



Appendix H - Part 1

Biodiversity Development Assessment Report

Westlink M7 Widening, between M5 and Richmond Road

Biodiversity Development Assessment Report

Prepared for Transport for NSW | 31 July 2022



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Declaration

This Biodiversity Development Assessment Report has been prepared on the basis of the requirements of (and information provided under) the Biodiversity Assessment Method as certified by Stephen Bloomfield (BAAS 18054)



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Executive summary

Context

Niche Environment and Heritage Pty Ltd (Niche) has been engaged by AECOM, on behalf of Transport for NSW (Transport), to prepare a Biodiversity Development Assessment Report (BDAR) for the proposed widening of Westlink M7 between the Westlink M7/M5 Motorway (M5) interchange, Prestons, and Richmond Road, Oakhurst (the proposed modification). For the purposes of this study, the area to be impacted by the proposed modification is referred to as the Subject Land.

This report describes the ecological values within the Subject Land as per the Biodiversity Assessment Methodology (BAM) (DPIE 2020a) and determines whether the proposed modification is likely to have an impact on threatened biodiversity listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The ecological assessment, undertaken in accordance with the BAM (DPIE 2020a), included the following:

- Site walkover to map type and extent of native vegetation and determine habitat for threatened biodiversity.
- Collection of floristic and habitat data from 21 BAM plots¹ and 99 Rapid Data Points (RDPs).
- Targeted surveys for six threatened flora species:
 - Downy Wattle (*Acacia pubescens*)
 - Juniper-leaved Grevillea (*Grevillea juniperina* subsp. *juniperina*)
 - *Marsdenia viridiflora* subsp. *viridiflora* (endangered population) (in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith Local Government Areas (LGAs))
 - Matted Bush-pea (*Pultenaea pedunculata*)
 - Spiked Rice-flower (*Pimelea spicata*)
 - Tall Knotweed (*Persicaria elatior*).
- Targeted surveys for five threatened fauna species:
 - Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
 - Little Bent-winged Bat (*Miniopterus australis*)
 - Southern Myotis (*Myotis macropus*)
 - Cumberland Plain Land Snail (*Meridolum corneovirens*)
 - Dural Land Snail (*Pommerhelix duralensis*).

The full BAM and planted native vegetation streamlined module (Appendix D of the BAM) have both been applied to the Subject Land as part of this BDAR.

¹ It is noted that due to late design changes four of the plots are no longer within the Subject Land. Two BAM plots have been removed from the PCT 849_poor vegetation zone and two BAM plots from the PCT 849_low vegetation zone. As a result, the plot requirement for the PCT 849_poor vegetation zone, as per the BAM, has not been satisfied. However, the values recorded from all four plots has been applied throughout the BDAR and used within the BAM-C to determine the offset requirement for the proposed modification.

Results

The survey area (including the operational study area) is around 54.12 hectares (ha) in size. Of the 54.12 ha to be removed from the Subject Land:

- Around 7.48 ha has been mapped as a plant community type (PCT) and has been assessed in accordance with the BAM
- The remaining area is either hard surface areas and infrastructure, or planted native vegetation and has been assessed in accordance with the native vegetation streamlined module (Appendix D) of the BAM.

Seven plant community types (PCT) were mapped within the Subject Land:

- PCT 724 *Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion*
- PCT 725 *Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion*
- PCT 835 *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*
- PCT 849 *Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion*
- PCT 850 *Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion*
- PCT 1737 *Typha rushland*
- PCT 1800 *Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter Valley.*

PCT 724 aligns with *Shale Gravel Transition Forest in the Sydney Basin Bioregion* (SGTF) Threatened Ecological Community (TEC). SGTF is listed as Endangered under the BC Act and Critically Endangered under the EPBC Act². The proposed modification would impact the SGTF TEC at both the State (BC Act) and Commonwealth level (EPBC Act), as the SGTF within the Subject Land satisfies the condition thresholds making it eligible for State and Commonwealth listing.

PCT 725 aligns with *Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion* (CRCIF) TEC. CRCIF is listed as Endangered under the BC Act and Critically Endangered under the EPBC Act. However, with reference to the Commonwealth conservation advice for CRCIF, PCT 725 within the Subject Land would not satisfy the condition thresholds provided to make it eligible for Commonwealth listing. The proposed modification would therefore only impact the CRCIF TEC protected at a State level (BC Act).

