Transport for NSW

Beaches Link and Gore Hill Freeway Connection

Appendix F (Part 1) – Further information on biodiversity matters

November 2021

Transport for NSW

Beaches Link and Gore Hill Freeway Connection

Appendix F1 – Updated Duffys Forest threatened ecological community mapping and assessment

November 2021

Contents

1 Introduction

The project includes the replacement of the existing pedestrian bridge across the Wakehurst Parkway in the northern extent of the project footprint. Since the exhibition of the environmental impact statement, the design of the shared user bridge has been refined (refer to Section A4.3 of this submissions report for further details). As a result of this design refinement, the area of Duffys Forest endangered ecological community that would be impacted by the project has been revised from 1.38 hectares to 1.21 hectares.

Further, in response to the Department of Planning, Industry and Environment (Environment, Energy and Science Group)'s (referred to as Environment, Energy and Science Group hereafter) submission on the environmental impact statement (refer to Section B4.2.2 of the submissions report), the extent of Duffys Forest endangered ecological community as mapped by OEH (2016) was reviewed with reference to the Mona Vale Road West Upgrade Species Impact Statement and the most recent aerial imagery available from SIX Maps (NSW Government, 2016). The OEH (2016) mapping includes about 13 hectares of Plant Community Type (PCT) 1786 (Red Bloodwood – Scribbly Gum/Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast), equivalent to Duffys Forest endangered ecological community, within the Mona Vale Road West Upgrade study area.

The vegetation in this area was ground truthed for the Mona Vale Road West Upgrade Species Impact Statement, and only 4.79 hectares of Duffys Forest endangered ecological community was identified within the same area. Of this, 1.86 hectares will be directly impacted by the Mona Vale Road West Upgrade project. The areas mapped as Duffys Forest endangered ecological community by OEH (2016) that have been identified during ground truthing as not meeting the criteria for this community, as well as areas that will be directly impacted by the Mona Vale Road West Upgrade project, were removed from the layer; these total about 10 hectares. Detailed analysis of the aerial imagery resulted in removal of an additional 16.65 hectares of cleared and disturbed areas from the layer; these areas include patches of Duffys Forest endangered ecological community that have been cleared since the date of the aerial photography that the mapping was based on, as well as areas that were mapped at a higher scale and with less detail than the current aerial photograph resolution affords.

As a result of the above, a revised serious and irreversible impact assessment for Duffys Forest endangered ecological community is required.

2 Purpose of this report

Guidance to assist a decision-maker to determine a serious and irreversible impact (OEH, 2017a) identifies threatened species and ecological communities most at risk of serious and irreversible impacts. To assist the consent authority to evaluate the nature of an impact on a potential entity at risk of a serious and irreversible impact, the Biodiversity Development Assessment Report must contain details of the assessment of serious and irreversible impact, in accordance with the assessment criteria set out in Section 10.2 of the *Biodiversity Assessment Method* (OEH, 2017b).

Due to the revised area of Duffys Forest endangered ecological community being impacted by the project and updated mapping carried out in response to Environment, Energy and Science Group's submission, a revised serious and irreversible impact assessment has been prepared which updates the assessment included in Section 5.3.1 of Appendix S (Technical working paper: Biodiversity development assessment report). The results of the revised serious and irreversible impact assessment is provided in Section 3 below.

3 Revised serious and irreversible impact assessment

Table 3-1 presents the updated revised serious and irreversible impact assessment for Duffys Forest endangered ecological community, given project refinements and consideration of additional information from recent aerial photographs and mapping from the Mona Vale Road West Upgrade project. The information provided in Table 3-1 is required by the *Biodiversity Assessment Method* (OEH, 2017b) to be provided for potential serious and irreversible impacts to threatened ecological communities.

Table 3-1 Serious and irreversible impact assessment for Duffys Forest endangered ecological community

Assessment requirement	Assessment
(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an Serious and Irreversible Impact	Impacts to Duffys Forest endangered ecological community have been minimised through the design process during preparation of the environmental impact statement, with the footprint adjusted to minimise impacts to areas of Duffys Forest endangered ecological community adjoining the southern end of the Wakehurst Parkway. As noted above, since the exhibition of the environmental impact statement, Transport for NSW has refined the design for the new shared user bridge in the northern extent of the project footprint as outlined in Section A4.3 of this submissions report. The design refinement has reduced the area of Duffys Forest endangered ecological community that would be impacted by the project from 1.38 hectares to 1.21 hectares.
(b) the area (ha) and condition of the threatened ecological community to be impacted directly and indirectly by the proposed development. The condition of the endangered ecological community is to be represented by the vegetation integrity score for each vegetation zone	Construction of the project would require the removal of 1.21 hectares of Duffys Forest endangered ecological community. The areas of endangered ecological community to be removed adjoin the Wakehurst Parkway between Killarney Heights and Frenchs Forest. An additional area of 1.26 hectares would be subject to indirect impacts. The vegetation integrity score of the areas of Duffys Forest endangered ecological community to be directly and indirectly impacted varies from 69.1 for the 0.85 hectares of the endangered ecological community in good condition, to 40.5 for the 0.37 hectares of the endangered ecological community in moderate condition.
(c) a description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the *Guidance to assist a decision-maker to determine a serious and irreversible impact*	There is currently no threshold for Duffys Forest endangered ecological community specified in the Department of Planning, Industry and Environment (Environment, Energy and Science) guidance, nor in the Threatened Biodiversity Data Collection. The webpage for Serious and irreversible impacts (Department of Planning, Industry and Environment (Environment, Energy and Science), 2020) states that thresholds have not been assigned to any endangered ecological communities, and that in the absence of thresholds, the consent authority can disregard references to considering thresholds in the Department of Planning, Industry and Environment (Environment, Energy and Science) guidance when making their determination.

Assessment requirement	Assessment
(d) the extent and overall condition of the potential threatened ecological community within an area of 1000 hectares, and then 10,000 hectares, surrounding the proposed subject land	For this assessment, the 'proposed subject land' is limited to the area of the subject land on and adjoining the Wakehurst Parkway. The Wakehurst Parkway section of the subject land is at the southern extent of the distribution of the Duffys Forest endangered ecological community. Based on OEH (2016) mapping with additional aerial photograph review, and excluding areas within the subject land and the areas impacted by the Northern Beaches Hospital road upgrade project and to be impacted by the Mona Vale Road West Upgrade project), there is 28.92 hectares of Duffys Forest endangered ecological community mapped within an area of 1000 hectares (refer to Figure 3-1 and around 59.31 hectares of Duffys Forest endangered ecological community mapped within an area of 10,000 hectares surrounding the subject land (refer to Figure 3-2). The removal of 1.21 hectares of Duffys Forest endangered ecological community represents a reduction of 4 per cent of the area of the endangered ecological community within 1000 hectares, and 2 per cent of the area of the endangered ecological community within 10,000 hectares. It should be noted that while the assessment of serious and irreversible impacts in accordance with the *Biodiversity Assessment Method* (OEH, 2017b) does not require consideration of areas future impacts, the area of Duffys Forest endangered ecological community to be cleared as part of the Mona Vale Road West Upgrade project has been included for completeness.
(e) an estimate of the extant area and overall condition of the potential threatened ecological community remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration	There is a total of 359.63 hectares of Duffys Forest endangered ecological community mapped within the Pittwater IBRA subregion (based on OEH (2016) mapping with additional aerial photograph review, and excluding areas within the subject land and the areas impacted by the Northern Beaches Hospital road upgrade project and Mona Vale Road West upgrade project) (refer to Figure 3-2). Together with the 1.21 hectares of Duffys Forest mapped in the subject land, a total of 360.84 hectares of the endangered ecological community has been identified in the Pittwater IBRA subregion. Given that the Duffys Forest endangered ecological community only occurs within the Pittwater IBRA subregion, this figure also represents the total area of Duffys Forest endangered ecological community remaining in NSW. The removal of 1.21 hectares of Duffys Forest endangered ecological community represents a reduction of 0.34 per cent of the area of the endangered ecological community in the Pittwater IBRA subregion. Following the removal of 1.21 hectares of Duffys Forest endangered ecological community for the project, the total area remaining would be 359.63 hectares.
(f) an estimate of the area of the potential threatened ecological community that is in the reserve	Of the total of 359.63 hectares of Duffys Forest endangered ecological community mapped within the Pittwater IBRA subregion (based on OEH (2016) mapping with additional

Assessment requirement	Assessment
system within the IBRA region and the IBRA subregion	aerial photograph review, and excluding areas within the subject land and the areas impacted by the Northern Beaches Hospital road upgrade project and Mona Vale Road West Upgrade project), 155.04 hectares (43 per cent) is located within Garigal and Ku-ring-gai National Parks.
(g) the development, clearing or biodiversity certification proposal's impact on: (i) abiotic factors critical to the long-term survival of the potential threatened ecological community; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns (ii) characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants (iii) the quality and integrity of an occurrence of the potential threatened ecological community through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential threatened ecological community	The project may result in water table drawdown beneath patches of Duffys Forest endangered ecological community adjoining the Wakehurst Parkway to the east and south of Seaforth Oval. 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 2128 respectively) (refer to Appendix N (Technical working paper: Groundwater)). The Duffys Forest endangered ecological community is not considered to be a groundwater dependent ecosystem and would likely only draw on groundwater opportunistically during periods of low rainfall. Further to the above, revised groundwater drawdown modelling has been conducted following exhibition of the environmental impact statement in response to submissions received (refer Appendix E of this submissions report). The findings of the revised groundwater modelling and impact assessments are consistent with and confirmed the findings of the environmental impact statement. Unmanaged construction activities along the Wakehurst Parkway could result in alteration of surface water patterns allowing soil erosion, siltation and off-site movement of eroded sediments into adjacent areas of the endangered ecological community. However, standard controls would be installed before and maintained throughout the construction period to prevent these impacts. Vegetation occurring along the margins of the Wakehurst Parkway is currently subject to edge effects, and the widening of the road would expand edge effects into new areas. The new edge could be subject to degradation by the establishment and spread of weeds, enriched runoff from road pavement and dumping of rubbish. Management measures would be implemented to minimise the risk of introduction and spread of weeds.
(h) direct or indirect fragmentation and isolation of an important area of the potential threatened ecological community	The Duffys Forest endangered ecological community in the subject land is currently fragmented by the existing Wakehurst Parkway and adjoining areas of residential development. The project would result in some increases to the existing fragmentation as a result of the widening of the Wakehurst Parkway. The gap in native vegetation created by the existing Wakehurst Parkway ranges from 10 to 15 metres in the vicinity of patches of Duffys Forest endangered ecological community. This gap would increase to 40 to 45 metres across most of the Wakehurst Parkway, and about 60 metres in the northernmost extent of the project.

Assessment requirement	Assessment
(i) the measures proposed to contribute to the recovery of the potential threatened ecological community in the IBRA subregion.	The 1.21 hectares of Duffys Forest endangered ecological community to be removed would be offset in accordance with the Biodiversity Offsets Scheme.

