Appendix H - Part 4

Biodiversity Development Assessment Report

Operational study area
Survey area
Area to be offset (VI > 15)

301000

302000

6259000

6258000

0 150
m

GDA 1994 MGA Zone 56

niche Environment and Heritage

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Impacts and offsetting
M7 Widening

Figure 7c

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

v2.0

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Operational study area
Survey area
Area to be offset (VI > 15)

301000

6257000

6256000

0 150
m

GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Impacts and offsetting
M7 Widening

Figure 7d

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

v2.0

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Operational study area
Survey area
Area to be offset (VI > 15)

302000

6254000

6253000

0 150
m

GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Impacts and offsetting
M7 Widening

Figure 7e

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

v2.0

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Operational study area
Survey area
Area to be offset (VI > 15)

301000

6252000

6251000

6250000

0 150
m

GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Impacts and offsetting
M7 Widening

Figure 7f

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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Impacts and offsetting
M7 Widening

Figure 7g

0 150
m
GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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v2.0

Operational study area
Survey area
Area to be offset (VI > 15)

301000
302000
6246000
6245000

0 150
m
GDA 1994 MGA Zone 56

niche Environment and Heritage

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Niche Proj. #: 6450
Client: AECOM

Impacts and offsetting
M7 Widening

Figure 7h

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

v2.0

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Operational study area
Survey area
Area to be offset (VI > 15)

303000
304000
6244000
6243000
6242000

0 200
m

GDA 1994 MGA Zone 56

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Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Impacts and offsetting
M7 Widening

Figure 7i

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

v2.0

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0 150
m

GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Southern Motis species polygon
M7 Widening

Figure 8a

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

v2.0

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0 150

m

GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Southern Motis species polygon
M7 Widening

Figure 8b

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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v2.0

Survey area

301000

302000

6259000

6258000

0 150

m

GDA 1994 MGA Zone 56

niche Environment and Heritage

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Southern Motis species polygon
M7 Widening

Figure 8c

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

v2.0

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Southern Motis species polygon
M7 Widening

Figure 8d

0 150
m
GDA 1994 MGA Zone 56

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Client: AECOM

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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Drawn by: Neil Berry File: T:\spatial\projects\a6400\a6450_Confidential_FreewayProject_NSW\Maps\report\BDAR\6450_Figure_8_SouthernMyotisSP.mxd Last updated: 7/25/2022 12:08:48 PM

Survey area

Southern Myotis species polygon

Suitable waterbodies for Southern Myotis

PCT, Condition

835, Low

302000

6254000

6253000

0 150

m

GDA 1994 MGA Zone 56

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Client: AECOM

Southern Motis species polygon
M7 Widening

Figure 8e

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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0 150
m

GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Southern Motis species polygon
M7 Widening

Figure 8f

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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niche Environment and Heritage

0 150
m
GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Southern Motis species polygon
M7 Widening

Figure 8g

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

v2.0

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niche Environment and Heritage

0 150
m
GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Southern Motis species polygon
M7 Widening

Figure 8h

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

v2.0

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0 225 m

GDA 1994 MGA Zone 56

Niche PM: Stephen Bloomfield
Niche Proj. #: 6450
Client: AECOM

Southern Motis species polygon
M7 Widening

Figure 8i

World Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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Annex 1. Aquatic Ecology Report

Excellence in your environment

niche Environment and Heritage

Aquatic Ecology Assessment
Westlink M7 Widening

Prepared for Transport for NSW | 31 July 2022

niche-eh.com

Excellence in your environment

Document control

Project number	Client	Project manager	LGA
6450	AECOM	Stephen Bloomfield	Liverpool, Fairfield, Blacktown

Version	Author	Review	Status	Date
D1	Sophia Dunn, Jessie Bear, Matthew Russell	Stephen Bloomfield	Issued as Rev0	28 October 2021
Rev0	Matthew Russell	Stephen Bloomfield	Issued as Rev1	29 October 2021
Rev1	Matthew Russell	Stephen Bloomfield	Issued as Rev2	11 November 2021
Rev2	Matthew Russell	Stephen Bloomfield	Issued as Rev2	23 November 2021
Rev3	Matthew Russell, Luke Stone	Stephen Bloomfield	Issued as Rev3	20 May 2022
Rev4	Matthew Russell, Luke Stone	Stephen Bloomfield	Issued as Rev4	25 May 2022
Rev5	Luke Stone	Stephen Bloomfield	Issued as Rev5	7 June 2022

Niche Environment and Heritage Pty Ltd (ACN 137 111 721)
Enquiries should be addressed to Niche Environment and Heritage
PO Box 2443, Parramatta NSW 1750, Australia
Email: info@niche-eh.com

Executive summary

Context

The Westlink M7 is an existing 39-kilometre-long toll road connecting the M5 Motorway at Prestons, The Hills M2 Motorway at Baulkham Hills and the M4 Motorway at Eastern Creek ('the approved project') (DPE reference number SSI-663). Transport for NSW (Transport) is seeking a modification to the approved project to widen part of the Westlink M7 in response to current and future traffic growth, and to improve motorway efficiency, travel time performance and safety.

Niche Environment and Heritage Pty Ltd (Niche) has been engaged by AECOM, on behalf of Transport to prepare an aquatic ecology assessment for the proposed modification. For the purposes of this study, the area to be impacted by the proposed modification is referred to as the construction footprint.

Aims

This aquatic ecology assessment assesses the potential impact of the proposed modification on aquatic biodiversity and provides information required to meet the assessment requirements stipulated under State and Commonwealth legislation governing the conservation of aquatic threatened species, populations, and ecological communities and Key Fish Habitat (KFH) in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued for the proposed modification.

Methods

A desktop review and field investigations were undertaken to inform the assessment.

Relevant databases and literature were reviewed as part of the desktop assessment. The information obtained from the desktop review was used to assess the potential impacts of the proposed modification on aquatic biodiversity and KFH. A habitat assessment through field investigation was also conducted.

Impact assessment

- The main construction risk for aquatic ecology associated with the proposed modification is contamination of surface water either though run-off from stockpiles or construction materials, or from direct leakage from on-site chemicals, the potential introduction of contaminated sediments into waterways, as well as impacts associated with stream modification (stream realignment, crossings and work platforms) (e.g. from proposed widening of bridges).
- Recommended mitigation measures would significantly reduce the risks associated with construction surface water impacts and their potential impact to the aquatic environment. Careful management of stream alterations is required, particularly at Cabramatta Creek, the largest waterway potentially affected by the proposed modification.
- Surface water quality and quantity would be managed with existing stormwater infrastructure, which was designed to accommodate future widening of the motorway (now proposed), and would be upgraded where necessary. The potential water quality impacts are expected to be negligible and would therefore not lead to long term impacts to the aquatic ecology.
- The impacts associated with alteration of flow and local hydraulics from the bridge widening (additional bridge piers) may cause localised change in benthic sediments and associated aquatic habitat in high flows; however, this change is expected to have a negligible impact to aquatic ecology overall and would not impose a significant barrier to fish communities that may occur in the waterways.

Threatened species

No known threatened freshwater species occur in waterways affected by the proposed modification and, therefore, no threatened species would be impacted by the proposed widening.

Management of impacts

Existing stormwater infrastructure would be utilised for the management of operational impacts associated with the proposed modification.

The mitigation measures to reduce or eliminate impacts to the aquatic environment are related to management of surface water during construction. Mitigation includes measures to reduce or eliminate impacts, monitoring requirements and management plans (Surface Water Management Plan [SWMP], and Erosion Sediment Control Plan [ESCP]). General aquatic mitigation measures relevant to the bridge widening construction impacts include:

- If sediment/erosion booms are used, they should be placed so they do no obstruct fish passage, where possible
- Design of temporary crossings and stream diversions are consistent with *Managing Urban Stormwater: Soils and construction – Volume 1 and 2D* (Landcom, 2004), *Policy and Guidelines for Fish Habitat Conservation and Management* (Fairfull, 2013) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries, 2003)
- Sediment and erosion control measures in line with those detailed in *Managing Urban Stormwater: Soils and construction – Volume 1 and 2D* (Landcom, 2004) and *Policy and Guidelines for Fish Habitat Conservation and Management* (Fairfull, 2013)
- Regular monitoring of stream alterations by an ecologist during construction activities i.e. stream diversions, temporary crossings or dewatering activities
- Where required, a trained aquatic ecologist should relocate any native fish stranded by construction activities.

Conclusions

The aquatic ecology assessment concluded the following:

- There are no threatened aquatic species that occur in the area that would be impacted from the proposed modification.
- The potential impacts associated with construction include:
  - Short-term water quality changes associated with sedimentation and potentially contaminated sediments entering the waterways.
  - Alteration of waterways from stream diversion and temporary stream crossings.
- Bridge construction may temporarily affect fish passage in some KFH areas during construction. The most sensitive waterway with regards to KFH and fish passage is Cabramatta Creek.
- There are expected to be no long-term changes to fish passage from the proposed modification.
- Operational surface water quality and quantity impacts would be managed with existing stormwater infrastructure, which would be upgraded or augmented in select locations where required to maintain their existing function. The potential impacts are expected to be negligible and would therefore not lead to long-term impacts to aquatic ecology.
- The proposed modification would not significantly impact the downstream sensitive aquatic habitat.
- The long-term overall changes to integrity of aquatic habitat and water quality of the waterways within the construction footprint are expected to be negligible. As such, there is expected to be no net loss of KFH.

Glossary and list of abbreviations

Term or abbreviation	Definition
AUSRIVAS	Australian River Assessment System
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
BC Act	NSW *Biodiversity Conservation Act 2016*
DAWE	Commonwealth Department of Agriculture, Water, and the Environment (previously DoEE)
DoEE	Commonwealth Department of Environment and Energy (now DAWE)
DPE	Department of Planning and Environment (previously DPIE)
DPIE	NSW Department of Planning, Industry and Environment (now DPE)
DPI	NSW Department of Primary industries
EEC	Endangered Ecological Communities
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FFA	Flora and Fauna Assessment
FM Act	NSW *Fisheries Management Act 1994*
KTPs	Key Threatening Processes
KFH	Key Fish Habitat
LGA	Local Government Area
MNES	Commonwealth Matters of National Environmental Significance
Niche	Niche Environment and Heritage Pty Ltd
SEARs	Secretary Environmental Assessment Requirements
SIS	Species Impact Statement
TEC	Threatened Ecological Community
Transport	Transport for NSW
WSUD	Water Sensitive Urban Design

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1. Introduction

1.1 Context

Transport for NSW (Transport) as the proponent for the proposed modification, has submitted a request to the NSW Department of Planning and Environment (DPE) to modify the project planning approval for the Western Sydney Orbital (now referred to as Westlink M7) under section 5.25 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).

The Westlink M7 is an existing 39-kilometre-long toll road connecting the M5 Motorway at Prestons, the Hills M2 Motorway at Baulkham Hills and the M4 Motorway at Eastern Creek ('the approved project') (DPE reference number SSI-663). Transport is seeking a modification to the approved project to widen part of the Westlink M7 in response to current and future traffic growth, and to address reduced motorway efficiency, travel time performance and safety.

The original approval (DPE reference number SSI-663) was for the construction and operation of the four-traffic lane motorway. The approved project, with the implementation of the proposed modification, would permit the addition of a trafficable lane in both directions within the existing median of the Westlink M7, from about 140 metres south of the Kurrajong Road overhead bridge at Prestons (southern end) to Richmond Road in Oakhurst/Glendenning (northern end), excluding widening through the M4 Motorway/Westlink M7 Motorway (Light Horse) Interchange (see Figure 1 of the Biodiversity Development Assessment Report (BDAR)).

Niche Environment and Heritage Pty Ltd (Niche) has been engaged by AECOM, on behalf of Transport for NSW (Transport), to prepare an aquatic ecology assessment for the proposed modification.

This aquatic ecology assessment assesses the potential impact of the proposed modification on aquatic biodiversity in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the DPE, NSW *Fisheries Management Act 1994* (FM Act) and Commonwealth *Environment Protection* and *Biodiversity Conservation Act 1999* (EPBC Act).

1.2 The proposed modification

A full description of the construction activities and operational features associated with the proposed modification are provided in detailed in Chapter 4 (Proposed modification) of the modification report.

The proposed modification to the approval for the Westlink M7 would include the following key operational components:

- Widening into the existing median for a length of about 26 kilometres along the Westlink M7, from about 140 metres south of the Kurrajong Road overhead bridge at Prestons (southern end) to Richmond Road interchange in Oakhurst/Glendenning (northern end)
- Widening the exit from the Westlink M7 northbound onto the M4 Motorway westbound from one lane to two lanes
- Widening of 43 existing northbound and southbound bridges on the Westlink M7 at 23 locations within the centre median, and widening on the outside of the bridges on the approach to the M4 Motorway from Old Wallgrove Road
- Upgrades and modifications to noise wall infrastructure

- Utility works and upgrades to drainage infrastructure
- Intelligent Transport System (ITS) installations, adjustments and relocations to cover the new lane configurations.

The following activities would be required to facilitate construction of the proposed modification:

- Multiple construction ancillary facility sites within and adjacent to Westlink M7 for stockpiling, construction support at bridge and median widening locations, project offices and compounds
- Vegetation clearing within the widening areas and construction ancillary facilities (including construction accesses)
- Demolition of existing structures and infrastructure within the construction footprint
- Provision of temporary water management infrastructure including the maintenance of stormwater drainage and establishment of waterway crossings and diversions
- Utility works within Westlink M7 and adjoining roads, particularly around existing motorway bridge substructures
- Earthworks for bridge and road widening within the existing median, and placement and compaction of fill material
- Bridge widening works to existing structures including establishment of substructures including piles, abutments, piers and headstocks and superstructures including beams, girders, decks and barriers
- Pavement widening works within the road median
- Finishing works including asphalting the carriageway surface, line marking, signage, permanent barriers and median infill, adjustments to noise walls, installation of communications infrastructure and landscaping treatments.

Key features that were assessed as part of the aquatic ecology assessment included:

- The bridge widening areas and proposed temporary creek crossing locations
- Areas adjacent to bridges where piers and supports are proposed
- Potential construction ancillary facilities (including stockpiling) and associated temporary access tracks identified within, or near to, riparian areas
- Proposed temporary creek realignments and diversions.

For the purposes of this study, the area to be impacted by the proposed modification is referred to as the construction footprint.

1.3 Purpose of this report

This report assesses the potential aquatic ecology impacts of the proposed modification. It supports the modification report being prepared for Transport under section 5.25 of the EP&A Act. The report also addresses the potential impact of the proposed modification on aquatic biodiversity in accordance with the relevant SEARs (DPE, 2022), identified in Table 1.

Table 1: SEARs relevant to the Aquatic Ecology Assessment (DPE, 2022)

Desired Performance Outcome	Requirement	Guidelines
Biodiversity The project design considers all feasible measures to avoid and minimise impacts on	Impacts on biodiversity values not covered by the BAM must be assessed. This includes a threatened aquatic species assessment (Part 7A *Fisheries*	Policy and Guidelines for Fish Habitat Conservation and Management – Update 2013 (Fairfull, 2013). Threatened Species Survey and Assessment Guidelines

Desired Performance Outcome	Requirement	Guidelines
terrestrial and aquatic biodiversity.	*Management Act 1994*) to address whether there are likely to be any significant impact on listed threatened species, populations or ecological communities listed under the *Fisheries Management Act 1994* (FM Act). Identify whether the project, or any component of the project, would be classified as a Key Threatening Process (KTP) in accordance with the listings in the BC Act, FM Act and the *Environment Protection and the Biodiversity Conservation Act 2000* (EPBC Act).	Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries, 2003) Aquatic Ecology in Environmental Impact Assessment – EIA Guideline (Marcus Lincoln Smith, 2003). Freshwater threatened species distribution maps (www.dpi.nsw.gov.au/fishing/species-protection/threatened-species-distributions-in-nsw/freshwater-threatened-species-distribution-maps.

2. Methods

The assessment consisted of a desktop review and field survey to identify the potential impacts of the proposed modification on aquatic ecology. The following guidelines were considered in the aquatic ecology impact assessment survey design and assessment approach:

- Fisheries NSW *Policy and Guidelines for Fish Habitat Conservation and Management* (Fairfull, 2013).
- *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries, 2003).
- *Aquatic Ecology in Environmental Impact Assessment – EIA Guideline* (Marcus Lincoln Smith 2003).

2.1 Database searches and literature review

Relevant databases and literature were reviewed to inform the desktop assessment, including:

- Database searches for threatened aquatic flora and fauna:
  - NSW Department of Primary Industries (DPI) Fisheries Spatial data portal under the FM Act (DPI, 2021a)
  - Australian Department of Agriculture, Water, and the Environment (DAWE) Protected Matters Search Tool (PMST) (DAWE, 2021) (using a 10 kilometre buffer)
  - NSW Department of Planning, Industry and Environment (DPIE) BioNet, Atlas of NSW Wildlife (DPIE 2021).
- BDAR for the proposed modification (Niche, 2022)
- M7 Motorway Proposed Modification Surface water and flooding assessment (Lyall and Associates, 2022).

2.1.1 Threatened species likelihood of occurrence

A list of all threatened aquatic species within the locality was derived from the database searches detailed in Section 2.1. To determine the relevant level of assessment to apply to potentially affected species, further analysis of the likelihood of those species occurring within and up and downstream of the impacted waterways was completed. Five categories for 'likelihood of occurrence' were attributed to threatened biodiversity after considering the number and proximity of known records, presence, or absence of preferred habitat types (e.g. native vegetation types), the mobility of the species, field survey results and professional judgement. The categories are outlined in Table 2.

Where species are categorised as 'Known,' 'High' or 'Moderate', and where impacts on the species could reasonably occur from the proposed modification, formal assessments of significance under the FM Act and EPBC Act would be required. Species listed as having a 'Low' or 'None' likelihood of occurrence are those for which there is limited or no suitable habitat present within the construction footprint of the proposed modification.

Table 2: Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	The species was observed in the construction footprint (the area required for construction of the proposed widening, as shown in Figure 1 and Figure 2) during the current field surveys
High	It is highly likely that a species inhabits the construction footprint and is dependent on identified suitable habitat (i.e., for breeding or important life cycle periods), has been recorded recently in

Likelihood	Criteria
	the locality (within 10 kilometres of the location) and is known or likely to maintain resident populations in the construction footprint. Also includes species known or likely to visit the construction footprint during regular seasonal movements or migration.
Moderate	Potential habitat is present in the construction footprint. Species unlikely to maintain sedentary populations, however, may seasonally use resources within the construction footprint opportunistically or during migration. The species is unlikely to be dependent (i.e., for breeding or important life cycle periods) on habitat within the construction footprint, or habitat is in a modified or degraded state.
Low	It is unlikely that the species inhabits the construction footprint. It may be an occasional visitor, but habitat similar to that present in the construction footprint is widely distributed in the local area, meaning that the species is not dependent on these habitats (i.e. for breeding or important life cycle periods).
Unlikely	Suitable habitat is absent from the construction footprint or published distribution maps (DPI, 2021b) show that it does not occur in the construction footprint.

Where species are categorised as 'Known,' 'High' or 'Moderate', and where impacts on the species could reasonably occur from the proposed modification, formal assessments of significance under the FM Act and EPBC Act would be required. Species listed as having a 'Low' or 'None' likelihood of occurrence are those for which there is limited or no suitable habitat present within the construction footprint of the proposed modification.

2.2 Field survey

An AUSRIVAS habitat assessment at waterway crossings in the construction footprint was conducted. This was conducted at 13 locations over five days between 7-10 September (assessment sites 1-10) and on 23 September 2021 (assessment sites 11-13) (Figure 1 and Figure 2, Table 3). The field inspection included the assessment of the following attributes:

- Dimensions of waterway and depth of water
- Ecosystem type (e.g., wetlands, floodplains, dams, streams, estuaries, lakes)
- Habitat types (e.g., pools, riffles, billabongs)
- Flow characteristics and hydrological features of aquatic habitat
- Bed substrate (e.g., bedrock, boulder, gravel, sand, silt)
- Existing infrastructure and barriers to fish movement (natural or artificial)
- Other existing impacts such as visual indicators of pollution (e.g. the presence of surface oils), litter, or riparian weed infestations
- Width and species composition of riparian vegetation including the type of vegetation present (e.g., macrophytes, snags) and condition.

Table 3: Field survey locations

Assessment site	Location	Eastings	Northings
1	Angus Creek downstream and upstream	300853	6261104
2	Unnamed tributary of Reedy Creek	301190	6256932
3	Reedy Creek	301191	6256483
4	Concrete channel - unnamed	301591	6253817
5	Ropes Creek	300827	6250588

Assessment site	Location	Eastings	Northings
6	Tributary of Hinchinbrook Creek north	299989	6247249
7	Tributary of Hinchinbrook Creek south	300909	6246222
8	Hinchinbrook Creek – main channel	302025	6244214
9	Cabramatta creek	302833	6243529
10	Maxwells Creek	303967	6242498
11	Concrete channel- unnamed	300091	6248548
12	Tributary of Hinchinbrook Creek	302274	6244137
13	Tributary of Maxwell Creek	303792	6242872

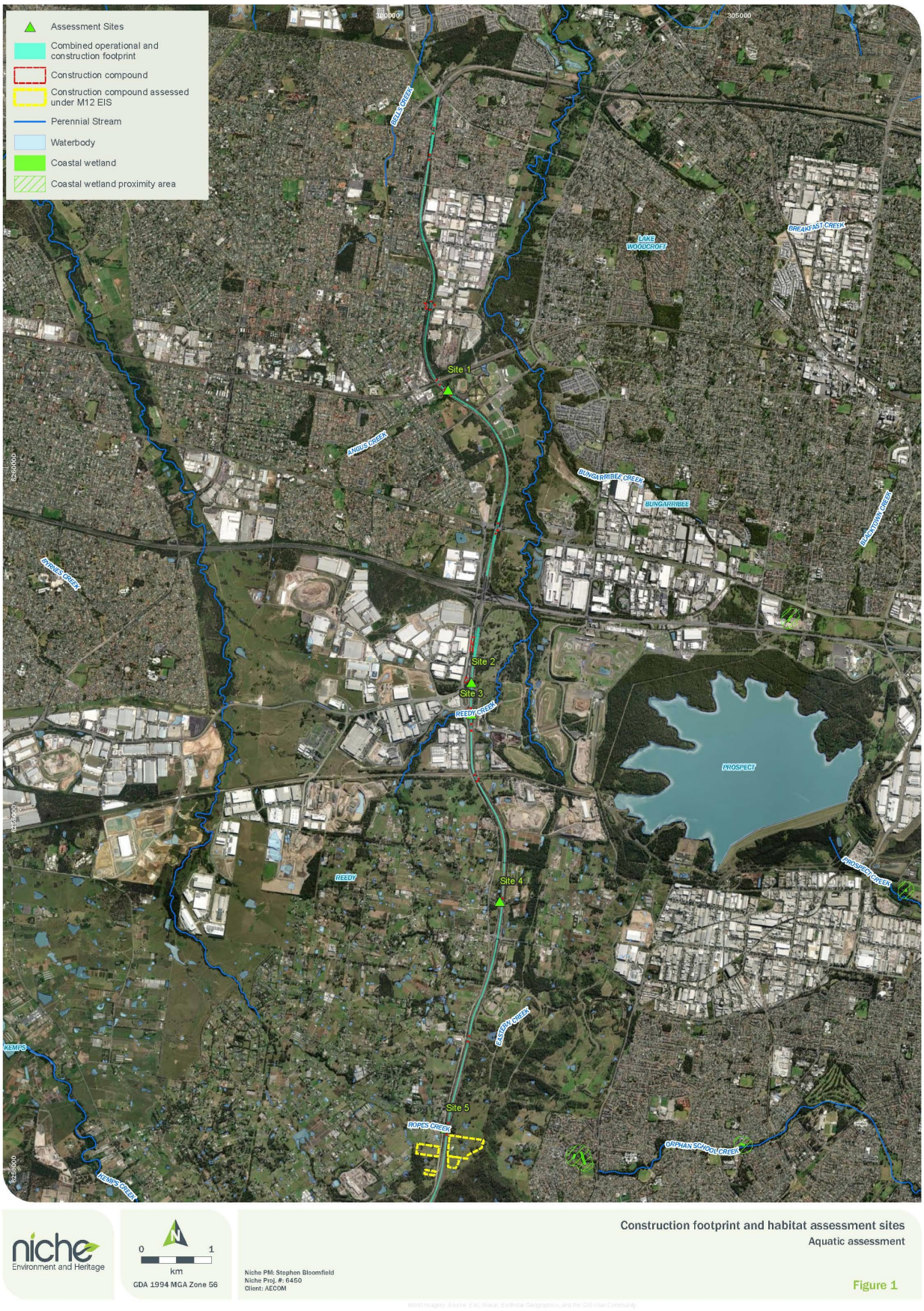

Figure 1: Construction footprint and habitat assessment sites (sheet 1 of 1)

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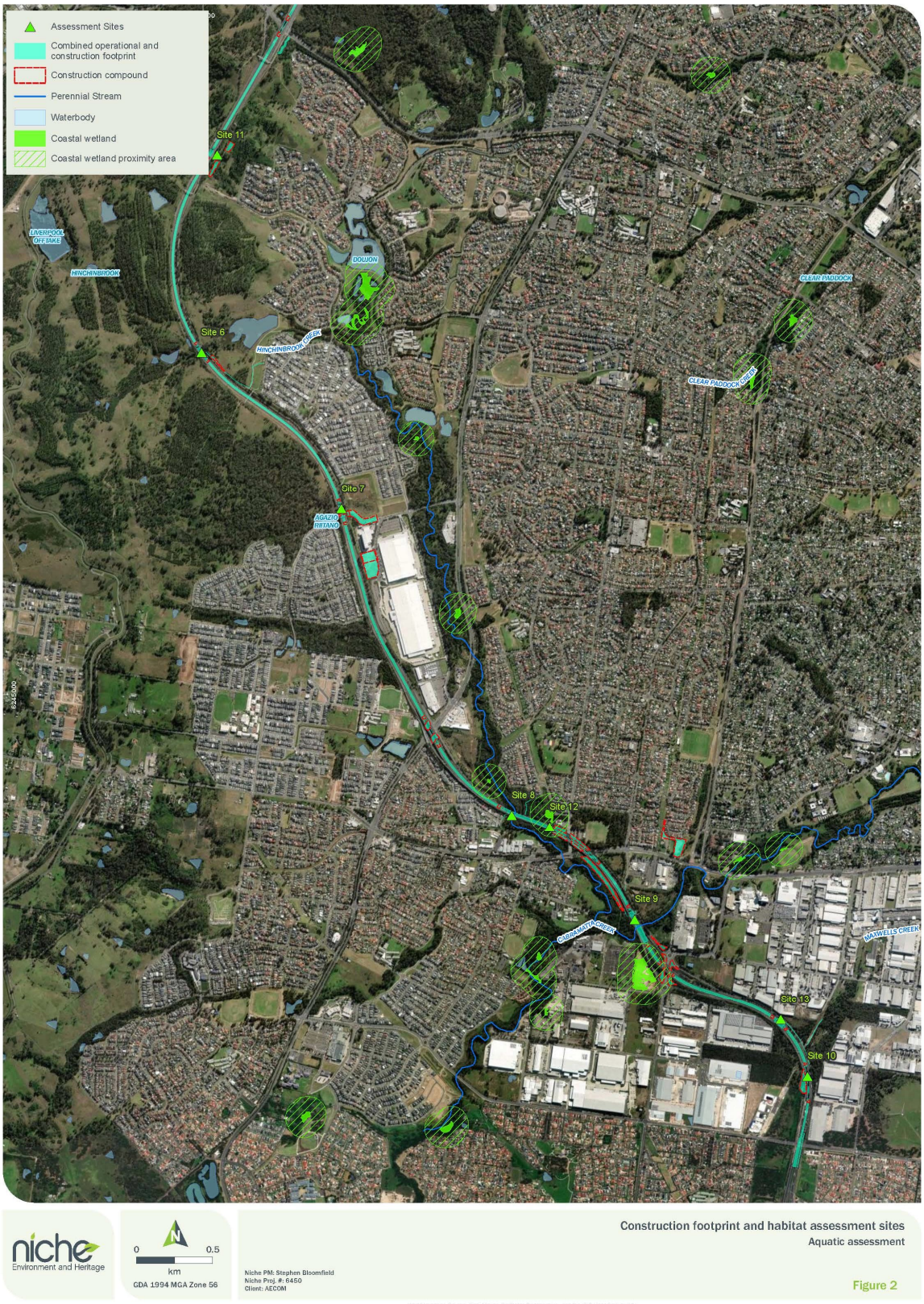


Figure 2: Construction footprint and habitat assessment sites (sheet 2 of 2)

2.3 Impact assessment

There were no aquatic threatened species, populations, or communities considered to have a moderate to high likelihood of occurrence within, or up and downstream of, the waterways present within the construction footprint. As such, there was no requirement to undertake a 7-part test under the FM Act or test of significance under the EPBC Act for the proposed modification.

