peer-reviewed guidelines). Monitoring should enable the proponent to determine if measures are being implemented as planned and provide an early warning of measures that are ineffective and/or the uncertain impact is being realised
  - frequency and type of reporting
  - completion and performance criteria which adhere to SMART principles and are ecologically based, that can be used as triggers for management intervention actions

- information that will be necessary to measure the impact over time and consideration given to how these results could be used to inform ongoing (or future) operations.

#### Red-crowned Toadlet

The BDAR notes the project would result in an increase in total annual nitrogen loading of 188 kilograms per year for the overall combined Wakehurst Parkway catchments and the increase in nitrogen downstream of the proposed water quality basin at chainage 4250, above the identified potential breeding habitat for Red-crowned Toadlet, would be 44 kilograms per year (page 231). It is unclear if the Red-crowned Toadlet and/or its habitat could potentially be impacted by a potential increase in total nitrogen load. The RtS should clarify this.

The BDAR states “potential construction impacts on Red-crowned Toadlet habitat would be managed by the implementation of standard management and environmental management measures as outlined in Technical working paper: Surface water quality and hydrology (Jacobs, 2020a), and that water quality of Red-crowned Toadlet habitat is unlikely to be significantly impacted during operation of the project, adverse impacts on potential Red-crowned Toadlet habitat are unlikely” (Section 5.4.5.2.1, page 231). The ephemeral streams which occur near the Wakehurst Parkway and flow in either a west and east direction could be a potential conduit for the spread of weeds (figure 5.2, 199). Management measures are required to minimise the risk of introduction and spread of weeds (section 5.2.4, page 207) along these streams, especially as the BDAR states “these first-order ephemeral streams are likely to provide sheltering, foraging and breeding habitat for the Red-crowned Toadlet” (Sections 3.6.2.4.1 and 5.4.5.2.1, pages 146 and 230).

#### Nest boxes

The BDAR refers to the temporary installation of nest boxes in trees within the subject land to survey small to medium sized arboreal mammals. It notes twelve nest boxes were installed in native vegetation communities near the Wakehurst Parkway, in the northern extent of the subject land, for a period of 12 weeks and were checked for fauna presence and to identify the presence of any arboreal fauna species” (Section 2.6.2.2.10, page 39). The BDAR does not indicate what the results were from the nest box installation and if any native fauna were found to use the nest boxes and if so what species and whether there is a need to permanently install nest boxes.

#### Pre-clearance fauna surveys and relocation of native fauna

EMM (B14) states that that pre-clearing surveys for threatened fauna species will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA, 2011). It indicates this will “include inspections of hollows and dead timber for Eastern Pygmy-possum (Table 19-18 in the EIS ,page 19-76)”.

A separate EMM (B23) is included in the EIS to undertake pre-clearing surveys for non-threatened fauna species. While EMM B23 indicates the surveys (for non-threatened species) will include human made structures that have been identified as potentially providing habitat for microbats and are subject to demolition or modification (page 19-79), it is unclear if pre-clearing surveys are proposed to be undertaken for threatened bats/microbats of the human made structures. Clarification is required on this .

The fauna inspection/ relocation of native fauna should apply to all “protected animals” under the *Biodiversity Conservation Act 2016* (BC Act). Protected animals are defined in Schedule 5 of the BC Act to include any of the following that are native to Australia or that periodically or occasionally migrate to Australia (including their eggs and young)

- amphibians - frogs or other members of the class amphibia
- birds - birds of any species
- mammals - mammals of any species (including aquatic or amphibious mammals but not including dingoes)
- reptiles - snakes, lizards, crocodiles, tortoises, turtles or other members of the class reptilia.



EES recommends pre-clearance fauna surveys are undertaken by a qualified ecologist prior to removing:

- native and non-native/invasive/ exotic trees to determine the presence of resident native fauna using nests, dreys or hollows
- hollow bearing logs, rocky habitat boulders, crevices and ledges)
- human made structures within the construction footprint
- any other habitat .