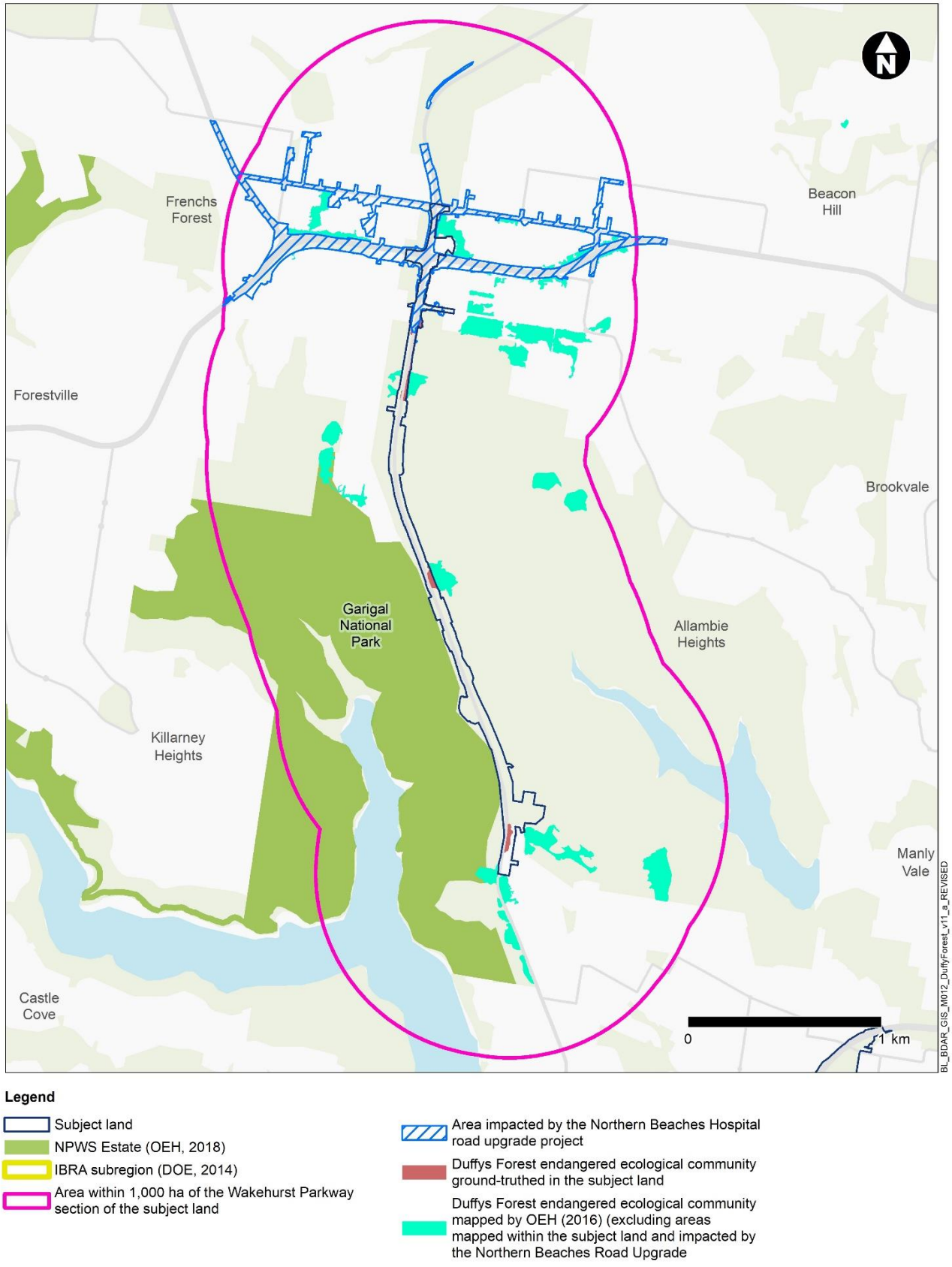

Figure 3-1 Updated Duffys Forest endangered ecological community mapped within an area of 1000 hectares of the subject land (update to Figure 5-3 of Appendix S (Technical working paper: Biodiversity development assessment report))

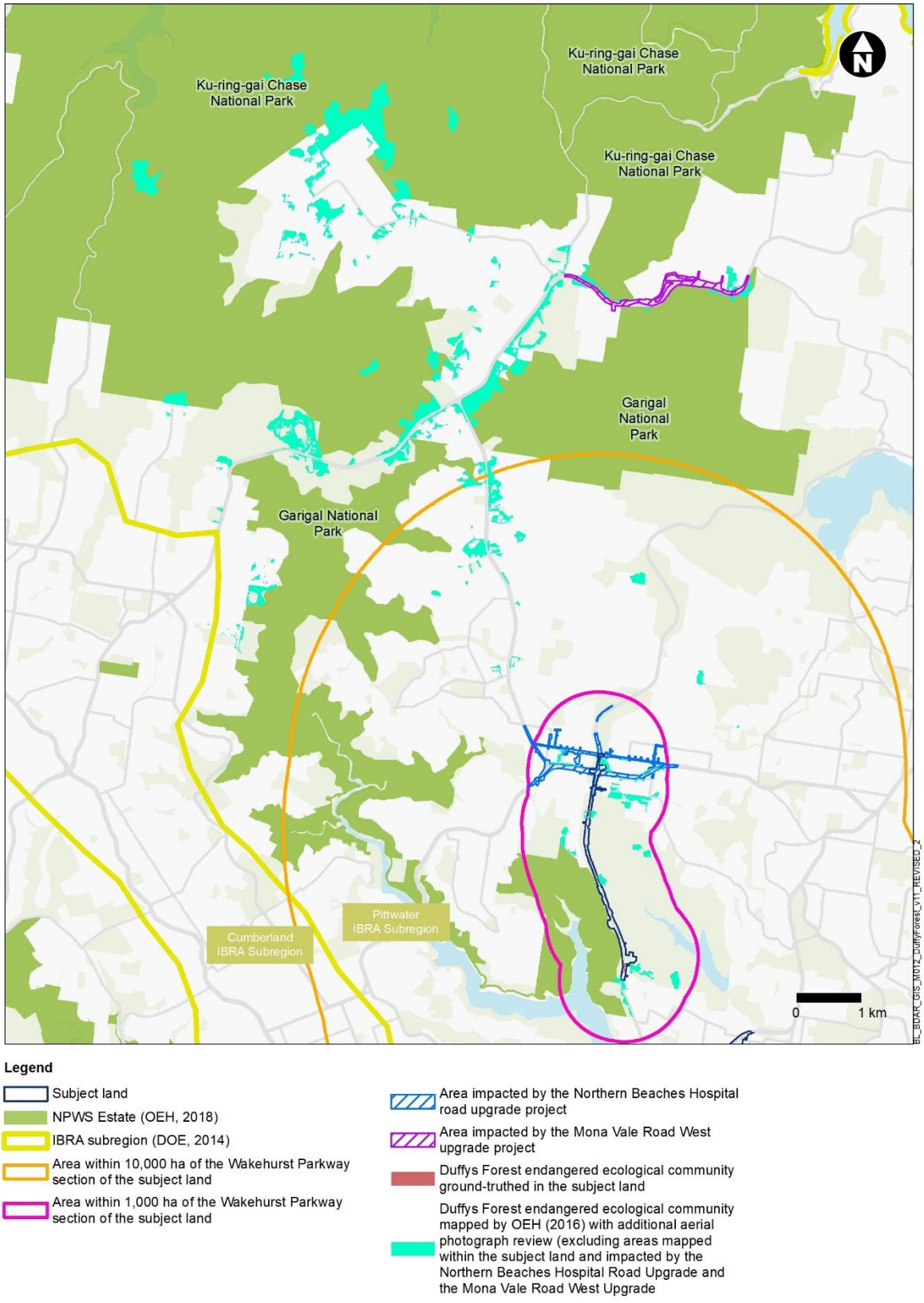

Figure 3-2 Updated Duffys Forest endangered ecological community mapped within an area of 10,000 hectares of the subject land (update to Figure 5-4 of Appendix S (Technical working paper: Biodiversity development assessment report))

4 References

Department of Planning, Industry and Environment (Environment, Energy and Science), *Serious and irreversible impacts of development on biodiversity.* https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity-offsets-scheme/local-government-and-other-decision-makers/serious-and-irreversible-impacts-of-development, accessed 8 September 2021

NSW Government (2016), Spatial Information eXchange Map Viewer, https://maps.six.nsw.gov.au, accessed 24 August 2021

Office of Environment and Heritage (OEH) (2016), *The Native Vegetation of the Sydney Metropolitan Area*. Version 3.0

OEH (2017a), *Guidance to assist a decision-maker to determine a serious and irreversible impact.* Office of Environment and Heritage, Sydney, NSW.

OEH (2017b), *Biodiversity Assessment Method,* Office of Environment and Heritage, Sydney, NSW.

Transport for NSW

Beaches Link and Gore Hill Freeway Connection

Appendix F2 – Updated biodiversity credit reports

November 2021

Contents

1 Introduction

The project includes the replacement of the existing pedestrian bridge across the Wakehurst Parkway in the northern extent of the project footprint. Since the exhibition of the environmental impact statement, the design of the shared user bridge has been refined (refer to Section A4.3 of this submissions report for further details). As a result of this design refinement, the area of Duffys Forest endangered ecological community that would be impacted by the project has been reduced and revised from 1.38 hectares to 1.21 hectares.

Further, in response to the Department of Planning, Industry and Environment (Environment, Energy and Science Group)'s submission on the environmental impact statement (refer to Section B4.4 of the submissions report), the vegetation in Plant Community Type (PCT) 1292 along Burnt Bridge Creek within the subject land was reviewed to determine whether it is classified correctly or whether PCT 1780 may be a more suitable fit for this vegetation. A brief analysis of the characteristic species recorded in each stratum of this vegetation, as well as the published diagnostic species lists for potentially suitable PCTs, suggests that PCT 1250, which also occurs adjacent to Wakehurst Parkway in the subject land, is the most suitable fit for this vegetation. The vegetation zone 1292_Moderate/Good is therefore reclassified and would form an additional zone within PCT 1250, namely 1250_Moderate/Good – Moderate.

As a result of the above, a revised biodiversity credit calculation is required and is provided below in Section 2.

2 Revised credit calculations

The ecosystem credits required to offset the revised direct impacts of the project, following design refinements and the change in Plant Community Type classification, and as determined using the Biodiversity Assessment Method credit calculator, are listed in Table 2-1. A revised and reduced total of 383 ecosystem credits are required to offset the direct impacts of the project.

Table 2-1 is an update to Table 7.1 of Appendix S (Technical working paper: Biodiversity development assessment report) and also supersedes the relevant information provided in Table 19-9 of the environmental impact statement.

The process for calculating the indirect impacts of the project is described in sections 5.2.2 and 7.1 of Appendix S (Technical working paper: Biodiversity development assessment report). The design refinements have removed indirect impacts that would result in isolated patched of vegetation 1786 Moderate/Good, and slightly increased the area of indirect patches that would result in new edges created in patches of the same vegetation zone. The revised number of ecosystem credits calculated for the potential indirect impacts of the revised project has been reduced to 45, with details provided in Table 2-2 below.

Table 2-2 is an update to Table 7.2 of Appendix S (Technical working paper: Biodiversity development assessment report) and also supersedes the relevant information provided in Table 19-20 of the environmental impact statement.

The full updated biodiversity offset credit reports are provided in Annexure A of this Appendix F2.