The waterways were also assessed under the Fisheries NSW *Policy and Guidelines for Fish Habitat Conservation and Management* (Fairfull, 2013). The waterways were compared to the sensitivity classification scheme for assessing potential impacts of certain activities and developments on key fish habitat (KFH) types (Table 4), and the classification of waterways for fish passage (Table 5). This assessment was used to determine the likely sensitivity of waterways within the construction footprint and the potential severity of potential impacts from barriers to fish passage affected by the bridge widenings.

Table 4: KFH and associated sensitivity classification scheme

KFH and associated sensitivity classification scheme	
TYPE 1 - Highly sensitive KFH: • *Posidonia australis* (strapweed) • *Zostera, Heterozostera, Halophila* and *Ruppia* species of seagrass beds more than 5 m^2 in area • Coastal saltmarsh more than 5 m^2 in area • Coral communities • Coastal lakes and lagoons that have a natural opening and closing regime (i.e. are not permanently open or artificially opened or are subject to one off unauthorised openings) • Marine park, an aquatic reserve or intertidal protected area • State Environmental Planning Policy (SEPP) No. 14 Coastal Wetlands (note: now SEPP (Resilience and Hazards) 2021), wetlands recognised under international agreements (e.g. Ramsar, JAMBA, CAMBA, ROKAMBA wetlands), wetlands listed in the Directory of Important Wetlands of Australia • Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 m in length, or native aquatic plants • Any known or expected protected or threatened species habitat or area of declared 'critical habitat' under the FM Act • Mound springs.	TYPE 2 – Moderately sensitive KFH: • *Zostera, Heterozostera, Halophila* and *Ruppia* species of seagrass beds <5 m^2 in area • Mangroves • Coastal saltmarsh <5 m^2 in area • Marine macroalgae such as *Ecklonia* and *Sargassum* species • Estuarine and marine rocky reefs • Coastal lakes and lagoons that are permanently open or subject to artificial opening via agreed management arrangements (e.g. managed in line with an entrance management plan) • Aquatic habitat within 100 m of a marine park, an aquatic reserve or intertidal protected area • Stable intertidal sand/mud flats, coastal and estuarine sandy beaches with large populations of in-fauna • Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in TYPE 1 • Weir pools and dams up to full supply level where the weir or dam is across a natural waterway. TYPE 3 – Minimally sensitive KFH may include: • Unstable or unvegetated sand or mud substrate, coastal and estuarine sandy beaches with minimal or no in-fauna • Coastal and freshwater habitats not included in TYPES 1 or 2 • Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation.

Table 5: Classification of waterways for fish passage

Classification	Characteristics of waterway class
CLASS 1 Major KFH	Marine or estuarine waterway or permanently flowing or flooded freshwater waterway (e.g. river or major creek), habitat of a threatened or protected fish species or 'critical habitat'.
CLASS 2 Moderate KFH	Non-permanently flowing (intermittent) stream, creek or waterway (generally named) with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Freshwater aquatic vegetation is present. TYPE 1 and 2 habitats present.
CLASS 3 Minimal KFH	Named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or other CLASS 1-3 fish habitats.
CLASS 4 Unlikely KFH	Waterway (generally unnamed) with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free-standing water or pools post rain events (e.g. dry gullies or shallow floodplain depressions with no aquatic flora present).

2.4 Limitations

Limitations to this report based off desktop and field analysis are as follows:

- A habitat assessment was used to assess impacts to the aquatic environment; no macroinvertebrate surveys were used to assess stream health.
- As this was a habitat-based assessment, targeted species surveys were not undertaken, thus could limit the true presence of target species within the construction footprint. This specifically limits the data on fish and their likelihood of occurring in the surveyed waterways, particularly those listed on the EPBC Act and FM Act. The potential presence of threatened species was determined by the presence or absence of suitable habitat. However, considering the degraded nature of the waterways present, the existing road infrastructure, and the absence of threatened aquatic species records (DPI 2021a, DAWE 2021), this level of assessment was considered adequate.

3. Relevant legislation, policy, and guidelines

3.1 Legislative context

The following relevant legislation and planning documents have been considered in this assessment:

- EP&A Act
- FM Act
- EPBC Act.

The proposed modification is exempt from requiring a controlled activity approval under the *Water Management Act 2000;* refer to Chapter 5 (Statutory context) of the Modification Repot for further information.

3.1.1 NSW *Environmental Planning and Assessment Act 1979*

The EP&A Act provides a statutory basis for planning and environmental assessment in NSW. The purpose of the EP&A Act is to ensure the potential environmental impacts of a development are assessed and considered in the proposal approval process. The proposed modification is subject to assessment under Division 5.2 (section 5.25) of the EP&A Act.

3.1.2 NSW *Fisheries Management Act 1994*

The main objectives of the FM Act are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations, and in particular:

- To conserve fish stocks and KFH
- To conserve threatened species, populations and ecological communities of fish and marine vegetation
- To promote ecologically sustainable development, including the conservation of biological diversity, and be consistent with these objectives
- To promote quality recreational fishing opportunities
- To appropriately share fisheries resources between the users of those resources
- To provide social and economic benefits for the wider community of NSW
- To recognise the spiritual, social, and customary significance to Aboriginal persons of fisheries resources and to protect, and promote the continuation of, Aboriginal cultural fishing.

To meet the primary objectives, Part 7 of the FM Act deals with the protection of aquatic habitats and Part 7A deals with threatened species conservation. The FM Act applies to the proposed modification for KFH, State listed threatened species, populations, and ecological communities.

Regarding approved State significant infrastructure, a permit under section 201, 205 or 219 of the FM Act (clause 5.23 of the EP&A Act) is not required.

Five of the waterways within the construction footprint fall within the definition of 'KFH' based on DPI policy and guidelines (Fairfull, 2013) and KFH mapping (see Section 4.3).

Impacts of the proposed modification on threatened species, populations and ecological communities known, or considered to have suitable habitat, are required to be assessed to determine if significant impacts are likely to occur. Under section 1.7 of the EP&A Act, the additional requirements in Part 7A of the FM Act must be considered during assessment, consent and approval of a proposed activity under Part 5 of the Act. Part 7A (section 221ZV) of the FM Act lists factors which must be considered to determine whether a proposed activity is likely to have a significant effect on threatened species, populations, and ecological communities or their habitats (the '7-part test').

Policy and guidelines

Policy and Guidelines for fish habitat, conservation, and management (Fairfull, 2013) outlines policies and guidelines aimed at maintaining and enhancing fish habitat for the benefit of native fish species, including threatened species in marine, estuarine and freshwater environments. The document aims to help developers, their consultants, and government and non-government organisations to ensure compliance with legislation, policies, and guidelines as they relate to fish habitat conservation and management.

The NSW Fisheries document *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries, 2003) aims to minimise impacts on fish passage and general aquatic wildlife by providing practical guidelines to those involved in the planning, design, construction and maintenance of waterway crossings.

3.1.3 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on Matters of National Environmental Significance (MNES) undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, will have or is likely to have a significant impact on MNES' is deemed to be a controlled action and may not be undertaken without prior approval from the Commonwealth Minister for the Environment.

The EPBC Act identifies MNES as:

- World heritage properties
- National heritage places
- Wetlands of international importance (Ramsar wetlands)
- Threatened species and ecological communities
- Migratory species
- Commonwealth marine area
- Nuclear actions (including uranium mining)
- The Great Barrier Reef Marine Park
- A water resource, in relation to coal seam gas development and large coal mining development.

Threatened species and ecological communities were identified from searches as potentially occurring or having habitat in the locality (within a 10 kilometre search radius). These are addressed in Section 4.5.

4. Existing environment

4.1 Catchment condition

The majority of the operational footprint of the proposed modification is located within the Hawkesbury River catchment, with the majority of the assessment sites relevant to aquatic ecology located in the Georges River catchment.

The Georges River catchment drains 930 km^2 of land, including parts of 14 local government areas and covers a sizeable portion of the Greater Sydney Metropolitan Region. The Georges River itself extends 60 km from south-west of Sydney, flowing northward for about half its length and then in an easterly direction from Liverpool to its mouth into Botany Bay.

The Georges River catchment is one of Australia's most urbanised and developed catchments and this has led to poor water quality conditions throughout the lower portion of the catchment. Land use within the lower catchment varies, and includes residential, industrial, agricultural, mining and Defence activities. Protected areas such as drinking water catchments and conservation land dominates the upper portion of the catchment.

Within the catchment, assessment sites 6-13 for this assessment lie within the Cabramatta Creek sub-catchment (Georges Riverkeeper (GR) 2020). Cabramatta Creek waterways are present within a mix of forest and urban land. Overall, the sub-catchment is of poor quality, rating C- on the River Health Report Card with 22,770 kg of litter removed between 2018/2019 and 2019/2020 (GR, 2020). The report card is broken down into categories of riparian vegetation, water quality, and freshwater macroinvertebrates:

- Riparian vegetation: Overall condition C (Fair)
- Water quality: Overall condition C (Fair)
- Freshwater macroinvertebrates: Overall condition D- (Poor).

Assessment sites 1-5 fall within the Hawkesbury-Nepean catchment. The Hawkesbury-Nepean catchment is the longest coastal catchment in NSW, with the Hawkesbury River flowing for 470 kilometres from Goulburn to Broken Bay (DPI 2021b). This catchment drains around 2.14 million hectares of land. Blacktown Local Government Area (LGA) has reported on the health of waterways within their LGA. Much like the Georges River catchment, the Blacktown LGA waterways have experienced disturbances from land use, such as agriculture and urbanisation. Blacktown City Council Asset Design (2020) completed a waterway health report, which included an assessment of several waterways within the construction footprint. The report provides an overall waterway health grade considering riparian vegetation, water quality, and freshwater macroinvertebrates. Grades relevant to the proposed modification are:

- Ropes Creek (North): Overall condition C (Fair)
- Ropes Creek (South): Overall condition B (Good)
- Angus Creek: Overall condition C (Fair).

4.2 Water quality

A review of the Georges River catchment and the Blacktown LGA stormwater system water quality data shows that water quality is often poor. Stormwater-generated flows in these urban catchments transfer high pollutant loads into the waterways. A study on the Georges River catchment within the sub-catchment of Cabramatta Creek observed the following results for some of the assessment sites (GR, 2020):

- Hinchinbrook Creek: C (Fair water quality)
- Cabramatta Creek Upper: D+ (Poor water quality)
- Cabramatta Creek Lower: B (Good water quality).

A similar study on the Blacktown LGA stormwater catchment detected the following results for other assessment sites (Blacktown City Council Asset Design, 2020):

- Ropes Creek (North): C (Fair water quality)
- Ropes Creek (South): B (Good water quality)
- Angus Creek: D (Poor water quality).

4.3 Aquatic habitat

The aquatic ecology of the waterways in the Georges River and Hawkesbury-Nepean catchment is varied, with significant proportions of the catchments containing bushland and urbanised environments. A few waterways are mapped as KFH and have a freshwater fish community listed as 'fair' or uncategorised (DPI 2021a). Of the 13 waterways surveyed (Table 6):

- Four are categorised TYPE 1 – Highly sensitive KFH:
    - Tributary of Hinchinbrook Creek north
    - Hinchinbrook Creek – main channel
    - Cabramatta Creek
    - Maxwells Creek.
- One is categorised TYPE 3 – Minimally sensitive KFH:
    - Reedy Creek.
- All five are classified CLASS 3 Minimal KFH classification of waterways for fish passage.

There are small coastal wetlands mapped in the southern portion of the construction footprint near Cabramatta Creek (DPI, 2021a).

Table 6: Habitat sensitivity and waterway classification

Assessment site	Stream name/description	Stream order	Mapped as KFH (Y/N)	KFH and sensitivity classification	Classification of waterways for fish passage
1	Angus Creek downstream and upstream	1	N	-	-
2	Unnamed tributary of Reedy Creek	2	N	-	-
3	Reedy Creek	3	Y	Hawkesbury-Nepean- Type 3	CLASS 3 Minimal KFH

Assessment site	Stream name/description	Stream order	Mapped as KFH (Y/N)	KFH and sensitivity classification	Classification of waterways for fish passage
4	Concrete channel - unnamed	1	N	-	-
5	Ropes Creek	1	N	-	-
6	Tributary of Hinchinbrook Creek north	3	Y	Sydney Metro- Type 1	CLASS 3 Minimal KFH
7	Tributary of Hinchinbrook Creek south	3	N	-	-
8	Hinchinbrook Creek – main channel	4	Y	Sydney Metro- Type 1	CLASS 3 Minimal KFH
9	Cabramatta Creek	5	Y	Sydney Metro- Type 1	CLASS 3 Minimal KFH
10	Maxwells Creek	3	Y	Sydney Metro- Type 1	CLASS 3 Minimal KFH
11	Concrete channel- unnamed	1	N	-	-
12	Tributary of Hinchinbrook Creek	1	N	-	-
13	Tributary of Maxwell Creek	1	N	-	-

4.3.1 Riparian vegetation

The riparian vegetation surveyed along the Westlink M7 was mapped as consisting predominantly of the following Endangered Ecological Communities (EEC's) (as listed under the NSW *Biodiversity Conservation Act 2016*):

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

The riparian vegetation across all assessment sites is typically modified, dominated by exotic vegetation, and provides little function for the waterway. Native canopy is provided by *Casuarina glauca* at many assessment sites, however the under storey is comprised of mostly exotic grasses and annuals. Within the Georges River catchment, the riparian vegetation of the following creeks are graded as (GR, 2020):

- Hinchinbrook Creek: C (Fair)
- Cabramatta Creek (Upper): D+ (Poor)
- Cabramatta Creek (Lower): B (Good).

Within the Blacktown LGA stormwater catchment, the riparian vegetation of the following creeks is described as (Blacktown City Council Asset Design, 2020):

- Ropes Creek (North): B (Good)
- Ropes Creek (South): B (Good)
- Angus Creek: D (Poor).

4.4 Fish

No targeted fish surveys were undertaken as part of this assessment. A desktop analysis of fish species records within proximity of the construction footprint identified the following species as having been previously recorded within 10 square kilometres of the construction footprint (DPIE, 2021): Long-finned Eel (*Anguilla reinhardtii*), Short-finned Eel (*A.* spp.), Carp (*Cyprinus carpio*) and Eastern Gambusia (*Gambusia holbrooki*).

Both the Sydney Metropolitan and Hawkesbury-Nepean catchments, as described by DPI (2021b, 2021c), are home to numerous fish species categorised as common, endangered, and exotic that depend on healthy streams and diverse habitat with available passage for their survival (Nicholis and McGirr 2005; DPI 2006). Within the Sydney Metropolitan catchment of the lower Georges River resides some of the assessment sites, such as Cabramatta Creek and Hinchinbrook Creek. These waterways are described as degraded, draining extensively cleared and highly modified catchments likely attributing to the low diversity and abundance of aquatic species (Nicholis and McGirr, 2005). Within the lower Hawkesbury-Nepean subregion resides the northern portion of the construction footprint for the proposed modification. Most of the Hawkesbury-Nepean catchment is urbanised with agricultural and industrial presence (DPI, 2006). Both catchment areas are impaired by barriers to fish passage from culverts, weirs, bridges, and erosion control structures that impede diversity and abundance of fish, favouring common or exotic species tolerant to disturbed habitats (Nicholis and McGirr 2005; DPI 2006).

4.5 Threatened species

Threatened species searches of the DAWE's Protected Matters Search Tool (PMST) (10 kilometre buffer) (DAWE, 2021) and Fisheries NSW spatial data portal (DPI, 2021a) identified three threatened fish species with potential to occur in the Georges River and Hawkesbury-Nepean catchments (Table 7). No threatened invertebrates listed under the EPBC Act or FM Act were identified as having the potential to occur within the PMST search area.

The potential for occurrence of all species is considered to be unlikely in all waterways in the construction footprint, either having no potential habitat identified during field surveys, no previous records and/or known or modelled distribution under threatened species distribution mapping in proximity to the construction footprint (DPI, 2021a).

Table 7: Likelihood of occurrence of threatened species

Threatened species	EPBC Act	FM Act	Likelihood of occurrence
Black rock cod (*Epinephelus daemelii*)	Vulnerable	Vulnerable	Unlikely Estuarine/marine species. There is no suitable estuarine or marine habitat in the construction footprint.

Threatened species	EPBC Act	FM Act	Likelihood of occurrence
Macquarie perch (*Macquaria australasica*)	Endangered	Endangered	Unlikely There are no records for this species within 10 kilometres of the construction footprint (DPIE, 2021). Additionally, published distribution maps (DPI, 2021a) did not show the species habitat in proximity to the construction footprint.
Australian Grayling (*Prototroctes maraena*)	Vulnerable	Endangered	Unlikely PMST showed Australian Grayling as potential to occur; however, the more detailed distribution mapping from the Fisheries NSW spatial data portal (DPI, 2021a) showed them not occurring in proximity to the construction footprint. Additionally, there are no records of this species in proximity to the construction footprint (DPIE, 2021).

4.6 Stream health - macroinvertebrates

Within the construction footprint, the surveyed creeks are likely to contain macroinvertebrates that are pollution tolerant and prefer lentic (or slow moving) habitat. Macroinvertebrates were not surveyed for as part of the habitat site assessment. A study on the Georges River catchment within the sub-catchment of Cabramatta Creek observed the following results for freshwater macroinvertebrate studies relevant to some of the assessment sites (GR, 2020):

- Hinchinbrook Creek: 'D-' (Poor macroinvertebrate diversity)
- Cabramatta Creek Upper: 'F-' (Poor macroinvertebrate diversity)
- Cabramatta Creek Lower: 'C+' (Fair macroinvertebrate diversity).

A similar study in the Blacktown LGA stormwater catchment (Blacktown City Council Asset Design, 2020) detected the following results:

- Ropes Creek (North): C (Fair) only containing pollution tolerant macroinvertebrate species
- Ropes Creek (South): B (Good) containing moderately diverse macroinvertebrate species
- Angus Creek: D (Poor) only containing pollution tolerant macroinvertebrate species.

This indicates that the waterways are likely to be 'severely impaired' with few macroinvertebrate species present, most being pollution tolerant species.

4.7 Downstream environment

With reference to ecological values relevant to the State Environmental Planning Policy (Resilience and Hazards) 2021[1], there are small coastal wetlands present within the vicinity of the construction footprint (southern section) and downstream of some of the assessment sites (Figure 1 and Figure 2). The Proximity Area buffers of three of these wetlands intersect the construction footprint. All wetlands within the vicinity of the construction footprint occur within the Georges River catchment. KFH (Sydney Metropolitan and Hawkesbury-Nepean) is present adjacent to and downstream of some of the waterways present within the construction footprint. Estuarine KFH, notably the nationally important RAMSAR (The Convention on

[1] It is noted that SEPP (Resilience and Hazards) 2021 does not apply to SSI.

Wetlands of International Importance) wetland, Towra Point Nature Reserve, is positioned at Botany Bay at the mouth of the Georges River (DPI, 2021a). The Ramsar site is about 25 kilometres downstream of the southern end of the construction footprint.

5. Field survey results

5.1 Results of field surveys

Field surveys were conducted over five days between 7-10 September 2021 (assessment sites 1-10) and on 23 September 2021 (assessment sites 11-13). Thirteen assessment sites were surveyed in total over the fieldwork period (Figure 1 and Figure 2, Table 3).

5.1.1 Aquatic habitat

The water levels of the assessment sites at the time of the field survey varied from low to moderate depths (Table 8). The banks in these locations were mostly eroded and partially vegetated, except for assessment site 6 which had a mixed coverage of exotic grasses and trees (Table 8). There was consistent evidence of soil erosion and sedimentation likely attributed to vegetation clearing, and pollution along these drainage lines with barriers and crossings catching rubbish in overflow (Table 8). The riparian vegetation was a mix of dominant tree species with *Casuarina glauca* present at assessment sites 1-3, 5-9 and 12; the most diversity was at assessment site 1 with *Melaleuca decora* and *Eucalyptus tereticornis* present. Aquatic vegetation was present at assessment sites 1, 2, 5-10, and included *Typha* spp. at assessment site 10 (Table 8). The aquatic habitat appeared to coincide with areas of pooling and riffles along the drainage lines. Exotic vegetation was present throughout these locations, given their proximity to edge effects and weed incursion from water overflow, with assessment sites infested with exotics grasses and annuals on the banks. The width of the channels varied, with main channels such as Maxwell Creek, Cabramatta Creek, and Hinchinbrook Creek reaching 10-20 m. The width of channels of the smaller drainage lines and tributaries from these larger creeks were confined to around three metres, particularly around residential and industrial land use.

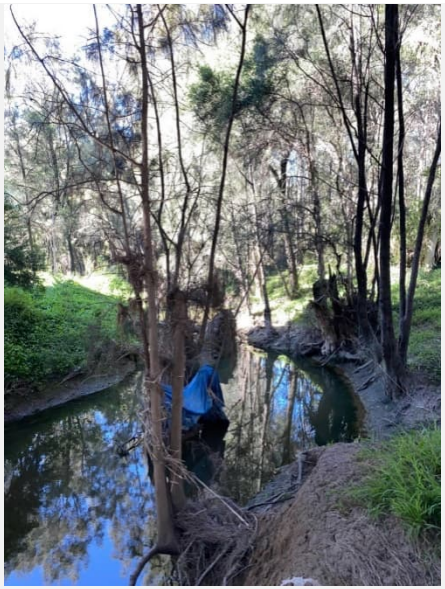
No field water quality measurement were taken as part of the habitat survey, however there were consistent observations of turbid, stagnant, discoloured water at assessment sites 1, 6-9, 12 and 13. The assessment sites generally exhibiting visual indicators of poor water quality conditions, with the presence of pollution, rubbish, and sedimentation, particularly at the subject waterways located within the Georges River catchment (Table 8). The water quality observations made during the field survey are consistent with the desktop review of data. Observations of water quality at each field survey location are included in Table 8.

The observations recorded at the assessment sites are indicative of the extensive land use history of significant modification for agricultural and residential development in the region. This is reflected in the widespread observations of vegetation clearing leading to soil erosion and sedimentation as well as existing disturbance from road crossings and barriers.

Table 8: Aquatic habitat description

Assessment site	Upstream	Downstream	Description
1 Angus Creek			Vegetation: C*asuarina glauca*, *Melaleuca decor*a, and *Eucalyptus tereticornis* Stream shading: Moderate- High Exotic vegetation: Exotic grasses and annuals Average width: Three metres Aquatic habitat: Boulders, snags, and aquatic vegetation. Bank condition: Sandstone blocks on both sides of stream, partially eroded and unvegetated Benthic substrate: Boulders Flow/depth: No flow. Low to moderate depth Macrophytes/algae: None observed Water quality observations: Drainage line with stagnant water Other disturbances: This assessment site has been subject to vegetation clearing leading to soil erosion and sedimentation. There is also disturbance from road crossings and barriers with signs of rubbish and pollution.

Assessment site	Upstream	Downstream	Description
2 Reedy Creek tributary			Dominant vegetation: *Casuarina glauca* Stream shading: High Exotic vegetation: Annuals Average width: Six metres Aquatic habitat: Boulders, snags, pool, and aquatic vegetation Bank condition: Partially eroded and unvegetated Benthic substrate: Boulders Flow/depth: No flow. Low to moderate depth Macrophytes/algae: None observed Water quality observations: Clear Other disturbances: This assessment site has been subject to vegetation clearing leading to soil erosion and sedimentation. There is also disturbance from road crossings and barriers with signs of rubbish and pollution.

Assessment site	Upstream	Downstream	Description
3 Reedy Creek			Dominant vegetation: *Casuarina glauca* Stream shading: High Exotic vegetation: Exotic grasses Average width: 1.5 m Aquatic habitat: Boulders, snags, and a pool Bank condition: Partially eroded and unvegetated Benthic substrate: Boulders and fine sediment. Flow/depth: No flow. Low to moderate depth Macrophytes/algae: None observed Water quality observations: Clear, rubbish present Other disturbances: This assessment site has been subject to vegetation clearing leading to soil erosion and sedimentation. There is also disturbance from road crossings and barriers with signs of rubbish and pollution.
4 Unnamed concrete channel			Dominant vegetation: None observed Stream shading: Low Exotic vegetation: Exotic grasses and annuals Average width: Two metres Aquatic habitat: None observed Bank condition: Partially eroded and unvegetated Benthic substrate: Concrete Flow/depth: Low depth Macrophytes/algae: Minor algae present Water quality observations: Clear surface visibility, algae and fine sediment present.

Assessment site	Upstream	Downstream	Description
			Other disturbances: Paved waterway with signs of rubbish and pollution.
5 Ropes Creek			Dominant vegetation: *Casuarina glauca* Stream shading: Low Exotic vegetation: *Ehrharta erecta* Average width: Five metres Aquatic habitat: Snags, pool, and aquatic vegetation Bank condition: Mostly vegetated Benthic substrate: Fine sediment Flow/depth: No flow, low depth Macrophytes/algae: Minor algae present Water quality observations: Clear surface visibility, algae present Other disturbances: This assessment site has been subject to soil erosion and sedimentation. There is also disturbance from barriers with signs of rubbish and pollution.
6 Tributary of Hinchinbrook Creek north			Vegetation: *Casuarina glauca* Stream shading: High Exotic vegetation: Exotic grasses Average width: Five metres Aquatic habitat: Aquatic vegetation with *Crinia signifera* observed Bank condition: Eroded and partially vegetated Benthic substrate: Fine sediment. Flow/depth: No flow. Low depth Macrophytes/algae: None observed Water quality observations: Turbid, stagnant, and discoloured

Assessment site	Upstream	Downstream	Description
			Other disturbances: There is disturbance from barriers with signs of rubbish and pollution.
7 Tributary of Hinchinbrook Creek south			Vegetation: *Casuarina glauca* Stream shading: Moderate Exotic vegetation: Exotic grasses Average width: Six metres Aquatic habitat: Pooling and aquatic vegetation with *Crinia signifera* observed Bank condition: Eroded and partially vegetated Benthic substrate: Fine sediment Flow/depth: Low depth. No flow Macrophytes/algae: None observed Water quality observations: Stagnant Other disturbances: This assessment site has been subject to soil erosion and sedimentation. There is signs of rubbish and pollution.
8 Hinchinbrook Creek – main channel			Vegetation: *Casuarina glauca* Stream shading: High Exotic vegetation: Exotic grasses and annuals Average width: Seven metres Aquatic habitat: Snags, riffles, deep pools, and aquatic vegetation Bank condition: Eroded and unvegetated Benthic substrate: Fine sediment Flow/depth: Low depth. No flow Macrophytes/algae: None observed Water quality observations: Turbid, stagnant, and discoloured

Assessment site	Upstream	Downstream	Description
			Other disturbances: This assessment site has been subject to vegetation clearing leading to soil erosion and sedimentation. There are also barriers and signs of rubbish and pollution.
9 Cabramatta Creek			Vegetation: *Casuarina glauca* Stream shading: High Exotic vegetation: Exotic grasses Average width: Seven metres Aquatic habitat: Deep pools, and aquatic vegetation with *Crinia signifera* observed Bank condition: Steep, Eroded and partially unvegetated Benthic substrate: Fine sediment Flow/depth: Low to moderate depth. No flow Macrophytes/algae: None observed Water quality observations: Turbid, stagnant, and discoloured Other disturbances: This assessment site has been subject to soil erosion and sedimentation. There is also disturbance from barriers with signs of rubbish and pollution.