Any resident native fauna potentially impacted by the removal of trees and other habitat should be relocated to an appropriate nearby location and in a sensitive manner under the supervision of a qualified ecologist/licensed wildlife handler.

Evidence of the pre-clearing surveys and inspections for fauna and any relocation of fauna must be provided to the satisfaction of the Certifying Authority.

### Revegetation /Landscaping

#### *Tree removal and replacement*

Appendix W indicates 3009 trees would be directly impacted by construction and removed and of these 135 have high retention value and 1508 have moderate retention value. In addition it notes another 500 trees have the potential to be impacted.

Any invasive/exotic tree species within the assessment area should be removed as part of the project, including invasive exotic species which are not directly impacted by the project, particularly if they adjoin Garigal National Park, bushland reserves/remnant vegetation.

The EIS includes the following environmental management measure (EMM):

- V13 Where amenity trees are removed as a result of the establishment of construction support sites, they will be replaced at a ratio equal to or greater than 1:1. The replacement trees will consist of local native provenance species from the vegetation community that once occurred in the locality (rather than plant exotic or non-local native trees) where available and subject to the urban design and landscape plan. Where replacement trees cannot be accommodated within the operational footprint of the project, consultation will be carried out with the adjacent land owner and relevant local council (where appropriate) to determine if they can accommodate the replacement tree(s) (Table 22.25, page 22.67)

EES supports the replacement trees consisting of local native provenance species from the vegetation community that once occurred in the locality (rather than plant exotic or non-local native trees).

EES recommends the removed trees are replaced at a ratio greater than 1:1 for trees that are not covered by a biodiversity offset strategy to mitigate the local urban heat island effect and improve local biodiversity over time. In order to achieve a net increase details need to be provided on the number of trees to be removed. It is recommended details area also provided on the tree species, and whether the trees to be removed are exotic, non-local natives or local native species.

#### *Seed collection from native plants to be removed*

Appendix W states "Seasonal seed collection should be carried out where appropriate for reuse in landscaping and hydromulching (section 4.6.2, page 23). EES recommends seed from native plants to be removed is collected prior to clearing and it is used in revegetation across the project area, including planting along the Wakehurst Parkway as the road adjoins Garigal National Park and Manly Dam Reserve, rehabilitation of Burnt Bridge Creek riparian corridor etc.

It is important seed collection commences early in the project so that local native provenance plant species are available to be planted, and the trees are advanced and established in size to improve the urban tree canopy and local biodiversity.



EES recommends a condition of consent is included to this effect.

#### *Reuse of removed trees*

The EIS notes site establishment would include vegetation clearing, chipping and mulching where required (Section 6.3.2, page 6-7) and Appendix W states “all native trees to be removed should be mulched and chipped for reuse on site in landscaping works (section 4.6.1, page 23). Rather than chip and mulch the removed trees, it is recommended the SSI also reuses native trees that are removed including hollows and tree trunks (greater than approximately 25-30cm in diameter and 3m in length) and root balls and these are used by the project in landscape/rehabilitated areas, including the rehabilitation of Burnt Bridge Creek riparian corridor to enhance habitat.

The EIS indicates two hollow-bearing trees would also be removed as part of construction works along the Wakehurst Parkway. One has a hollow diameter of 0.10 to 0.15 metres, and the other has a hollow diameter more than 0.20 metres (section 19.5.2). EES recommends the hollows are salvaged and reused

As it would not be possible for the project to reuse all removed native trees, EES recommends a condition of consent is included that the proponent consults with local community restoration/rehabilitation groups, Landcare groups, and surrounding reserve managers including the National Parks and Wildlife Service (NPWS) and councils etc prior to any clearing commencing to determine if the removed trees can be re-used by others in habitat enhancement and rehabilitation work. This detail including consultation with the community groups and their responses should be documented in the CEMP/Flora Fauna Management Plan.