Table 2-1 Revised ecosystem credit calculations – direct impacts (update to Table 7.1 of Appendix S (Technical working paper: Biodiversity development assessment report))

Vegetation zone	PCT name	Vegetation integrity loss	Area impacted (ha)	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Ecosystems credits required
1250 Moderate/ Good - Good	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion	82.5	0.20	High	1.50	6
1250 Moderate/ Good - Moderate		54	0.40	High	1.50	8
1783 Moderate/ Good	Red Bloodwood - Scribbly Gum/Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	62.9	4.23	High	1.50	100
1786 Moderate/ Good - Good	Red Bloodwood - Silvertop Ash - Stringybark open forest on ironstone in the Sydney region (Duffys Forest endangered ecological community)	69.1	0.84	High	2.00	29
1786 Moderate/ Good - Moderate		40.5	0.37	High	2.00	7
1824 Moderate/ Good	Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin	66.4	6.18	High	1.50	154
1841 Moderate/ Good	Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region	65.3	1.37	High	1.75	39
1841_Revegetation		37.7	1.29	High	1.75	21
1845 Moderate/ Good	Smooth-barked Apple - Red Bloodwood - Blackbutt tall open forest on shale sandstone transition soils in eastern Sydney	78.1	0.39	High	2.50	19
Total						**383**

Table 2-2 Revised ecosystem credit calculations – indirect impacts (update to Table 7.2 of Appendix S (Technical working paper: Biodiversity development assessment report))

Vegetation zone	PCT name	Vegetation integrity loss	Area impacted (ha)	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Ecosystems credits required
Isolated patches						
1783 Moderate/ Good	Red Bloodwood - Scribbly Gum/Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	62.9	0.05	High	1.50	1
1824 Moderate/ Good	Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin	66.4	0.01	High	1.50	1
New edges						
1250 Moderate/ Good - Good	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion	16.5	0.22	High	1.50	1
1783 Moderate/ Good	Red Bloodwood - Scribbly Gum/Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast	12.58	2.59	High	1.50	12
1786 Moderate/ Good - Good	Red Bloodwood - Silvertop Ash - Stringybark open forest on ironstone in the Sydney region (Duffys Forest endangered ecological community)	13.82	1.26	High	2.00	9
1824 Moderate/ Good	Mallee - Banksia - Tea-tree - Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin	13.28	4.20	High	1.50	21
Total						**45**

The species credits required to offset the impacts of the refined project, as determined using the Biodiversity Assessment Method credit calculator, are listed in Table 2-3. The total species credits has been reduced to 1081.

Table 2-3 is an update to Table 7.3 of Appendix S (Technical working paper: Biodiversity development assessment report) and also supersedes the relevant information provided in Table 19-21 of the environmental impact statement.

Table 2-3 Revised species credit calculations (update to Table 7.3 of Appendix S (Technical working paper: Biodiversity development assessment report))

Species	Vegetation zone name	Area per vegetation zone	Individuals/ total area	Biodiversity risk weighting	Species credits
Syzygium paniculatum (Magenta Lilly Pilly)	1250_Mod_Good-Good	N/A	1 individual	2	2
Red-crowned Toadlet (*Pseudophryne australis*)	1250_Mod_Good-Good 1783_Mod_Good 1786_Mod_Good-Moderate 1824_Mod_Good	0.20 ha 0.66 ha 0.07 ha 0.05 ha	0.98 ha	1.5	24
Eastern Pygmy-possum (*Cercartetus nanus*)	1250_Mod_Good-Good 1783_Mod_Good 1786_Mod_Good-Good 1786_Mod_Good-Moderate 1824_Mod_Good 1845_Mod_Good	0.20 ha 4.23 ha 0.84 ha 0.37 ha 6.18 ha 0.39 ha	12.21 ha	2	397
Large-eared Pied-bat (*Chalinolobus dwyeri*)	1250_Mod_Good-Good 1250_Mod_Good-Moderate 1783_Mod_Good 1786_Mod_Good-Good 1786_Mod_Good-Moderate 1824_Mod_Good 1841_Mod_Good 1845_Mod_Good	0.20 ha 0.40 ha 4.23 ha 0.84 ha 0.37 ha 6.18 ha 0.90 ha 0.39 ha	13.51 ha	3	658
Total					**1081**

Annexure A. Updated biodiversity credit reports

BAM Credit Summary Report

Proposal Details

Assessment Id
00022275/BAAS17030/20/00022276

Proposal Name
Beaches Link and Gore Hill Freeway Connection - Direct Impacts

BAM data last updated *
10/06/2021

Assessor Name
Jane Rodd

Report Created
15/11/2021

BAM Data version *
45

Assessor Number
BAAS17030

BAM Case Status
Finalised

Date Finalised
22/10/2021

Assessment Revision
1

Assessment Type
Major Projects

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Coastal enriched sandstone moist forest											
7	1841_Mod_Good	Not a TEC	65.3	65.3	1.4			High Sensitivity to Potential Gain	1.75		39
9	1841_Reveg	Not a TEC	37.7	37.7	1.3			High Sensitivity to Potential Gain	1.75		21

										Subtotal	**60**
Coastal sandstone gully forest											
1	1250_Mod_Good	Not a TEC	82.5	82.5	0.2			High Sensitivity to Potential Gain	1.50		6
2	1250_Mod	Not a TEC	54	54.0	0.4			High Sensitivity to Potential Gain	1.50		8
										Subtotal	**14**
Coastal sandstone Heath-Mallee											
6	1824_Mod_Good	Not a TEC	66.4	66.4	6.2			High Sensitivity to Potential Gain	1.50		154
										Subtotal	**154**
Coastal shale-sandstone forest											
8	1845_Mod_Good	Not a TEC	78.1	78.1	0.39			High Sensitivity to Potential Gain	2.50		19
										Subtotal	**19**
Sydney ironstone Bloodwood-Silvertop Ash forest											
4	1786_Mod_Good	Duffys Forest Ecological Community in the Sydney Basin Bioregion	69.1	69.1	0.84	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00	TRUE	29
5	1786_Mod	Duffys Forest Ecological Community in the Sydney Basin Bioregion	40.5	40.5	0.37	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00	TRUE	7
										Subtotal	**36**

Sydney North exposed sandstone woodland										
3	1783_Mod_Good	Not a TEC	62.9	62.9	4.2			High Sensitivity to Potential Gain	1.50	100
									Subtotal	**100**
									Total	**383**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Species credits
Cercartetus nanus / Eastern Pygmy-possum (Fauna)								
1250_Mod_Good	82.5	82.5	0.2	Vulnerable	Not Listed	2	False	8
1783_Mod_Good	62.9	62.9	4.2	Vulnerable	Not Listed	2	False	133
1786_Mod_Good	69.1	69.1	0.84	Vulnerable	Not Listed	2	False	29
1786_Mod	40.5	40.5	0.37	Vulnerable	Not Listed	2	False	7
1824_Mod_Good	66.4	66.4	6.2	Vulnerable	Not Listed	2	False	205
1845_Mod_Good	78.1	78.1	0.39	Vulnerable	Not Listed	2	False	15
							Subtotal	**397**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)								
1250_Mod_Good	82.5	82.5	0.2	Vulnerable	Vulnerable	3	True	12
1783_Mod_Good	62.9	62.9	4.2	Vulnerable	Vulnerable	3	True	200
1786_Mod_Good	69.1	69.1	0.84	Vulnerable	Vulnerable	3	True	44
1786_Mod	40.5	40.5	0.37	Vulnerable	Vulnerable	3	True	11
1824_Mod_Good	66.4	66.4	6.2	Vulnerable	Vulnerable	3	True	308
1841_Mod_Good	65.3	65.3	0.9	Vulnerable	Vulnerable	3	True	44

1845_Mod_Good	78.1	78.1	0.39	Vulnerable	Vulnerable	3	True	23
1250_Mod	54.0	54.0	0.4	Vulnerable	Vulnerable	3	True	16
							Subtotal	**658**
Pseudophryne australis / Red-crowned Toadlet (Fauna)								
1250_Mod_Good	82.5	82.5	0.2	Vulnerable	Not Listed	1.5	False	6
1783_Mod_Good	62.9	62.9	0.66	Vulnerable	Not Listed	1.5	False	16
1786_Mod	40.5	40.5	0.07	Vulnerable	Not Listed	1.5	False	1
1824_Mod_Good	66.4	66.4	0.05	Vulnerable	Not Listed	1.5	False	1
							Subtotal	**24**
Syzygium paniculatum / Magenta Lilly Pilly (Flora)								
1250_Mod_Good	N/A	N/A	1	Endangered	Vulnerable	2	False	2
							Subtotal	**2**

BAM Credit Summary Report

Proposal Details

Assessment Id
00022275/BAAS17030/20/00022282

Proposal Name
Beaches Link and Gore Hill Freeway Connection - Indirect Impacts

BAM data last updated *
10/06/2021

Assessor Name
Jane Rodd

Report Created
15/11/2021

BAM Data version *
45

Assessor Number
BAAS17030

BAM Case Status
Finalised

Date Finalised
22/10/2021

Assessment Revision
1

Assessment Type
Major Projects

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Coastal sandstone gully forest											
3	1250_MG_NewEdge	Not a TEC	82.5	16.5	0.22			High Sensitivity to Potential Gain	1.50		1
										Subtotal	**1**

Coastal sandstone Heath-Mallee											
2	1824_MG_IsolatedPatch	Not a TEC	66.4	66.4	0.01			High Sensitivity to Potential Gain	1.50		1
6	1824_MG_NewEdge	Not a TEC	66.4	13.3	4.2			High Sensitivity to Potential Gain	1.50		21
										Subtotal	**22**
Sydney ironstone Bloodwood-Silvertop Ash forest											
5	1786_MG_NewEdge	Duffys Forest Ecological Community in the Sydney Basin Bioregion	69.1	13.8	1.3	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00	TRUE	9
										Subtotal	**9**
Sydney North exposed sandstone woodland											
1	1783_MG_IsolatedPatch	Not a TEC	62.9	62.9	0.05			High Sensitivity to Potential Gain	1.50		1
4	1783_MG_NewEdge	Not a TEC	62.9	12.6	2.6			High Sensitivity to Potential Gain	1.50		12
										Subtotal	**13**
										Total	**45**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Species credits

Transport for NSW

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Appendix F3 – Supplementary koala survey and assessment

November 2021

Contents

1 Introduction

1.1 Background

Biodiversity impacts associated with the Beaches Link and Gore Hill Freeway Connection project (the project) were identified in Appendix S (Technical working paper: Biodiversity development assessment report) and were also summarised in Chapter 19 (Biodiversity) of the environmental impact statement. Appendix S (Technical working paper: Biodiversity development assessment report) was prepared in accordance with the *Biodiversity Assessment Method* (OEH, 2017) and the environmental assessment requirements issued by the Secretary of the Department of Planning, Industry and Environment on 15 December 2017 and reissued on 22 April 2020.

The environmental impact statement was placed on public exhibition from 9 December 2020 to 1 March 2021. Public exhibition provided the community, interested parties and key stakeholders (including government agencies and councils) with an understanding of the project and the opportunity to make a submission on the environmental impact statement.