Assessment site	Upstream	Downstream	Description
10 Maxwells Creek			Vegetation: *Typha* spp. Stream shading: Low Exotic vegetation: Exotic grasses and annuals Average width: Four metres Aquatic habitat: Boulders, snags, riffles, and aquatic vegetation Bank condition: Stable and vegetated Benthic substrate: Boulders and fine sediment Flow/depth: No flow. Low depth Macrophytes/algae: *Typha spp.* Water quality observations: Turbid and discoloured Other disturbances: This assessment site has been subject to vegetation clearing leading to soil erosion and sedimentation. There is also disturbance from road crossings and barriers with signs of rubbish and pollution.

Assessment site	Upstream	Downstream	Description
11 Unnamed channel			Vegetation: None Stream shading: None Exotic vegetation: Exotic grasses and annuals Average width: Dry at the time of survey Aquatic habitat: Dry ephemeral drainage line Bank condition: Stable and vegetated Benthic substrate: Grassland Flow/depth: No water Macrophytes/algae: None observed Water quality observations: None observed Other disturbances: There is disturbance from road crossings and barriers with signs of rubbish and pollution. Exotic pasture adjacent to Westlink M7.
12 Tributary of Hinchinbrook Creek			Vegetation: *Typha orientalis* and *Casuarina glauca* Stream shading: Moderate Exotic vegetation: *Tradescantia fluminensis*, other exotics grasses and annuals Average width: Eight metres Aquatic habitat: Deep pools, and aquatic vegetation Bank condition: Eroded and shallow Benthic substrate: Sand and silt Flow/depth: No flow, Low to moderate depth Macrophytes/algae: Eutrophic with macroinvertebrates sighted, and floating macrophytes. Filamentous algae present. Water quality observations: Turbid, stagnant, and discoloured

Assessment site	Upstream	Downstream	Description
			Other disturbances: There is disturbance from road crossings with signs of rubbish and pollution. Areas have been cleared of vegetation.
13 Tributary of Maxwell Creek			Vegetation: *Melaleuca* spp. Stream shading: Low Exotic vegetation: Exotic grasses and annuals such as *Cyprus* spp. and *Chamaesyce hirta* Average width: Eight metres Aquatic habitat: Deep pools, and aquatic vegetation with *Crinia signifera* observed Bank condition: Partially eroded, vegetated and shallow Benthic substrate: Silt Flow/depth: No flow, Low depth Macrophytes/algae: No algae observed. Macrophytes present. Water quality observations: Turbid, stagnant, and discoloured Other disturbances: The site has been subject to soil erosion and sedimentation. There is also disturbance from road crossings and barriers with signs of rubbish and pollution.

6. Impact assessment

6.1 Waterway impacts

An impact rating is used in this aquatic ecology impact assessment, with the level of impact described as very low, low, medium or high, and the impact ratings based on impact severity, prior to any mitigation or management measures, and/or probability of occurrence. The residual risk to aquatic ecosystems, following the application of mitigation or management measures (as discussed in section 7) is also included in the assessment. Definitions used in the impact assessment are detailed in Table 9. It should be noted that the severity, likelihood and residual risk impact ratings may be independent of one another, for example a hazard may have a low severity but high likelihood of occurring. The risk and severity of potential impacts to the aquatic environment are assessed for both construction (Table 10) and operation (Table 11) of the proposed modification. The residual risks from the construction and operational of the proposed modification are discussed in Section 6.2.

Table 9: Definitions of impact assessment

Impact rating	Severity (prior to mitigation or management)	Likelihood	Residual Risk (following mitigation or management)
Low	Potential adverse impact could result in a minimal decline in the aquatic ecology in the construction footprint during construction or operation of the modification.	Probability of event occurring is not anticipated.	Low risk to aquatic ecology with standard construction mitigation measures in place. No long-term impacts expected.
Moderate	Potential adverse impact could result in a slight decline in the quality of aquatic ecology in the construction footprint during construction or operation of the modification.	Probability of event occurring may be unlikely.	Moderate risk to aquatic ecology. Mitigation measures and monitoring required to limit impact on the aquatic environment.
High	Potential adverse impact could result in a decline in the quality of aquatic ecology to lower-than-existing conditions in the construction footprint.	Probability of event occurring may be probable/possible.	Management actions such as research, monitoring and/or recovery initiatives may be required.

Table 10: Potential impacts during construction and risk assessment of impacts to aquatic ecology

Hazard	Potential impact	Potential severity of impact to aquatic ecology (prior to mitigation or management)	Likelihood of occurrence	Residual risk to the aquatic environment (following mitigation or management)
Clearance of vegetation, earthworks during construction in proximity to waterways	Sediment laden water may lead to an increase of particulate-bound contaminant loading to natural waterways.	High – Water pollution and toxicity issues to resident species plus, stimulation of the growth of nuisance plants, algae, and cyanobacteria from increased nutrients.	Moderate – This has moderate likelihood of occurring.	Low -Mitigation measures including erosion and sediment controls would reduce this overall risk. The potential impact of the overall change to the current water quality of waterways to aquatic ecology is low. No long-term measurable change is expected
	Erosion of soil and scouring (erosion) / alteration to morphology, due to lack of vegetation protection and increased volume / rate of channelised discharges to the environment.	Low – Elevated flow may result in short-term changes to water quality in wet weather events.	High– Wet weather events are likely to occur that could affect water quality and aquatic ecology. However, it is expected that there would be no long-term measurable change to aquatic ecology.	Low - Mitigation measures including soil and erosion control would reduce this overall risk and no long-term measurable change is expected.
Construction above and within waterways / bridge widening – disturbance of waterways and flow paths	Construction work could potentially lead to erosion or disturbance of the bed and banks of watercourses which could alter the channel form and stability and lead to sedimentation in the watercourse and water quality impacts.	Moderate – This could lead to localised physical changes in aquatic habitat. However, considering the water quality is currently characterised by high suspended fine sediment loads and dominated by fine sediment benthic habitat, this is unlikely to lead to long term changes in ecology. Sedimentation could lead to local short-term changes in ecological processes (e.g. photosynthesis, food webs) through increased suspended sediment and increased turbidity; however, if mitigation measures are in place to maintain the integrity of the stream banks this potential risk would be substantially reduced.	Moderate – This has moderate likelihood of occurring.	Low - Mitigation measures including soil and erosion control would reduce this overall risk and no long-term measurable change is expected.

Hazard	Potential impact	Potential severity of impact to aquatic ecology (prior to mitigation or management)	Likelihood of occurrence	Residual risk to the aquatic environment (following mitigation or management)
General construction	Release of alkaline concrete wash water from stored concrete materials and plant or equipment washout waste, which may cause localised groundwater or surface water contamination.	Low – Water quality is unlikely to be measurably affected by localised alkaline materials to the extent that it could affect the aquatic ecology of the waterways present in the construction footprint.	Moderate – Potential for alkaline material to enter waterway after rainfall events.	Low – The severity is low and mitigation measures would be installed to capture runoff from these materials.
	Waste materials such as concrete, timber, and contaminated soil spreading via surface run-off to near site drainage pathways.	Moderate -High – This is dependent upon the type of material and sensitivity of receiving waterway. This impact would affect the visual amenity of the waterway. Contaminated soil could be toxic to or bioaccumulate in aquatic fauna. It is expected that all waste materials would be managed to reduce the risk to the waterways with waste disposed off-site and/or stored in areas that are bunded and not located in flow paths.	Moderate – Potential for material to enter waterway after heavy rainfall events or high winds.	Low - Mitigation measures including soil and erosion control and stockpile management would reduce this overall risk and no long-term measurable change is expected.
Construction ancillary facilities	Spills and leaks from ancillary facilities.	Low – This could cause runoff and affect aquatic ecology locally. This should be able to be effectively managed through locating facilities in areas away from direct access to waterways and monitoring and maintenance of facilities.	Low – Unlikely to occur under the recommended management approach.	Low -The severity is low and likelihood of occurring is low. It is expected that site management would effectively manage this risk.
Flood and flow paths during construction	The ancillary facilities have potential to impact local flooding conditions by altering flow depths, velocities, or flow paths. Alternatively, portable buildings and large	Low – Local aquatic habitat may be temporarily altered by a change in hydraulics. However, this is not expected to change the ecology of the waterway.	Low - The likelihood of a major flood occurring during construction is low.	Low -The severity and likelihood of this risk occurring are low. Where possible, facilities should be located above areas that are susceptible to flooding.

Hazard	Potential impact	Potential severity of impact to aquatic ecology (prior to mitigation or management)	Likelihood of occurrence	Residual risk to the aquatic environment (following mitigation or management)
	unsecured construction objects have the greatest potential to affect flooding. They can be carried away by deep floodwaters and worsen local flood conditions by blocking bridges, culverts, and flood control structures downstream.			
Leaks and spills - construction	Leaks and spills of chemicals and other hazardous construction materials, and uncontrolled discharge of contaminants to receiving waterways.	Moderate – Any chemical or hazardous substance spill could be toxic to aquatic flora and fauna, could have acute impacts and lead to localised mortality.	Moderate - There is potential for spills to occur during construction.	Low - Mitigation measures including site management and bunding and spill management procedures be in place to reduce the risk to the receiving environment.
Stockpiles and contaminants	Movement of loose material stored within the ancillary facility has the potential for sedimentation within adjoining watercourses and habitat degradation along natural waterways. Discharges of sediment-laden stormwater from stockpiles may result in	High - There is significant risk associated with liberation of legacy contaminants which could lead to mortality or bioaccumulation in aquatic fauna.	Moderate -This could occur if appropriate management measures are not in place.	Moderate - The construction management plan would need to carefully consider mitigation measures to reduce the likelihood of uncontrolled releases in order to reduce this risk significantly.

Hazard	Potential impact	Potential severity of impact to aquatic ecology (prior to mitigation or management)	Likelihood of occurrence	Residual risk to the aquatic environment (following mitigation or management)
	an increase of particulate-bound contaminant loading to natural waterways, water pollution and toxicity issues to resident biodiversity plus stimulation of the growth of nuisance plants, algae, and cyanobacteria from increased nutrients.			
Controlled discharges – construction	Disposal requirements for excess site water including stormwater collected in sediment basins or dewatering of groundwater from deeper excavations.	Moderate - The impact to aquatic ecology is dependent on how the dewatering is managed and the quality of water in the sediment basins. The future project EPL would have requirements and control measures to mitigate impacts to the aquatic environment.	Low – Only limited dewatering is likely to be required during some pile excavation.	Low - It is expected that dewatering would be appropriately managed under a dewatering plan and / or Environmental Protection Licence (EPL). Additionally, it is expected that contaminants or poor water quality would be appropriately treated prior to any discharge.
Temporary stream realignment - construction	A realignment has the potential to increase stream velocity and severity of flooding, causing erosion and releasing sedimentation downstream of the realignment. This could reduce water quality if not mitigated.	Moderate -High– This would depend on locations and sensitivity of the waterways. Minor tributaries or drainages, or highly altered waterways are expected to have minor changes to the aquatic ecology whereas higher order perennial or intermittent streams (e.g. Cabramatta Creek) could experience a greater magnitude relative change to the aquatic environment. It is expected that the impact would have short term effect on aquatic flora and fauna locally through	High - This has a high likelihood of occurring and temporarily impacting the aquatic environment during construction.	High – The residual risk to the aquatic environment is high and should be avoided where possible. Management plans, including an erosion and sediment control plan, would be required to conduct stream realignments. Work would need to be conducted under relevant EPL conditions and Conditions of Approval, and in accordance with policies, standards and procedures for

Hazard	Potential impact	Potential severity of impact to aquatic ecology (prior to mitigation or management)	Likelihood of occurrence	Residual risk to the aquatic environment (following mitigation or management)
		obstruction of fish passage, altering existing flow paths and removal of aquatic habitat.		working in waterways. Additionally, fish may need relocating if sections of waterway become cut off from the main channel. Monitoring of the works would also need to be incorporated into the management of these works.
Temporary waterway crossings - construction	Temporary waterway crossings are likely to be required to provide access for the works and for haul roads across the construction footprint. These crossings would typically utilise pipes or culverts to allow water flow beneath the access tracks. A stream crossing has potential to affect fish passage. Erosion and sedimentation could also affect the waterway if not mitigated.	Moderate -High - This would depend on locations and sensitivity of the waterways. Minor tributaries or drainages, or highly altered waterways are expected to have minor changes to the aquatic ecology whereas higher order perennial or intermittent streams (e.g. Cabramatta Creek) could experience a greater magnitude relative change to the aquatic environment. It is expected that the impact would have short term effect on aquatic flora and fauna locally through obstruction of fish passage, altering existing flow paths and removal of aquatic habitat.	High - This has a high likelihood of occurring and temporarily impacting the aquatic environment during construction.	High - The residual risk to the aquatic environment is high and should be avoided where possible. Management plans would be required for creek crossings. Temporary waterway crossings would be designed in accordance with the requirements of the *Policy and Guidelines for Fish Habitat Conservation and Management* (Fairfull, 2013). The crossings would be required to maintain low flow conditions and be checked by a qualified person to confirm no adverse flooding impacts would occur during design flood events.
Platform in waterway - construction	Partial reclamation of a creek bed may be required for temporary works access and for working platforms during construction, specifically for the bridge widening	High - This would depend on locations and sensitivity of the waterways. Minor tributaries or drainages, or highly altered waterways are expected to have minor changes to the aquatic ecology whereas higher order perennial or intermittent stream (e.g. Cabramatta creek) could experience a greater magnitude relative change to the aquatic environment. It is expected that the impact	High - This has a high likelihood of temporarily impacting the aquatic environment during construction.	High - The residual risk to the aquatic environment is high and should be avoided where possible. Management plans would be required for works conducted in the waterway. Work must be carried out in accordance with *Managing Urban Stormwater – Soils and*

Hazard	Potential impact	Potential severity of impact to aquatic ecology (prior to mitigation or management)	Likelihood of occurrence	Residual risk to the aquatic environment (following mitigation or management)
	works or drainage works. The original creek alignment would remain with only partial impact on the creek from the temporary works. Erosion and sedimentation could also affect the waterway if not mitigated.	would have short term effect on aquatic flora and fauna locally through obstruction of fish passage, altering existing flow paths and removal of aquatic habitat.		*Construction Volume 1 Fourth Edition* (Landcom, 2004) and Transport standard procedures.

Table 11: Potential operational surface water impacts and risk assessment of impacts to aquatic ecology

Hazard	Potential impact	Potential severity of impact to aquatic ecology (prior to mitigation or management)	Likelihood of occurrence	Residual risk to the aquatic environment (following mitigation or management)
Discharge associated with wet weather stormflows	The key pollutants contained in road runoff include: • Suspended solids as a result of pavement wear, tyre wear, atmospheric deposition, and deposition from vehicles • Heavy metals bound to dust particles washed off pavement surface • Oil and grease and other hydrocarbons deposited by vehicles • Nutrients as a result of atmospheric deposition. The increased pollutant load would be captured in existing basins across the length of the Westlink M7. These devices may overtop during rain events exceeding the design capacity of the basins and discharge via the stormwater network to the waterways in accordance with their design.	Low - The sediment basins function by providing reduced flow velocities therefore encouraging the settlement of coarse sediments. The surface water report (Lyall and Associates, 2022) concluded that there were negligible differences between the median pollutant concentrations under pre- and post-proposed modification conditions. Also, that the median concentrations of total suspended solids and levels of turbidity are below the guideline values set out in the water quality objectives, and are typically less than or similar to the levels recorded in the receiving watercourses. Under both pre- and post-proposed modification conditions, the median concentrations for nutrients are typically comparable and were in range of, or below concentration level observed in most waterways. However, it was identified that levels of nitrogen in post-proposed modification conditions in Maxwells Creek, Cabramatta Creek, Lower Hinchinbrook Creek and Eskdale Creek were 14 to 48 per cent higher than the corresponding concentration levels of total nitrogen as part of the sampling that has been undertaken for the proposed modification. It is noted that in the instance that during detailed design that it cannot be demonstrated that the existing operational stormwater quality controls would be effective in mitigating potential impacts, then	Low - Discharges are likely to occur when the waterway is experiencing runoff from a highly urbanised catchment and any impact to aquatic ecology is likely to be immeasurable. The existing sediment basins would need to continue to be monitored and maintained in the long term to ensure they are working effectively.	Low - It is expected that the overall risk to the receiving environment is low and the existing operational stormwater quality controls would be effective in mitigating potential impacts, or modified to ensure that they are effective.

Hazard	Potential impact	Potential severity of impact to aquatic ecology (prior to mitigation or management)	Likelihood of occurrence	Residual risk to the aquatic environment (following mitigation or management)
		additional mitigation measures would be identified and implemented (Lyall and Associates, 2022).		
	Scouring and erosion of drainage channels and creeks at entry of stormwater discharges due to increased rates of water flow because of higher surface area of impervious surfaces.	Low - Any impacts to aquatic habitat are likely to be localised to entry points. Scour protection is already present as part of the existing stormwater infrastructure. It is noted that (Lyall and Associates, 2022) identified that changes in peak discharges from the Westlink M7 corridor would have only a minor impact on both the depth and velocity of flow in the receiving drainage lines downstream of the Westlink M7 corridor.	Low- Scouring and erosion is unlikely to occur due to existing protection measures.	Low - The severity is low as existing stormwater measures are mitigating this potential impact.
In-channel flow modifications caused by structural emplacements	Low – Alterations to erosion and deposition zones around bridge footings, culverts or pipes leading to habitat modification in the waterway's channel bed. This impact is envisaged to be localised. It could lead to formation of turbulent flows and secondary flow circulation patterns around structures.	Moderate - Potential localised change around permanent structures. This can lead to erosion and sedimentation and affect aquatic habitat and flora and fauna. Change in flow hydraulics could potentially act as a barrier to fish movement in sensitives waterways. It is noted that scour protection measures would be incorporated into the detailed design using standard Transport procedures to manage localised increases in velocities and scour potential around new bridge piers.	Moderate – This may occur over time for some structures.	Low – The residual risk is low as the bridges, culverts and pipes would be designed in accordance with *Policy and Guidelines for Fish Habitat Conservation and Management* (Fairfull, 2013) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries 2003) to limit potential hydraulic impacts. Minor changes to flow or flooding are not expected to impact the aquatic environment.

6.2 Potential impacts to aquatic habitat and ecology

6.2.1 Construction

The majority of potential impacts are associated with construction activities (Table 10). Of the potential impacts, the activities which could cause sedimentation and contamination, and the physical alteration of the waterway from stream realignments, crossing and platforms, have the greatest risk of impact to the aquatic environment within the construction footprint. For the most part, these impacts would be short-term and temporary in their nature.

Surface water quality impacts

The impact of sedimentation or increased suspended solids can physically affect aquatic habitat and ecological processes. However, the physical impact of sedimentation associated with vegetation removal, changed flow paths, or excavations is expected to be localised and short-lived. The main construction risk associated with the proposed modification is contamination of the local waterways either though sediments and particulates particularly from the existing water quality and detention basins, run off from stockpiles or construction materials, or from direct leakage from on-site chemicals (diesel, etc). Recommended mitigation measures provided in Section 7, along with other mitigations described in the modification report would be expected to substantially reduce the risks associated with surface water impacts and their potential impact on the aquatic environment.

Temporary waterway diversion and crossings

The temporary construction of waterway diversions physically alters the waterway morphology, flow and aquatic habitat and can create a barrier to fish passage. Temporary waterway crossings required for construction are provided in Table 12.

This is likely to be a key concern in perennial high order streams which have a more diverse habitat and fish ecology (e.g. Cabramatta Creek) (Table 12). This impact is expected to be localised and short-lived when the waterway is reinstated in accordance with environmental/landscape design requirements. Consultation with DPI Fisheries may be required for any stream diversions, dredging and reclamation and/or obstruction of fish passage. This would temporarily affect waterways and limit fish movement. The design and location of the crossings would also lead to removal of aquatic habitat, increase the risk of erosion and sedimentation. The crossing would need to be consistent with the requirements of the *Policy and Guidelines for Fish Habitat Conservation and Management* (Fairfull 2013) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries 2003).

Table 12: Location requiring temporary waterway diversion and/or crossing

Stream crossing or diversion	KFH sensitivity type and water class for fish passage	Potential impact
Maxwells Creek Bridge 1 (B9817)	Type 1- Highly sensitive KFH - CLASS 3 Minimal KFH	Although the waterway has aquatic vegetation and is classed as Type 1 KFH, the system is highly modified and in poor stream health. The waterway crossing or diversion is likely to have minor impact to KFH and fish passage if planning and mitigation measures are in place and are consistent with DPI guidelines (Fairfull 2003; NSW Fisheries 2003).
Maxwells Creek Bridge 2 (B9821)		

Stream crossing or diversion	KFH sensitivity type and water class for fish passage	Potential impact
Cabramatta Creek Bridge (B9825/B9826)	Type 1- Highly sensitive KFH CLASS 1 Major KFH	Although the waterway has aquatic vegetation and is classed as Type 1 KFH, the system is highly modified and in poor stream health. Cabramatta Creek is a 5th order stream and is likely to provide habitat to a variety of freshwater fish. Planning and mitigation measures would be required to reduce the construction impact at the bridge location. Waterway crossings should also be designed and implemented in accordance with DPI guidelines (Fairfull 2003; NSW Fisheries 2003). Monitoring of the waterway should be conducted during construction. Relocation of fish may be required if sections of the waterway become isolated from stream diversions.
Hoxton Park Road Bridge (Hinchinbrook Creek – main channel) (B9829/B9830)	Type 1- Highly sensitive KFH - CLASS 3 Minimal KFH	Although the waterway has aquatic vegetation and is classed as Type 1 KFH, the system is highly modified and in poor stream health. The stream crossing or diversion is likely to have minor impact to KFH and fish passage if planning and mitigation measures are in place and are consistent with DPI guidelines (Fairfull 2003; NSW Fisheries 2003).
Aviation Road - Hinchinbrook tributary (B9839/B9840)	Not KFH	Minimal impact as the site is generally lacking in aquatic habitats and is highly modified or degraded.
Hinchinbrook Creek (Hichen brook Creek north (B9841/B9842)	Sydney Metro- Type 1CLASS 3 Minimal KFH	Although the waterway has aquatic vegetation and is classed as Type 1 KFH, the system is highly modified and in poor stream health. The stream crossing or diversion is likely to have minor impact to KFH and fish passage if planning and mitigation measures are in place and are consistent with DPI guidelines (Fairfull 2003; NSW Fisheries 2003).
Villiers Road (Ropes Creek) (B9851/B9852)	Not KFH	Minimal impact as the site is generally lacking in aquatic habitats and is highly modified or degraded.
Unnamed eastern creek tributary (assessment site 4)	Not KFH	Minimal impact as the site is generally lacking in aquatic habitats and is highly modified or degraded.
Reedy Creek (B9870/B9871)	Type 3 Minimally sensitive KFH may include: CLASS 3 Minimal KFH	Reedy Creek is unlikely to provide high quality key habitat for fish. Standard control

Stream crossing or diversion	KFH sensitivity type and water class for fish passage	Potential impact
		measures should be in place to limit impacts from erosion and sedimentation.
Reedy Creek Tributary Bridge (B9873/B9874)	Not KFH	Minimal impact as the site is generally lacking in aquatic habitats and is highly modified or degraded.
Angus Creek (B9898/B9899).	Not KFH	Minimal impact as the site is generally lacking in aquatic habitats and is highly modified or degraded.

6.2.2 Operational impacts

The operational impacts are generally long-term impacts associated with the infrastructure and stormwater management. There are likely to be low, long-term impacts associated with discharge of water from operational detention and water quality basins. Wet weather events can lead to discharge that could potentially result in water quality impacts, such as sedimentation, increased turbidity, increased toxicant and nutrient concentrations, and lower dissolved oxygen levels within the waterways. The overall impact from sedimentation to creek substrate on aquatic ecology is low as the waterways are considered to already be highly sediment laden and generally have an elevated turbidity. Additionally, any potential influence on the waterways' water quality would occur during a wet weather event, when stormwater from the surrounding catchments would also be flowing into the creeks. The proposed modification would be managed through existing storm water infrastructure (i.e. detention and water quality basins), which would be upgraded or augmented where required to maintain their existing function, and would assist in mitigating this long-term impact. Water quality modelling (Lyall and Associates, 2022) of water pre- and post- modifications found the following:

- There are negligible differences between the median pollutant concentrations under pre- and post-conditions for the proposed modification. It was concluded that there is negligible difference in the ability of the stormwater quality controls to meet the water quality objectives between pre- and post-conditions.
- Under both pre- and post-conditions, the median concentrations of total suspended solids and levels of turbidity are below the guideline values set out in the water quality objectives, and are typically less than or similar to the levels recorded in the receiving watercourses. It was concluded that the stormwater quality controls would achieve the water quality objectives.
- Under both pre- and post-proposed modification conditions, the median concentrations of total phosphorus and total nitrogen are:
  - Above the guideline values set out in the water quality objectives
  - Within the range of concentration levels for total discharge into the major creek systems of Cabramatta Creek, Ropes Creek and Eastern Creek
  - Below the concentration levels of total phosphorus that have been measured in Maxwells Creek, Cabramatta Creek, Lower Hinchinbrook Creek and Eskdale Creek as part of the sampling that has been undertaken for the surface water assessment
  - Above the concentration levels of total nitrogen that have been measured in Maxwells Creek, Cabramatta Creek, Hinchinbrook Creek and Eskdale Creek as part of the sampling that has been undertaken for the surface water assessment
  - Below the concentration levels that have been measured in Upper Hinchinbrook Creek and Bells Creek as part of the sampling that has been undertaken for the surface water assessment

- Below the concentration level of total phosphorus that has been measured in Angus Creek as part of the sampling that has been undertaken for the surface water assessment, and similar to the measured concentration level of total nitrogen.

Overall, it is likely that there would be negligible change between pre- and post- widening concentrations of pollutants, and that any change can be managed with the existing operational detention and water quality basins. The negligible impact to water quality would be unlikely to affect aquatic ecology.

The impacts associated with alteration of flow and local hydraulic changes from the widened bridges, culverts and pipes may cause localised change in sediments and aquatic habitat; however, this change is expected to have a negligible impact to the aquatic ecology if design and construction methods are best practice and consistent with DPI policies and guidelines and Managing Urban Stormwater: Soils and construction – Volume2D (Landcom, 2004).

Along the proposed modification are five 'KFH' waterways in close proximity. One is within the Hawkesbury-Nepean Catchment: Reedy Creek (3rd Order Stream), and four are within the Sydney Metro Catchment: Tributary of Hinchinbrook Creek (3rd Order Stream), Hinchinbrook Creek (4th Order Stream), Cabramatta Creek (5th Order Stream), and Maxwells Creek (3rd Order Stream) (Table 6).

All the waterways are mapped as Freshwater Fish Community presence (DPI, 2021a), however five were listed as KFH (Table 6). Of these, four were categorised as Type 1 Highly sensitive KFH due to the presence of aquatic macrophytes, however, as discussed, the quality of the habitat is low as is the potential for significant fish movement. As such, while there is likely to be temporary localised impact to aquatic habitat at these locations from stream modification, it is considered unlikely that there would be any long-term reduction in stream health as part of the operation associated with the modification.

The operational impacts associated with the proposed modification would potentially affect KFH; however, most impacts associated with sedimentation and water quality would be reduced through the existing stormwater infrastructure, which would be upgraded or augmented where required to maintain the existing function. In addition mitigation and management measures under operational management plans, including ongoing monitoring and maintenance of water quality and storm water infrastructure will be used to manage potential operational impacts.

While there is expected to be some impact to the waterway in the proposed locations of the bridges, culverts and pipes associated with the proposed modification, the reaches of streams within the construction footprint are already degraded and in poor condition. In the long-term it is expected that, with the implementation of the mitigation measures provided and rehabilitation of the construction footprint, there would be no net loss of KFH.

6.3 Riparian vegetation

The condition of riparian vegetation within the construction footprint is considered poor-moderate, with intact vegetation and fauna habitat features being uncommon. As a result of its occurrence within an urban/semi-urban catchment, the aquatic habitat within the construction footprint is highly degraded and subject to pollution and bank instability. Exotic vegetation was observed as mostly exotic grasses and annuals along the banks such as *Ehrharta erecta*, with native canopy species recorded, including *Casuarina glauca* (Table 8).