EES has previously suggested the inclusion of a similar condition for other infrastructure projects, including the Sydney Gateway project - see condition E85 in the consent for SSI-9737 (dated 27 August 2020).

It is suggested the project includes following condition:

- ***The Proponent must identify where it is practicable to reuse any of the native trees that are to be removed as part of this project, including tree hollows and tree trunks (greater than 25-30 centimetres in diameter and three metres in length), and root balls to enhance habitat. If the removed native trees are not able to be entirely re-used by the project, the proponent must consult with local community restoration/rehabilitation groups, Landcare groups and surrounding reserve managers including the National Parks and Wildlife Service (NPWS) and Councils prior to removing any native trees to determine if the removed trees can be reused in habitat enhancement and rehabilitation work. This detail including consultation with the community groups and their responses must be documented in the CEMP***

Section 5.2.12 of the EIS notes the landscape treatments would be designed and implemented with the aims of maximising the use of endemic species and providing opportunity for improvements in urban ecology (page 5.49).

EES recommends that any landscaping/planting associated with the surface works for the Beaches link component and the Gore Hill Freeway Connection component of the project (including the screen planting, restoration of areas disturbed during construction, revegetation of the disturbed area of Burnt Bridge Creek etc) uses a diversity of local provenance native species from the relevant native vegetation community (or communities) that occurs, or once occurred in the locality of the proposed surface works rather than use exotic species or non-local native species.

Details need to be provided on where the replacement trees are proposed to be planted and the number of replacement trees and the species. Trees should preferably be of an advanced size to assist in improving the urban tree canopy and local biodiversity.

As noted above, EES recommends the SSI replaces any trees removed by this project at a ratio greater than 1:1 for trees that are not covered by a biodiversity offset strategy. EES has provided similar advice for other infrastructure projects, including the Botany Rail Duplication project (SSI-9714) and the Sydney Gateway project (SSI-9737). Condition E6 of the consent for SSI-9714 (dated 28 July 2020) and condition E82 of the consent for SSI-9737 (dated 27 August 2020) require these projects to deliver a net increase in trees.

It is suggested the following conditions of consent are included:

- ***Any planting for the project shall use a diversity of local provenance native trees, shrubs and groundcover species (rather than exotic species or non-local native species) from the relevant native vegetation community (or communities) that occurs or once occurred in proximity to the surface works***
- ***Trees removed by the project must be replaced at a ratio greater than 1:1 for trees that are not covered by a biodiversity offset strategy***
- ***Tree planting shall use advanced and established trees with a minimum plant container pot size of 100 litres, or greater for tree species which are commercially available. Other tree species which are not commercially available may be sourced as juvenile sized trees or pre-grown from provenance seed.***
- ***Enough area/space is provided to allow the trees to grow to maturity***
- ***A Landscape Plan is to be prepared and implemented by an appropriately qualified bush regenerator and include details on:***
  - a. seed collection – the location of all native seed sources should be identified***
  - b. the type, species, size, quantity and location of replacement trees and the plan demonstrates replacement trees plantings will deliver a net increase in trees for trees that are not covered by a biodiversity offset strategy***
  - c. the species, quantity and location of shrubs and groundcover plantings***
  - d. the native vegetation community (or communities) that once occurred in the areas to be planted and the plan demonstrates that the plant species consist of local provenance***
  - e. the quantity and location of plantings***
  - f. the pot size of the trees to be planted***
  - g. the area/space required to allow the planted trees to grow to maturity.***

#### Balgowlah Golf Course stormwater harvesting dam

The EIS notes as construction progresses, the Balgowlah Golf Course stormwater harvesting dam would be dewatered and filled in. (section 19.5.3). It states the dam is unlikely to provide habitat for native fish but dewatering procedures would be implemented in the event that native aquatic fauna are encountered and Table 19-18 in the EIS includes an Environmental Management Measure (B8) that “dewatering of the stormwater harvesting dam at Balgowlah Golf Course will be carried out with consideration of native fauna and appropriate measures will be implemented to relocate native aquatic fauna as required.