1.2 Purpose of this assessment

Koalas (*Phascolarctos cinereus*) are listed as Vulnerable under the NSW *Biodiversity Conservation Act 2016,* and the combined populations of Queensland, NSW and the ACT are listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. They are listed as a split species/ecosystem credit species in the *NSW BioNet Threatened Biodiversity Data Collection* (DPIE (EES), 2021b), which allocates offsetting requirements under the *Biodiversity Assessment Method* (OEH, 2017).

Koalas were discounted as a candidate species by the Biodiversity Assessment Method credit calculator, as assessed for Appendix S (Technical working paper: Biodiversity development assessment report), based on information available at the time of preparation.

Following exhibition of the environmental impact statement, a submission was received from Department of Planning, Industry and Environment (Environment, Energy and Science Group) (referred to as Environment, Energy and Science Group hereafter) that included concerns with regard to the project's potential impact to Koalas. Specifically, this included:

- Since Appendix S (Technical working paper: Biodiversity development assessment report) was prepared, new BioNet records were submitted in December 2020 of Koala calls having been heard in 2017 and 2019 in the locality. Environment, Energy and Science Group recommended consideration of this new information
- There were inconsistencies in Appendix S (Technical working paper: Biodiversity development assessment report) as to how the likelihood of occurrence of the Koala was treated compared to the likelihood of occurrence of the Southern Brown Bandicoot (*Isoodon obesulus obesulus*)
- Due to the recent BioNet records of Koalas in the locality, Environment, Energy and Science Group requested consideration of the likelihood of Koalas using the proposed underpasses, including details on specific underpass design features that are known to be required for Koala use.

This supplementary Koala survey and assessment has been prepared in response to the issues raised above. Section B4 of this submissions report provides the full response to Environment, Energy and Science Group's submission on the environmental impact statement, including concerns raised regarding Koalas.

The methodology of this supplementary assessment is outlined in Section 2, results of targeted surveys provided in Section 3, the implications of the survey results discussed in Section 4, and a conclusion is provided in Section 5.

Terminology and definitions used within this supplementary assessment are consistent with those included in the ‘Glossary of terms and abbreviations’ and Section 2.2 of Appendix S (Technical working paper: Biodiversity development assessment report).

2 Methods

2.1 Study area and survey timing

To assist in addressing the concerns raised by Environment, Energy and Science Group, targeted surveys were carried out in June and July 2021 to determine presence of Koalas within the subject land (construction footprint) and subsequent implications for impact assessment, offsets and mitigation in accordance with the *Biodiversity Assessment Method* (OEH, 2017).

The area surveyed (study area) for this supplementary assessment included the subject land (construction footprint) plus a 100 metre buffer in areas of potential Koala habitat.

Two areas within the subject land contain potential Koala habitat, including Wakehurst Parkway and Burnt Bridge Creek, which were both surveyed for this assessment. These areas contain Plant Community Types (PCTs) that are associated with the species in the *NSW BioNet Threatened Biodiversity Data Collection* (DPIE (EES), 2021b). These Plant Community Types are:

- PCT 1783 – Red Bloodwood – Scribbly Gum/Old-man Banksia open forest on sandstone ridges of northern Sydney and the Central Coast
- PCT 1786 – Red Bloodwood - Silvertop Ash – Stringybark open forest on ironstone in the Sydney region
- PCT 1824 – Mallee - Banksia - Tea-tree – Hakea heath-woodland of the coastal sandstone plateaus of the Sydney basin
- PCT 1841 – Smooth-barked Apple – Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region.

These areas are also dominated by canopy species that are known feed trees in the Central Coast Koala Management Area identified in either:

- Schedule 1 of the State Environmental Planning Policy (Koala Habitat Protection) 2021
- *A review of koala tree use across New South Wales* (OEH, 2018).

No other areas of the subject land were considered to have the potential to contain Koalas due to lack of nearby records and minimal native vegetation/connectivity to habitat and known locations.

Arcadis senior ecologist Kate Carroll (Biodiversity Assessment Method accredited assessor (No. BAAS17070)) and environmental consultants Taylor Bliss-Henaghan and Kristen Branks attended the study area on 15, 17 and 22 June 2021, and 1 July 2021. Targeted surveys were carried out using three survey techniques:

1) The Spot Assessment Technique (SAT) Koala survey method)
2) Nocturnal spotlighting surveys
3) Camera traps.

There are no specific guidelines on Koala survey techniques by Environment, Energy and Science Group to determine presence. However there are *Environment Protection Biodiversity Act* (EPBC) *1999* guidelines – namely The *EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (Commonwealth of Australia, 2014) - which outline a number of survey methods (in Tables 2 and 3 of the document), recommending selecting methods most suited to the type of data desired and the size and complexity of the site. The approach adopted for the targeted surveys, as described above, contains survey methods outlined in the referral guidelines and is considered appropriate for the study area size with a level of survey effort sufficient to detect the species, if present. The *NSW BioNet*

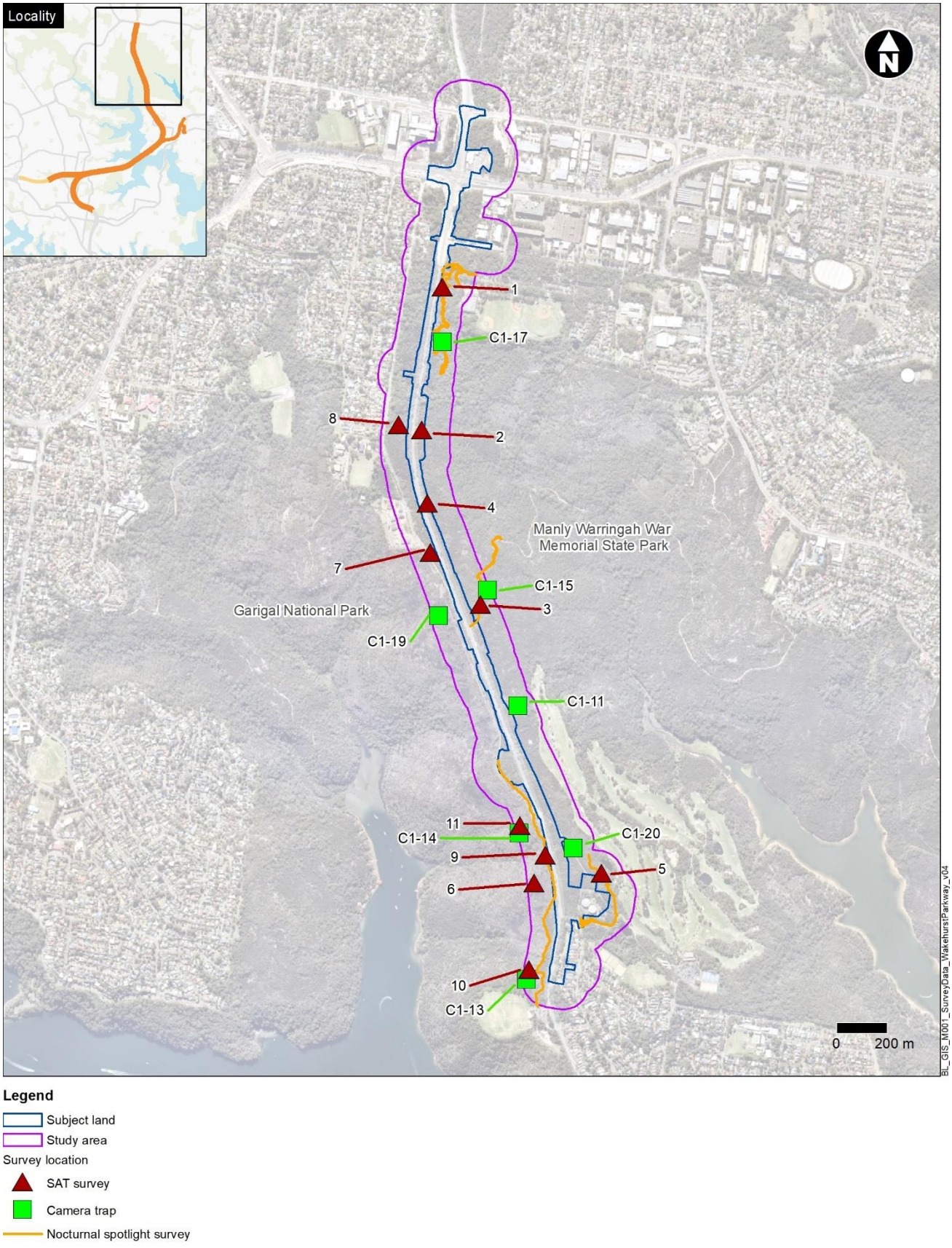
Threatened Biodiversity Data Collection (DPIE (EES), 2021b) specifies that the species can be surveyed at all times of the year.

Surveys were conducted only on days with suitable weather – in cases of high winds and rainfall, surveys were postponed. Weather conditions for the survey dates are outlined in Table 2-1.

Table 2-1 Climate data from the nearest weather station to the study area, Sydney Harbour NSW (station number 066196) (BOM, 2021) for targeted survey dates

Date	Maximum temperature (C°)	Rainfall (mm)	Max wind gust (km/hr)
15/06/2021	16.7	0	28
17/06/2021	17.0	5.0	50
22/06/2021	18.6	1.2	28
01/07/2021	18.1	0.6	26

Locations for each survey point are shown in Figure 2-1 and Figure 2-2.