PCT 835 aligns with *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (RFEF) TEC. RFEF is listed as Endangered under the BC Act and Critically Endangered under the EPBC Act³. However, with reference to the Commonwealth conservation advice for RFEF, PCT 835 within the Subject Land would not satisfy the condition thresholds provided to make it eligible for Commonwealth listing. The proposed modification would therefore only impact the RFEF TEC protected at a State level (BC Act).

² Listed as Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.

³ Listed as River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria.

PCT 849 aligns with *Cumberland Plain Woodland in the Sydney Basin Bioregion* (CPW) TEC. CPW is listed as Critically Endangered under both the BC Act and EPBC Act⁴. The proposed modification would impact the CPW TEC at both the State (BC Act) and Commonwealth level (EPBC Act).

PCT 850 also aligns with CPW TEC, listed under both the BC Act and EPBC Act. The proposed modification would impact the CPW TEC at both the State (BC Act) and Commonwealth level (EPBC Act).

PCT 1737 aligns with *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* TEC, listed as an EEC under the BC Act. The proposed modification would impact this TEC.

PCT 1800 aligns with *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (SOFF) TEC. SOFF is listed as Endangered under both the BC Act and EPBC Act⁵. However, with reference to the Commonwealth conservation advice for RFEF, PCT 835 within the Subject Land would not satisfy the condition thresholds provided to make it eligible for Commonwealth listing. The proposed modification would therefore only impact the SOFF TEC protected at a State level (BC Act).

No threatened flora were recorded within the Subject Land.

No threatened fauna species were recorded within the Subject Land. One species, Southern Myotis, is presumed to be present due to the field survey occurring outside this species' recommended period of detection.

No other threatened fauna are considered to rely on any portion of the Subject Land for breeding or roosting purposes.

Impact assessment

The proposed modification would result in the following impacts to biodiversity:

- Direct removal of 7.48 ha of native (non-planted) vegetation (highly modified and invaded by introduced species) consisting of:
 - 0.11 of PCT 724, 0.08 ha of PCT 725, 0.9 ha of PCT 835, 2.95 ha of PCT 849, 0.84 ha of PCT 850, 0.1 ha of PCT 1737 and 3.29 ha of PCT 1800
 - 0.46 ha of EPBC Act listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
- Removal of 2.31 ha of foraging habitat for the Southern Myotis
- Removal of fauna habitat (native vegetation) and temporary disturbance to aquatic fauna habitat (drainage lines)
- Impact on Serious and Irreversible Impacts (SAIL) entities: CRCIF and CPW TECs.

Avoid/mitigate impacts

The proposed modification has been designed to avoid and reduce impacts on biodiversity by:

- Conducting the majority of the widening within the median of the Westlink M7, as opposed to its shoulders where the majority of native vegetation occurs.
- 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.

⁴ Listed as Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.

⁵ Listed as Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland.

- Conducting preliminary vegetation mapping to identify areas that contained TECs that were likely to conform to the national listing under the EPBC Act as well as any other significant/sensitive environments. This survey identified better condition areas of vegetation and TECs to avoid.
- Removing the proposed clearing on the slow-lane side of bridges for their inspection/maintenance.

Locating the proposed modification within predominantly cleared and disturbed areas minimises further fragmentation of adjoining bushland, minimises disturbance to waterways and maintains connectivity of surrounding bushland areas, where present. Measures to reduce the unavoidable impacts of the proposed modification on biodiversity values are detailed in this report.

Credit calculations and offsetting

A total of 67 ecosystem credits are required to offset impacts to native vegetation as a result of the proposed modification:

- PCT 724 - *Broad-leaved Ironbark - Grey Box - Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - 2 ecosystem credits
- PCT 725 *Broad-leaved Ironbark - Melaleuca decora* shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion - 1 ecosystem credit
- PCT 835 *Forest Red Gum - Rough-barked Apple* grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - 9 ecosystem credits
- PCT 849 – *Forest Red Gum* grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - 7 ecosystem credits
- PCT 850 *Grey Box - Forest Red Gum* grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion - 15 ecosystem credits
- PCT 1737 *Typha* rushland - 3 ecosystem credits
- PCT 1800 *Swamp Oak* open forest on riverflats of the Cumberland Plain and Hunter valley - 30 ecosystem credits

A total of 33 species credits for Southern Myotis are required to offset impacts to its foraging habitat as a result of the proposed modification.