Details are required as to whether the dam provides potential habitat for native fauna including native aquatic fauna/foraging habitat for threatened flora etc. If the dam provides potential habitat for native fauna:

- the Construction Flora and Fauna Management Plan should include a de-watering / fauna relocation plan, and
- the following condition of consent should be included:
  - ***A dewatering plan will be developed by a suitably qualified and experienced ecologist prior to dewatering Balgowlah Golf Course stormwater harvesting dam. The plan will include details on:***
    - ***the native fauna species known to inhabit and/or use the dam which require transfer from the dam***

- *the methodology proposed to transfer the fauna*
- *the location and suitability of the proposed relocation sites*
- *any potential impacts of relocating the fauna to the relocation sites*
- *the need for a suitably qualified ecologist to be present during the dam dewatering.*

### **Garigal National Park**

As surface works associated with this SSI (the upgrade and realignment of Wakehurst Parkway) adjoin Garigal National Park, the SSI should be consistent with the Office of Environment and Heritage (2013) Guidelines for developments adjoining land managed by the Office of Environment and Heritage (OEH) where relevant:

<https://www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/development-guidelines>

The EIS notes “widening of Wakehurst Parkway, is facilitated mostly on the eastern side to avoid impacts on the Garigal National Park (section 22.5.1, page 22.29). It is important the SSI avoids impacts on the National Park and this includes additional edge effects, the introduction and spread of weeds, soil disturbance, soil erosion and sediment deposition (sections 5.2.1, and 5.2.2 BDAR, page 198).

Drainage lines/ephemeral streams near the Wakehurst Parkway which flow to the west and east provide a potential conduit to spread weeds into the National Park and Manly Dam Reserve. The BDAR states management measures are required to minimise the risk of introduction and spread of weeds (section 5.2.4, page 207). The EMMs need to be in place prior to construction commencing, and regularly maintained during construction and operation of the project. It is suggested the drainage lines are monitored prior to construction commencing, during and following construction to assess if weed invasion impacts have occurred as a result of the project.

The following comments are provided by NPWS:

- NPWS considers there are opportunities for monitoring programs and also pest control activities to facilitate positive outcomes of the fauna crossings.
- Regarding potential impacts to groundwater dependant systems nearby and the estimate that there will be a groundwater draw down. In addition to the mitigation measures in the EIS, it is suggested monitoring of the wetlands and peripheral areas is undertaken to assess for fauna and flora changes and mitigation/offset type actions such as weed invasion, feral pest control/bush regeneration/natural heritage enhancement activities.
- Ongoing monitoring and pest control is recommended to check and enhance survival of threatened species – such as the Southern Brown Bandicoots and Southern Myotis, two species that may be affected by the road crossing. Such studies may establish a base population and to determine if the fauna fencing and underpasses/rope crossings are effective, including, the installation of cameras at the crossings and /or a combination of surveys. The RtS needs to address funding for survey monitoring and fox control (i.e. to mitigate the impacts of foxes preying on native fauna using the underpass crossings).
- NPWS has an interest in the design of the Fauna Fence (fire fighter access/ logical MTB connection/ Aboriginal site protection). The Fauna Fencing needs to consider fire fighter access due to its long boundary. The fauna fencing should include for example, a lockable pedestrian gate approximately every 100 meters, with a fire lock so fire fighters can establish escape routes during fire operations.
- Access points through the fauna fencing for Mountain Bikes need to be considered, providing logical access from Gahnia MTB trail in Garigal National Park to Manly Dam MTB trails but it should not jeopardise the Bantry Bay Engravings from alternative MTB short cuts/ unauthorised access to other trails. NPWS support the fauna fence being located on the western side of engravings track as this will help protect the engravings.

EES considers that any access points through the fauna fencing for fire fighter access and Mountain Bikes should not jeopardise biodiversity conservation outcomes.