Legend

- Subject land
- Study area

Survey location

- SAT survey
- Camera trap
- Nocturnal spotlight survey

Figure 2-1 Koala survey locations along Wakehurst Parkway

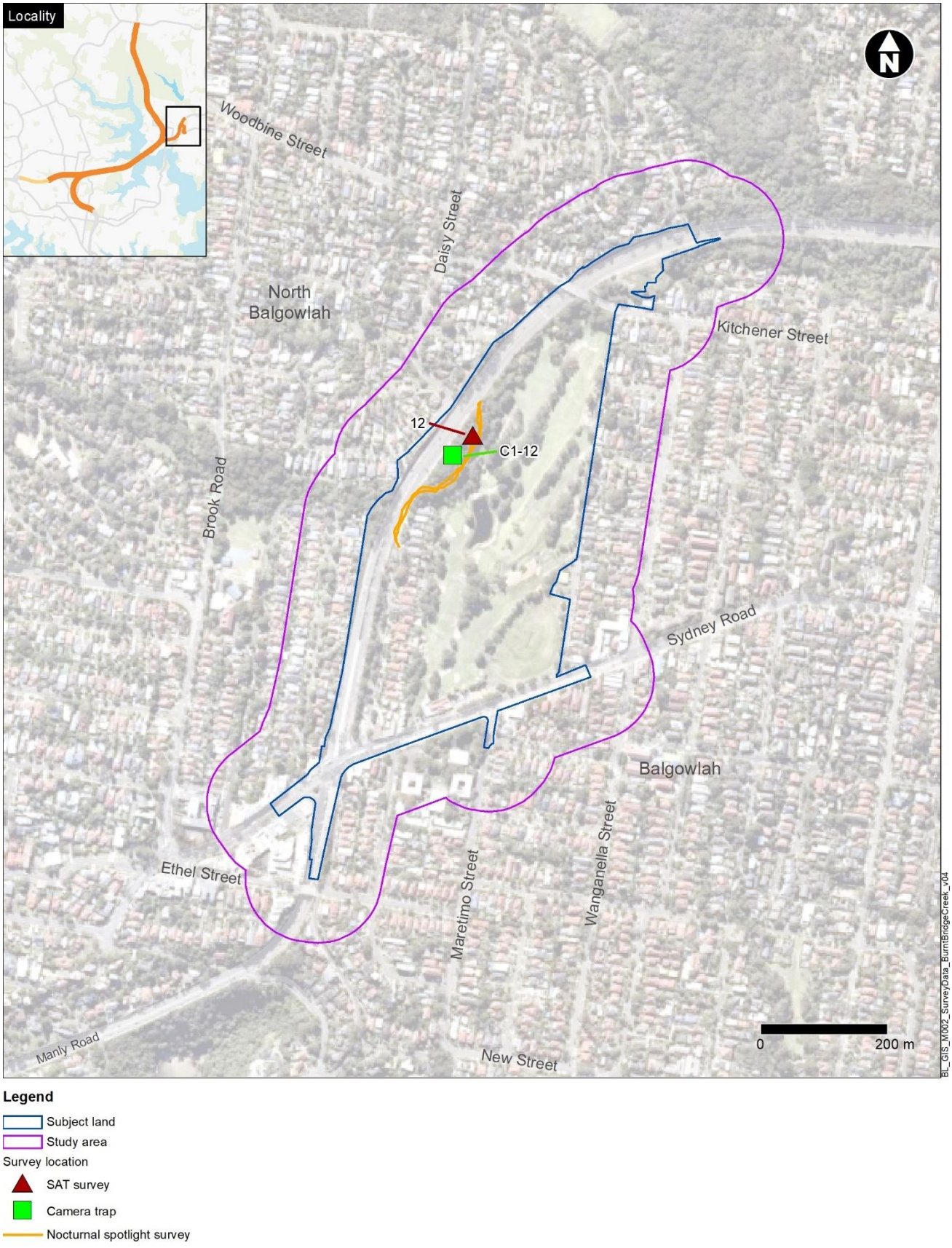


Figure 2-2 Koala survey locations at Burnt Bridge Creek

2.2 SAT surveys

The SAT Koala survey method was employed to identify the presence and activity of Koalas through searching for scat within the study area in suitable habitat. Twelve SAT surveys were conducted in accordance with the method prescribed by Steve Phillips and John Callaghan (2011) as summarised below:

- A central tree that meets one or more of the following selection criteria was located:
  - A tree of any species beneath which one or more Koala faecal pellets have been observed and/or
  - A tree in which a Koala has been observed and/or
  - Any other tree known or considered to be potentially important for Koala, or of interest for other assessment purposes
- Selecting an additional 29 trees in proximity to the central tree that have a minimum diameter at breast height of over 100 millimetres
- A 2-minute search for faecal pellets was carried out beneath each of the 30 identified trees. This involved an inspection of the undisturbed ground surface within a distance of 100 centimetres around the base of each tree, followed by a more thorough inspection involving disturbance of the leaf litter and ground cover within the prescribed search area.

For all SAT surveys conducted, the selected central tree was a Koala feed tree, as no other selection criteria was met by any trees in the area. The SAT surveys were conducted over three sampling dates: 17 June, 22 June and 1 July 2021. Surveys sites were chosen in areas of suitable habitat within the study area, where Koala feed trees were present and within associated Plant Community Types (as listed in the species profile in the *NSW BioNet Threatened Biodiversity Data Collection* (DPIE (EES), 2021b)). Locations for each survey point are shown in Figure 2-1 and Figure 2-2 above. The mapped PCTs at each SAT survey location are detailed in Table 2-2.

Any scat samples that were potential koala specimens were sent to Scatsabout (a scat identification specialist) for analysis.

Table 2-2 SAT survey locations

Site Number	Site location	PCT	Survey date
1	Wakehurst Parkway East	1786	17/06/2021
2	Wakehurst Parkway East	1783	17/06/2021
3	Wakehurst Parkway East	1786	17/06/2021
4	Wakehurst Parkway East	1824	17/06/2021
5	Wakehurst Parkway East	1783	17/06/2021
6	Wakehurst Parkway West	1783	22/06/2021
7	Wakehurst Parkway West	1783	22/06/2021
8	Wakehurst Parkway West	1783	22/06/2021
9	Wakehurst Parkway West	1783	22/06/2021
10	Wakehurst Parkway West	1783	01/07/2021
11	Wakehurst Parkway West	1784/1824	01/07/2021
12	Burnt Bridge Creek	1841	22/06/2021

2.3 Nocturnal spotlight surveys

Nocturnal spotlight surveys were conducted on three sampling dates (15 June, 22 June and 1 July 2021). Standard spotlight survey techniques were followed, whereby handheld spotlights were used to scan vegetation while following a transect line, with surveys commencing approximately an hour after sunset, from 6.30pm until 9pm. A total of 15 person hours of spotlighting was carried out. In conjunction with spotlights, a Hikmicro Lynx Pro LH19 Thermal Monocular was used to assist in detecting the presence of Koalas by scanning vegetation. This survey method is effective at detecting arboreal mammals from heat, often more effective at detection than spotlighting (Vinson et al, 2020; Allison and Destefano, 2006; McGregor et al, 2021). Each transect is shown in Figure 2-1 and Figure 2-2. Further detail on the nocturnal spotlight surveys is provided in Table 2-3.

Table 2-3 Nocturnal spotlight surveys

Location	Length of transect (m)	Survey date
Eastern Wakehurst Parkway, North end	1748	22/06/2021
Eastern Wakehurst Parkway, Central	684	22/06/2021
Eastern Wakehurst Parkway, Southern end	761	01/07/2021
Western Wakehurst Parkway, Southern end	1181	15/06/2021
Burnt Bridge Creek	592	01/07/2021

2.4 Camera traps

Camera traps were deployed in the study area in suitable habitat. Eight Browning Trail Cameras were placed facing a Koala feed tree at ground level and set to capture images when movement was detected. An example of camera trap setup is shown in Plate 2-1. Location descriptions and PCTs of each trap is given in Table 2-4, and locations of the traps are shown in Figure 2-1 and Figure 2-2. All cameras were set on 15 June 2021 and recovered on 1 July 2021, giving two weeks of data.

Table 2-4 Camera trap locations

Camera	Location	PCT
C1-19	Wakehurst Parkway West (North)	1824
C1-14	Wakehurst Parkway West (Middle)	1783
C1-13	Wakehurst Parkway West (South)	1783
C1-17	Wakehurst Parkway East (North)	1786
C1-15	Wakehurst Parkway East (North middle)	1786
C1-11	Wakehurst Parkway East (South Middle)	1783
C1-20	Wakehurst Parkway East (South)	1783
C1-12	Burnt Bridge Creek	1841

Plate 2-1 Camera Trap setup facing Scribbly Gum, Wakehurst Parkway East

3 Results

3.1 SAT surveys

No Koalas were detected in the SAT surveys. Four scat samples were sent to Scatsabout for analysis. Two species were identified following the analysis, namely Swamp Wallaby (*Wallabia bicolor*) and Common Brushtail Possum (*Trichosurus vulpecula*).

A number of other species scats, including large amounts of macropods, were identified during surveys. A full list of species is provided in Annexure A of this assessment.

3.2 Nocturnal spotlight surveys

No Koalas were detected during nocturnal spotlight surveys. The Eastern Pygmy-possum (*Cercartetus nanus*), listed as Vulnerable under the *Biodiversity Conservation Act 2016*, was detected on two separate occasions through the thermal monocular at Wakehurst Parkway (east); one individual is shown in Plate 3-1.

Additionally, common nocturnal fauna species such as Sugar Glider (*Petaurus breviceps*), Tawny Frogmouth (*Podargus strigoides*) and Common Ringtail Possum (*Pseudocheirus peregrinus*) were detected during the nocturnal spotlight surveys. The full list of species identified during spotlight surveys is provided in Annexure A of this assessment.

Plate 3-1 Eastern Pygmy Possum observed during spotlight surveys at Wakehurst Parkway East

3.3 Camera traps

No Koalas were detected on any camera trap images. A total of 2780 images were analysed, however many of these were false positives where the camera was triggered (likely from vegetation movement) but no animal was detected. A total of 100 individuals were detected in the camera trap images. This was determined by separate events of capture, whereby images less than one minute apart were considered to be the same individual. Of these 100 individuals, many were unidentifiable due to poor image quality – identification was particularly difficult for small mammal species.

Common species with confirmed identification in the camera trap images include Swamp Wallaby and European Fox (*Vulpes vulpes*). A list of full camera survey results is included in Annexure B, and a survey species list provided in Annexure A, of this assessment.

4 Discussion

Koalas have historically been recorded in very low numbers in the Northern Beaches local government area. BioNet database (DPIE (EES), 2021a) records contain a total of 10 records of the species within around five kilometres of the subject land at Wakehurst Parkway and Burnt Bridge Creek. An additional three records of the species from 2020 are located just over 5 kilometres from the subject land and are considered relevant to this discussion, and the submission from Environment, Energy and Science Group. All 13 record locations are mapped in Figure 4-1 and a summary of the records is provided in Table 4-1 .

Table 4-1 Koala records about five kilometres from the subject land (BioNet database, DPIE (EES), 2021)

Year of record	Location	Distance from subject land
1994	Warringah Road, Frenchs Forest	85 m
1994	Manly Warringah War Memorial State Park, east of Wakehurst Parkway	450 m
1960	Manly Warringah War Memorial State Park, north of Burnt Bridge Creek	785 m
2017	West of Wakehurst Parkway in urban area adjacent to Garigal National Park, Frenchs Forest	810 m
2019	West of Wakehurst Parkway in urban area adjacent to Garigal National Park, Frenchs Forest (identical location to above)	810 m
1940	Frenchs Forest off Forest Way by Adams Street, northwest of subject land	1.03 km
1997	Vegetation near St Andrews Close, Frenchs Forest	1.95 km
1940	Garigal National Park west of subject land	2.75 km
1967	Kerr Close, Cromer	4.06 km
2020	Wakehurst Parkway 800 m west of the Narrabeen Sport & Recreation centre	4.17 km
2020	22 Narabang Way, Belrose	5.06 km
2020	22 Narabang Way, Belrose	5.06 km
2020	Narabang Way, Belrose, close to Mona Vale Road	5.46 km

As detailed in Table 4-1 , there are recent records of the species to the west of the project in close proximity to the subject land (about 810 metres away) and several further north (more than 4 kilometres). Most of the remaining records are dated (ie 1994 or older) and of varying distances from the subject land.

Koalas were not detected during any targeted surveys on the subject land or within 100 metres of the subject land. Previous surveys carried out by WSP in 2017 to inform Appendix S (Technical working paper: Biodiversity development assessment report), including three surveys using the SAT

survey technique and spotlighting in vegetation adjacent to the Wakehurst Parkway, also did not detect the species (refer to Table 2.6 of Appendix S (Technical working paper: Biodiversity development assessment report)).