Riparian vegetation has been assessed as part of the BDAR (Niche, 2022). The existing riparian vegetation provides limited ecological function within the construction footprint. Other than potential bank erosion and sedimentation, the removal of vegetation is expected to have a negligible impact to the aquatic environment.

6.4 Threatened species

A review of background databases for threatened aquatic species listed under the EPBC Act and FM Act identified three threatened species as potentially occurring, or previously recorded, in proximity to the construction footprint. Based upon a review of the ecology and distribution of these species (Table 7), all of these species are considered unlikely to occur in either of the waterways affected by the proposed modification. As such, no impact assessment is required and threatened aquatic species are not considered further.

6.5 Key threatening processes

The proposed modification is not considered likely to contribute to the operation of any KTP's listed under the EPBC Act. The proposed modification does have the potential to contribute to the operation of the following KTP's listed under the FM Act:

- Degradation of native riparian vegetation along New South Wales water courses
- Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.

The proposed modification is not considered likely to significantly increase the instance of these KTP's, based upon the impact assessment discussed in sections 6.2 and 6.3. This is primarily due to the poor and modified condition of existing aquatic environments, with the potential impacts resulting from the proposed modification considered minor in the context of the significant existing levels of instance of these KTP's in the construction footprint and broader region.

Recommended management and mitigation measures to limit the potential for impacts to aquatic ecosystems, including these KTP's, have been included in this report (section 7).

6.6 Downstream environment

Most impacts associated with the proposed modification include localised impacts which could affect the downstream environment; however, it is expected that mitigation measures to ensure sediments or contaminates do not enter the waterway during construction would reduce this risk. With the implementation of the mitigation measures provided in Section 7 of this report, the proposed modification is unlikely to impact any KFH of the Sydney Metropolitan or Hawkesbury-Nepean catchments, small coastal wetlands present within the vicinity of the construction footprint, or the Towra Point Ramsar wetland (located 25 kilometres downstream). The Georges River and Hawkesbury-Nepean catchments are highly urbanised, and, as such, the waterways present within the construction footprint have existing impacts and ecological impairment. The long-term operational impacts are not expected to alter the downstream environment from its current condition.

7. Management of impacts

The mitigation measures to reduce or eliminate impacts to the aquatic environment are primarily related to management of surface water. The surface water impact assessment (Lyall and Associates, 2022) details the management of impacts which includes mitigation measures to reduce or eliminate impacts, monitoring requirements and construction management plans (Surface Water Management Plan [SWMP], and Erosion Sediment Control Plan [ESCP]).

7.1 Mitigation measures

In addition to measures recommended for the management of surface water as described in the surface water and flooding assessment for the proposed modification (Lyall and Associates, 2022) it is recommended that:

- If sediment/erosion booms are used, they are placed so they do not obstruct fish passage, where possible
- Design of temporary waterway crossings and diversions are consistent with Managing Urban Stormwater: Soils and construction – Volume 1 and 2D (Landcom, 2004) and *Policy and Guidelines for Fish Habitat Conservation and Management* (Fairfull 2013) and *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (NSW Fisheries,2003)
- Relocation of native fish by a trained aquatic ecologist if they become stranded as a result of waterway diversions, temporary crossings or dewatering activities.

7.2 Monitoring

A detailed water monitoring program would be implemented during construction, where site observations are recorded by a suitably qualified person, including:

- Routine inspections of temporary waterway crossings, waterway diversions and dewatering activities
- Rapid geomorphic survey, including aquatic macrophyte mapping, bank erosion, channel stability and sediment deposition
- Stormwater discharges into the receiving watercourses, including an estimate of flows, visual appearance, and water quality (handheld meter) testing on an opportunistic basis
- Visual and olfactory observation of pollution (e.g., oil sheens, coarse debris, odours)
- Opportunistic observations of aquatic fauna (e.g. stranded fish).

7.3 Management plans

It is understood that a construction SWMP, and ESCP are to be prepared prior to construction of the proposed modification. In addition, a Biodiversity Management Plan (BMP) would be developed and implemented to complement these mitigation strategies, including procedures for the management/rehabilitation of riparian vegetation during construction. The BMP would detail management and mitigation measures to protect biodiversity values during construction activities. Relevant to aquatic ecology for example, it is recommended that a procedure is prepared for the protection of native riparian and aquatic vegetation to be retained during clearing activities and the protection of fish and fish passage during the use of coffer dams and sediment booms. It is recommended that dewatering activities be managed under a construction dewatering plan, or set of procedures incorporated into a SWMP, including relevant discharge criteria and that a spill response plan should also be prepared. The rehabilitation of waterways after the removal of temporary waterway crossing and diversions, including erosion and

sediment control, management of flow, stockpile management, stabilisation of bed and banks and revegetation, should be included in the management plans where applicable.

The operational impacts associated with the proposed modification would potentially affect KFH; however, most impacts associated with sedimentation and water quality would be reduced through the existing stormwater infrastructure, which would be upgraded or augmented where required to maintain the existing function. In addition, mitigation and management measures under operational management plans, including ongoing monitoring and maintenance of water quality and storm water infrastructure will be used to manage potential operational impacts.

8. Conclusion

This aquatic ecology assessment made the following conclusions:

- There are no threatened aquatic species that occur in the area that would be impacted by the proposed modification
- Key impacts associated with construction of the proposed modification include potential short-term water quality changes associated with sedimentation and potential contaminated sediments, and alteration of waterways from temporary waterway diversion and crossings
- Bridge construction may temporarily affect fish passage in some KFH during construction. The most sensitive waterway with regards to KFH and fish passage is Cabramatta Creek
- There are expected to be no long-term changes to fish passage from the widening of the Westlink M7
- The proposed modification would not significantly impact the downstream sensitive aquatic habitat
- The long-term overall changes to integrity of aquatic habitat and water quality of the waterways within the construction footprint are expected to be negligible. As such, there is expected to be no net loss of KFH
- Mitigation measures and careful management would significantly reduce the risk of impact to the waterways during construction. Management plans would be prepared prior to construction, and regular monitoring of water quality and aquatic habitat conducted during construction
- Surface water quality and quantity during operation would be managed with existing stormwater infrastructure, which would be upgraded or augmented where required to maintain their existing function. The potential impacts are expected to be negligible and would therefore not lead to long-term impacts to aquatic ecology.

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Offset site establishment and management
Offset brokerage
Advanced Offset establishment (QLD)

Annex 2. Threatened species matrix, status and likelihood of occurrence

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Amphibians							
Heleioporus australiacus	Giant Burrowing Frog	V		1 record within 10km, last recorded 1997 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	The Giant Burrowing Frog is distributed in south eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. It is found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	Low	Nil
Litoria aurea	Green and Golden Bell Frog	E	V	59 records within 10km, last recorded 2019 (DPIE 2021a) (8.5km to the east on the eastern side of the Georges River; Species or species' habitat predicted to occur within 10km (DAWE 2021a)	Since 1990 there have been about 50 recorded locations of Green and Golden Bell Frog in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands. The species inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Optimal habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area nearby and diurnal sheltering sites available. Some sites the species has been recorded in, occur in highly disturbed areas.	Low	Nil
Litoria raniformis	Southern Bell Frog	E	V	Species or species' habitat may occur within 10km (DoEE 2021a)	Currently, the Growling Grass Frog is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. A few yet unconfirmed records have also been made in the Murray Irrigation Area in recent years. The species is usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Breeding occurs during the	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
					warmer months and is triggered by flooding or a significant rise in water levels. The species has been known to breed anytime from early spring through to late summer/early autumn		
Pseudophryne australis	Red-crowned Toadlet	V		5 records within 10km, last recorded 2010 (DPIE 2021a)	The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. It occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. The species inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	Low	Nil
Birds							
Actitis hypoleucos	Common Sandpiper		C,J,K	2 records within 10km, last recorded 1988 (DPIE 2021a); Species or species' habitat likely to occur within 10km (DoEE 2021a)	Does not breed in Australia. When in Australia it is found on all coastlines and in inland areas but is concentrated in the north and west with important areas in WA, the NT and Qld. Utilises a wide range of coastal and inland wetlands with varying salinity levels.	Low	Nil
Anthochaera phrygia	Regent Honeyeater	CE	CE	28 records within 10km, last recorded 2019 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW, the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
					significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.		
Apus pacificus	Fork-tailed Swift		C,J,K	9 records within 10km, last recorded 2020 (DPIE 2021a); Species or species' habitat likely to occur within 10km (DoEE 2021a)	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines.	Low - may occur over the Subject Land, but is unlikely to utilise the habitat in the Subject Land.	Nil
Artamus cyanopterus	Dusky Woodswallow	V		98 records within 10km, last recorded 2018 (DPIE 2021a)	The Dusky Woodswallow is widespread from the coast to inland, including the western slopes of the Great Dividing Range and farther west. It is often recorded in woodlands and dry open sclerophyll forests, and has also been recorded in shrublands, heathlands regenerating forests and very occasionally in moist forests or rainforests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, often with coarse woody debris. It is also recorded in farmland, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. The nest is an open shallow untidy cup frequently built in an open hollow, crevice or stump. Although Dusky Woodswallows have large home ranges, individuals may spend most of their time in about a 2 ha range and defend an area about 50 m around the nest. Dusky Woodswallows prefer larger remnants over smaller remnants. Competitive exclusion by Noisy Miners (*Manorina melanocephala*) is a significant threat to this species.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Botaurus poiciloptilus	Australasian Bittern	E	E	3 records within 10km, last recorded 2002 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW, they may be found over most of the state except for the far north-west. The Species favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spikerushes (Eleocharis spp.), it hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. The species may construct feeding platforms over deeper water from reeds trampled by the bird; platforms are often littered with prey remains.	Low	Nil
Burhinus grallarius	Bush Stone-curlew	E		4 records within 10km, last recorded 2016 (DPIE 2021a)	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. It inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber, its diet consists of insects and small vertebrates, such as frogs, lizards and snakes. It is largely nocturnal, being especially active on moonlit nights and nests on the ground in a scrape or small bare patch.	Low	Nil
Calidris acuminata	Sharp-tailed Sandpiper		C,J,K	49 records within 10km, last recorded 2018 (DPIE 2021a); Species or species' habitat likely to occur within 10km (DoEE 2021a)	Spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. In Australasia, prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. Breeds in northern Siberia.	Low	Nil
Calidris ferruginea	Curlew Sandpiper	E	CE,C,J,K	4 records within 10km, last recorded 2016 (DPIE 2021a); Species or species' habitat may occur	The Curlew Sandpiper is distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. The Curlew	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
				within 10km (DoEE 2021a)	Sandpiper breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed.		
Calidris melanotos	Pectoral Sandpiper		J,K	10 records within 10km, last recorded 2015 (DPIE 2021a); Species or species' habitat may occur within 10km (DoEE 2021a)	Widespread but scattered records across NSW, east of the divide and in the Riverina and Lower Western regions. Breeds in the northern hemisphere. In Australasia, prefers shallow fresh to saline wetlands and is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. Usually in coastal or near-coastal habitats, and prefers wetlands with open mudflats and low emergent or fringing vegetation such as grass or samphire.	Low	Nil
Calidris ruficollis	Red-necked Stint		C,J,K	11 records within 10km, last recorded 2016 (DPIE 2021a)	The Red-necked Stint breeds in north-eastern Siberia and northern and western Alaska. It follows the East Asian-Australasian Flyway to spend the southern summer months in Australia. It is found widely in Australia, except in the arid inland. Red-necked Stints are found on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They may also be seen in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands. They are often in dense flocks, feeding or roosting.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Callocephalon fimbriatum	Gang-gang Cockatoo	V		4 records within 10km, last recorded 2011 (DPIE 2021a)	In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. In spring and summer the species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas.	Low	Nil
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		7 records within 10km, last recorded 2015 (DPIE 2021a)	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. It inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, *Allocasuaraina diminuta*, and *A. gymnathera*. Belah is also utilised and may be a critical food source for some populations. The species is dependent on large hollow-bearing eucalypts for nest sites.	Low	Low - potential feed trees may be removed for the proposed modification.
Charadrius leschenaultii	Greater Sand-plover	V	V,C,J,K	Species or species' habitat likely to occur within 10km (DoEE 2021a)	The Greater Sand-plover breeds in central Asia from Armenia to Mongolia, moving further south for winter. In Australia, the species is commonly recorded in parties of 10-20 on the west coast, with the far northwest being the stronghold of the population. The species is apparently rare on the east coast, usually found singly. In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. The species is almost entirely restricted to coastal areas in	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
					NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.		
Chthonicola sagittata	Speckled Warbler	V		7 records within 10km, last recorded 2008 (DPIE 2021a)	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100 ha survive. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies, typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	Low	Nil
Circus assimilis	Spotted Harrier	V		11 records within 10km, last recorded 2017 (DPIE 2021a)	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. The species occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Low	Nil
Cuculus optatus	Oriental Cuckoo		C,J,K	Species or species' habitat known to occur within 10km (DoEE 2021a)	This species migrates to northern and eastern Australia in the warmer months. Occurs south to the Shoalhaven area. Occurs in a range of habitats, including monsoon forest, rainforest edges, leafy trees in paddocks, river flats, roadsides and mangroves.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Daphoenositta chrysoptera	Varied Sittella	V		115 records within 10km, last recorded 2018 (DPIE 2021a)	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The species inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Low	Nil
Ephippiorhynchus asiaticus	Black-necked Stork	E		3 records within 10km, last recorded 2010 (DPIE 2021a)	In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Buladelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.	Low	Nil
Epthianura albifrons	White-fronted Chat	V		1 record within 10km, last recorded 1996 (DPIE 2021a)	The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. The species is typically usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Falco hypoleucos	Grey Falcon	E		Species or species' habitat likely to occur within 10km (DoEE 2021a)	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The species is usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. It also occurs near wetlands where surface water attracts prey.	Low	Nil
Falco subniger	Black Falcon	V		5 records within 10km, last recorded 2014 (DPIE 2021a)	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. Occurs in plains, grasslands, foothills, timbered watercourses, wetland environs, crops, and occasionally over towns and cities. Breeding occurs along timbered waterways in in land areas.	Low	Nil
Gallinago hardwickii	Latham's Snipe		J,K	84 records within 10km, last recorded 2019 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Latham's Snipe is a non-breeding migrant to the south east of Australia including Tasmania, passing through the north and New Guinea on passage. Latham's Snipe breed in Japan and on the east Asian mainland. Latham's Snipe are seen in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. They also use crops and pasture.	Low	Nil
Glossopsitta pusilla	Little Lorikeet	V		79 records within 10km, last recorded 2021 (DPIE 2021a)	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs. The species forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
					species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.		
Grantiella picta	Painted Honeyeater	V	V	Species or species' habitat likely to occur within 10km (DoEE 2021a)	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. The species inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. It is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema.	Low	Nil
Haliaeetus leucogaster	White-bellied Sea-Eagle	V		42 records within 10km, last recorded 2020 (DPIE 2021a)	The White-bellied Sea-eagle is widespread along the New South Wales coast, and along all major inland rivers and waterways. The species habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. It occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. The terrestrial habitats the species has been recorded in, include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).	Low	White-bellied Sea-Eagle stick nests are conspicuous and were not detected during the field survey.
Hieraaetus morphnoides	Little Eagle	V		67 records within 10km, last recorded 2020 (DPIE 2021a)	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. The species occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. It nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Hirundapus caudacutus	White-throated Needletail		V,C,J,K	9 records within 10km, last recorded 2018 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	White-throated Needletails often occur in large numbers over eastern and northern Australia. White-throated Needletails are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds would roost in trees, and radio-tracking has since confirmed that this is a regular activity.	Low - it may occur over the Subject Land, but is unlikely to utilise the habitat in the Subject Land.	Low
Hydroprogne caspia	Caspian Tern		J	1 record within 10km, last recorded 2007 (DPIE 2021a)	The Caspian Tern is found in coastal and inland areas. In NSW, widespread east of the divide, mainly in coastal regions as well as the Riverina and Western regions, with occasional records elsewhere. Breeding has been recorded in the Menindee Lakes. Mostly found in sheltered coastal embayments, preferring areas with sandy or muddy margins. Usually forages in open wetlands, including lakes and rivers.	Low	Nil
Ixobrychus flavicollis	Black Bittern	V		10 records within 10km, last recorded 2016 (DPIE 2021a)	In NSW, records of the Black Bittern are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. The species inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Low	Nil
Lathamus discolor	Swift Parrot	E	CE	95 records within 10km, last recorded 2020 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW, mostly occurs on the coast and south west slopes. On the mainland the species occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Their favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Forest Red Gum *E. tereticornis*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Lophoictinia isura	Square-tailed Kite	V		12 records within 10km, last recorded 2021 (DPIE 2021a)	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. The species is found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, it has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland.	Low	Nil
Melithreptus gularis	Black-chinned Honeyeater (eastern subspecies)	V		9 records within 10km, last recorded 2013 (DPIE 2021a)	In NSW, the Black-chinned Honeyeater is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. The species occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum *(E. blakelyi)* and Forest Red Gum (*E. tereticornis*). It also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	Low	Nil
Monarcha melanopsis	Black-faced Monarch		CMS	Species or species' habitat known to occur within 10km (DoEE 2021a)	The Black-faced Monarch is found along the coast of eastern Australia, becoming less common further south. It is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Motacilla flava	Yellow Wagtail		C,J,K	Species or species' habitat likely to occur within 10km (DoEE 2021a)	The Yellow Wagtail breeds in temperate Europe and Asia. They occur within Australia in open country habitat with disturbed ground and some water. Recorded in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns.	Low	Nil
Myiagra cyanoleuca	Satin Flycatcher		CMS	Species or species' habitat known to occur within 10km (DoEE 2021a)	The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. It is also found in New Guinea. The Satin Flycatcher is not a commonly seen species, especially in the far south of its range, where it is a summer breeding migrant. The Satin Flycatcher is found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Low	Nil
Neophema pulchella	Turquoise Parrot	V		6 records within 10km, last recorded 2019 (DPIE 2021a)	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. The species typically lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	Low	Nil
Ninox connivens	Barking Owl	V		5 records within 10km, last recorded 2018 (DPIE 2021a)	The Barking Owl is found throughout continental Australia except for the central arid regions. The owls sometimes extend their home range into urban areas, hunting birds in garden trees and insects attracted to streetlights. Extensive wildfires in 2019-20 reduced habitat quality further, burnt many old, hollow-bearing trees needed as refuge by prey species and reduced the viability of some regional owl populations. The species inhabit woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils. The species typically roost in shaded portions of tree canopies, including	Low - The fragmented and disturbed vegetation in the Subject Land is unlikely to provide important habitat for this species. In addition no suitable hollows are present.	Low

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
					tall midstorey trees with dense foliage such as Acacia and Casuarina species.		
Ninox strenua	Powerful Owl	V		40 records within 10km, last recorded 2019 (DPIE 2021a)	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera,* Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species.	Low - The fragmented and disturbed vegetation in the Subject Land is unlikely to provide important habitat for this species. In addition no suitable hollows are present.	Low
Numenius madagascariensis	Eastern Curlew		CE,C,J,K	Species or species' habitat may occur within 10km (DoEE 2021a)	The Eastern Curlew is widespread in coastal regions in the north-east and south of Australia, including Tasmania, and scattered in other coastal areas. It is rarely seen inland. It breeds in Russia and north-eastern China. On passage, they are commonly seen in Japan, Korea and Borneo. Small numbers visit New Zealand. The Eastern Curlew is found on intertidal mudflats and sandflats, often with beds of seagrass, on sheltered coasts, especially estuaries, mangrove swamps, bays, harbours and lagoons.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Oxyura australis	Blue-billed Duck	V		2 records within 10km, last recorded 1989 (DPIE 2021a)	The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. The species disperses during the breeding season to deep swamps up to 300 km away, and is generally only during summer or in drier years that they are seen in coastal areas. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It would fly if disturbed, but prefers to dive if approached.	Low	Nil
Pandion cristatus	Eastern Osprey	V	CMS	4 records within 10km, last recorded 2014 (DPIE 2021a)	Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. The species favour coastal areas, especially the mouths of large rivers, lagoons and lakes. The species breeds in NSW from July to September.	Low	Nil
Petroica boodang	Scarlet Robin	V		13 records within 10km, last recorded 2017 (DPIE 2021a)	In NSW, the Scarlet Robin from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. The species habitat usually contains abundant logs and fallen timber: these are important components of its habitat.	Low	Nil
Petroica phoenicea	Flame Robin	V		12 records within 10km, last recorded 2014 (DPIE 2021a)	In NSW, the Flame Robin breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. The species	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
					breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes, it prefers clearings or areas with open understoreys.		
Pluvialis fulva	Pacific Golden Plover		C,J,K	8 records within 10km, last recorded 2015 (DPIE 2021a)	The Pacific Golden Plover breeds on the Arctic tundra in western Alaska. It winters in South America and islands of the Pacific Ocean to India, Indonesia and Australia. In Australia it is widespread along the coastline. The Pacific Golden Plover is found on muddy, rocky and sandy wetlands, shores, paddocks, saltmarsh, coastal golf courses, estuaries and lagoons.	Low	Nil
Pluvialis squatarola	Grey Plover		C,J,K	7 records within 10km, last recorded 2014 (DPIE 2021a)	The Grey Plover breeds around the Arctic regions and migrates to the southern hemisphere, being a regular summer migrant to Australia, mostly to the west and south coasts. It is generally sparse but not uncommon in some areas. It is occasionally found inland. The Grey Plover is almost entirely coastal, being found mainly on marine shores, inlets, estuaries and lagoons with large tidal mudflats or sandflats for feeding, sandy beaches for roosting, and also on rocky coasts.	Low	Nil
Rhipidura rufifrons	Rufous Fantail		CMS	Species or species' habitat known to occur within 10km (DoEE 2021a)	The Rufous Fantail is found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas.	Low	Nil
Rostratula australis	Australian Painted Snipe	E	E	6 records within 10km, last recorded 2015 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	In NSW, many records of the Australian Painted Snipe are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. The species prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Stagonopleura guttata	Diamond Firetail	V		1 record within 10km, last recorded 2012 (DPIE 2021a)	The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, though is very rare west of the Darling River. The species is found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. It also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities, and often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	Low	Nil
Stictonetta naevosa	Freckled Duck	V		1 record within 10km, last recorded 2018 (DPIE 2021a)	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. The species prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Low	Nil
Symposiachrus trivirgatus	Spectacled Monarch		M	Species or species' habitat may occur within 10km (DoEE 2021a)	The Spectacled Monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. Prefers thick understorey in rainforest, wet gullies and waterside vegetation as well as mangroves.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Tringa glareola	Wood Sandpiper		C,J,K	6 records within 10km, last recorded 2015 (DPIE 2021a)	Breeds in Northern Hemisphere. In Australia, the Wood Sandpiper shuns coastal mudflats, instead occurring in shallow, freshwater wetlands, usually where there is grass or aquatic plants protruding above the water, and often with trees and much fallen timber. The species occurs in largest numbers in NW Australia, with all sites of national importance within WA. In NSW, there are records east of the Divide north from Nowra, and inland from the upper and lower Western regions. Uses well-vegetated, shallow, freshwater wetlands and are typically associated with wetlands supporting emergent aquatic plants or grass and taller fringing vegetation such as dense reeds/rushes, shrubs or trees. Also frequent flooded grasslands and irrigated crops. Rarely in brackish wetlands or saltmarsh. Known from artificial wetlands.	Low	Nil
Tringa nebularia	Common Greenshank		C,J,K	2 records within 10km, last recorded 2012 (DPIE 2021a); Species or species' habitat likely to occur within 10km (DoEE 2021a)	The Common Greenshank breeds in the Palaearctic regions and is widespread in Africa, Coastal Asia, the Indian subcontinent, the Philippines and southern New Guinea. They are common throughout Australia in the summer. Common Greenshanks are found both on the coast and inland, in estuaries and mudflats, mangrove swamps and lagoons, and in billabongs, swamps, sewage farms and flooded crops.	Low	Nil
Tringa stagnatilis	Marsh Sandpiper		C,J,K	3 records within 10km, last recorded 2015 (DPIE 2021a)	The Marsh Sandpiper is found on coastal and inland wetlands throughout Australia. It is recorded in all regions of NSW but especially the central and south coasts and (inland) on the western slopes of Great Divide and western plains. The Hunter River Estuary and the Macquarie Marshes are internationally important sites for this species. The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Tyto novaehollandiae	Masked Owl	V		5 records within 10km, last recorded 2018 (DPIE 2021a)	The Masked Owl occurs from the coast where it is most abundant to the western plains. Overall records for this species fall within about 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. This species lives in dry eucalypt forests and woodlands from sea level to 1,100 m an often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	Low	Nil
Tyto tenebricosa	Sooty Owl	V		1 record within 10km, last recorded 2007 (DPIE 2021a)	The Sooty Owl occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. This species occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Sooty Owls roost by day in the hollow of a tall forest tree or in heavy vegetation and nest in very large tree hollows. This species hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (*Pseudocheirus peregrinus*) or Sugar Glider (*Petaurus breviceps*).	Low	Nil
Fish							
Macquaria australasica	Macquarie Perch	E	E	Species or species' habitat may occur within 10km (DoEE 2021a)	The Macquarie Perch is known only from scattered localities in the cool upper reaches of the Murray-Darling system of New South Wales, including the Hawkesbury-Nepean and Shoalhaven catchments, Victoria and the Australian Capital Territory. Also found in man-made lakes on the NSW coast. The species inhabits cool, clear freshwaters of rivers with deep holes and shallow riffles. They are also found in lakes and reservoirs, where adults aggregate in small shoals during the spawning season.	Low	Nil
Prototroctes maraena	Australian Grayling		V	Species or species' habitat may occur within 10km (DoEE 2021a)	The Australian Grayling occurs in streams and rivers on the eastern and southern flanks of the Great Dividing Range, from Sydney, southwards to the Otway Ranges of Victoria and in Tasmania. The	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
					species is found in fresh and brackish waters of coastal lagoons, from Shoalhaven River in NSW to Ewan Ponds in South Australia		
Gastropods							
Meridolum corneovirens	Cumberland Plain Land Snail	E		846 records within 10km, last recorded 2021 (DPIE 2021a)	Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. The species primarily inhabits Cumberland Plain Woodland (a critically endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities. It lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	Moderate - potential habitat in Cumberland Plain Woodland in the Subject Land, however, it is predominantly low quality habitat	Moderate
Pommerhelix duralensis	Dural Land Snail	E	E	12 records within 10km, last recorded 2018 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	The Dural Land Snail is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes. The species is definitely found within the Local Government Areas of The Hills Shire, Hawkesbury Shire and Hornsby Shire. Records from the Blue Mountains City, Penrith City and Parramatta City may represent this species. Occurrence in Wollondilly Shire is considered unlikely in light of current knowledge. It favours sheltering under rocks or inside curled-up bark, it does not burrow nor climb.	Low	Low - potential habitat in shale-sandstone transition landscapes in the locality, however it is predominantly low quality habitat.

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Mammals							
Cercartetus nanus	Eastern Pygmy-possum	V		1 record within 10km, last recorded 2012 (DPIE 2021a)	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. The species is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. It feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes and is an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable.	Low	Nil
Chalinolobus dwyeri	Large-eared Pied Bat	V		10 records within 10km, last recorded 2017 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	The Large-eared Pied Bat is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. The species roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. It is found in well-timbered areas containing gullies.	Low	Nil
Dasyurus maculatus	Spotted-tailed Quoll	V		10 records within 10km, last recorded 2013 (DPIE 2021a); Species or species' habitat known to	The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. The species has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
				occur within 10km (DoEE 2021a)	forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creeklines.		
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		66 records within 10km, last recorded 2021 (DPIE 2021a)	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. The species prefer moist habitats, with trees taller than 20 m.	Moderate	Low – while one hollow-bearing tree is likely to require removal it is unlikely to be used by native fauna. Eastern False Pipistrelle would be offset as part of the ecosystem credit offsets.
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V		163 records within 10km, last recorded 2020 (DPIE 2021a)	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW.The species typically inhabit dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. It roosts mainly in tree hollows but would also roost under bark or in man-made structures.	Moderate	Low – while one hollow-bearing tree is likely to require removal it is unlikely to be used by native fauna. The Eastern Freetail-bat would be offset as part of the ecosystem credit offsets.