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Glossary and list of abbreviations

Term or abbreviation	Definition
BAM	Biodiversity Assessment Methodology
BAM-C	Biodiversity Credit Calculator
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW)
BC Reg	<i>NSW Biodiversity Conservation Regulation 2017</i>
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BOS	NSW Biodiversity Offsets Scheme
CEEC	Critically Endangered Ecological Community
cm	Centimetre/s
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DPE	NSW Department of Planning and Environment (formerly DPIE)
DPIE	NSW Department of Planning, Industry and Environment (now DPE)
EEC	Endangered Ecological Community
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDE	Groundwater Dependant Ecosystem
ha	Hectare/s
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometre/s
LGA	Local Government Area
Locality	The Subject Land and surrounds, nominally a 10 km radius from the Subject Land
m	Metre/s
MNES	Matters of National Environmental Significance (from the EPBC Act).
OEH	Office of Environment and Heritage
PCT	Plant Community Type
RDP	Rapid Data Point
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
SSI	State Significant Infrastructure
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
Transport	Transport for NSW
VI	Vegetation Integrity as calculated by the BAM-C
Westlink M7	M7 Motorway (previously known as Western Sydney Orbital)
WSO Co	Western Sydney Orbital Co Pty Limited

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1. Introduction

1.1 Context

Niche Environment and Heritage Pty Ltd (Niche) has been engaged by AECOM, on behalf of Transport for NSW (Transport), to undertake a Terrestrial and Aquatic Biodiversity Assessment and prepare a Biodiversity Development Assessment Report (BDAR) for the proposed widening of Westlink M7 between the Westlink M7/M5 Motorway (M5) interchange, Prestons, and Richmond Road, Oakhurst (the proposed modification) (Figure 1).

The existing Westlink M7 State Significant Infrastructure (SSI) approval (dated 28/02/2002) is proposed to be modified under section 5.25 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act).

The objective of this BDAR is to use the BAM (DPIE 2020a) to describe and assess the ecological values within the Subject Land (those areas to be disturbed as a result of the proposed modification) and surrounds, determine whether the proposed modification is likely to have an impact on threatened biodiversity listed under the *NSW Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and identify and quantify any associated biodiversity offsetting requirements.

The aquatic ecology assessment conducted by Niche is provided in Annex 1. Aquatic Ecology Report

1.2 Background and need for the proposed modification

Transport as the proponent for the proposed modification, is submitting a request to the Minister to modify the project planning approval for the Westlink M7 under section 5.25 of the EP&A Act.

Section 5.25 (2) of the EP&A Act states that “*the proponent may request the Minister to modify the Minister’s approval for State Significant Infrastructure. The Minister’s approval for a modification is not required if the infrastructure as modified would be consistent with the existing approval under this Division*”.

Transport is seeking the modification to enable widening of the Westlink M7, in response to current and future traffic growth, and to address reduced motorway efficiency, travel time performance and safety.

The approved project was for the construction and operation of the four-traffic lane motorway. The approved project, with the implementation of the proposed modification, would be substantially the same development as it would retain its approved use as a 39 kilometre (km)-long tolled motorway. The proposed widening 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 the Westlink M7 bridge at Richmond Road in Oakhurst/Glendenning (northern end), excluding at the M4/Westlink M7 Light Horse Interchange. The potential to use the median for additional traffic lanes or public transport in future was identified in the Environmental Impact Statement (EIS) for the approved project, such that the modification would be consistent with the intent of the original approval.

AECOM, on behalf of Transport, are preparing the modification report that requires an assessment of the likely impacts to biodiversity as a result of the proposed modification.

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1.3 The proposed modification

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 at Richmond Road in Oakhurst/Glendenning (northern end), excluding at the M4 Motorway/Westlink M7 (Light Horse) Interchange (see Figure 2 for extent).