Given the lack of detection, it is considered unlikely that there is a resident Koala population within 100 metres of, or on the subject land, or that the subject land forms part of the core habitat for this species. The relatively low frequency of species records and age of most records mean it is likely that the species occurs in the locality in very low densities. Given the five recent records in the locality, it is possible that the Koala could occur as a vagrant and use the subject land for movement purposes. Given the above, and the additional survey effort described in sections 2 and 3 above, the species is identified as having a low likelihood of occurrence within the subject land. This is consistent with the conclusions made in Table 3.29 and Annexure A of Appendix S (Technical working paper: Biodiversity development assessment report).

Offsets are not required for this species in accordance with Section 5.2.4 of the *Biodiversity Assessment Method* (OEH, 2017) due to the lack of detection during targeted surveys carried during the preparation of Appendix S (Technical working paper: Biodiversity development assessment report) and subsequent surveys in 2021, as discussed above.

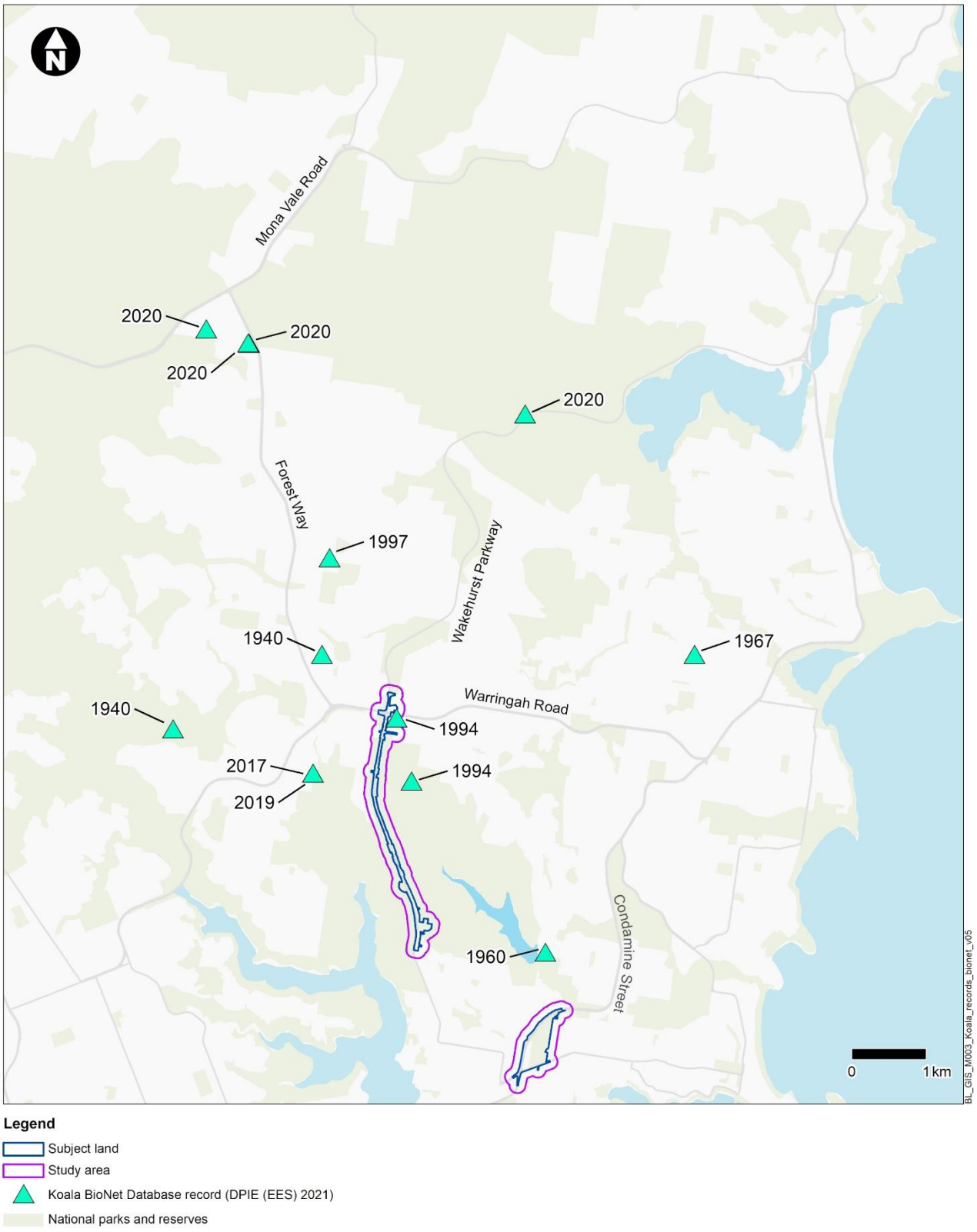


Figure 4-1 Koala records within around five kilometres of the subject land (DPIE (EES), 2021a)

5 Conclusions

A number of environmental management measures were proposed in Section 6 of Appendix S (Technical working paper: Biodiversity development assessment report) and included in Appendix Y (Compilation of environmental management measures) to manage impacts to biodiversity during construction and operation. These environmental management measures are included in Table D2-1 of this submissions report and are applicable to minimising potential impacts to Koala and Koala habitat. These include pre-clearing surveys for threatened fauna species (revised environmental management measure B14), fauna handling measures that could be triggered if a Koala passes through the site (environmental management measure B22) as well as environmental awareness training and an unexpected finds procedures (new environmental management measure B43).

No additional environmental management measures would be required.

The proposed fauna underpasses for the project would allow for incidental Koala crossings and ensure habitat connectivity across the landscape is retained for the species.

6 References

Allison, N.L. and Destefano. S. (2006), *Equipment and Techniques for Nocturnal Wildlife Studies. Wildlife Society Bulletin*, 34, pp. 1036-1044

Commonwealth of Australia (2014), The *EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)*

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McGregor, H., Moseby, K., Johnson, C.N., and Legge, S. (2021*), Effectiveness of thermal cameras compared to spotlights for counts of arid zone mammals across a range of ambient temperatures. Australian Mammalogy* https://doi.org/10.1071/AM20040

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Phillips, S., and Callaghan, J. (2011), *The spot assessment technique: a tool for determining localised levels of habitat use by koalas Phascolarctos cinereus*. Australian Zoologist 35, pp. 774–780

Vinson, S.G., Johnson, A.P., and Mikac, K.M. (2020), *Thermal cameras as a survey method for Australian arboreal mammals: a focus on the greater glider*. Australian Mammalogy, 42, pp. 367-374 https://doi.org/10.1071/AM19051

Annexure A. Fauna species list

Common name	Scientific name	Observation type	Status	
			Biodiversity Conservation Act 2016	***Environment Protection and Biodiversity Conservation Act 1999***
BIRDS				
Grey Goshawk	*Accipiter novaehollandiae*	O	-	-
Grey Shrike-thrush	*Colluricincla harmonica*	Q	-	-
Tawny Frogmouth	*Podargus strigoides*	O	-	-
Yellow Robin	*Eopsaltria australis*	Q, O	-	-
MAMMALS				
Bandicoot Sp.	-	Q	-	-
Common Brushtail Possum	*Trichosurus vulpecula*	Q, P	-	-
Common Ringtail Possum	*Pseudocheirus peregrinus*	Q, P	-	-
Domestic Dog *	*Canis lupus familiaris*	P	-	-
Eastern Pygmy-possum	*Cercartetus nanus*	O	V	-
European Rabbit *	*Oryctolagus cuniculus*	P	-	-
European Red Fox *	*Vulpes vulpes*	Q, P	-	-
Sugar Glider	*Petaurus breviceps*	O	-	-
Swamp Wallaby	*Wallabia bicolor*	Q, P	-	-
-	Antechinus sp.	Q	-	-
-	Macropus sp.	P	-	-
-	Rattus sp.	Q	-	-
-	Rodentia sp.	Q	-	-

Observation type key: O – Observed, Q – Camera, P – Scat
* denotes introduced species

Annexure B. Camera trap results

Camera	Location	Total images	Number of individuals	Confirmed IDs
C1-19	Wakehurst Parkway West (North)	372	15	3 Swamp Wallaby, 2 Grey Shrike-thrush, 5 Bandicoot sp.
C1-14	Wakehurst Parkway West (Middle)	1674	19	15 Swamp Wallaby
C1-13	Wakehurst Parkway West (South)	177	22	2 European Red Fox, 1 Common Brushtail Possum, 1 Common Ringtail Possum, 10 Swamp Wallaby, 1 Bandicoot sp., 8 Rattus sp.
C1-17	Wakehurst Parkway East (North)	60	1	1 Swamp Wallaby
C1-15	Wakehurst Parkway East (North middle)	108	18	13 Rattus Sp.
C1-11	Wakehurst Parkway East (South Middle)	234	8	3 Swamp Wallaby, 1 Yellow Robin, 1 European Red Fox
C1-20	Wakehurst Parkway East (South)	99	11	8 Swamp Wallaby, 1 European Red Fox
C1-12	Burnt Bridge Creek	56	6	1 European Red Fox, 1 Rattus sp., 1 Bandicoot sp.
All Cameras		**2780**	**100**	**40 Swamp Wallaby, 2 Grey Shrike-thrush, 5 European Red Fox, 1 Yellow Robin, 1 Common Brushtail Possum, 1 Common Ringtail Possum, 7 Bandicoot sp., 22 Rattus sp.**

Transport for NSW

Beaches Link and Gore Hill Freeway Connection

Appendix F4 – Biodiversity development assessment report roadmap

November 2021

Contents

1 Introduction

The Department of Planning, Industry and Environment (Environment, Energy and Science Group) (referred to as Environment, Energy and Science Group hereafter) raised a number of issues in their submission on the environmental impact statement in relation to Appendix S (Technical working paper: Biodiversity development assessment report). Additional requests for information on the content of Appendix S (Technical working paper: Biodiversity development assessment report) by government agencies and the community, including any additional or supplementary biodiversity assessments are addressed in the relevant sections of Part B, Section C18 and supported by Appendices F1, F2 and F3 of this submissions report. In particular, the full response to the Environment Energy and Science Group's submission on the environmental impact statement is provided in Section B4 of this submissions report.

This biodiversity development assessment report roadmap has been developed to aid stakeholders in understanding updates to the biodiversity assessment which have occurred since the exhibition of the environmental impact statement, and to navigate where this information is included in this submissions report.

2 Biodiversity development assessment report roadmap

The purpose of the biodiversity development assessment report roadmap provided in Table 1 is to provide a convenient, high-level overview of updates to Appendix S (Technical working paper: Biodiversity development assessment report) which have occurred in response to feedback from government agencies and the community either by updated or supplemented information within the submissions report. Table 1 should also be read in conjunction with Table A5-13 of this submissions report which identifies and clarifies several minor errors and discrepancies in Appendix S (Technical working paper: Biodiversity development assessment report).

Appendix F5 of this submissions report provides an updated biodiversity assessment to synthesis the updated and supplementary information provided in this submissions report and outlined in Table 1, with Appendix S (Technical working paper: Biodiversity development assessment report).