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
							The bridges proposed to be widened are considered to be of low habitat value.
Miniopterus australis	Little Bent-winged Bat	V		31 records within 10km, last recorded 2019 (DPIE 2021a)	The Little Bentwing-bat occurs along the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. It prefers moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. The species roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Moderate	Low – while one hollow-bearing tree is likely to require removal it is unlikely to be used by native fauna. The Little Bentwing-bat would be offset as part of the ecosystem credit offsets. The bridges proposed to be widened are considered to be of low habitat value.
Miniopterus orianae oceanensis	Large Bent-winged Bat	V		203 records within 10km, last recorded 2021 (DPIE 2021a)	Large Bentwing-bats occur along the east and north-west coasts of Australia. The species use caves as the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Moderate	Low - the bridges proposed to be widened are considered to be of low habitat value.

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Myotis macropus	Southern Myotis	V		139 records within 10km, last recorded 2021 (DPIE 2021a)	The Southern Myotis is mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water.	Moderate	Low – while one hollow-bearing tree is likely to require removal it is unlikely to be used by native fauna. In addition, the tree does not occur within 200 m of a suitable water body for Southern Myotis. . The bridges proposed to be widened are considered to be of low habitat value. However, as Southern Myotis is a species credit species, and survey timing was not in accordance with guidelines, the species is presumed present and is required to be offset.

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Petauroides volans	Greater Glider *Petauroides volans* (Kerr, 1792) population in the Mount Gibraltar Reserve area	EP	V	Species or species' habitat likely to occur within 10km (DoEE 2021a)	The Greater Glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1,200 m above sea level. It prefers taller montane, moist eucalypt forest with relatively old trees and abundant hollows.	Low	Nil
Petaurus australis	Yellow-bellied Glider	V		2 records within 10km, last recorded 2018 (DPIE 2021a)	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. The species occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Vegetation preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.	Low	Nil
Petaurus norfolcensis	Squirrel Glider	V		2 records within 10km, last recorded 2011 (DPIE 2021a)	The Squirrel Glider is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. The species inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	Low	Nil
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	1 record within 10km, last recorded 1996 (DPIE 2021a); Species or species' habitat may occur within 10km (DoEE 2021a)	In NSW, the Brush-tailed Rock-wallaby occurs from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. The species occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. It typically shelters or basks during the day in rock crevices, caves and overhangs and are most active at night when foraging.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Phascolarctos cinereus	Koala	V		262 records within 10km, last recorded 2021 (DPIE 2021a); no records within the vicinity of the Subject Land for 15 years. Species or species' habitat known to occur within 10km (DoEE 2021a)	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales, koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range. The species inhabit eucalypt woodlands and forests, and feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area would select preferred browse species.	Low	Nil
Pseudomys novaehollandiae	New Holland Mouse		V	7 records within 10km, last recorded 2020 (DPIE 2021a); Species or species' habitat may occur within 10km (DoEE 2021a)	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. The species is known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes	Low	Nil
Pteropus poliocephalus	Grey-headed Flying-fox	V		1165 records within 10km, last recorded 2021 (DPIE 2021a); Roosting known to occur within 10km (DoEE 2021a)	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. The species occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Moderate	Moderate - Most of the Eucalyptus species recorded in the Subject Land are considered a food source for this species, the removal of these trees is unlikely to have a significant impact on this species given

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
							the large amount of similar or better condition vegetation in the locality. No Flying-fox camps observed.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		41 records within 10km, last recorded 2019 (DPIE 2021a)	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. It forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Moderate	Low - no hollow-bearing trees proposed to be removed.
Scoteanax rueppellii	Greater Broad-nosed Bat	V		98 records within 10km, last recorded 2021 (DPIE 2021a)	The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW, it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m. The species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.	Moderate	Low - no hollow-bearing trees proposed to be removed.
Vespadelus troughtoni	Eastern Cave Bat	V		1 record within 10km, last recorded 2020 (DPIE 2021a)	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. The Eastern Cave Bat is a cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
					500 individuals. This species is occasionally found along cliff-lines in wet eucalypt forest and rainforest. They forage over a small area, but are capable of flying 500 m over clear paddocks.		
Flora							
Acacia bynoeana	Bynoe's Wattle	E	V	80 records within 10km, last recorded 2020 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Endemic to central eastern NSW, known a limited number of locations, often comprising populations of few plants. Grows mainly in heath/ dry sclerophyll forest on sandy soils, prefers open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches. Flowers September to March, and fruit matures in November.	Low	Nil
Acacia pubescens	Downy Wattle	V	V	619 records within 10km, last recorded 2020 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Occurs mainly in Bankstown-Fairfield-Rookwood and Pitt Town areas, with outliers at Barden Ridge, Oakdale and Mountain Lagoon. Grows on alluviums, shales and shale/sandstone intergrades. Soils characteristically gravely, often with ironstone. Occurs in open woodland and forest, in communities including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland. Flowers from August to October.	Moderate	Low - The species is conspicuous and no individuals were recorded during surveys.
Allocasuarina diminuta subsp. *mimica* - endangered population	*Allocasuarina diminuta* subsp. *mimica* population in the Sutherland Shire and Liverpool City local government areas	EP		1 record within 10km, last recorded 1987 (DPIE 2021a)	Occurs along sandstone ridges and upper hillsides in the region northwest from Heathcote, towards Menai and Holsworthy, in heathy woodlands, healthlands and low open woodland communities. It is restricted to the Local Government Areas listed in this instance (Sutherland and Liverpool).	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Allocasuarina glareicola		E	E	15 records within 10km, last recorded 2018 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Primarily found in Richmond district; although outlier populations exist in Voyager Point, Liverpool. Found in open castlereagh woodland on lateritic soil. The species is associated with the following species: Parramatta Red Gum, Red Ironbark, Narrow-leaved Apple, Hard-leaved Scribbly Gum and Melaleuca decora. Common associated understorey species include Prickly-leaved Paperbark, Finger Hakea, Needlebush, *Dillwynia tenuifolia*, *Micromyrtus minutiflora*, Swamp Wattle, *Acacia brownei*, *Themeda australis* and *Xanthorrhoea minor*.	Low	Nil
Asterolasia elegans		E	E	Species or species' habitat may occur within 10km (DoEE 2021a)	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs, may also occur in the western part of Gosford LGA with seven known populations. Occurs on Hawkesbury sandstone, commonly amongst rocky outcrops and boulders in sheltered forests on mid- to lower slopes and valleys.	Low	Nil
Caladenia tessellata	Thick Lip Spider Orchid	E	V	Species or species' habitat may occur within 10km (DoEE 2021a)	Occurs from Central Coast NSW to southern Victoria. Mostly coastal but extends inland to Braidwood in southern NSW. In NSW, this species grows in grassy dry sclerophyll woodland on clay loam or sandy soils, and less commonly in heathland on sandy loam soils. Flowers between September and November.	Low	Nil
Callistemon linearifolius	Netted Bottle Brush	V		29 records within 10km, last recorded 2016 (DPIE 2021a)	Recorded from the Georges to Hawkesbury Rivers in Sydney, and north to Nelson Bay. There is also a recent record from the northern Illawarra. Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers from spring to summer	Low	Nil
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Species or species' habitat may occur within 10km (DoEE 2021a)	Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with Large Tongue Orchid and the Bonnet Orchid. Soils include moist sands, moist to dry	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
					clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.		
Cynanchum elegans	White-flowered Wax Plant	E	E	1 record within 10km, last recorded 1993 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Occurs from Gerroa (Illawarra) to Brunswick Heads and west to Merriwa in the upper Hunter. Most common near Kempsey. Usually occurs on the edge of dry rainforest or littoral rainforest, but also occurs in Coastal Banksia Scrub, open forest and woodland, and Melaleuca scrub. Soil and geology types are not limiting. Flowering occurs between August and May, with the peak in November.	Low	Nil
Darwinia biflora		V	V	Species or species' habitat likely to occur within 10km (DoEE 2021a)	Known from north and north-western Sydney, in the Ryde, Baulkham Hills, Hornsby and Ku-Ring-Gai LGAs. Grows on the edges of weathered shale-capped ridges, at the intergrade with Hawkesbury Sandstone. Occurs in woodland, open forest and scrub/heath and is associated overstorey species include Scribbly Gum, Red Bloodwood and/or Scaly Bark.	Low	Nil
Dillwynia tenuifolia		V		1128 records within 10km, last recorded 2020 (DPIE 2021a); 92 records within 10km, last recorded 2019 (DPIE 2021a)	Occurs in western Sydney, predominately the Cumberland Plain as well as the Lower Blue Mountains and north to Yengo. Grows in scrubby/dry heath areas of Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays, and associated transitional communities including Castlereagh Scribbly Gum Woodland.	Moderate	Low - The species is conspicuous and no individuals were recorded during surveys.
Diuris aequalis	Buttercup Doubletail	E	V	1 record within 10km, last recorded 1905 (DPIE 2021a)	Occurs in higher areas of the tablelands between Braidwood and Kanangra-Boyd NP. Grows in forest, low open woodland with grassy understorey and secondary grassland on the higher parts of the Southern and Central Tablelands. Recorded from gravelly clay-loam soils, often on gentle slopes.	Low	Nil

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Epacris purpurascens var. *purpurascens*		V		5 records within 10km, last recorded 2015 (DPIE 2021a)	Occurs from Gosford in the north, Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Grows in a range of sclerophyll forest, scrubs and swamps, most of which have a strong shale soil influence.	Low	Nil
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	4 records within 10km, last recorded 2009 (DPIE 2021a)	Naturally occurs only in New England Tablelands from Nundle to north of Tenterfield. Widely planted as urban street tree well outside its range. Grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.	Low	Nil
Eucalyptus scoparia	Wallangarra White Gum	E	V	1 record within 10km, last recorded 2005 (DPIE 2021a)	In NSW, this species is known from only three locations near Tenterfield, including Bald Rock National Park. Found in open eucalypt forest, woodland and heaths on well-drained granite/rhyolite hilltops, slopes and rocky outcrops, typically at high altitudes. At lower elevations can occur in less rocky soils in damp situations	Low	Nil
Eucalyptus sp. Cattai		CE		Species or species' habitat likely to occur within 10km (DoEE 2021a)	Occurs in The Hills Local Government Area, with known populations occurring within the area bounded by Kellyville - Maraylya - Glenorie. Occurs as a rare emergent tree in scrub, heath and low woodland on sandy soils, usually as isolated individuals or occasionally in small, clustered groups. The sites at which it occurs are generally flat and on ridge tops. Associated soils are laterised clays overlying sandstone.	Low	Nil
Genoplesium baueri	Bauer's Midge Orchid	E	E	Species or species' habitat likely to occur within 10km (DoEE 2021a)	Occurs from Ulladulla to Port Stephens, with only 13 known extant populations. Grows in sparse sclerophyll forest and moss gardens over sandstone. Flowers from February to March.	Low	Nil
Grevillea juniperina subsp. *juniperina*	Juniper-leaved Grevillea	V		3335 records within 10km, last recorded 2020 (DPIE 2021a)	Occurs only within western Sydney in an area bounded by Blacktown, Erskine Park, Londonderry and Windsor. Outlier populations also at Kemps Creek and Pitt Town. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium, typically containing lateritic gravels. Occurs in association with Cumberland	Moderate	Low - The species is conspicuous and no individuals were

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
					Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forests.		recorded during surveys.
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	1253 records within 10km, last recorded 2021 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Occurs between Moss Vale/Bargo and lower Hunter Valley, with most occurrences in Appin, Wedderburn, Picton and Bargo. Broad habitat range including heath, shrubby woodland and open forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks.	Moderate	Low - The species is conspicuous and no individuals were recorded during surveys.
Gyrostemon thesioides		E		31 records within 10km, last recorded 1967 (DPIE 2021a)	Within NSW, has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. The most recent sighting was of a single male plant near the Colo River within Wollemi National Park. Despite searches, the species has not been recorded from the Nepean and Georges Rivers for 90 and 30 years, respectively. Grows on hillsides and riverbanks and may be restricted to fine sandy soils.	Low	Nil
Haloragis exalata subsp. *exalata*	Square Raspwort	V	V	Species or species' habitat may occur within 10km (DoEE 2021a)	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Requires protected and shaded damp situations in riparian habitats.	Low	Nil
Hibbertia fumana		CE		1071 records within 10km, last recorded 2020 (DPIE 2021a)	Currently only known from a single population at Moorebank but potentially elsewhere in greater Sydney. Generally found in areas of woodland with a more open understorey, in a long intergrade between Castlereagh Scribbly Gum Woodland and Castlereagh Ironbark Forest. Has the potential to occur in similar intergrade alluvial habitats rich in sands and laterite in other parts of western Sydney.	Low	Low - Moorebank is not in or near the Subject Land

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Hibbertia puberula		E		1255 records within 10km, last recorded 2020 (DPIE 2021a)	Distribution extending from Wollemi National Park south to Morton National Park and the south coast near Nowra. It favours low heath on sandy soils or rarely in clay, with or without rocks underneath. Habitats are typically dry sclerophyll woodland communities, although heaths are also occupied. Flowers from October to January	Low	Nil
Hibbertia sp. Bankstown		CE	CE	217 records within 10km, last recorded 2019 (DPIE 2021a)	Listed under EPBC Act as *Hibbertia puberula* subsp. *glabrescens.* Known only from Bankstown airport. Habitat is very heavily modified, lacks canopy species and is currently a low grass/shrub association with many pasture grasses and other introduced herbaceous weeds. Soil at the site is a sandy (Tertiary) alluvium with a high silt content and is associated with Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion.	Low	Low - The Bankstown airport is not in or near the Subject Land
Isotoma fluviatilis subsp. *fluviatilis*			X	10 records within 10km, last recorded 2008 (DPIE 2021a)	Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Previous sightings are all from western Sydney, at Homebush and at Agnes Banks. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone. May be an early successional species that benefits from some disturbance. Possibly out competed when overgrown by some species such as *Cyndon dactylon*.	Low	Nil
Lasiopetalum joyceae		V	V	1 record within 10km, last recorded 1955 (DPIE 2021a); Species or species' habitat may occur within 10km (DoEE 2021a)	Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River. Grows on heath on sandstone.	Low	Nil

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Leucopogon exolasius	Woronora Beard-heath	V	V	5 records within 10km, last recorded 2019 (DPIE 2021a); Species or species' habitat likely to occur within 10km (DoEE 2021a)	Occurs along the upper Georges River and in Heathcote NP, Royal NP and is also known from the Blue Mountains along the Grose River. Grows in woodland on sandstone and prefers rocky hillsides along creek banks up to 100 m altitude. Associated species include Sydney Peppermint and Silvertop Ash and Graceful Bush-pea, Flaky-barked Tea-tree and *Dillwynia retorta.*	Low	Nil
Leucopogon fletcheri subsp. *fletcheri*		E		4 records within 10km, last recorded 2015 (DPIE 2021a)	Restricted to northwest Sydney between St Albans and Annangrove, within the Hawkesbury, The Hills and Blue Mountains LGAs. Occurs in dry eucalypt woodland or shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs. Flowers August to September.	Low	Nil
Macadamia integrifolia	Macadamia Nut		V	6 records within 10km, last recorded 2020 (DPIE 2021a)	The Macadamia Nut is found in remnant rainforest in northern NSW and south-east Queensland, preferring partially open areas such as rainforest edges. While specimens have been collected from the North Coast of NSW, this species is not known to occur naturally in NSW.	Low	Nil
Marsdenia viridiflora subsp. *viridiflora* - endangered population	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	EP		104 records within 10km, last recorded 2020 (DPIE 2021a)	Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range. A climber that grows in vine thickets and open shale woodland.	Moderate	Low - Potential habitat in better condition habitat, however the species is conspicuous and no individuals were recorded during the targeted surveys.

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Melaleuca deanei	Deane's Paperbark	V	V	2 records within 10km, last recorded 2011 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Occurs from Nowra to St Albans and west to the Blue Mountains, with most records in Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas. Mostly grows on broad flat ridgetops, dry ridges and slopes and strongly associated with low nutrient sandy loam soils, sometimes with ironstone. Grows in heath- open forest, often in sandstone ridgetop woodland communities.	Low	Nil
Micromyrtus minutiflora		E	V	25 records within 10km, last recorded 2020 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Occurs in Richmond and Penrith areas in western Sydney. Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments.	Low	Nil
Persicaria elatior	Tall Knotweed	V	V	Species or species' habitat likely to occur within 10km (DoEE 2021a)	Tall Knotweed has been recorded in south-eastern NSW from Ulladulla to the Victorian border. In northern NSW it is known from Raymond Terrace and the Grafton area. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Low	Nil
Persoonia hirsuta	Hairy Geebung	E	E	4 records within 10km, last recorded 2020 (DPIE 2021a); Species or species' habitat likely to occur within 10km (DoEE 2021a)	Occurs within the Blue Mountains, Southern Highlands and Sydney coastal regions from Hilltop to Glen Davis and Royal NP to Gosford. Population within the Hills Shire particularly important due to high density of plants. Grows on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone up to 600 m above sea level.	Low	Nil
Persoonia nutans	Nodding Geebung	E	E	537 records within 10km, last recorded 2021 (DPIE 2021a); Species or species'	Occurs from Richmond to Macquarie Fields on the Cumberland Plain. Grows only on aeolian and alluvial sediments in sclerophyll forest and	Low	Low - The species is conspicuous and no

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
				habitat known to occur within 10km (DoEE 2021a)	woodland vegetation communities. Largest populations occur in Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland.		individuals were recorded during surveys.
Pilularia novae-hollandiae	Austral Pillwort	E		1 record within 10km, last recorded 1966 (DPIE 2021a)	Only known extant populations in NSW are at Lake Cowal and Oolambeyan NP, but the species is obscure and may be overlooked elsewhere. Grows in shallow swamps and waterways, often among grasses and sedges. Previous records in Albury-Urana were from table drains beside roads, whereas the only record in the ACT was from a subalpine grassy plain.	Low	Low
Pimelea curviflora var. *curviflora*		V	V	3 records within 10km, last recorded 2018 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Confined to area between north Sydney in the south and Maroota in the north-west. Grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Often grows amongst dense grasses and sedges. Flowers October to May.	Low	Nil
Pimelea spicata	Spiked Rice-flower	E	E	329 records within 10km, last recorded 2019 (DPIE 2021a); Species or species' habitat known to occur within 10km (DoEE 2021a)	Disjunct populations within the Cumberland Plain ((Marayong and Prospect Reservoir south to Narellan and Douglas Park) and Illawarra (Landsdowne to Shellharbour to northern Kiama). In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. On the Cumberland Plain sites it is associated with Grey Box communities. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland.	High	Moderate - limited potential habitat in the Subject Land and no individuals were recorded during targeted surveys, however this species is cryptic.

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
Pomaderris brunnea	Brown Pomaderris	E	V	7 records within 10km, last recorded 2019 (DPIE 2021a); Species or species' habitat likely to occur within 10km (DoEE 2021a)	Brown Pomaderris is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Low	Nil
Pterostylis gibbosa	Illawarra Greenhood	E	E	Species or species' habitat may occur within 10km (DoEE 2021a)	Known from a small number of populations in the Illawarra, Shoalhaven and Hunter regions. Grows in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum, Woollybutt and Melaleuca decora. Near Nowra, the species grows in an open forest of Spotted Gum, Forest Red Gum and Grey Ironbark. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark, Forest Red Gum and Black Cypress Pine.	Low	Nil
Pterostylis nigricans	Dark Greenhood	V		1 record within 10km, last recorded 1967 (DPIE 2021a)	Occurs in north-east NSW north from Evans Head, and in Queensland. Grows in coastal heathland with *Banksia ericifolia*, and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils.	Low	Nil
Pterostylis saxicola	Sydney Plains Greenhood	E	E	16 records within 10km, last recorded 2019 (DPIE 2021a); Species or species' habitat likely to occur within 10km (DoEE 2021a)	Occurs in western Sydney between Picton and Freemans Reach. Grows in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. Associated vegetation above these rock shelves is sclerophyll forest or woodland on shale or shale/sandstone transition soils.	Low	Nil
Pultenaea parviflora		E	V	709 records within 10km, last recorded 2021 (DPIE 2021a); Species or species'	Occurs on the Cumberland Plain, with core distribution from Windsor to Penrith and east to Dean Park, and outliers in Kemps Creek and Wilberforce. Grows in dry sclerophyll woodlands, forest or in grasslands on Wianamatta Shale, laterite or Tertiary alluvium, on	Moderate	Low - The species is conspicuous and no

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
				habitat known to occur within 10km (DoEE 2021a)	infertile sandy to clay soils. Associated communities include Castlereagh Ironbark Forest, Shale Gravel transition Forest and intergrade with Castlereagh Scribbly Gum Woodland.		individuals were recorded during surveys.
Pultenaea pedunculata	Matted Bush-pea	E		14 records within 10km, last recorded 2008 (DPIE 2021a)	In NSW, there are three disjunct populations in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. NSW populations typically among woodland vegetation but also found on road batters and coastal cliffs. In Windellama it is largely confined to loamy soils in dry gullies.	Moderate	Low - The species is conspicuous and no individuals were recorded during surveys.
Rhizanthella slateri	Eastern Australian Underground Orchid	V	E	Species or species' habitat may occur within 10km (DoEE 2021a)	Currently known only from 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. The species grows in eucalypt forest but no informative assessment of the likely preferred habitat for the species is available. Flowers September and November.	Low	Nil
Rhodamnia rubescens	Scrub Turpentine	CE	CE	Species or species' habitat likely to occur within 10km (DoEE 2021a)	Occurs in coastal districts north from Batemans Bay in NSW, to areas inland of Bundaberg in Queensland. Populations of R. rubescens typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000 -1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	Low	Nil
Rhodomyrtus psidioides	Native Guava	CE	CE	Species or species' habitat may occur within 10km (DoEE 2021a)	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. This species is characterised being extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	Low	Nil
Syzygium paniculatum	Magenta Lilly Pilly	E	V	10 records within 10km, last recorded 2020 (DPIE 2021a); Species or species' habitat likely to occur	Occurs in narrow coastal strip from Upper Lansdowne to Conjola State Forest. Grows in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas, often in remnant littoral or gallery rainforests.	Low	Nil

Scientific name	Common name	BC Act	EPBC Act	Source	Habitat	Likelihood of occurrence	Likelihood of impact
				within 10km (DoEE 2021a)			
Thesium australe	Austral Toadflax	V	V	Species or species' habitat may occur within 10km (DoEE 2021a)	Found in small, scattered populations along the east coast, northern and southern tablelands. Occurs in grassland or grassy woodland, and is often found in association with Kangaroo Grass.	Low	Nil
Wahlenbergia multicaulis - endangered population	Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	EP		2 records within 10km, last recorded 2015 (DPIE 2021a)	There are 13 known sites, two of which are in northern Sydney (Thornleigh and Mt Ku-Ring-Gai) with the remainder in western Sydney (Rookwood, Chullora, Bass Hill, Bankstown, Georges Hall, Campsie, South Granville and Greenacre). Found in disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and the edges of watercourses and wetlands. Typically occurs in damp, disturbed sites (with natural or human disturbance of various forms), typically amongst other herbs rather than in the open.	Low	Nil - The area of impact does not occur in the endangered populations extent.
Wilsonia backhousei	Narrow-leafed Wilsonia	V		1 record within 10km, last recorded 2015 (DPIE 2021a)	Is found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney (Nelson's Lake, Potato Point, Sussex Inlet, Wowly Gully, Parramatta River at Ermington, Clovelly, Voyager Point, Wollongong and Royal National Park). This species grows on the margins of salt marshes and lakes.	Low	Nil
Zieria involucrata		E	V	Species or species' habitat may occur within 10km (DoEE 2021a)	*Zieria involucrata* is found within The Hills, Hawkesbury, Hornsby and Blue Mountains local government areas. It occurs primarily on Hawkesbury sandstone but has also been found on Narrabeen Group sandstone and Quaternary alluvium. It has been recorded in sheltered forests on mid-lower slopes and valleys.	Low	Nil

Notes: V – Vulnerable, E – Endangered, CE – Critically Endangered, EP – Endangered Population, C - China – Australia Migratory Agreement, J - Japan – Australia Migratory Agreement, K - Republic of Korea – Australia Migratory Agreement, CMS - Convention on the Conservation of Migratory Species of Wild Animals (also known as the Bonn Convention), X – Presumed Extinct

Annex 3. Plant community descriptions

PCT 724 - Broad-leaved Ironbark - Grey Box - *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	
Vegetation formation	Dry Sclerophyll Forests (Shrub/grass sub-formation)
Vegetation class	Cumberland Dry Sclerophyll Forests
Conservation status	Aligns to Shale Gravel Transition Forest in the Sydney Basin Bioregion listed as a CEEC under the BC Act and EPBC Act.
% cleared	75
Characteristics of the PCT	DPIE (2021d) characterises PCT 724 as being associated with shale-influenced sandy soils that support a component of ironstone gravels. The combination of the parent material produces a soil of relatively low fertility compared to the deeper Wianamatta shale soils of the Cumberland Plain. Together with a relatively low mean annual rainfall (800-900 millimetres) these conditions produce an open eucalypt forest with an understorey that may vary between dense shrubs and a low sparse shrub cover with an abundant ground cover of grasses. Typically the canopy includes *Eucalyptus fibrosa* (Broad-leaved Ironbark) along with a wide variety of other eucalypts depending on location. The taller paperbark *Melaleuca decora* may be prominent above a lower open shrub layer of *Bursaria spinosa* (Native Blackthorn) and *Daviesia ulicifolia* (Gorse Bitter Pea). The ground cover is a mix of grasses, sedges and herbs.
Extent in the assessment area (ha)	0.11 ha
Condition	The condition of this vegetation zone is moderate. There were no mature canopy species within this vegetation condition, however there was evidence of regeneration. The midstorey ranged from mature to scattered and regenerating where present, comprising *Bursaria spinosa* and *Melaleuca decora*. The groundcover was sparse in this vegetation zone however native species were dominant in the groundcover.
Plots completed	1 (plot 13)
Composition condition score	24.8
Structure condition score	44.5
Function condition score	38.9
Vegetation integrity score	35

PCT 724 - Broad-leaved Ironbark - Grey Box - *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	
Photo	 Photo taken at Plot 13 (moderate condition)
Justification	No canopy species diagnostic of PCT 724 were recorded in this vegetation zone. As mentioned above, *Melaleuca decora* and *Bursaria spinosa* are diagnostic species of PCT 724 and was observed throughout this vegetation zone. Plots sampled confirm the presence of groundcover species diagnostic of PCT 724, including *Microlaena stipoides* (Weeping Grass), *Themeda australis* (Kangaroo Grass) and *Cheilanthes sieberi* (Rock Fern). A full species list for all surveyed plots is found in Annex 4 and the extent of vegetation within the Subject Land is shown in Figure 3. The native vegetation and other diagnostic features within these areas conformed with NSW State and the Commonwealth description for the TEC (as explained below).
How it meets the BC Act Determination	PCT 724 in moderate condition meets the BC Act listing of the CEEC Shale Gravel Transition Forest based on the following characteristics (DPIE 2021g): • The vegetation zone was characterised by the presence of *Melaleuca decora*. • A shrub layer with *Bursaria spinosa* was present. • Characteristic species were present as identified in the Scientific Determination • Occurs within the known range of the TEC.
How it meets the EPBC Act Determination	PCT 724 in a moderate condition meets the moderate condition class for the EPBC Act listing of the CEEC Shale Gravel Transition Forest based on the following characteristics (DEWHA 2010): • The patch size was greater than 0.5 ha • Native species cover in the understorey was more than 50%. All 0.11 ha aligns with the EPBC Act listing of the CEEC CPW.