## **Floodplain Risk Management**

The EIS presents comprehensive flood modelling and impact assessment of the project. However, EES highlights the following issues:

- Environmental management measure F1 (Impact of the project on flood behaviour) should be extended. Currently, the measure aims to minimise flood level increases on residential, commercial and/or industrial buildings in the 1% Annual Exceedance Probability (AEP) flood event. The measure should also include relevant consideration of:
  - All flood events up to and including the Probable Maximum Flood (PMF) and climate change events.
  - Critical infrastructure and sensitive land uses.

The technical report notes the following significant increases in PMF levels:

- about 110 millimetres in existing residential development along the main arm of Flat Rock Creek to the east of the rail corridor
- about 500 millimetres in up to six existing dwellings upstream of the Burnt Bridge Creek Deviation
- about 600 millimetres increases in six residential properties in Kitchener Street and Balgowlah Road

These impacts and those under projected climate change should be considered in the intent of the environmental management measure.

- Environmental management measure F4 (Impact of the project on scour potential) should be extended to include all relevant areas, not only along Wakehurst Parkway and drainage outlets. The project has the potential to cause scour of Burnt Bridge Creek beyond the outlet of the transverse drainage structure, as documented in the EIS. Figure 6-5 of Appendix O (Surface Water Quality and Hydrology) shows scour protection at the outlet only, however Part 2 of Appendix R (Flooding) shows high velocity increases through the Balgowlah Golf Course. The potential use of stormwater detention to mitigate scour impacts should be explicitly included for the Wakehurst Parkway segment.
- The figures indicate a significant impact (increase in flood levels and duration of inundation) in Sydney Road at Balgowlah Oval that may impact emergency management. This impact has not been discussed in the EIS and needs detailed consideration. The proponent may be required to prepare an emergency management response plan in consultation with the SES and Council (refer SEAR 11.2.h). This may also be necessary in the area of Dickson Avenue and Reserve Road in Artarmon. For locations where emergency management may be affected, the consultant should provide further detail and confirm the extent of the impact. Emergency management should consider the full range of flooding up to the PMF.

EES also notes the following:

- The consultant claims modelling issues are the likely cause of some flood impacts shown. This uncertainty should be resolved as soon as feasible to ensure any genuine impacts are identified.
- Where offsite impacts remain after mitigation measures, then the consultant should assess if there is any significant change in hazard category (H1-H6). This is also relevant where emergency management may be impacted.
- The EIS suggests that land located outside areas of high hazard would be suitable for site facilities. EES recommends the use of H1-H6 hazard categories, rather than the high/low hazard categories used in the EIS to ensure the land is suitable for the intended purpose.

- The consultant should consider the following documents in future stages of the project where applicable.
  - The Flat Rock Creek Floodplain Risk Management Study and Plan was adopted by Willoughby Council in December 2020. The report ranked highly a drainage upgrade at Waltham Street, Artarmon, which may adjoin surface works for the project.
  - The North Sydney LGA-wide Floodplain Risk Management Study and Plan is planned to be exhibited early 2021. A detention basin in the Cammeray Golf Course immediately downstream of construction support site BL1 is recommended in the report.
  - The Manly to Seaforth Floodplain Risk Management Study and Plan is planned to be exhibited mid-late 2021 and covers the area of Seaforth draining to Middle Harbour.
- Environmental management measure F9 refers to 'operational' in Chapter 18, yet 'construction sites' are referred to. This should be amended.
- The resolution of the flooding figures provided made it difficult to see the extent of impacts. For future submissions, the consultant could consider providing insets or additional figures to show locations with genuine impacts. For example, the extent of PMF level increases in six residential properties in Kitchener Street and Balgowlah Road and that these are confined to the creek as stated in the technical report following should be visible on the figures.
- Future assessments of scour potential should not be limited to an assessment of velocity but should consider the resistance of the soil materials to the hydraulic forces in question.

End of Submission