Table 1 Biodiversity development assessment report roadmap

Issue	Appendix S (Technical working paper: Biodiversity development assessment report) reference	Submissions report reference	Summary of updated biodiversity assessment
Extant distribution of Duffys Forest endangered ecological community within the Pittwater Interim Biogeographically Regionalisation of Australia (IBRA) subregion	Section 5.3.1 – Duffys Forest Ecological Community in the Sydney Basin Bioregion	Section B4.2.2 – Extent of Duffys Forest threatened ecological community Appendix F1 – Updated Duffys Forest threatened ecological community mapping and assessment	Environment, Energy and Science Group raised concerns about the extant distribution of Duffys Forest endangered ecological community within the Pittwater IBRA subregion, and the need to revise the serious and irreversible impact assessment for Duffys Forest endangered ecological community in Appendix S (Technical working paper: Biodiversity development assessment report). As such, the extent of Duffys Forest endangered ecological community as mapped by OEH (2016) was reviewed with reference to the Mona Vale Road West Upgrade Species Impact Statement and the most recent aerial imagery available from SIX Maps (available at: maps.six.nsw.gov.au). In addition, since the exhibition of the environmental impact statement, Transport for NSW has refined the design of the ramps for the new shared user bridge at the northern end of the upgraded and realigned Wakehurst Parkway as outlined in Section A4.3 of this submissions report. The design refinement has reduced the area of Duffys Forest endangered ecological community that would be impacted by the project from 1.38 hectares to 1.21 hectares. Based on the above, Appendix F1 of this submissions report provides a revised serious and irreversible impact assessment for Duffys Forest endangered ecological community that updates the information provided in Section 5.3.1 of Appendix S (Technical working paper: Biodiversity development assessment report). Due to the reduction in the project's impact on Duffys Forest endangered ecological community, a key finding of the revised serious and irreversible impact assessment is that the area of the endangered ecological community in the Pittwater IBRA subregion has reduced from 0.36 per cent to 0.34 per cent. The summary of the revised serious and irreversible impact assessment is provided in Section B4.2.2 of this submissions report.
Identification of Plant Community Type (PCT) 1292 Coastal	Section 3.3.1.2 – Water Gum – Coachwood riparian scrub	Section B4.4 – Plant community type identification	In consideration of issues raised by Environment, Energy and Science Group, the identification of PCT 1292 along Burnt Bridge Creek within the Balgowlah Golf Course construction support site (BL10) was reviewed against OEH (2016) regional vegetation mapping and several other PCTs in the locality which could be a suitable fit based on

Issue	Appendix S (Technical working paper: Biodiversity development assessment report) reference	Submissions report reference	Summary of updated biodiversity assessment
Sandstone Riparian Scrub (Water Gum - Coachwood riparian scrub along sandstone streams, Sydney Basin)	along sandstone streams, Sydney basin bioregion		floristics and landscape position. A brief analysis of the characteristic species in each strata, as well as the diagnostic species lists in OEH (2016) is provided in Table B4-1 of this submissions report. This analysis suggests that PCT 1250 Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion is the most suitable fit for the vegetation previously identified as PCT 1292 within Appendix S (Technical working paper: Biodiversity development assessment report). Due to reclassifying the vegetation identified as PCT 1292 to an additional vegetation zone within PCT 1250, references to PCT 1292 throughout Appendix S (Technical working paper: Biodiversity development assessment report) should be read as PCT 1250. In addition, the discussion in Section 3.3.1.2 of Appendix S (Technical working paper: Biodiversity development assessment report) has been updated by Section B4.4 of this submissions report.
Offset credit requirements under the Biodiversity Offsets Scheme	Section 7 – Offsetting required Annexure F – Biodiversity credit reports	Appendix F2 – Updated biodiversity credit reports	Due to reclassifying PCT 1292 to PCT 1250 (refer to Section B4.4 of this submissions report) and changes to vegetation impacts associated with the new shared user bridge at the northern end of the upgraded and realigned Wakehurst Parkway (refer to Section A4.3 of this submissions report), a revised biodiversity credit calculation has been carried out and is provided in Appendix F2 of this submissions report. Appendix F2 provides updates to the ecosystem credits required to offset the revised direct and indirect impacts, in addition to the species credits. The method for calculating the offset requirements is consistent with that described in Section 7 of Appendix S (Technical working paper: Biodiversity development assessment report). In summary: • Table 2-1 of Appendix F2 updates Table 7.1 of Appendix S (Technical working paper: Biodiversity development assessment report) and overall direct ecosystem credits for the project have reduced from 391 to 383 • Table 2-2 of Appendix F2 updates Table 7.2 of Appendix S (Technical working paper: Biodiversity development assessment report) and overall indirect ecosystem credits for the project have reduced from 50 to 45

Issue	Appendix S (Technical working paper: Biodiversity development assessment report) reference	Submissions report reference	Summary of updated biodiversity assessment
			• Table 2-3 of Appendix F2 updates Table 7.3 of Appendix S (Technical working paper: Biodiversity development assessment report) and overall species credits for the project have reduced from 1099 to 1081 • Annexure A of Appendix F2 replaces Annexure F of Appendix S (Technical working paper: Biodiversity development assessment report).
Adequacy of proposed fauna connectivity measures	Section 5.4.4 – Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	Section A4.4 – Relocation and reclassification of fauna underpasses Section B4.6 – Fauna crossing of Wakehurst Parkway Section B4.7 – Efficacy of fauna passage structures proposed as mitigation for target fauna Section B4.8 – Target species Section B4.9 – Fauna underpasses Section B4.10 – Culverts for drainage purposes Section B4.11 – Fauna fencing	Following exhibition of the environmental impact statement and receipt of Environment, Energy and Science Group submission, Transport for NSW carried out further investigations and development of the design to refine the location and type of fauna underpasses. This included investigating opportunities to further optimise the location of the underpasses along the Wakehurst Parkway and their dimensions, and to determine if any of the combined drainage/fauna underpasses could become dedicated fauna underpasses. This was done in the context of biodiversity, design and topographical constraints. The investigation resulted in some refinements to fauna underpass locations and characteristics, which would potentially result in higher use by target fauna. The investigation also included refinement of the dry passage criteria to take into account best available knowledge from recent Pacific Highway upgrade projects. In addition, Lace Monitor (*Varanus varius*), Peron's Tree Frog (*Litoria peronii*) and Common Brushtail Possum (*Trichosurus vulpecula*) have been included as additional fauna underpass target species due to further review of roadkill records and habitat availability (refer to Section B4.8.1 of this submissions report). Information provided in Section 5.4.4 of Appendix S (Technical working paper: Biodiversity development assessment report) has been updated to take into account the above and detail provided in Section A4.4 of this submissions report. Table A4-3 of this submissions report provides an update to Table 5.16 of Appendix S (Technical working paper: Biodiversity development assessment report). Further information on the fauna connectivity measures for the project and their potential effectiveness is provided in sections B4.6 to B4.15 of this submissions report. This also

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		Section B4.12 – Underpass guidance fencing Section B4.13 – Fauna rope canopy bridges Section B4.14 – Maintenance of underpasses, fencing and rope crossings Section B4.15 – Monitoring	includes provision for monitoring the structures during operation (refer to Section B4.15 of this submissions report).
Further consideration of Koalas (*Phascolarctos cinereus*)	Table 2.6 – Threatened fauna species survey techniques, locations and timing Table 3.29 – Threatened fauna species recorded within 1.5 kilometres of the subject land (DPIE (EES) 2020a) Annexure A – Habitat assessment tables	Section B4.8.2 – Consideration of Koalas Appendix F3 – Supplementary koala survey and assessment	In consideration of issues raised by Environment, Energy and Science Group including new BioNet Koala records since exhibition of the environmental impact statement, a supplementary Koala survey and assessment has been carried out and provided as Appendix F3 of this submissions report. Koala surveys were carried out in June and July 2021 within the subject land (ie construction footprint) plus a 100 metre buffer in areas of potential Koala habitat at Wakehurst Parkway and Burnt Bridge Creek. Targeted surveys were carried out using three survey techniques: the Spot Assessment Technique (SAT – Koala survey method) (Phillips and Callaghan, 2011), camera traps and nocturnal spotlighting surveys which included the use of a thermal monocular to increase chances of detection. The above survey effort is detailed in Section 2 of Appendix F3 of this submissions report and supplements the survey effort carried out for the environmental impacts statement as documented in Table 2.6 of Appendix S (Technical working paper: Biodiversity development assessment report). No Koalas or evidence of their presence were detected during targeted surveys. Given the lack of detection in surveys carried out in 2021 and as part of Appendix S (Technical working paper: Biodiversity development assessment report), it is considered unlikely that there is a resident Koala population within 100 metres of or on the subject land, or

Issue	Appendix S (Technical working paper: Biodiversity development assessment report) reference	Submissions report reference	Summary of updated biodiversity assessment
			that the subject land forms part of the core habitat for this species. Further discussion and consideration of historic BioNet records is provided in Section B4.8.2 and Appendix F3 of this submissions report. Based on the above, the species is identified as having a low likelihood of occurrence within the subject land. This is consistent with the conclusions made in Table 3.29 and Annexure A of Appendix S (Technical working paper: Biodiversity development assessment report).
Identification of additional groundwater dependent ecosystems at Flat Rock Creek Reserve/Munro Reserve and further groundwater dependent ecosystem mapping	Section 3.8 – Groundwater dependent ecosystems	Section B4.16 – Impacts on groundwater dependent ecosystems (refer to sections B4.16.1 to B4.16.3) Appendix E – Further information on predicted groundwater drawdown, baseflow reductions and related environmental assessment	In consideration of issues raised by Environment, Energy and Science Group, further review of Bureau of Meteorology (BOM) (2018) and ground truthing of groundwater dependent ecosystems around Flat Rock Creek has been carried out. In addition, the areas of Coastal Upland Swamp in the Sydney Basin Bioregion threatened ecological community (Coastal Upland Swamp TEC) mapped in Garigal National Park to the west of the Wakehurst Parkway section of the subject land, have also been inspected. The outcomes of the above are documented in sections B4.16.2 and B4.16.3 and have resulted in: • Identification of small patches of Coastal Sandstone Plateau Heath, Estuarine Fringe Forest and Illawarra Gully Wet Forest groundwater dependent ecosystems along the edges of the larger patches of Coastal Sandstone Gully Forest, Sandstone Riparian Scrub and Coastal Sand Forest mapped at Flat Rock Creek as shown in Figure B4-7 of this submissions report • Field verification of the BOM (2018) mapping of groundwater dependent ecosystems against OEH (2016) vegetation mapping as shown in Figure B4-8 of this submissions report • Field verification and revised mapping of the extent of the Coastal Upland Swamp TEC as mapped by OEH (2016) as shown in Figure B4-9 of this submissions report. Further, Figure 3-11 from Appendix S (Technical working paper: Biodiversity development assessment report) has been updated by Figure B4-6 of this submissions report and is complemented by discussion in Section B4.16.1 of this submissions report