PCT 725 - Broad-leaved Ironbark - *Melaleuca decora* shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	
Vegetation formation	Dry Sclerophyll Forests (Shrub/grass sub-formation)
Vegetation class	Cumberland Dry Sclerophyll Forests
Conservation status	Aligns to Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion listed as an EEC under the BC Act and a CEEC EPBC Act.
% cleared	95
Characteristics of the PCT	DPIE (2021d) characterises PCT 725 as a moderately tall open eucalypt forest or woodland to a low dense thicket of paperbarks with low emergent eucalypts. The latter is prevalent across the catchment of the Cooks River and is recognised in other classifications as Cooks River Clay Plain Scrub. These scrubs may arise from human-induced changes to the original forest structure. *Eucalyptus fibrosa* (Broad-leaved Ironbark) is the most commonly recorded eucalypt although at some sites it may be absent. *Eucalyptus longifolia* (Woollybutt) is regularly associated although sites often have a diverse canopy composition which reflects subtle grades between substrates sourced from Tertiary sand, sandstone bedrock, shale and ironstone gravels. For this reason there are localised unusual occurrences of *Eucalyptus sclerophylla* (Hard-leaved Scribbly Gum), *Angophora costata* (Smooth-barked Apple) and *Angophora bakeri* (Narrow-leaved Apple), species more typically associated with siliceous soils of sand deposits and the sandstone plateau. A prominent small tree layer of *Melaleuca decora* features above a dense cover of shrubs that include *Melaleuca nodosa*, *Bursaria spinosa* (Native Blackthorn) and *Lissanthe strigosa* (Peach Heath). The ground layer is a sparse cover of grasses and forbs. These may be very depauperate in locations where dense shrub layers exclude light and suppress plant growth.
Extent in the assessment area (ha)	0.08 ha
Condition	The condition of this vegetation zone is moderate. There were no mature canopy species within this vegetation condition, however there was evidence of regeneration. The midstorey was scattered and regenerating, but where present comprises *Kunzea ambigua* (Tick Bush) and *Bursaria spinosa*. Native ground cover was present in this zone, with patches of *Microlaena stipoides* (Weeping Grass) recorded in the single plot sampled. Weed cover was high throughout the zone, and was typically dominated by *Eragrostis curvula* (African Lovegrass) in the understorey.
Plots completed	1 (plot 11)
Composition condition score	17.4
Structure condition score	31.1
Function condition score	30.3

PCT 725 - Broad-leaved Ironbark - *Melaleuca decora* shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	
Vegetation integrity score	25.4
Photo	 Photo taken at plot 11 (moderate condition)
Justification	The vegetation in the vicinity of PCT 725 in the Subject Land has been mapped as PCT 725 and shows the diagnostic species of it, with *Melaleuca decora* dominating surrounding vegetation. A large portion of the plot comprised the diagnostic species *Microlaena stipoides*, *Cheilanthes sieberi* (Rock Fern) was also recorded in the plot sampled. A full species list for all surveyed plots is found in Annex 4 and the extent of vegetation within the Subject Land is shown in Figure 3. The native vegetation and other diagnostic features within these areas conformed with NSW State description for the TEC (as explained below).
How it meets the BC Act Determination	PCT 725 in a moderate condition meets the BC Act listing of the CRCIF EEC based on the following characteristics (DPIE 2021g): • The vegetation zone was characterised by the presence *Melaleuca decora*. • The understorey was characterised by a high cover of native grass and other diagnostic species. • Characteristic species were present as identified in the Scientific Determination • The vegetation occurs on shale soils on Wianamatta Shale. • Occurs within the known range of the TEC.
How it meets the EPBC Act Determination	Whilst more than 30% of the perennial understorey cover comprises native species, PCT 725 in a moderate condition still does not meet the EPBC Act listing of the CRCIF CEEC given (DAWE 2010): • The patch size was smaller than 0.5 ha. • The patch was not contiguous with a native vegetation remnant. • No mature trees or hollow bearing trees were recorded in the patch.

PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	
Vegetation formation	Forested Wetlands
Vegetation class	Coastal Floodplain Wetlands
Conservation status	Aligns to River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions listed as an EEC under the BC Act and a CEEC under the EPBC Act.
% cleared	93
Characteristics of the PCT	DPIE (2021d) characterises PCT 835 as an open eucalypt forest situated on broad alluvial flats of the Hawkesbury and Nepean river systems. It also forms narrower ribbons alongside streams and creeks that drain the Cumberland Plain. Typically the canopy includes one of either *Angophora floribunda* (Rough-barked Apple) or *Angophora subvelutina* (Broad-leaved Apple) and one or both of *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus amplifolia* (Cabbage Gum). On the Georges River near Bankstown and on Cabramatta and Prospect creeks *Eucalyptus baueriana* (Blue Box) is commonly encountered.
Extent in the assessment area (ha)	0.9 ha
Condition	The condition of this vegetation zone is poor and low. There were no mature canopy species within this vegetation condition, however there was evidence of regeneration. The midstorey was very sparse. Native ground cover was present in the zone, however it was typically suppressed by exotic species. Weed cover was high throughout the zone, and was typically dominated by *Chloris gayana* (Rhodes Grass) in the understorey.
Plots completed	4 (plots 3, 4, and 8)
Composition condition score	Poor – 1.5 Low – 15.6
Structure condition score	Poor – 2.1 Low – 17.6
Function condition score	Poor – 2.7 Low – 59.6
Vegetation integrity score	Poor – 2.1 Low – 25.4

PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	
Photo	 Photo taken at plot 4 (poor condition)  Photo taken at plot 8 (low condition)
Justification	As mentioned above, *Eucalyptus tereticornis* is a diagnostic canopy species of PCT 835. *Eucalyptus baueriana* was also recorded in this vegetation zone (adjacent to Cabramatta Creek). Other diagnostic characteristics that were recorded in this zone included *Melaleuca linariifolia* (Flax-leaved Paperbark) and *Melaleuca styphelioides* (Prickly-leaved Tea Tree) in low

PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	
	densities in the midstorey. Additionally two characteristic species were recorded in the understorey. This vegetation zone occurs within the known extent of PCT 835, and all of PCT 835 in the Subject Land occurs in close proximity to a waterway. A full species list for all surveyed plots is found in Annex 4 and the extent of vegetation within the Subject Land is shown in Figure 3. The native vegetation and other diagnostic features within these areas conformed with NSW State description for the TEC (as explained below).
How it meets the BC Act Determination	PCT 835 in a low condition meets the BC Act listing of the EEC RFEF based on the following characteristics (DPIE 2021g): • The vegetation zone was characterised by the presence of *Eucalyptus tereticornis* and *Eucalyptus baueriana*. • The shrub layer was sparse, but where present included characteristic Melaleuca species. • Where present the understorey had some characteristic native species. • Characteristic species were present as identified in the Scientific Determination • Occurs within the known range of the TEC.
How it meets the EPBC Act Determination	PCT 835 in a poor, low and moderate condition, does not meet the EPBC Act listing for the CEEC RFEF based on the following characteristics: • Exotic species cover was too high (all plots); no more than 10% of its total perennial understorey vegetation cover was comprised of native species (plot 4) • No canopy trees were present (plot 4) • Patch size was too small (plot 3).

PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	
Vegetation formation	Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands
Conservation status	Aligns to Cumberland Plain Woodland in the Sydney Basin Bioregion listed as a CEEC under the BC Act and EPBC Act.
% cleared	93
Characteristics of the PCT	DPIE (2021d) characterises PCT 849 as having a gentle topography associated with the shale plains of western Sydney and carries an open grassy woodland dominated by *Eucalyptus moluccana* (Grey Box), *Eucalyptus tereticornis* (Forest Red Gum) and Ironbark species such as *Eucalyptus crebra* (Small-leaved Ironbark) or *Eucalyptus fibrosa* (Broad-leaved Ironbark). It is typified by a sparse to moderate cover of shrubs and a high cover of grasses and forbs. Tozer et al. (2010) define the primary habitat for the community as occurring at elevations less than 150 meters above sea level with some sites occurring at higher elevations where the landscape remains gently inclined.
Extent in the assessment area (ha)	2.95 ha
Condition	The condition of this vegetation zone is poor and low. There were no mature canopy species within this vegetation condition, however there was evidence of regeneration. The midstorey was scattered and regenerating, but where present comprised *Bursaria spinosa* (Native Blackthorn). Native ground cover was present in the zone, however it was typically suppressed by exotic species. Weed cover was high throughout the zone, and was typically dominated by *Eragrostis curvula* (African Lovegrass) in the understorey and *Olea europaea* subsp. *cuspidata* (African Olive) in the midstorey.
Plots completed	5 (plots 1, 2, 10, 17 and 18)[13]
Composition condition score	Poor – 1.1 Low – 8.2
Structure condition score	Poor – 40.5 Low – 26.1
Function condition score	Poor – 15.2 Low – 33.6

[13] It is noted that, due to late design changes, plots 1, 2, 17 and 18 are no longer within the Subject Land. However, the values recorded from these plots have been used in the BAM-C to provide the values here and to determine the offset requirement for the proposed modification.

PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	
Vegetation integrity score	Poor – 8.7 Low – 19.3
Photo	 Photo taken at plot 10 (low condition) 

PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	
	Photo taken via RDP at the construction compound at Blackbird Close (poor condition)[14]
Justification	As mentioned above, diagnostic canopy species of PCT 849 included *Eucalyptus tereticornis* and *Eucalyptus moluccana*, both of which were observed throughout this vegetation zone. The majority of the observed trees were around 30 diametre at breast height (dbh), however, some juvenile (<5 dbh) trees were also observed and recorded in this vegetation zone. The midstorey was predominantly sparse, and where present comprised *Bursaria spinosa* which is a diagnostic species of Cumberland Plain Woodland. Plots sampled confirm the presence of groundcover species diagnostic of PCT 849, including *Microlaena stipoides* (Weeping Grass) and *Themeda australis* (Kangaroo Grass). Forb species included *Dichondra repens* (Kidney Weed), *Brunoniella australis* (Blue Trumpet), *Wahlenbergia gracilis* (Australian Bluebell) and *Pullenia gunnii* (Slender Tick Trefoil), the fern *Cheilanthes sieberi* subsp. *sieberi* (Rock Fern) was recorded throughout the vegetation. A full species list for all surveyed plots is found in Anne A and the extent of vegetation within the Subject Land is shown in Figure 3. The native vegetation and other diagnostic features within these areas conformed with NSW State description for the TEC (as explained below).
How it meets the BC Act Determination	PCT 849 in poor and low condition meets the BC Act listing of the CEEC Cumberland Plain Woodland based on the following characteristics (DPIE 2021g): • The vegetation zone was characterised by the presence of *Eucalyptus tereticornis* (Red Gum) and *E. moluccana* (Grey Gum). • A shrub layer dominated by *Bursaria spinosa* (Blackthorn) was present. • The understorey was characterised by a moderate abundance of native grasses and a high diversity of forbs. • Characteristic species were present as identified in the Scientific Determination • Occurs within the known range of the TEC.
How it meets the EPBC Act Determination	PCT 849 in a low condition meets the EPBC Act listing of the CEEC CPW due to the following characteristics (DAWE 2010): • Of the perennial understorey vegetative cover present, more than 30% was made up of native species. • Each patch is less than 5 ha in size. PCT 849 does not meet the EPBC Act listing of the CEEC CPW due to the following characteristics (DAWE 2010): • Canopy did meet the minimum projective foliage cover of 10%.

[14] This photo represents the PCT 849 (poor) vegetation zone, however, no plot for PCT 849 (poor) exists within the Subject Land.

PCT 850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	
Vegetation formation	Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands
Conservation status	Aligns to Cumberland Plain Woodland in the Sydney Basin Bioregion listed as a CEEC under the BC Act and EPBC Act.
% cleared	88
Characteristics of the PCT	DPIE (2021d) characterises PCT 850 as an open woodland of *Eucalyptus moluccana* (Grey Box), *Eucalyptus tereticornis* (Forest Red Gum) with *Eucalyptus crebra* (Small-leaved Ironbark). *Acacia implexa* (Hickory Wattle) occurs amongst the small tree layer, often amongst regrowth stands. The latter species is one of the more distinctive floristic attributes that helps distinguish between PCT 849 and PCT 850. The woodland is characterised by an open shrub layer and a grassy ground cover. The community occupies higher elevations associated with the hills and rises south from Prospect. It is most extensive in Campbelltown and Liverpool local government areas. It extends beyond the Subject Land west across the Razorback range and once dominated the southern half of the Cumberland Plain.
Extent in the assessment area (ha)	0.83 ha
Condition	The condition of this vegetation zone is low. There were no mature canopy species within this vegetation condition, however there was evidence of regeneration. The midstorey was scattered and regenerating, but where present, comprised *Bursaria spinosa* (Native Blackthorn) and *Acacia implexa* (Hickory Wattle). Native ground cover was present in the zone, however it was typically suppressed by exotic species. Weed cover was high throughout the zone, and was typically dominated by *Cenchrus clandestinus* (Kikuyu) in the understorey.
Plots completed	1 (plots 5, 19 and 20)
Composition condition score	Low – 21.9 Moderate – 42
Structure condition score	Low – 23.6 Moderate – 39
Function condition score	Low – 37.6 Moderate – 43.8
Vegetation integrity score	Low – 26.9 Moderate – 41.5

PCT 850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	
Photo	 Photo taken at Plot 5 (low condition)  Photo taken at Plot 19 (moderate condition)
Justification	As mentioned above, diagnostic canopy species of PCT 850 included *Eucalyptus tereticornis* and *Eucalyptus moluccana* (which whilst not recorded in the plot, was in the surrounding area), both of which were observed throughout this vegetation zone. The majority of the observed trees were around 30 dbh, however, juvenile (<5 dbh) trees were also observed and recorded in this vegetation zone. *Acacia implexa* which is a distinguishing species of PCT 850

PCT 850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	
	was recorded in the plot. The midstorey had a very sparse cover of *Bursaria spinosa* (Blackthorn) which is a diagnostic species of Cumberland Plain Woodland. A full species list for all surveyed plots is found in Annex 4. Floristic plot data and the extent of vegetation within the Subject Land is shown in Figure 3. The native vegetation and other diagnostic features within these areas conformed with NSW State description for the TEC (as explained below).
How it meets the BC Act Determination	PCT 850 in a low condition meets the BC Act listing of the CEEC Cumberland Plain Woodland based on the following characteristics (DPIE 2021g): • The vegetation zone was characterised by the presence of *Eucalyptus tereticornis* and *Eucalyptus moluccana* in the canopy layer and *Acacia implexa* in the sub canopy. • A shrub layer with *Bursaria spinosa* was present. • Characteristic species were present as identified in the Scientific Determination • Occurs within the known range of the TEC.
How it meets the EPBC Act Determination	Around 0.48 ha of PCT 850 in a low condition does not meet the EPBC Act listing of the CEEC CPW due to the following (DAWE 2010): • Of the perennial understorey vegetative cover present, less than 50% was made up of native species. • Each patch was less than 5 ha in size. • Of the perennial understorey vegetative cover present, less than 30% was made up of native species. 0.35 ha aligns with the EPBC Act listing of the CEEC CPW.

PCT 1737 - Typha rushland	
Vegetation formation	Freshwater Wetlands
Vegetation class	Coastal Freshwater Lagoons
Conservation status	Aligns to Freshwater wetlands on coastal floodplains of the NSW North Coast Sydney Basin and South East Corner bioregions listed as an EEC under the BC Act.
% cleared	70
Characteristics of the PCT	DPIE (2021d) characterises PCT 1737 as tall rushlands dominated by Typha and Melaleuca may occur as isolated emergent. This community typically occurs at the margins of standing fresh water along the coast from about Woy Woy to Hexham. There is one isolated occurrence in the Goulburn River NP. Substrates are generally sands and muds. Coastal occurrences have elevations of less than 50 m the western occurrence has an elevation of 367 m.
Extent in the assessment area (ha)	0.1 ha
Condition	The condition of this vegetation zone is moderate, the dominant species recorded was *Typha orientalis* (Broadleaf Cumbungi), however the weed cover was moderate to high throughout the zone.
Plots completed	2 (plots 9 and 12)
Composition condition score	Moderate – 14.4 High – 39.6
Structure condition score	Moderate – 82.6 High – 93.5
Function condition score	Moderate – 0 High – 0
Vegetation integrity score	Moderate – 34.5 High – 60.8

PCT 1737 - Typha rushland	
Photo	 Photo taken at plot 12 (moderate condition)  Photo taken at plot 9 (high condition)
Justification	As mentioned above, dominance of the diagnostic species *Typha orientalis* is characteristic of PCT 1737. Additionally, *Melaleuca styphelioides* (Prickly-leaved Paperbark) was recorded in one of the plots sampled and the diagnostic species *Cynodon dactylon* (Couch) was also recorded in this vegetation zone. The location of this vegetation aligns with the known occurrence of PCT 1737.

PCT 1737 - Typha rushland	
	A full species list for all surveyed plots is found in Anne4 and the extent of vegetation within the Subject Land is shown in Figure 3. The native vegetation and other diagnostic features within these areas conformed with NSW State description for the TEC (as explained below).
How it meets the BC Act Determination	PCT 1737 in a moderate condition meets the BC Act listing of the EEC Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions based on the following characteristics (DPIE 2021g): • The vegetation zone was characterised by the dominance of *Typha orientalis*. • Characteristic species were present as identified in the Scientific Determination • Occurs within the known range of the TEC.

PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley.	
Vegetation formation	Forested Wetlands
Vegetation class	Coastal Floodplain Wetlands
Conservation status	Aligns to Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (SOFF) listed as an EEC under the BC Act and EPBC Act.
% cleared	60
Characteristics of the PCT	DPIE (2021d) characterises PCT 1800 as being found on the riverflats of the Cumberland Plain in western Sydney and in the Hunter Valley. The distinguishing feature is the prominent stands of Swamp Oak (*Casuarina glauca*) found along or near streams. Often these are relatively young trees, swarming amongst a mix of old and young eucalypts such as *Angophora floribunda* (Rough-barked Apple), *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box). This community features an open grassy and herbaceous understorey, as is typical of river-flat forests.
Extent in the assessment area (ha)	3.29 ha
Condition	The condition of this vegetation zone was low. There were no mature canopy species within this vegetation condition, however there was evidence of regeneration. The midstorey was very sparse, but where present comprised *Callistemon citrinus* (Crimson Bottlebrush), *Kunzea ambigua* (Tick Bush), *Melaleuca nodosa* (Prickly-leaved Paperbark) and *Melaleuca styphelioides* (Prickly-leaved Tea Tree). Native ground cover was present in the zone, however it was sparse and typically suppressed by exotic species. Weed cover was high throughout the zone, and was typically dominated by grass species such as *Chloris gayana* (Rhodes Grass) and *Ehrharta erecta* (Panic Veldtgrass) and the spreading forb *Tradescantia fluminensis* (Trad).
Plots completed	6 (plots 6, 7, 14, 15, 16 and 21)
Composition condition score	Poor – 0.7 Low – 22 Moderate –38.3
Structure condition score	Poor – 0 Low – 19.8 Moderate – 22.7
Function condition score	Poor – 15 Low – 34.6 Moderate – 41.1

PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley.	
Vegetation integrity score	Poor – 0.1 Low – 24.7 Moderate – 32.9
Photo	 Photo taken at plot 16 (poor condition)  Photo taken at plot 7 (low condition)

PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley.	
	 Photo taken at plot 14 (moderate condition)
Justification	As mentioned above, a canopy dominated by *Casuarina glauca* is a characteristic of PCT 1800. This species was recorded throughout this zone. Additionally, diagnostic canopy species *Eucalyptus tereticornis* was recorded in one of the plots sampled. The midstorey was mostly absent to sparse, the two diagnostic species, *Melaleuca nodosa* and *Melaleuca styphelioides* were recorded in this vegetation zone. The ground layer was sparse, and predominantly weed species were present, however two species diagnostic of PCT 1800 were recorded, *Commelina cyanea* and *Microlaena stipoides*. A full species list for all surveyed plots is found in Annex 4 and the extent of vegetation within the Subject Land is shown in Figure 3. The native vegetation and other diagnostic features within these areas conformed with NSW State description for the TEC (as explained below).
How it meets the BC Act Determination	PCT 1800 in a low condition meets the BC Act listing of the EEC SOFF based on the following characteristics (DPIE 2021g): • The vegetation zone was characterised by the presence of *Casuarina glauca* and *Eucalyptus tereticornis*. • Characteristic species were present as identified in the Scientific Determination • Occurs within the known range of the TEC.
How it meets the EPBC Act Determination	PCT 1800 in a poor, low and moderate condition does not meet the EPBC Act listing of the EEC SOFF due to the following: • None of the SOFF in the Subject Land occurred as large or medium sized patches • Non-native species comprised the majority (more than 80%) of the total understorey vegetation cover • Swamp-oak did not dominate the canopy in some areas.

Annex 4. Floristic plot data

Species	6450_01		6450_02		6450_03		6450_04		6450_05		6450_06		6450_07		6450_08		6450_09		6450_10	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Acacia decurrens			5	15																
Acacia implexa									0.5	2										
Acacia irrorata																				
Acacia linearifolia																				
Acacia linifolia															0.1	1				
Acacia mearnsii																				
Acacia parramattensis																				
*Acetosella vulgaris**	0.1	2					0.1	2												
Acmena smithii					0.5	1														
*Alternanthera philoxeroides**																				
*Anagallis arvensis**	0.1	10	0.1	10			0.1	10	0.1	10	0.1	1								
Angophora floribunda																				
*Anredera cordifolia**					20	50														
*Araujia sericifera**															0.1	10				
*Araujia sericiflora**													1	50					0.5	10
*Asparagus asparagoides**	0.1	1	0.1	1									0.1	1						
Asperula conferta																				
Austrostipa spp.																				
Austrostipa verticillata																				
*Avena barbata**																			0.5	20
*Bidens pilosa**	0.1	10									0.1	50	0.1	10			0.2	10		
*Brassica rapa**									0.1	5	0.1	10			0.1	2			0.1	5
Breynia oblongifolia																				
*Briza subaristata**																				

Species	6450_01		6450_02		6450_03		6450_04		6450_05		6450_06		6450_07		6450_08		6450_09		6450_10	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*Bromus cartharticus**																				
Brunoniella australis																				
*Bryophyllum delagoense**																				
Bursaria spinosa									0.5	2										
Callistemon citrinus																				
Calystegia marginata																				
Casuarina glauca					15	3					2	4	20	20	0.1	2			0.5	1
*Centaurea melitensis**																				
Centella asiatica																				
*Cestrum parqui**					5	10														
Cheilanthes sieberi																				
*Chloris gayana**			0.5	3			10	100	2	200	8	100	35	200	65	300			0.1	1
*Cirsium vulgare**	0.1	10	0.1	2					1	20	0.1	10	0.2	10	0.1	5				
Clematis aristata													0.1	1						
*Colocasia esculenta**					1	1														
Commelina cyanea															0.1	2				
Convolvulus erubescens																				
*Convolvulus farinosus**													0.1	1	0.2	50				
*Conyza bonariensis**			0.1	10			0.2	30	0.2	20	0.1	10	0.1	5	0.1	5				
Corymbia maculata	5	1									1	1								
*Crassula multicava subsp. multicava**																				
*Crassula multicava**																				
Cupaniopsis anacardioides																				
*Cyclospermum leptophyllum**																				
Cynodon dactylon	0.5	100	85	500			10	100	10	500	5	500	15	500			5	500		

Species	6450_01		6450_02		6450_03		6450_04		6450_05		6450_06		6450_07		6450_08		6450_09		6450_10	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*Cyperus eragrostis**																				
Cyperus gracilis																			0.1	10
Cyperus gunnii subsp. gunnii																				
*Cyperus rotundus**																				
*Daucus carota**	0.1	10	0.1	5							0.1	50								
Desmodium gunnii																				
Desmodium varians																				
Dianella caerulea																			0.1	3
Dichondra repens	0.5	500					0.1	10			0.1	50	0.1	50	0.1	50	0.2	50		
Dillwynia sieberi																				
*Ehrharta erecta**					0.1	10					0.2	100			0.5	100			35	500
Einadia hastata																				
Einadia nutans															0.1	3			0.1	2
*Eragrostis curvula**	0.8	30	3	50			25	100			0.1	10			2	50			5	50
Eragrostis leptostachya																				
*Eragrostis spp.**	0.1	5	0.2	5																
Eucalyptus amplifolia																				
Eucalyptus baueriana															35	21				
Eucalyptus crebra											3	2	5	5						
Eucalyptus eugenioides											5	6								
Eucalyptus fibrosa																				
Eucalyptus moluccana	40	21											5	5					25	20
Eucalyptus tereticornis					10	1			3	2			15	15						
Euchiton sphaericus																				
*Foeniculum vulgare**									1	50										
*Fumaria muralis**																				

Species	6450_01		6450_02		6450_03		6450_04		6450_05		6450_06		6450_07		6450_08		6450_09		6450_10	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*Galium aparine**					0.1	10									0.1	5				
Glycine microphylla																				
Glycine tabacina																				
*Gnaphalium calviceps**			0.1	1							0.1	1								
*Gomphocarpus fruticosus**											0.1	6							0.1	1
Goodenia hederacea																				
Hardenbergia violacea																				
*Hydrocotyle bonariensis**																				
Hypericum gramineum																				
*Hypericum perforatum**			5	200							0.1	20	0.1	50						
*Hypochaeris radicata**	0.1	5	0.1	1									0.1	5						
Indigofera australis																				
*Ipomoea indica**																				
Juncus spp.																				
Juncus usitatus																				
Kennedia rubicunda																				
Kunzea ambigua																				
*Lantana camara**																				
*Ligustrum lucidum**					10	10							0.1	1						
*Ligustrum sinense**					10	10							0.2	2						
Lomandra longifolia											0.5	6							0.1	3
*Lotus tenuis**																				
*Ludwigia peruviana**																				
*Lycium ferocissimum**																			0.1	1
*Medicago sativa**	0.1	5	0.1	10			20	500			0.1	50			0.1	1				
Melaleuca decora																				

Species	6450_01		6450_02		6450_03		6450_04		6450_05		6450_06		6450_07		6450_08		6450_09		6450_10	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Melaleuca linariifolia													2	5						
Melaleuca nodosa																			1	3
Melaleuca quinquenervia																				
Melaleuca styphelioides															0.1	1	0.5	2		
Microlaena stipoides																				
*Modiola caroliniana**	0.1	10									0.1	5			0.1	5				
*Morus alba**					10	3														
*Myriophyllum aquaticum**																				
*Nothoscordum inodorum**	0.1	1			0.1	1	0.1	2												
*Olea europaea subsp. cuspidata**																				
Oplismenus aemulus																				
Oxalis perennans			0.1	20					0.1	20	0.1	10	0.1	50						
*Oxalis pes-caprae**																				
Oxalis spp.											0.1	10								
*Paronychia brasiliana**																				
*Paspalum dilatatum**																			0.1	5
*Pavonia hastata**																	0.1	2		
*Pellaea viridis**																				
*Pennisetum clandestinum**									75	1000	50	500	10	500					1	50
Persicaria decipiens																				
*Persicaria spp.**					0.5	100											1	200		
*Phoenix canariensis**					10	1														
Phragmites australis					0.1	5														
*Plantago lanceolata**	0.1	50					35	200	10	500	0.5	500	0.2	200	0.1	10	0.1	5	0.1	10
Plectranthus parviflorus																				

Species	6450_01		6450_02		6450_03		6450_04		6450_05		6450_06		6450_07		6450_08		6450_09		6450_10	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*Ricinus communis**									0.1	1										
*Rumex crispus**					0.1	3											0.5	2		
*Senecio madagascariensis**	0.2	20	0.5	20			0.1	5	0.1	10	0.1	5			0.1	3				
*Senecio pterophorus**									40	100					0.1	1			0.1	1
*Senna occidentalis**					0.2	1														
*Setaria parviflora**	0.1	5	0.5	50																
*Sida rhombifolia**	0.1	5							0.1	5	0.1	20			0.1	5	0.1	3	0.1	5
*Solanum nigrum**	0.1	1	0.1	1											0.1	2			0.1	3
*Solanum sisymbriifolium**																			0.1	2
*Soliva sessilis**							0.1	100												
*Sonchus oleraceus**	0.1	10					0.8	50	0.1	5	0.1	10	0.1	5	0.1	5			0.1	5
*Sporobolus africanus**			0.1	2																
Sporobolus creber	0.2	20	0.1	3																
*Stachys arvensis**											0.1	2								
*Stellaria media**			0.1	2																
Themeda triandra																				
*Tradescantia fluminensis**					70	500														
*Trifolium repens**																				
Typha orientalis					0.2	10											90	500		
*Verbena bonariensis**	0.1	5	0.1	1					0.5	10	0.1	50	0.1	100	0.1	10			0.1	5
*Verbena spp.**													0.2	100						
*Veronica persica**			0.1	1																
Veronica plebeia																				
*Vicia sativa**	0.1	10	0.1	10			0.1	1	0.1	50	0.1	5	0.1	10	0.1	10				
Wahlenbergia gracilis																				
*Yucca aloifolia**																				