A full description of the construction activities and operational features associated with the proposed modification is 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 lanes 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, additions and modifications to noise walls
- 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)
- Temporary removal of some areas of the Australian Light Horse Sculpture Parade (to be stored and reinstated elsewhere within the memorial following construction)
- Demolition of existing structures and infrastructure within the widening areas
- 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 asphaltting the carriageway surface, line marking, signage, permanent barriers and median infill, adjustments to noise walls, installation of communications infrastructure and landscaping treatments.

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1.4 The Subject Land

In accordance with the BAM, the Subject Land includes those areas to be disturbed as a result of the proposed modification. The location and extent of the Subject Land is shown on Figure 1.

The Subject Land assessed as part of this BDAR is restricted to:

- The median strip
- Areas below the bridges that require widening
- Areas adjacent to bridges where pylons and supports are proposed
- Construction ancillary facilities (e.g. stockpile sites) and associated access tracks
- Named and unnamed creek lines below the bridges proposed to be widened.

The proposed areas of bridge widening, grubbing, access tracks and site compounds are taken to be the full extent of disturbance (including both direct and indirect impacts) (the 'survey area'). No additional areas beyond the survey area have been assessed as part of this BDAR.

No other ancillary features form part of the Subject Land.

The Subject Land is not continuous and occurs as linear and disjunct sections that are present between the Westlink M7/M5 interchange to Richmond Road. It crosses three Local Government Areas (LGA) of Blacktown, Fairfield and Liverpool, and is zoned, for the most part, SP2 (Infrastructure).

As a result of the establishment of the Westlink M7, as well as historical farming practices and urban development, the Subject Land and surrounding area has been subject to a high degree of disturbance and vegetation clearing. This has resulted in a modified and fragmented landscape.

Numerous named and unnamed creek lines occur within the Subject Land, the key waterways being Angus, Reedy, Ropes, Hinchinbrook, Cabramatta and Maxwells Creeks.

As shown on Figure 1, the Subject Land occurs within the:

- Sydney Interim Biogeographic Regionalisation of Australia (IBRA) Bioregion
- Cumberland IBRA Subregion
- Cumberland Plain Mitchell Landscape.

1.4.1 Operational study area

The operational study area includes the existing Westlink M7 infrastructure plus the additional lanes and ancillary infrastructure (for example, noise walls). The operational study area is shown in Figure 2 and is around 19.1 ha in size. This area consists of either hard surface areas and infrastructure, or planted native vegetation.

1.4.2 Survey area

The survey area includes the Westlink M7 widening and the additional clearing associated with the construction ancillary facilities and accesses. The survey area is shown in Figure 2 and is 54.12 ha in size (which includes the operational study area). It would result in the removal of 7.48 ha of native (non-planted) vegetation mapped as a PCT, with the remaining area being either hard surface, infrastructure or planted native vegetation.

1.5 Legislative context

The following legislation or planning instruments are relevant to the works associated with the proposed modification within the Subject Land.

1.5.1 State approval and assessment process

NSW Environmental Planning and Assessment Act 1979 (EP&A Act)

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 approval process.

The proposed widening would require modification to the approved project approval (M7 State Significant Infrastructure [SSI] approval - dated 28/02/2002) and would be assessed under section 5.25 of the EP&A Act.

NSW Biodiversity Conservation Act 2016 (BC Act)

The BC Act establishes a framework for assessing and offsetting biodiversity impacts from proposed development. The purpose of the BC Act is to “maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development”.

The BC Act is supported by the NSW *Biodiversity Conservation Regulation 2017* (BC Reg), the Biodiversity Assessment Method (BAM) (DPIE 2020a), offsetting rules, sensitive biodiversity mapping, credit pricing spreadsheet and other guidance documents.

Under Section 6 of the BC Act, the Biodiversity Offsets Scheme (BOS) provides a framework for offsetting unavoidable impacts on biodiversity from development through application of the BAM. The residual impacts from a development are offset by the purchase and/or retirement of biodiversity credits or payment into the Biodiversity Conservation Fund.

The BAM is also established for the purpose of assessing the impact of actions on threatened species and threatened ecological communities, and their habitats, and the impact on biodiversity values of other actions prescribed by the BC Reg (whether or not the biodiversity offsets scheme applies to the impact of those actions on biodiversity values).