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			to assist in explaining how groundwater dependent ecosystems were identified for the purposes of the biodiversity development assessment report. Accordingly, the detail in sections B4.16.1 to B4.16.3 supplements and updates the existing environment information on groundwater dependent ecosystems in Section 3.8 of Appendix S (Technical working paper: Biodiversity development assessment report). This detail has also been considered in the further assessment of groundwater dependent ecosystems provided in Appendix E of this submissions report and discussed below.
Further consideration of impacts on groundwater dependent ecosystems	Section 5.6 – Impacts on Groundwater dependent ecosystems	Section A5.1.15 – Clarification of groundwater baseflow impacts Section B4.16 – Impacts on groundwater dependent ecosystems Appendix E – Further information on predicted groundwater drawdown, baseflow reductions and related environmental assessment	As a result of submissions received from government agencies, including Environment, Energy and Science Group, and the community regarding the level of groundwater drawdown and associated baseflow reductions predicted in Flat Rock Creek, Quarry Creek and Burnt Bridge Creek, Transport for NSW has carried out further investigations and groundwater modelling to support a focused assessment of the potential environmental impacts to these creek systems. This has included both revised predictions of groundwater baseflow reductions as well as changes to observable streamflow. An overview of the further investigations and assessment is provided in Section A5.1.15 of this submissions report and a detailed report summarising the results of the additional studies completed including further assessment of groundwater dependent ecosystems is provided in Appendix E of this submissions report. Annexure B of Appendix E of this submissions report presents an assessment of the potential impact on groundwater dependent ecosystems. Information within Appendix E of this submissions report has been used in addressing concerns raised by Environment, Energy and Science Group in sections B4.16.5 to B4.16.19 of this submissions report. The overall findings of the additional investigation and analysis carried out as part of Appendix E of this submissions report are generally consistent with statements contained in Section 5.6 of Appendix S (Technical working paper: Biodiversity development assessment report) and no additional environmental management

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			measures are considered necessary to address the predicted impacts from groundwater baseflow reductions. The further assessment of groundwater dependent ecosystems provided in Appendix E of this submissions report and used in sections B4.16.5 to B4.16.19 of this submissions report supplements the impact assessment provided in Section 5.6 of Appendix S (Technical working paper: Biodiversity development assessment report).
Terrestrial fauna habitat provided by Balgowlah Golf Course stormwater harvesting dam	Section 3.7.1 – Vegetated habitats	Section B4.23 – Balgowlah Golf Course stormwater harvesting dam Section C18.3.1 – Impacts to fauna and fauna habitat	Balgowlah Golf Course was identified as potentially offering foraging, nesting and roosting habitat to bats, birds and arboreal mammals, including Grey-headed Flying-fox *(Pteropus poliocephalus*) in Section 3.7.1 of Appendix S (Technical working paper: Biodiversity development assessment report). In consideration of issues raised by Environment, Energy and Science Group and the community, an additional field survey of the existing stormwater harvesting dam in the Balgowlah Golf Course was carried out in June 2021 to assess habitat potential of the dam. The outcomes of the additional field survey and its consideration as terrestrial fauna habitat is provided in sections B4.23 and C18.3.1 of this submissions report. While the existing stormwater harvesting dam is unlikely to provide potential habitat for threatened fauna species, it could provide a water source for terrestrial fauna. Discussion on alternate water sources and management of the decommissioning of the existing stormwater harvesting dam and construction of a replacement water quality basin is also provide in sections B4.23 and C18.3.1 of this submissions report. The detail provided in sections B4.23 and C18.3.1 of this submissions report supplements the habitat discussion included in Section 3.7.1 and Section 3.7.3 of Appendix S (Technical working paper: Biodiversity development assessment report).
Further consideration of Seaforth Mint Bush (*Prostanthera marifolia*),	Section 3.6.1.4 – Threatened flora species recorded in surveys near the subject land	Section C18.2.2 – Impacts to threatened flora	Following receipt of a number of community submissions which raised concerns in regard to Seaforth Mint Bush, a new search of the BioNet database was carried out in March 2021. Two NSW herbarium records dating from 2002 and 2008, previously identified as *Prostanthera junonis*,were reclassified to Seaforth Mint Bush at some point in the 12 months prior to March 2021.

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Pimelea curviflora var. *curviflora*, *Tetratheca glandulosa* and Angus's Onion Orchid (*Microtis angusii*)	Annexure A – Habitat assessment tables		Neither species is recorded in the subject land. One of these individuals is located about 32 metres to the west of the construction footprint, the location description for this record is 'Western side of Wakehurst Parkway, opposite Seaforth Oval, Seaforth'. As the subject land is on the eastern side of Wakehurst Parkway, this supports the conclusion that the location is outside the subject land and would not be impacted. The BioNet database records of *Tetratheca glandulosa, Pimelea curviflora* var. *curviflora* and Angus's Onion Orchid in the locality were also reviewed for additional records along Wakehurst Parkway. None of the records for *Tetratheca glandulosa* or *Pimelea curviflora* var. *curviflora* are located within the construction footprint (refer to Figure C18-1 of this submissions report). The location descriptions of most records around the southern end of the Wakehurst Parkway section indicate that the records are south of Judith Street or west of the Wakehurst Parkway. As such, the assessment conclusions for *Tetratheca glandulosa* and *Pimelea curviflora* var. *curviflora* remain appropriate. There have been no new records for Angus's Onion Orchid along Wakehurst Parkway in the vicinity of the project since 2002. Further discussion on the above is provide in Section C18.2.2 of this submissions report and includes discussion on how potential impacts during construction will be managed. Accordingly, the detail provided in C18.2.2 of this submissions report regarding Seaforth Mint Bush, *Pimelea curviflora* var. *curviflora*, *Tetratheca glandulosa* and Angus's Onion Orchid supplements the discussion provided in Section 3.6.1.4 and Annexure A of Appendix S (Technical working paper: Biodiversity development assessment report).
New or revised terrestrial biodiversity related environmental management measures	Table 6.1 – Environmental management measures	Table D2-1 – Revised environmental management measures	As a result of feedback received from government agencies, including Environment, Energy and Science Group, and the community, a number of new or revised terrestrial biodiversity related environmental management measures have been proposed which update the environmental management measures provided in Table 6.1 of Appendix S (Technical working paper: Biodiversity development assessment report). A full list of environmental management measures (including new and revised environmental management measures) for the project is included in Table D2-1 of this submissions report. New or revised environmental management measures which update

Issue	Appendix S (Technical working paper: Biodiversity development assessment report) reference	Submissions report reference	Summary of updated biodiversity assessment
			environmental management measures provided in Table 6.1 of Appendix S (Technical working paper: Biodiversity development assessment report) include: • New environmental management measure B39 – manages potential injury or mortality risks to fauna associated with works near or that impact the existing fauna fencing installed as part of the Northern Beaches Hospital road upgrade project. Refer to Section B4.6 of this submissions report for further detail • New environmental management measure B41 – manages risks of impacting the revegetated area within the eastern section of the site (planted as part of the Northern Beaches Hospital road upgrade project with species consistent with Duffys Forest endangered ecological community). Refer to Section B4.2.3 of this submissions report for further detail • New environmental management measure B43 – provides for biodiversity awareness training during construction. Refer to sections C18.2.2 and C18.9.1 of this submissions report for further detail • New environmental management measure B44 – provides for the monitoring of the proposed fauna connectivity measures and exclusion fencing to be provided as part of the project. Refer to sections B4.7.2 and B4.15 of this submissions report for further detail • New environmental management measure B45 – provides for the establishment of exclusion zones to manage risks to flora and fauna beyond the limit of clearing. Refer to sections C18.2.2 and C18.2.3 of this submissions report for further detail • Revised environmental management measures B2 and B3 – updated in response to concerns raised on the fauna connectivity measures and to ensure the design of connectivity measures takes into account best available knowledge. Refer to sections B4.6 to B4.15 of this submissions report • Revised environmental management measure B14 – updated to include pre-clearing surveys of human made structures that have been identified as potentially providing

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			habitat for microbats and are subject to demolition or modification. Refer to Section B4.19.1 of this submissions report for further detail • Revised environmental management measures B4, B6, B7, B9, B17, B18, B24 and B26 – updated to correct errors and/or modify the wording so that the outcome of a commitment is clearer to implement. The intent of these measures has not changed from that proposed in Table 6.1 of Appendix S (Technical working paper: Biodiversity development assessment report) • Revised environmental management measure SG6 – updated in response to concerns raised on groundwater dependent ecosystems and consideration to the additional investigation and analysis carried out as part of Appendix E of this submissions report. Refer to Section B4.16.16 of this submissions report for further detail.
New or revised other biodiversity related environmental management measures	N/A	Table D2-1 – Revised environmental management measures	In addition to the terrestrial biodiversity related environmental management measures detailed above, a number of other new or revised biodiversity related environmental management measures have been proposed in response to feedback received from government agencies and the community. These measures mainly relate to avoiding, minimising and mitigating impacts in marine and freshwater environments which would also be relevant to avoiding, minimising and mitigating impacts on wandering seabirds, shorebird species, Little Penguin and Red-crowned Toadlet and their habitats within and near the subject land. In addition, environmental management measures regarding replacing mature amenity trees and reuse of salvaged timber from the clearing process have also been revised which would have a benefit for terrestrial biodiversity. For completeness, these measures have been listed below and a full list of environmental management measures (including new and revised environmental management measures) for the project is included in Table D2-1 of this submissions report: • New environmental management measure B40 – provides for fish passage during design of all temporary and permanent waterway crossings and instream drainage infrastructure in addition to including instream habitat landscaping that favours

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			habitat requirements of native species. Refer to Section B5.1 of this submissions report for further detail • New environmental management measure B42 – manages any exotic fauna encountered during instream works and dewatering activities. Refer to Section B4.23 of this submissions report for further detail • Revised environmental management measure B5 – updated to include pre-construction surveys for White's Seahorse (*Hippocampus whitei*) are carried out in the 24 hour period prior to commencement of works that may impact potential habitat and a permit under Section 37 of the Fisheries Management Act 1994 is obtained. Refer to Section B5.4 of this submissions report for further detail • Revised environmental management measure B31 – updated to confirm additional silt curtains will be located around sensitive marine habitats adjacent to the Middle Harbour south cofferdam (BL7). Refer to Section B5.3 of this submissions report for further detail • Revised environmental management measure B34 – updated to include consultation with Department of Primary Industries (Fisheries) when carrying out rehabilitation and restoration of sensitive marine habitats adjacent Middle Harbour north cofferdam (BL8) and Spit West Reserve construction support site (BL9). Refer to Section B5.6 of this submissions report for further detail • Revised environmental management measure B35 – updated to modify the wording of the measure so that the outcome of the commitment is clearer to implement. The intent of this measure has not changed from that proposed in Appendix Y (Compilation of environmental management measures) • Revised environmental management measure V13 – updated in response to recommendations raised by Environment, Energy and Science Group regarding planting ratio, and to modify the wording so that the outcome of the commitment is clearer to implement. The revised measure commits to replacing removed mature amenity trees (other than trees offset under the NSW Biodiversity Offsets Scheme,

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			established under Part 6 of the *Biodiversity Conservation Act 2016*) at a ratio of 2:1. Refer to Section B4.20.2 of this submissions report for further detail • Revised environmental management measure WM8 – updated to detail further opportunities to reuse suitable timber and root balls for habitat enhancement and rehabilitation work. Refer to Section B4.21.2 of this submissions report for further detail.

3 References

Bureau of Meteorology (BOM) (2018), National Atlas of Groundwater Dependent Ecosystems. Retrieved 17 May 2021 from http://www.bom.gov.au/water/groundwater/gde/map.shtml

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Phillips, S and Callaghan, J (2011), 'The Spot Assessment Technique: A tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus', *Australian Zoologist*, vol 35, no. 3, pp. 774-780.