Species	6450_11		6450_12		6450_13		6450_14		6450_15		6450_16		6450_17		6450_18		6450_19		6450_20		6450_21	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Acacia decurrens	0.1	1																				
Acacia implexa					0.1	1											0.2	3	1	5		
Acacia irrorata	0.2	2																			5	10
Acacia linearifolia																					0.1	1
Acacia linifolia																						
Acacia mearnsii																			5	10		
Acacia parramattensis																	1	2				
*Acetosella vulgaris**																						
Acmena smithii																						
*Alternanthera philoxeroides**			5	500																		
*Anagallis arvensis**													0.1	1			0.1	10				
Angophora floribunda																			2	1		
*Anredera cordifolia**																						
*Araujia sericifera**	0.1	5																			0.2	3
*Araujia sericiflora**					0.1	1	0.1	1	0.1	3							0.2	10				
*Asparagus asparagoides**	0.1	1			0.2	15	0.1	15					1	10							0.1	10
Asperula conferta																	0.1	5				
Austrostipa spp.																	0.1	3				

Species	6450_11		6450_12		6450_13		6450_14		6450_15		6450_16		6450_17		6450_18		6450_19		6450_20		6450_21	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Austrostipa verticillata																			0.5	10		
*Avena barbata**													0.1	5								
*Bidens pilosa**	0.1	5							0.1	5											0.1	10
*Brassica rapa**									0.1	3												
Breynia oblongifolia																					0.1	3
*Briza subaristata**	0.1	5											0.1	10					0.1	1	0.1	5
*Bromus cartharticus**													0.5	50	20		0.1	10				
Brunoniella australis	*0.1*	*10*			*0.8*	*300*																
*Bryophyllum delagoense**					0.3	50	0.1	5														
Bursaria spinosa	5	10			0.2	3											5	6				
Callistemon citrinus							1	5														
Calystegia marginata	0.1	1																				
Casuarina glauca			2	2			25	30	40	33											30	30
*Centaurea melitensis**															0.1	1						
Centella asiatica																					0.1	50
*Cestrum parqui**																					5	20
Cheilanthes sieberi	0.1	50			0.1	5													0.1	10		
*Chloris gayana**	0.5	30			0.5	10	75	500	3	20							2	50	10	200		
*Cirsium vulgare**					0.1	1			0.1	1	0.1	20	0.5	10	1	15	0.1	1			0.1	3
Clematis aristata									0.1	1											0.1	2

Species	6450_11		6450_12		6450_13		6450_14		6450_15		6450_16		6450_17		6450_18		6450_19		6450_20		6450_21	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*Colocasia esculenta**			10	50																		
Commelina cyanea							0.1	5														
Convolvulus erubescens					0.1	2			0.2	50							0.2	50				
*Convolvulus farinosus**																						
*Conyza bonariensis**	0.1	10			0.1	10							0.1	10					0.1	1	0.2	50
Corymbia maculata																	5	1	5	3		
*Crassula multicava subsp. multicava**					1	30	6	200														
*Crassula multicava**																					0.1	10
Cupaniopsis anacardioides			0.1	1	0.1	1	0.1	3														
*Cyclospermum leptophyllum**																					0.1	50
Cynodon dactylon					0.1	10			0.2	30			10	500			5	500	15	500	0.5	100
*Cyperus eragrostis**															0.1	1						
Cyperus gracilis													1	300					0.1	1		
Cyperus gunnii subsp. gunnii																	0.1	10	0.1	1		
*Cyperus rotundus**													0.1	5								
*Daucus carota**							0.1	1			0.1	5					0.1	2				
Desmodium gunnii					0.1	50																

Species	6450_11		6450_12		6450_13		6450_14		6450_15		6450_16		6450_17		6450_18		6450_19		6450_20		6450_21	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Desmodium varians	0.1	1											0.1	10			0.1	50				
Dianella caerulea	0.2	50															0.1	1				
Dichondra repens					0.1	50			10	10000							0.5	500	0.1	50	1	500
Dillwynia sieberi																	1	2	20	20		
*Ehrharta erecta**	1	100			0.1	10	0.1	20			10	500	5	200			1	100			0.5	50
Einadia hastata													0.5	5								
Einadia nutans													0.1	1								
*Eragrostis curvula**	55	500							1	15											0.5	10
Eragrostis leptostachya					0.2	25							0.1	20								
*Eragrostis spp.**																						
Eucalyptus amplifolia													5	2							1	1
Eucalyptus baueriana																						
Eucalyptus crebra																						
Eucalyptus eugenioides																						
Eucalyptus fibrosa																			2	1		
Eucalyptus moluccana	0.5	6	5	4	20	7											15	15				
Eucalyptus tereticornis									6	4			15	5					10	5	5	3
Euchiton sphaericus																			0.1	3		
*Foeniculum vulgare**																						

Species	6450_11		6450_12		6450_13		6450_14		6450_15		6450_16		6450_17		6450_18		6450_19		6450_20		6450_21	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*Fumaria muralis**	5	100			0.1	10																
*Galium aparine**																					0.1	10
Glycine microphylla																					0.1	10
Glycine tabacina																			0.1	10	0.1	10
*Gnaphalium calviceps**					0.1	5	0.1	10														
*Gomphocarpus fruticosus**	0.1	1													0.1	1						
Goodenia hederacea					0.1	50																
Hardenbergia violacea																	2	10				
*Hydrocotyle bonariensis**											3	200										
Hypericum gramineum															10	500						
*Hypericum perforatum**											0.1	5										
*Hypochaeris radicata**																						
Indigofera australis																	1	3				
*Ipomoea indica**															0.1	1						
Juncus spp.															0.1	5						
Juncus usitatus											0.1	2							0.1	1		
Kennedia rubicunda																	0.1	2	0.5	10		
Kunzea ambigua	15	30							0.5	1												
*Lantana camara**	0.1	1																			0.2	2

Species	6450_11		6450_12		6450_13		6450_14		6450_15		6450_16		6450_17		6450_18		6450_19		6450_20		6450_21	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*Ligustrum lucidum**									0.1	2												
*Ligustrum sinense**																					0.1	1
Lomandra longifolia							0.2	2									0.1	1	0.1	1	0.3	3
*Lotus tenuis**																						
*Ludwigia peruviana**			5	15																		
*Lycium ferocissimum**													40	30							0.8	3
*Medicago sativa**					0.1	5											0.1	10			0.1	10
Melaleuca decora	5	3			5	3																
Melaleuca linariifolia																					0.5	2
Melaleuca nodosa							1	2	2	2												
Melaleuca quinquenervia							0.5	1														
Melaleuca styphelioides					30	12	1	2													5	10
Microlaena stipoides	15	1000			1		0.1	20					2	100			20	1000	0.2	50		
*Modiola caroliniana**					0.1	20					0.1	5	0.1	5	0.1	10	0.1	10			0.1	5
*Morus alba**																						
*Myriophyllum aquaticum**			0.5	100																		
*Nothoscordum inodorum**							0.1	1			0.2	50										

Species	6450_11		6450_12		6450_13		6450_14		6450_15		6450_16		6450_17		6450_18		6450_19		6450_20		6450_21	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*Olea europaea subsp. cuspidata**																	0.1	1				
Oplismenus aemulus																					0.1	50
Oxalis perennans													0.1	20							0.1	5
*Oxalis pes-caprae**											0.1	5										
Oxalis spp.																						
*Paronychia brasiliana**															0.1	13						
*Paspalum dilatatum**					0.1	1							2	100	0.1	5			0.1	5		
*Pavonia hastata**																					0.2	2
*Pellaea viridis**																			0.1	1		
*Pennisetum clandestinum**									0.2	20	3	50					2	50			10	200
Persicaria decipiens			1	100																		
*Persicaria spp.**																						
*Phoenix canariensis**																						
Phragmites australis																						
*Plantago lanceolata**	0.1	5			0.1	10			0.1	10	1	500	0.1	1	0.5	100	0.2	50	0.1	10	0.2	40
Plectranthus parviflorus							0.1	5													1	50
*Ricinus communis**																						
*Rumex crispus**			0.8	5							0.1	5			1	30						

Species	6450_11		6450_12		6450_13		6450_14		6450_15		6450_16		6450_17		6450_18		6450_19		6450_20		6450_21	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
*Senecio madagascariensis**	0.2	20			0.1	3	0.1	5			0.1	5	0.2	50	1.5	50	0.1	10	0.1	5	0.1	5
*Senecio pterophorus**	0.1	10							0.1	2	0.1	10	0.1	1							0.2	2
*Senna occidentalis**																						
*Setaria parviflora**													0.1	20								
*Sida rhombifolia**	0.1	5			0.1	5	0.1	5	0.1	10	0.1	10	5	200			1	100	0.1	10	0.5	100
*Solanum nigrum**	0.1	1											0.1	2			0.1	1				
*Solanum sisymbriifolium**	0.1	5											0.1	1								
*Soliva sessilis**																						
*Sonchus oleraceus**	0.1	5			0.1	2			0.1	3	0.1	10					0.1	10			0.1	5
*Sporobolus africanus**																						
Sporobolus creber																						
*Stachys arvensis**											0.1	1										
*Stellaria media**																						
Themeda triandra					3	100													10	200		
*Tradescantia fluminensis**			5	500			10	500													1	100
*Trifolium repens**																	0.1	10				
Typha orientalis			80	1000																		
*Verbena bonariensis**					0.1	5	0.2	30					0.1	5	20		0.5	50			0.1	5
*Verbena spp.**																						
*Veronica persica**																						

Species	6450_11		6450_12		6450_13		6450_14		6450_15		6450_16		6450_17		6450_18		6450_19		6450_20		6450_21	
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Veronica plebeia																					0.2	100
*Vicia sativa**					0.1	10									0.1	10	0.1	5			0.1	10
Wahlenbergia gracilis																			0.1	1		
*Yucca aloifolia**																					0.2	2

Note:

- Cover (C) and abundance (A) were determined in accordance with the BAM
- Field data was collected in electronic format, therefore raw data sheets have not been provided.

Annex 5. BAM plot transect scores

Plots	PCT	Composition						Structure						Function						Easting	Northing	50 m transect bearing
		TG	SG	GG	FG	EG	OG	TG	SG	GG	FG	EG	OG	NLT	TSSC	NTH	FL	LL*	HTW			
P1	849	2	0	2	1	0	0	45.0	0.0	0.7	0.5	0.0	0.0	0	<5 5-9 10-19 20-29 30-49	0	0.0	41.0	9.1	300759	6265515	342
P2	849	1	0	2	1	0	0	5.0	0.0	85.1	0.1	0.0	0.0	0	0	0	0.0	1.8	126.1	300736	6265551	203
P3	835	3	0	2	1	0	0	25.5	0.0	0.3	0.5	0.0	0.0	0	<5 5-9 10-19 20-29 30-49	0	15.0	68.0	35.2	300806	6261001	199
P4	835	0	0	1	1	0	0	0.0	0.0	10.0	0.1	0.0	0.0	0	0	0	0.0	11.0	2.2	300780	6261060	231
P5	850	1	2	1	1	0	0	3.0	1.0	10.0	0.1	0.0	0.0	0	<5 5-9 10-19 20-29	0	0.0	17.0	8.6	300075	6248479	201
P6	1800	4	0	2	3	0	0	11.0	0.0	5.5	0.3	0.0	0.0	0	<5 5-9 10-19	0	5.0	45.0	35.6	300955	6246180	330
P7	1800	4	1	1	2	0	1	45.0	2.0	15.0	0.2	0.0	0.1	0	5-9 10-19	0	0.0	91.6	67.7	302699	6243693	309
P8	835	2	2	0	3	0	0	35.1	0.2	0.0	0.3	0.0	0.0	0	<5 5-9 10-19	0	0.0	30.0	0.2	302826	6243537	326
P9	1737	0	1	2	2	0	0	0.0	0.5	95.0	1.2	0.0	0.0	0	0	0	0.0	0.0	40.3	303780	6242857	210
P10	849	2	1	2	2	0	0	25.5	1.0	0.2	0.2	0.0	0.0	0	5-9 10-19	0	0.0	82.0	57.2	303008	6243190	168
P11	725	2	4	1	2	1	2	0.6	25.2	15.0	0.3	0.1	0.2	0	<5 10-19	0	0.0	42.0	25	303012	6243132	326

Plots	PCT	Composition						Structure						Function						Easting	Northing	50 m transect bearing
		TG	SG	GG	FG	EG	OG	TG	SG	GG	FG	EG	OG	NLT	TSSC	NTH	FL	LL*	HTW			
P12	1737	3	0	1	1	0	0	7.1	0.0	80.0	1.0	0.0	0.0	0	0	0	0.0	0.6	1.3	303934	6242394	30
P13	724	2	4	4	4	1	1	20.1	35.3	4.3	1.1	0.1	0.1	0	5-9 10-19 <5	0	0.0	68.0	85.4	303935	6242492	2
P14	1800	3	3	2	2	0	0	25.6	3.0	0.3	0.2	0.0	0.0	0	<5 5-9 10-19	0	2.0	19.0	4.2	303947	6242469	207
P15	1800	2	2	1	1	0	2	46.0	2.5	0.2	10.0	0.0	0.3	0	<5 5-9 10-19	0	0.0	98.6	10.2	303021	6243339	292
P16	1800	0	0	1	0	0	0	0.0	0.0	0.1	0.0	0.0	0.0	0	0	0	0.0	93.0	1.8	300939	6246200	119
P17	849	0	0	1	1	0	0	0.0	0.0	0.1	10.0	0.0	0.0	0	<5	0	0.0	27.0	48.3	301714	6258861	17
P18	849	2	0	4	3	0	1	20.0	0.0	13.1	0.7	0.0	0.1	1	10-19 20-29 30-49 50-79 0	0	2.0	32.0	3.2	301737	6258950	202
P19	850	3	4	5	3	0	4	21.0	7.2	25.3	0.7	0.0	2.4	0	<5 5-9 10-19 20-29	0	0.5	41.0	10.3	300544	6249255	237
P20	850	4	3	8	3	1	2	19.0	26.0	26.1	0.3	0.1	0.6	0	5-9 10-19 20-29	0	0.0	82.0	8.7	300213	6247074	303
P21	1800	4	4	3	5	0	3	36.1	10.6	0.9	2.4	0.0	0.2	0	<5 5-9 10-19 20-29	0	0.0	67.0	0.0	302122	6244287	146

Key to growth form groups: TG - Tree; SG - Shrub; GG - Grass and Grass-like; FG - Forb; EG - Fern; OG – Other; Function codes: NLT - Number of large trees; TSSC - Tree Stem Size Class; NTH - Number of trees with hollows; FL - Course Woody Debris (fallen logs); LL - mean leaf litter cover; HTW - High Threat Weeds

* 1 m^2 litter quadrats were placed at 5 m (left), 15 m (right), 25 m (left), 35 m (right) and 45 m (left) along the central 50 m transect, all positioned 5 m from the transect centreline and alternating to the left and right from the transect centreline (as indicated).

Note: field data was collected in electronic format, therefore raw data sheets have not been provided.

Annex 6. Microbat habitat assessment

Bridge Reference	latitude	longitude	Date	Kayla McGregor (microbat specialist) Notes	Further survey required	Outcome
Westlink M7 over Shared Path at Ainsley Ave near Stn 26820 (Seamless Pavement) (1)	-33.73808	150.84810	7/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a
Westlink M7 over Shared Path at Florence St near Stn 26420 (2)	-33.74156	150.84738	7/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a
Bridge over Woodstock Ave near Stn 24260 (3)	-33.76036	150.84724	7/09/2021	Low: Exposed, continued disturbance from vehicle traffic (light and noise), no nearby foraging resources, limited roost points (only available area is between the abutments of the bridge and pylon). Highly unlikely to be used by microbats.	No	n/a
Westlink M7 N/B over Rooty Hill Railway Bridge Widening near Stn 23110 (Seamless Pavement Alternative) (4)	-33.77057	150.84787	7/09/2021	Low: Continued disturbance from vehicle traffic (light and noise), no obvious roost points, seems relatively exposed and no adjacent foraging resources. Highly unlikely to be used by microbats.	No	n/a
Bridge over Angus Creek near Stn 22930 (5)	-33.77142	150.84944	7/09/2021	Low: Appears to be some potential roost points (roughened concrete and expansion joints), however, it is quite exposed. Adjacent foraging resources and minimal connectivity. Unlikely to be used by microbats.	No	n/a

Bridge Reference	latitude	longitude	Date	Kayla McGregor (microbat specialist) Notes	Further survey required	Outcome
Westlink M7 over Great Wesern Hwy near Stn 20610 (6)	-33.78963	150.85649	7/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a
Westlink M7 over Reedy Creek Tributary near Stn 18380 (Seamless Pavement alternative) (7)	-33.80997	150.85165	7/09/2021	Moderate: Potential roost points include expansion joints, abutments and scuppers. Likely to be protected. Adjacent foraging resources also present. Potential habitat for microbats (e.g. Southern Myotis).	Yes. Bridge inspected in more detail and with a hand held anabat with directional microphone.	No social calls detected. Further inspection of bridge in conjunction with lack of indicative signs of presence downgrades bridge to 'low: safeguards apply'.
Westlink M7 N/B & S/B over Reedy Creek near Stn 17940 (8)	-33.81310	150.85217	7/09/2021	Moderate: Potential roost points include scuppers. Area is protected and likely subject to minimal human disturbance. Connectivity to adjacent foraging resources present. Potential habitat for microbats.	Yes. Bridge inspected in more detail and with a hand held anabat with directional microphone.	No social calls detected. Further inspection of bridge in conjunction with lack of indicative signs of presence downgrades bridge to 'low:

Bridge Reference	latitude	longitude	Date	Kayla McGregor (microbat specialist) Notes	Further survey required	Outcome
						safeguards apply'.
Westlink M7 over Waste Services Access near Stn 17760 (9)	-33.81477	150.85243	7/09/2021	Low: Exposed with limited roost points (narrow expansion joints, smooth concrete surfaces, and limited 'dark' places). Unlikely to be used by microbats.	No	n/a
Westlink M7 over Austral Bricks Access Road near Ch 17030 (10)	-33.82126	150.85275	7/09/2021	Low: Exposed with limited roost points (narrow expansion joints, smooth concrete surfaces, and limited 'dark' places). Highly unlikely to be used by microbats.	No	n/a
Westlink M7 over Redmayne Road near Stn 15170 (Seamless Pavement) (11)	-33.83736	150.85612	7/09/2021	Low: Does not appear to have any adjacent foraging resources, although not always a determining factor but does increase the likelihood of individuals using the structure. Appears to be quite exposed, limited roost points (narrow expansion joints, smooth concrete surfaces, and limited "dark" places. Individuals are highly unlikely to be using this structure.	No	n/a
Westlink M7 over Saxony Road near Stn 13150 (12)	-33.85488	150.85089	7/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a
Westlink M7 over Pad 7 (13)	-33.86627	150.84684	8/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a

Bridge Reference	latitude	longitude	Date	Kayla McGregor (microbat specialist) Notes	Further survey required	Outcome
Westlink M7 over Elizabeth Drive near Stn 10580 (14)	-33.87669	150.84339	8/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a
Westlink M7 over future access road near Stn 9630 (15)	-33.88673	150.83639	8/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a
Bridges over Hinchinbrook Creek near Stn 8235 (Seamless Pavement Alternative) (16)	-33.89620	150.83728	8/09/2021	Low - Moderate: Scuppers and portholes provide potential roosting habitat.	No	n/a
Westlink M7 over Shared Path and Waterway near Stn 6820 (Seamless Pavement) Bridge (17)	-33.90557	150.84676	8/09/2021	Moderate: Good connectivity to foraging resources, limited disturbance, roost points in scuppers and behind pipework.	Yes. Bridge inspected in more detail and with a hand held anabat with directional microphone.	No social calls detected. Further inspection of bridge in conjunction with lack of indicative signs of presence downgrades bridge to 'low: safeguards apply'.
Westlink M7 over Cowpasture Road (18)	-33.91903	150.85282		Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a

Bridge Reference	latitude	longitude	Date	Kayla McGregor (microbat specialist) Notes	Further survey required	Outcome
Viaduct over Hoxton Park Road & Hinchbrook Creeks (N/B) (19)	-33.92387	150.85794	8/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a
Westlink M7 over Cabramatta Creek near Stn 3300 (20)	-33.93025	150.86691	9/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a
Bridge over Bernera Road near Stn 2975 (21)	-33.93320	150.86916	9/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a
Westlink M7 over Maxwell's Creek Flood Plain near Stn 2140 (Seamless Pavement) (22)	-33.93628	150.87682	9/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a
Westlink M7 over Maxwell's Creek near Stn 1700 (23)	-33.93931	150.87885	9/09/2021	Low: Exposed, limited to no roost points available. Highly unlikely to be used by microbats.	No	n/a

Annex 7. Fauna species list

Scientific name	Common name	Observation type
Aves		
Acanthiza pusilla	Brown Thornbill	W
Anthochaera paradoxa	Yellow Wattlebird	O
Aythya australis	Hardhead	W
Cacatua sanguinea	Little Corella	OW
Cormobates leucophaea	White-throated Treecreeper	W
Corvus coronoides	Australian Raven	W
Gymnorhina tibicen	Australian Magpie	O
Lichenostomus chrysops	Yellow-faced honeyeater	W
Malurus cyaneus	Superb Fairy-wren	W
Manorina melanocephala	Noisy Miner	O
Manorina melanophrys	Bell Miner	W
Neochmia temporalis	Red-browed finch	O
Pardalotus striatus	Striated pardalote	O
Philemon corniculatus	Noisy Friarbird	W
Porphyrio	Purple Swamphen	O
*Pycnonotus jocosus**	Red-whiskered Bulbul	W
Rhipidura albiscapa	Grey Fantail	O
Sericornis frontalis	White-browed Scrubwren	W
*Sturnus tristis**	Common Myna	O
*Sturnus vulgaris**	Common Starling	O
Threskiornis molucca	Australian White Ibis	O
Trichoglossus moluccanus	Rainbow lorikeet	W
Zosterops lateralis	Silvereye	W
Reptilia		
Eulamprus quoyii	Eastern Water skink	O
Pseudechis porphyriacus	Red-bellied Black Snake	O
Pseudonaja textilis	Eastern Brown snake	O
Lampropholis delicata	Dark-flecked Garden Sunskink	O
Tiliqua scincoides:	Eastern Blue-tongue Lizard	O
Amphibia		
Crinia signifera	Eastern Common Froglet	W
Limnodynastes peronii	Brown-striped Frog	W
Litora fallax	Eastern Dwarf Tree-frog	W
Invertebrate		
*Cornu aspersum**	Garden snail	O

Key: W – heard; O – observed; * introduced species

Note: field data was collected in electronic format, therefore raw data sheets have not been provided.

Annex 8. Hollow-bearing tree register

Tree number	Scientific name	Common name	No. of hollows	Hollow size class (cm)	Height above ground (m)
1	*Not specified*		2	5-10, 10-15	Not specified
2*	? Dead stag	? Dead stag	1	5-10	6

*Located within or close to edge of proposed impact footprint

Note: field data was collected in electronic format, therefore raw data sheets have not been provided.

Annex 9. EPBC Act Significant Impact Criteria Assessment

Assessments of Significance and supplementary information (where relevant) are presented for the following MNES in relation to the proposed modification:

- TECs
  - Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Critically Endangered)
Distribution Occurs on soils derived from Wianamatta Shale, and throughout the driest part of the Sydney Basin (DPIE 2021c). Impact Summary The proposed modification would result in the removal of 0.46 ha of CPW consisting of: ▪ PCT 724 – 0.11 ha (moderate condition) ▪ PCT 850 – 0.35 ha (low condition - 0.22, moderate condition - 0.13).
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it would:
1. *reduce the extent of an ecological community*
The proposed modification would result in the removal of around 0.46 ha of CPW, this occurring as discontinuous isolated patches in predominantly low condition, and across a distance of 23.5 km. The clearing of 0.46 ha is 0.1% of the mapped CPW (OEH 2013 and OEH 2016) within a 500 m buffer of the Subject Land (371.66 ha) and 0.004% of the current estimated extent of 11,200 ha (DPIE 2021d). All of this area within the Subject Land consists of plantings and/or natural regeneration, and post-works, as most of this area is within the operational study area, it would be permitted to naturally regenerate and/or be rehabilitated. Therefore, while the extent of the locality's CPW would be reduced, the loss of 0.46 ha of low and moderate condition CPW is unlikely to lead to long-term decrease in the size of the TEC or significantly impact its local viability.
2. *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*
The patches of CPW present within the Subject Land and wider locality is already heavily fragmented as a result of the past clearing practices, farms, industrial, commercial and residential development, as well as the Westlink M7. The removal of 0.46 ha of CPW as part of the proposed modification is unlikely to exacerbate the already fragmented CPW in the locality.
3. *adversely affect habitat critical to the survival of an ecological community*
Critical habitat has not been declared for the CPW, however, in accordance with the CPW Recovery Plan the Priority Conservation Lands are considered to contain the habitats critical to the survival of this CEEC (Department of Environment, Climate Change and Water 2010). No Priority Conservation lands are expected to be impacted by the proposed modification. In addition, no part of the Subject Land is listed on the EPBC Act's Register of Critical Habitat. The low and moderate condition patches of CPW to be impacted by the proposed widening are not considered necessary for its long-term persistence, including the maintenance of essential species such as pollinators, to maintain genetic diversity, or for its recovery. The areas of CPW to be impacted are, therefore, not considered critical to its survival.
4. *modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*
The proposed modification would result in a temporary disturbance to creek flows and surface water around the riparian areas. This impact is not considered to be significant such that it would affect the abiotic factors necessary for the survival of CPW.

Groundwater levels or surface water drainage patterns are unlikely to be significantly impacted by the proposed modification in the short or long term.

5. *cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting*

All parts of the CPW within, and adjacent to, the Subject Land are highly disturbed and subject to weed invasion. The proposed modification would not exacerbate the impacts currently taking place within those adjoining stands of CPW such that the species composition would be substantially modified. It is unlikely that functionally important species would decline or be lost as a result of the proposed widening.

6. *cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:*

   – assisting invasive species, that are harmful to the listed ecological community, to become established, or

   – causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or

All parts of the CPW within, and adjacent to, the Subject Land are highly disturbed and subject to weed invasion. Edge affects and weed invasion along newly created edges is considered to be negligent considering the adjacent vegetation is also weed affected. Regardless, weed management and rehabilitation of cleared areas has been recommended within the mitigations section of the report (3.2.6) to prevent further weed spread. The proposed modification would not assist invasive species to become established within the adjacent CPW areas.

The proposed modification would not result in the regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the CPW such that the growth of species present in the CPW would be adversely impacted..

7. *interfere with the recovery of an ecological community.*

The Cumberland Plain recovery plan consists of four recovery themes:

1. Building the Cumberland Plain protected area network, including both public and private land and concentrating on the identified Priority Conservation Lands
2. Delivering best management practices to prevent degradation of remaining bushland
3. Enhancing the community's understanding and awareness of the values of the Cumberland Plain
4. Improving our understanding of, and capacity to manage, the many threats to the biodiversity of the Cumberland Plain.

The recovery plan has been prepared to assist in the recovery of those threatened species, populations and ecological communities that are endemic to the Cumberland Plain or are primarily distributed on the Cumberland Plain, including CPW. While Priority Conservation lands occur in proximity to the Subject Land, none are expected to be impacted. While a small area of the Western Sydney Parklands would be disturbed as part of the proposed modification, the condition of the vegetation at this site does not meet the condition thresholds required to deem it eligible for protection under the EPBC Act.

The proposed modification is not likely to interfere with the recovery of CPW.

Conclusion: Direct impacts on 0.46 ha of CPW as part of the proposed widening is unlikely to have a significant impact on this TEC.