Under Section 6 of the BC Act, in regard to a development or activity, a BDAR is required to:

- assess the biodiversity values of the Subject Land
- assess the impact of a proposed activity on those values in accordance with the BAM
- provide measures that the proponent proposes to take to avoid or minimise the impact
- specify the number and class of biodiversity credits that are required to be retired to offset the residual impacts on biodiversity values.

Application of the BAM

The BAM has been applied to assess impacts of the proposed modification on biodiversity. The BAM provides a framework for assessment of biodiversity impacts and determination of offsetting requirements for major projects under the BOS. Implementation of the BAM and preparation of a BDAR is required when certain thresholds are triggered, as prescribed in the BC Reg; however, as the proposed development is

being assessed as a modification to a SSI, in accordance with section 7.9(2) of the BC Act, the SSI application must be accompanied by a BDAR.

The BDAR can be waived by the Planning Agency Head (or delegate) and the Environment Agency Head (or delegate) should they determine that the proposed development is not likely to have any significant impact on biodiversity values. In the case of the proposed widening, numerous ecological communities, including those listed as threatened under the BC Act, would be impacted. A BDAR waiver will not be prepared as part of the proposed modification.

This BDAR describes the biodiversity values present within the Subject Land and identifies impacts from the proposed modification on these values. This assessment has used the BAM Credit Calculator (version 1.3.0.00).

1.5.2 Commonwealth approval and assessment process

Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The Commonwealth EPBC Act is the Australian Government's key piece of environmental legislation. The EPBC Act applies to developments and associated activities that have the potential to significantly impact on Matters of National Environmental Significance (MNES) protected under the Act.

The BAM requires proponents to identify and assess the impacts on all nationally listed threatened species and threatened ecological communities that may be present on or near the Subject Land. Therefore, the BAM has partly been used to perform assessment of impacts under the EPBC Act.

Where an activity has the potential to result in a significant impacts on a MNES it must be referred to the Commonwealth Minister for Environment for assessment.

This BDAR assesses the impact of the proposed modification on MNES where relevant.

1.5.3 Other legislation

NSW Fisheries Management Act 1994

One of the key objectives of the FM Act is to conserve 'key fish habitat' (addressed in the Aquatic Ecology Report [Annex 1. Aquatic Ecology Report]).

DPI Fisheries, a division within the Department of Primary Industries (DPI), assesses applications for dredging and reclamation works, harm to marine vegetation and obstruction of fish passage in accordance with Part 7 of the *Fisheries Management Act 1994* (FM Act) and Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (Fairfull 2013). One of the key objectives of the FM Act is to conserve 'key fish habitat'. Under Part 7 of the FM Act a permit is to be obtained from the Department of Primary Industries (DPI) (Fisheries) for:

- Activities involving dredging and reclamation work (s201 of the FM Act)
- Harming marine vegetation (s205 of the FM Act)
- Activities temporarily or permanently obstructing fish passage (s209 of the FM Act).

Permits under sections 201, 205 and 209 are not required for the proposed modification as it is SSI. However, in accordance with section 199 of the Act, the Minister for Agriculture must be notified in writing of any proposed dredging or reclamation works proposed to be conducted as part of the proposed modification. Any matters that are raised by the Minister concerning the proposed dredging or reclamation works must be considered within 21 days after the giving of the notice.

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NSW Biosecurity Act 2015

The broad objectives for biosecurity in NSW under the *Biosecurity Act 2015* are to manage biosecurity risks from animal and plant pests and diseases, weeds and contaminants by:

- Preventing their entry into NSW
- Quickly finding, containing and eradicating any new entries
- Effectively minimising the impacts of those pests, diseases, weeds and contaminants that cannot be eradicated through robust management arrangements.

Under the *Biosecurity Act 2015*, priority weeds are defined in the following categories:

- Weeds of National Significance
- National environmental Alert List Weeds
- Water weeds
- Native plants considered weeds.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

State Environmental Planning Policy (Resilience and Hazards) 2021

The Resilience and Hazards State Environmental Planning Policy (SEPP) incorporates a number of former SEPPs, including the Coastal Management SEPP 2018 (now incorporated as Chapter 2). Chapter 2 aims to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the *Coastal Management Act 2016*, including the management objectives for each of the following coastal management areas:

- The coastal wetlands and littoral rainforests area
- The coastal vulnerability area
- The coastal environment area
- The coastal use area.