Annex 10. Consideration of serious and irreversible impacts

Cumberland Plain Woodland

Additional impact assessment provisions	Cumberland Plain Woodland
1. *the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII*	Refer to section 3.1.1 of the BDAR. Given the need for the proposed modification and the placement of the existing Westlink M7, the location of the additional lanes and bridge widening, is restricted. Nevertheless, the proposed modification has been designed to lessen the impact on the ecology of the locality by: ▪ Conducting the majority of the widening within the median of the Westlink M7, as opposed to its shoulders ▪ Utilising, as much as possible, the cleared and/or disturbed areas, as well as the existing shared pathway, within the Westlink M7 lease area for the construction ancillary facilities and access routes.
2. *report on the current status of the TEC including:* a. *evidence of reduction in geographic distribution as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)*	The pre-European area of occupancy of CPW was 71,200 ha[15] while the current extent is estimated at 11,054 ha (DPIE 2021d). This is a reduction of around 84%. However, the 'PCT percent cleared estimate' tab of the PCT 849 and PCT 850 profiles in the Bionet Vegetation Classification database state 93% and 88%, respectively (DPIE 2021d). Tozer (2003) and Benson & Howell (1990b) (in DPIE 2021e) estimate the total extent of CPW to be 8.8% and 6%, respectively, of the pre-European distribution of the community. Almost all remaining CPW CEEC across its distribution is regrowth forest and woodland from past clearing activities (Benson & Howell 1990a in DPIE 2021e).
b. *extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes indicated by:* *i. change in community structure* *ii. change in species composition*	The CPW in the Subject Land is highly degraded and has been subject to past clearing resulting in diminished to lack of structural integrity of the CPW present and habitat loss, and is likely present on a disturbed soil profile. Past activities (i.e. grazing) and land uses (i.e. infrastructure and residential development) are not unique to the Subject Land and have occurred, and continue to do so, across the entire Cumberland Plain. These activities have resulted in a highly degraded, weed infested, low quality fragmented landscape, of which intact CPW stands are uncommon, and better quality ones are rare.

[15] This is a combination of PCT 849 and PCT 850 that both constitute the CPW TEC.

Additional impact assessment provisions	Cumberland Plain Woodland
iii. disruption of ecological processes *iv. invasion and establishment of exotic species* *v. degradation of habitat, and* *vi. fragmentation of habitat*	The area of CPW to be impacted has little to no structural integrity, is impacted by weeds, has low floristic diversity and its ecological processes have been disrupted such that the community's functioning is reduced.
c. evidence of restricted geographic distribution, based on the TEC's geographic range in NSW according to the: *i. extent of occurrence* *ii. area of occupancy, and* *iii. number of threat-defined locations*	PCT 849 and Pct 850 is largely confined to the Cumberland IBRA subregion, however PCT 849 also occurs in margins of the Burragorang, Sydney Cataract and Yengo IBRA subregions (DPIE 2021d), while CPW was estimated to occur within an extent of occurrence of 2,788.65 km^2, and an area of occupancy of 2,800 km^2. While no specific data is provided in regard to threat defined locations, given the restricted area of occupancy and surrounding threats, it could be argued all areas of CPW are under threat.
d. evidence that the TEC is unlikely to respond to management.	The TBDC does not provide any data regarding this item.
3. the impact on the geographic extent of the TEC by estimating the total area of the TEC to be impacted by the proposal: *a. in hectares, and* *b. as a percentage of the current geographic extent of the TEC in NSW.*	The proposed modification is expected to impact 3.78 ha of CPW, consisting of: ▪ 2.37 ha in poor condition ▪ 1.28 ha in low condition ▪ 0.13 ha in moderate condition The clearing of 3.78 ha of CPW accounts for around 0.03% of the remaining CPW in NSW. It is noted that this 0.03% estimate includes a grassland variant of CPW (accounting for 62% of the CPW present) within the Subject Land but compares it to a vegetation mapping that does not generally include such variants. As such, a comparison to the vegetation mapping taking into consideration only the wooded variants of CPW present on the Subject Land (the low and moderate condition states of the relevant PCTs), estimates the total area of CPW to be impacted at 1.41 ha, which is 0.01% of the remaining CPW in NSW.
4. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes of the TEC by:	

Additional impact assessment provisions	Cumberland Plain Woodland
a. *estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals*	With reference to the vegetation mapping undertaken for the locality (OEH 2013), around 371.66 ha of CPW is mapped within 500 m of the Subject Land.
b. *describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:* *i. distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and* *ii. estimated maximum dispersal distance for native flora species characteristic of the TEC, and* *iii. other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development*	The CPW occurs as discontinuous isolated patches within the Subject Land across a distance of 23.5 km. The average distance between patches is 1.7 km. Mapped areas of CPW occur beyond, and immediately adjacent to, the Subject Land in many locations. It is evident that the CPW present occurs as a highly fragmented entity within a fragmented landscape; however, the proposed modification is unlikely to result in an adverse impact on the movement of pollinator vectors and other dispersal mechanisms operating within the CPW present within the locality.
c. *describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.*	The poor condition of PCT 849 (which is grassland) has a VI of 8.7 which, in accordance with the BAM (DPIE 2020a), does not need to be offset. The other condition zones of PCT 849 and 850 have a VI score above the required score of 15 for a PCT representative of a CEEC that triggers the requirement for offsets (DPIE 2020a) (see section 4.1 of the BDAR). The floristic composition, structure and function data of PCT 849 and PCT 850 obtained during the field assessment is provided in Annex 5. BAM plot transect scores, while the composition structure and function condition scores are provided below:

<table>
<tr><td>Additional impact assessment provisions</td><td>Cumberland Plain Woodland<table><tr><th>PCT/zone</th><th>Current VI score</th><th>composition</th><th>structure</th><th>function</th></tr><tr><td>849_poor</td><td>8.7</td><td>1.1</td><td>40.5</td><td>15.2</td></tr><tr><td>849_low</td><td>19.3</td><td>8.2</td><td>26.1</td><td>33.6</td></tr><tr><td>850_low</td><td>26.9</td><td>21.9</td><td>23.6</td><td>37.6</td></tr><tr><td>850_moderate</td><td>41.5</td><td>42</td><td>39</td><td>43.8</td></tr></table></td></tr>
<tr><td>5. Provision of new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.</td><td>N/A</td></tr>
</table>

Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion

Additional impact assessment provisions	Cooks River/Castlereagh Ironbark Forest
1. *the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII*	Refer to section 3.1.1 of the BDAR. Given the need for the proposed modification and the placement of the existing Westlink M7, the location of the additional lanes and bridge widening, is restricted. Nevertheless, the proposed modification has been designed to reduce the impact on biodiversity by: ▪ Conducting the majority of the widening within the median of the Westlink M7, as opposed to its shoulders ▪ Utilising, as much as possible, the cleared and/or disturbed areas, as well as the existing shared pathway, within the Westlink M7 lease area for the construction ancillary facilities sites and access routes. Given the location of the CRCIF, any avoidance of its occurrence is restricted and potentially not feasible to the objective of the proposed modification. Furthermore, as the TEC occurs as two very small, isolated patches (cumulatively 0.08 ha), the effort to avoid this SAII entity is limited.
2. *report on the current status of the TEC including:* a. *evidence of reduction in geographic distribution as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)*	The pre-European area of occupancy of CRCIF was 22,000 ha[16], while the current extent is estimated at 1,100 ha (DPIE 2021d). This is a reduction of around 95%. About 1.7% of the original distribution of this EEC is present within conservation reserves (DPIE 2021e).
b. *extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes indicated by:* *i. change in community structure* *ii. change in species composition* *iii. disruption of ecological processes* *iv. invasion and establishment of exotic species*	The CRCIF in the Subject Land is highly degraded and has been subject to past clearing resulting in diminished to no structural integrity of the CRCIF present and habitat loss, and is likely present on a disturbed soil profile. Past activities (i.e. grazing) and land uses (i.e. infrastructure and residential development) are not unique to the Subject Land and have occurred, and continue to do so, across the entire Cumberland Plain. These activities have resulted in a highly degraded, weed infested, low quality fragmented landscape, of which intact CRCIF stands are uncommon, and better quality ones are rare. The area of CRCIF to be impacted has little to no structural integrity, is impacted by weeds, has low floristic diversity and its ecological processes have been disrupted such that the community's functioning is reduced.

[16] This is a combination of PCT 849 and PCT 850 that both constitute the CPW TEC.

Additional impact assessment provisions	Cooks River/Castlereagh Ironbark Forest
v. degradation of habitat, and *vi. fragmentation of habitat* *c. evidence of restricted geographic distribution, based on the TEC's geographic range in NSW according to the:* *i. extent of occurrence* *ii. area of occupancy, and* *iii. number of threat-defined locations* *d. evidence that the TEC is unlikely to respond to management.*	PCT 725 occurs in Cumberland Plain, Sydney Cataract, and Yengo SRs. (DPIE 2021d), while CRCIF was estimated to occur within an extent of occurrence of 2,639.82 km^2, and an area of occupancy of 11,00 km^2. While no specific data is provided in regard to threat defined locations, given the restricted area of occupancy and surrounding threats, it could be argued all areas of CRCIF are under threat. The TBDC does not provide any data regarding this item.
3. the impact on the geographic extent of the TEC by estimating the total area of the TEC to be impacted by the proposal: *a. in hectares, and* *b. as a percentage of the current geographic extent of the TEC in NSW.*	The proposed modification is expected to impact 0.08 ha of CRCIF. This represents approximately 0.01% of the remaining CRCIF in NSW.
4. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes of the TEC by: *a. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals* *b. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:* *i. distance between isolated areas of the TEC, presented as the average distance if the*	With reference to the vegetation mapping undertaken for the locality (OEH 2013), around 19.68 ha of CRCIF is mapped within 500 m of the Subject Land. The CRCIF in the Subject Land occurs as two isolated patches 860 m apart; they are 500 m^2 and 250 m^2 in size. Both occur within the extent of occurrence of this TEC within the locality. One patch occurs 27 m from another larger patch of the TEC that would not be impacted, however is separated by a road (major on-ramp to the Westlink M7 at Bernera Road). The other patch is 35 m from the next patch of the TEC, the shared path and another PCT breaking the connectivity. Mapped areas of CRCIF occur beyond, however immediately adjacent to, the Subject Land at its southern end.

<table>
<tr><th>Additional impact assessment provisions</th><th>Cooks River/Castlereagh Ironbark Forest</th></tr>
<tr><td>remnant is retained AND the average distance if the remnant is removed as proposed, and
ii. estimated maximum dispersal distance for native flora species characteristic of the TEC, and
iii. other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development</td><td>While CRCIF is highly fragmented within the Subject Land, and the wider locality, the removal of around 0.08 ha of this TEC as a result of the proposed modification is unlikely to result in an adverse impact on the movement of pollinator vectors and other dispersal mechanisms operating within it.</td></tr>
<tr><td>c. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.</td><td>The moderate condition of PCT 725 has a VI of 25.4 which, in accordance with the BAM (DPIE 2020a), needs to be offset (see section 4.1 of the BDAR).
The floristic composition, structure and function data of PCT 725 obtained during the field assessment is provided in Annex 5. BAM plot transect scores, while the composition structure and function condition scores are provided below:
<table><tr><th>PCT/zone</th><th>Current VI score</th><th>composition</th><th>structure</th><th>function</th></tr><tr><td>725_moderate</td><td>25.4</td><td>17.4</td><td>31.1</td><td>30.3</td></tr></table></td></tr>
<tr><td>5. Provision of new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.</td><td>N/A</td></tr>
</table>

Annex 11. Ecosystem and species credits required (BAM-C Credit report)

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00027926/BAAS18054/21/00027945	M7 Widening BDAR - revised design_May 2022	24/11/2021
Assessor Name	Report Created	BAM Data version *
Stephen M Bloomfield	10/06/2022	50
Assessor Number	BAM Case Status	Date Finalised
BAAS18054	Open	To be finalised
Assessment Revision	Assessment Type	
1	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)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Castlereagh Ironbark forest												
2	725_Moderate	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	25.4	25.4	0.08	PCT Cleared - 95%	High Sensitivity to Potential Gain	Endangered Ecological Community	Critically Endangered	2.00	TRUE	1
											Subtotal	**1**
Castlereagh shale - gravel transition forest												
1	724_Moderate	Shale Gravel Transition Forest in the Sydney Basin Bioregion	35	35.0	0.11	PCT Cleared - 75%	High Sensitivity to Potential Gain	Endangered Ecological Community	Critically Endangered	2.00		2
											Subtotal	**2**
Cumberland riverflat forest												
5	835_Low	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	25.4	25.4	0.74	PCT Cleared - 93%	High Sensitivity to Potential Gain	Endangered Ecological Community	Critically Endangered	2.00		9

10	835_Poor	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	2.1	2.1	0.1	PCT Cleared - 93%	High Sensitivity to Potential Gain	Endangered Ecological Community	Critically Endangered	2.00		0
											Subtotal	**9**
Cumberland shale hills woodland												
4	850_Low	Cumberland Plain Woodland in the Sydney Basin Bioregion	26.9	26.9	0.7	PCT Cleared - 88%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	12
9	850_Moderate	Cumberland Plain Woodland in the Sydney Basin Bioregion	41.5	41.5	0.13	PCT Cleared - 88%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	3
											Subtotal	**15**

Cumberland shale plains woodland												
3	849_Poor	Cumberland Plain Woodland in the Sydney Basin Bioregion	8.7	8.7	2.4	PCT Cleared - 93%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	0
8	849_Low	Cumberland Plain Woodland in the Sydney Basin Bioregion	19.3	19.3	0.58	PCT Cleared - 93%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	7
											Subtotal	**7**
Cumberland Swamp Oak riparian forest												
7	1800_Low	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	24.7	24.7	0.68	PCT Cleared - 60%	High Sensitivity to Potential Gain	Endangered Ecological Community	Endangered	2.00		8

12	1800_Moderate	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	32.9	32.9	1.3	PCT Cleared - 60%	High Sensitivity to Potential Gain	Endangered Ecological Community	Endangered	2.00		22
13	1800_Poor	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.1	0.1	0.56	PCT Cleared - 60%	High Sensitivity to Potential Gain	Endangered Ecological Community	Endangered	2.00		0
											Subtotal	**30**

Typha rushland												
6	1737_High	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	60.8	60.8	0.01	PCT Cleared - 70%	High Sensitivity to Potential Gain	Endangered Ecological Community	Not Listed	2.00		1
11	1737_Moderate	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	34.5	34.5	0.09	PCT Cleared - 70%	High Sensitivity to Potential Gain	Endangered Ecological Community	Not Listed	2.00		2
											Subtotal	**3**
											Total	**67**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Myotis macropus / Southern Myotis (Fauna)									
725_Moderate	25.4	25.4	0.03			Vulnerable	Not Listed	False	1
850_Low	26.9	26.9	0.18			Vulnerable	Not Listed	False	2
835_Low	25.4	25.4	0.5			Vulnerable	Not Listed	False	6
1737_High	60.8	60.8	0.01			Vulnerable	Not Listed	False	1
1800_Low	24.7	24.7	0.26			Vulnerable	Not Listed	False	3
849_Low	19.3	19.3	0.22			Vulnerable	Not Listed	False	2
1800_Moderate	32.9	32.9	1.1			Vulnerable	Not Listed	False	18
								Subtotal	**33**

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00027926/BAAS18054/21/00027945

Proposal Name
M7 Widening BDAR - revised design_May 2022

BAM data last updated *
24/11/2021

Assessor Name
Stephen M Bloomfield

Assessor Number
BAAS18054

BAM Data version *
50

Proponent Names

Report Created
10/06/2022

BAM Case Status
Open

Assessment Revision
1

Assessment Type
Major Projects

Date Finalised
To be finalised

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Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	849-Cumberland shale plains woodland
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	850-Cumberland shale hills woodland
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	Endangered Ecological Community	725-Castlereagh Ironbark forest

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
724-Castlereagh shale - gravel transition forest	Shale Gravel Transition Forest in the Sydney Basin Bioregion	0.1	0	2	2
725-Castlereagh Ironbark forest	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	0.1	0	1	1
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	3.0	0	7	7
850-Cumberland shale hills woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.8	0	15	15
835-Cumberland riverflat forest	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.8	0	9	9
1737-Typha rushland	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.1	0	3	3
1800-Cumberland Swamp Oak riparian forest	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	2.6	0	30	30

724-Castlereagh shale - gravel transition forest

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	Shale Gravel Transition Forest in the Sydney Basin Bioregion This includes PCT's: 724, 808	-	724_Moderate	No	2	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
725-Castlereagh Ironbark forest	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion This includes PCT's: 725, 808	-	725_Moderate	No	1	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
835-Cumberland riverflat forest	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794	-	835_Low	No	9	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794	-	835_Poor	No	0	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

849-Cumberland shale plains woodland	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Poor	No	0	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Low	No	7	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
850-Cumberland shale hills woodland	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	850_Low	No	12	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	850_Moderate	No	3	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1737-Typha rushland	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 780, 781, 782, 828, 1071, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1911	-	1737_High	No	1	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 780, 781, 782, 828, 1071, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1911	-	1737_Moderate	No	2	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1800-Cumberland Swamp Oak riparian forest	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 915, 916, 917, 918, 919, 1125, 1230, 1232, 1234, 1235, 1236, 1726, 1727, 1728, 1729, 1731, 1800, 1808	-	1800_Low	No	8	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 915, 916, 917, 918, 919, 1125, 1230, 1232, 1234, 1235, 1236, 1726, 1727, 1728, 1729, 1731, 1800, 1808	-	1800_Moderate	No	22	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 915, 916, 917, 918, 919, 1125, 1230, 1232, 1234, 1235, 1236, 1726, 1727, 1728, 1729, 1731, 1800, 1808	-	1800_Poor	No	0	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Myotis macropus / Southern Myotis	**725_Moderate, 850_Low, 835_Low, 1737_High, 1800_Low, 849_Low, 1800_Moderate**	2.3	33.00

Credit Retirement Options

Like-for-like credit retirement options

Myotis macropus / Southern Myotis	Spp	IBRA subregion
	Myotis macropus / Southern Myotis	Any in NSW

BAM Candidate Species Report

Proposal Details

Assessment Id 00027926/BAAS18054/21/00027945	Proposal Name M7 Widening BDAR - revised design_May 2022	BAM data last updated * 24/11/2021
Assessor Name Stephen M Bloomfield	Report Created 10/06/2022	BAM Data version * 50
Assessor Number BAAS18054	Assessment Type Major Projects	BAM Case Status Open
Assessment Revision 1	Date Finalised To be finalised	

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List of Species Requiring Survey

Name	Presence	Survey Months
Acacia pubescens Downy Wattle	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☑ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Grevillea juniperina subsp. juniperina Juniper-leaved Grevillea	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☑ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Marsdenia viridiflora subsp. viridiflora - endangered population Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☑ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Meridolum corneovirens Cumberland Plain Land Snail	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☑ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Miniopterus australis Little Bent-winged Bat	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☑ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Miniopterus orianae oceanensis Large Bent-winged Bat	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☑ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Myotis macropus Southern Myotis	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Persicaria elatior Tall Knotweed	No (surveyed) *Survey months are outside of the months specified in Bionet.	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☑ Survey month outside the specified months?
Pimelea spicata Spiked Rice-flower	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pommerhelix duralensis Dural Land Snail	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Pultenaea pedunculata Matted Bush-pea	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☑ Sep ☑ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Common name	Scientific name	Justification in the BAM-C
Allocasuarina glareicola	Allocasuarina glareicola	Habitat degraded
Austral Pillwort	Pilularia novae-hollandiae	Habitat degraded
Austral Toadflax	Thesium australe	Habitat degraded
Bargo Geebung	Persoonia bargoensis	Habitat degraded

Barking Owl	Ninox connivens	Habitat constraints
Biconvex Paperbark	Melaleuca biconvexa	Habitat degraded
Black-tailed Godwit	Limosa limosa	Refer to BAR
Broad-billed Sandpiper	Limicola falcinellus	Refer to BAR
Brown Pomaderris	Pomaderris brunnea	Habitat degraded
Bush Stone-curlew	Burhinus grallarius	Refer to BAR
Bynoe's Wattle	Acacia bynoeana	Habitat degraded
Camden White Gum	Eucalyptus benthamii	Habitat degraded
Curlew Sandpiper	Calidris ferruginea	Refer to BAR
Deyeuxia appressa	Deyeuxia appressa	Habitat degraded
Dillwynia tenuifolia	Dillwynia tenuifolia	Habitat degraded
Dillwynia tenuifolia, Kemps Creek	Dillwynia tenuifolia - endangered population	Refer to BAR
Eastern Osprey	Pandion cristatus	Habitat constraints
Eastern Pygmy-possum	Cercartetus nanus	Habitat degraded
Epacris purpurascens var. purpurascens	Epacris purpurascens var. purpurascens	Habitat degraded
Gang-gang Cockatoo	Callocephalon fimbriatum	Refer to BAR
Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	Callocephalon fimbriatum - endangered population	Refer to BAR
Giant Burrowing Frog	Heleioporus australiacus	Habitat degraded
Glossy Black-Cockatoo	Calyptorhynchus lathami	Habitat constraints
Gosford Wattle, Hurstville and Kogarah Local Government Areas	Acacia prominens - endangered population	Refer to BAR
Greater Glider	Petauroides volans	Habitat constraints
Green and Golden Bell Frog	Litoria aurea	Habitat degraded
Grey-headed Flying-fox	Pteropus poliocephalus	Habitat constraints
Gyrostemon thesioides	Gyrostemon thesioides	Habitat constraints
Hairy Geebung	Persoonia hirsuta	Habitat degraded
Hibbertia fumana	Hibbertia fumana	Habitat degraded

Hibbertia sp. Bankstown	Hibbertia sp. Bankstown	Habitat degraded
Koala	Phascolarctos cinereus	Habitat degraded Habitat constraints
Large-eared Pied Bat	Chalinolobus dwyeri	Habitat constraints
Little Eagle	Hieraaetus morphnoides	Habitat constraints
Masked Owl	Tyto novaehollandiae	Habitat constraints
Maundia triglochinoides	Maundia triglochinoides	Habitat degraded
Micromyrtus minutiflora	Micromyrtus minutiflora	Habitat degraded
Netted Bottle Brush	Callistemon linearifolius	Habitat degraded
Nodding Geebung	Persoonia nutans	Habitat degraded
P. prunifolia in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	Pomaderris prunifolia - endangered population	Refer to BAR
Pimelea curviflora var. curviflora	Pimelea curviflora var. curviflora	Habitat degraded
Powerful Owl	Ninox strenua	Habitat constraints
Pultenaea parviflora	Pultenaea parviflora	Habitat degraded
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Small-flower Grevillea	Grevillea parviflora subsp. parviflora	Habitat degraded
Square Raspwort	Haloragis exalata subsp. exalata	Habitat degraded
Square-tailed Kite	Lophoictinia isura	Habitat constraints
Squirrel Glider	Petaurus norfolcensis	Habitat degraded
Swift Parrot	Lathamus discolor	Habitat constraints
Sydney Plains Greenhood	Pterostylis saxicola	Habitat degraded
Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	Wahlenbergia multicaulis - endangered population	Refer to BAR
Thick Lip Spider Orchid	Caladenia tessellata	Habitat degraded
White-bellied Sea-Eagle	Haliaeetus leucogaster	Habitat constraints

White-flowered Wax Plant	Cynanchum elegans	Habitat degraded
Zannichellia palustris	Zannichellia palustris	Habitat degraded

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00027926/BAAS18054/21/00027945	M7 Widening BDAR - revised design_May 2022	24/11/2021
Assessor Name	**Report Created**	**BAM Data version ***
Stephen M Bloomfield	10/06/2022	50
Assessor Number	**Assessment Type**	**BAM Case Status**
BAAS18054	Major Projects	Open
Assessment Revision		**Date Finalised**
1		To be finalised

* 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.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Australasian Bittern	Botaurus poiciloptilus	835-Cumberland riverflat forest
		1737-Typha rushland
Australian Painted Snipe	Rostratula australis	1737-Typha rushland
Barking Owl	Ninox connivens	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Black Bittern	Ixobrychus flavicollis	835-Cumberland riverflat forest
		1737-Typha rushland
		1800-Cumberland Swamp Oak riparian forest
Black Falcon	Falco subniger	1737-Typha rushland
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	724-Castlereagh shale - gravel transition forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest

Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis gularis	1800-Cumberland Swamp Oak riparian forest
Black-necked Stork	Ephippiorhynchus asiaticus	1737-Typha rushland
Black-tailed Godwit	Limosa limosa	1737-Typha rushland
Broad-billed Sandpiper	Limicola falcinellus	1737-Typha rushland
Brown Treecreeper (eastern subspecies)	Climacteris picumnus victoriae	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Comb-crested Jacana	Irediparra gallinacea	1737-Typha rushland
Curlew Sandpiper	Calidris ferruginea	1737-Typha rushland
Diamond Firetail	Stagonopleura guttata	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Dusky Woodswallow	Artamus cyanopterus cyanopterus	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest

Eastern False Pipistrelle	Falsistrellus tasmaniensis	724-Castlereagh shale - gravel transition forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Eastern Osprey	Pandion cristatus	724-Castlereagh shale - gravel transition forest
		835-Cumberland riverflat forest
		1737-Typha rushland
		1800-Cumberland Swamp Oak riparian forest
Flame Robin	Petroica phoenicea	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Freckled Duck	Stictonetta naevosa	1737-Typha rushland
Gang-gang Cockatoo	Callocephalon fimbriatum	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
Glossy Black-Cockatoo	Calyptorhynchus lathami	724-Castlereagh shale - gravel transition forest
Greater Broad-nosed Bat	Scoteanax rueppellii	724-Castlereagh shale - gravel transition forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Grey-headed Flying-fox	Pteropus poliocephalus	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest

Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Koala	Phascolarctos cinereus	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Large Bent-winged Bat	Miniopterus orianae oceanensis	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Little Bent-winged Bat	Miniopterus australis	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Little Eagle	Hieraaetus morphnoides	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1737-Typha rushland
		1800-Cumberland Swamp Oak riparian forest
Little Lorikeet	Glossopsitta pusilla	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland

Little Lorikeet	Glossopsitta pusilla	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Masked Owl	Tyto novaehollandiae	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Painted Honeyeater	Grantiella picta	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Powerful Owl	Ninox strenua	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Regent Honeyeater	Anthochaera phrygia	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Rosenberg's Goanna	Varanus rosenbergi	724-Castlereagh shale - gravel transition forest
Scarlet Robin	Petroica boodang	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Speckled Warbler	Chthonicola sagittata	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest

Speckled Warbler	Chthonicola sagittata	849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Spotted Harrier	Circus assimilis	849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		1737-Typha rushland
Spotted-tailed Quoll	Dasyurus maculatus	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Square-tailed Kite	Lophoictinia isura	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Swift Parrot	Lathamus discolor	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Turquoise Parrot	Neophema pulchella	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
Varied Sittella	Daphoenositta chrysoptera	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland

Varied Sittella	Daphoenositta chrysoptera	835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest
White-bellied Sea-Eagle	Haliaeetus leucogaster	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1737-Typha rushland
		1800-Cumberland Swamp Oak riparian forest
White-fronted Chat	Epthianura albifrons	1737-Typha rushland
White-throated Needletail	Hirundapus caudacutus	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1737-Typha rushland
		1800-Cumberland Swamp Oak riparian forest
Yellow-bellied Glider	Petaurus australis	724-Castlereagh shale - gravel transition forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	724-Castlereagh shale - gravel transition forest
		725-Castlereagh Ironbark forest
		849-Cumberland shale plains woodland
		850-Cumberland shale hills woodland
		835-Cumberland riverflat forest
		1800-Cumberland Swamp Oak riparian forest

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C

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Excellence in your environment

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Ecology and biodiversity
Terrestrial
Freshwater
Marine and coastal
Research and monitoring
Wildlife Schools and training

Heritage management
Aboriginal heritage
Historical heritage
Conservation management
Community consultation
Archaeological, built and landscape values

Environmental management and approvals
Impact assessments
Development and activity approvals
Rehabilitation
Stakeholder consultation and facilitation
Project management

Environmental offsetting
Offset strategy and assessment (NSW, QLD, Commonwealth)
Accredited BAM assessors (NSW)
Biodiversity Stewardship Site Agreements (NSW)
Offset site establishment and management
Offset brokerage
Advanced Offset establishment (QLD)