Development controls for each management area are provided under section 2.2 of the SEPP, and the hierarchy of avoid, minimise and mitigate is recognised.

With reference to the Coastal Management SEPP Data Portal (DPIE 2020b), three Coastal Wetlands are mapped within the vicinity of the Subject Land and their Proximity Area buffers intersect the Subject Land (Figure 2).

The Resilience and Hazards SEPP 2021 does not apply to the proposed modification as it is SSI.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

The Biodiversity and Conservation SEPP incorporates a number of former SEPPs, including the Koala Habitat Protection SEPP 2021 (now incorporated as Chapter 4). Chapter 4 aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline.

The Biodiversity and Conservation SEPP 2021 does not apply to SSI.

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1.6 Assessment objectives and format

The objective of this assessment is to use the guidelines and methodology provided in the BAM to determine the impact the proposed modification would have on biodiversity, avoid and mitigate these impacts and then calculate the proposed modification's biodiversity offset requirement.

This BDAR has two broad stages consistent with the BAM methodology:

Stage 1 – Biodiversity Assessment

- Assessment of landscape features
- Assessment of native vegetation
- Assessment of threatened species and populations.

Stage 2 – Impact Assessment

- Avoid and minimise impacts on biodiversity values
- Consider impact and offset thresholds
- Determine and calculate offset requirements.

1.6.1 Standard (full) BAM and streamlined module

The full BAM and planted native vegetation streamlined module (Appendix D of the BAM) have both been applied to the Subject Land as part of this BDAR. With reference to the decision making key in Appendix D of the BAM, question 5 applied to part of the Subject Land, namely the Westlink M7 median:

D1. 5. Is the native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as: windbreaks in agricultural landscapes, roadside plantings (including street trees, median strips, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or teatree farms?

As such, D2 of Appendix D applies, whereby Chapter 4 (assessment of native vegetation, threatened ecological communities and vegetation integrity) and Chapter 5 (assessment of habitat suitability for threatened species) of the BAM are not required to be applied as part of the BDAR. However, the suitability of the planted native vegetation for use by threatened species must be assessed and any incidental sightings or evidence (e.g. scats, stick nests) of threatened species credit species (flora and fauna) using, inhabiting or being part of the planted native vegetation recorded. Section 8.4 of the BAM (mitigate and manage impacts on biodiversity values) must be applied where evidence indicates that threatened species are using the planted native vegetation as habitat. Should this be the case, it is noted that species credits are not required to offset the proposed impacts.

This BDAR addresses the requirements of Table 28 (Appendix L) of the BAM. Specifically, section 2.6 of this BDAR describes and assesses the planted native vegetation.

This BDAR uses the full BAM and planted native vegetation streamlined module for the following areas of the Subject Land:

- Planted native vegetation streamlined module – those areas of the Subject Land disturbed and obviously landscaped as part of the establishment of the Westlink M7 and any subsequent landscaping activities, including:

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- the median of the Westlink M7 where the topographical nature of the land is the same level as the Westlink M7 itself
- cleared grassland areas that exhibit a primarily exotic groundcover.
- Full BAM – all other areas, including:
 - those areas below bridges and the elevated portions of the Westlink M7
 - access routes and portions thereof that are not part of the median assessed as part of the streamlined module
 - construction ancillary facilities not within the median.

1.7 Assessment resources and assessor qualifications

This BDAR has been prepared by the accredited personnel and support staff identified in Table 1. Resources and survey guidelines used in the development of this BDAR are detailed in Table 2.

Table 1: Assessor qualifications and resources

Personnel	Qualifications	Tasks carried out
Stephen Bloomfield	Senior Ecologist Accredited Biodiversity Assessor (BAAS 18054)	Flora field survey and targeted threatened flora searches, microbat habitat assessment, aquatic habitat assessment, data management, data entry, credit calculations, review of credit calculations, BDAR and aquatic ecology assessment report preparation
Isabel Lyons	Ecologist	BAM plots and targeted threatened flora searches, microbat habitat assessment, aquatic habitat assessment, data management, data entry, BDAR preparation
Annabel Grundy	Ecologist	BAM plots and targeted threatened flora searches, microbat habitat assessment, aquatic habitat assessment, data management
Kayla McGregor	Ecologist	Microbat habitat assessment, BAM plots and targeted threatened flora searches, aquatic habitat assessment, data management
Matthew Russell	Senior Aquatic Ecologist	Aquatic ecology assessment report
Luke Stone	Senior Ecologist	Aquatic ecology assessment report
Sophia Dunn	Ecologist	Aquatic ecology assessment report
Jessie Bear	Ecologist	Aquatic ecology assessment report
Amanda Griffith	Senior Ecologist Accredited Biodiversity Assessor (BAAS 19016)	BDAR review, quality assurance
Loren Laughlin	GIS Specialist	Mapping
Greg Tobin	GIS Specialist	Mapping
Yin Hua	GIS Specialist	Mapping

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Table 2: Assessment resources and guidelines used

Assessment resources/guideline	
Resources	<ul style="list-style-type: none"> • BAM (DPIE 2020a) • BAM 2020 Operational Manual – Stage 1 (DPIE 2020c) • BAM Operational Manual – Stage 2 (DPIE 2019a) • BAM Calculator User Guide (Office of Environment and Heritage [OEH] 2017) • Biodiversity Assessment Method Credit Calculator (BAM-C), app version 1.3.0.00, data version 37 (DPIE 2021a) • The BioNet Atlas of NSW Wildlife (DPIE 2021b) • EPBC Act Protected Matters Search Tool (PMST) (Commonwealth Department of the Agriculture, Water and Environment (DAWE 2021a) • BioNet Threatened Biodiversity Data Collection (TBDC) (DPIE 2021c) • The NSW BioNet Vegetation Information System database, access via the Bionet Vegetation Classification database (DPIE 2021d) • Species Profile and Threats Database (SPRAT) with information on threatened species profiles, recovery plans and final determinations (DAWE 2021b). • Draft Threatened Biodiversity Survey and Assessment Guidelines (NSW Department of Environment and Conservation 2004) • Department of Primary Industry, Fisheries Spatial Data Portal (DPI 2021a) • Policy and Guidelines for Fish Habitat Conservation and Management – Update 2013 (DPI 2013) • The federal Bureau of Meteorology's (BoM) Atlas of Groundwater Dependent Ecosystems (GDE) (BoM 2022)
Survey guidelines	<ul style="list-style-type: none"> • Surveying threatened plants and their habitats, NSW survey guide for the Biodiversity Assessment Method (DPIE 2020d)

2. Biodiversity Assessment

2.1 Landscape assessment

2.1.1 Methods

As detailed in section 3 of the BAM (DPIE 2020a), a landscape assessment for the proposed modification is required, which was conducted within the BAM Biodiversity Credit Calculator (BAM-C). Landscape value is an assessment of a number of factors including:

- Native vegetation cover
- Rivers, streams and estuaries
- Areas of geological significance
- Habitat connectivity.

For each factor, the current state of the landscape is assessed then compared with the state of the landscape if the proposed modification were to proceed.

2.1.2 Landscape features and scoring

Table 3 provides details of the landscape settings and scored landscape features for the proposed modification.

Table 3: Landscape features and scoring under the NSW BAM

Landscape features	Description	Figure reference
IBRA bioregion/subregion	The proposed modification is located in the Cumberland subregion which is within the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) bioregion.	Figure 1
NSW Mitchell Landscape	The Subject Land is mapped as occurring within the Cumberland Plain Landscape.	Figure 1
Rivers, streams and estuaries and Strahler stream order	18 waterways cross the Subject Land. Of those, seven are 1 st order, five are 2 nd order, four are 3 rd order, one is a 4 th order (Hinchinbrook Creek) and one is a 5 th order waterway (Cabramatta Creek).	Figure 2
Wetlands within and adjacent to development	With reference to the Coastal Management SEPP Data Portal, three Coastal Wetlands are mapped within the vicinity of the Subject Land while their Proximity Area buffers intersect the Subject Land.	Figure 2
GDEs	High, moderate and low potential GDEs are mapped within, and adjacent to, the Subject Land (BoM 2022).	Figure 2
Connectivity features	Extant vegetation within the Subject Land is patchy and primarily restricted to riparian corridors and the Western Sydney Parklands. A regional corridor has been mapped in the locality as part of the Biodiversity Investment Opportunities Map (OEH 2015). A minor portion of the survey area intersects with this corridor north of Hoxton Park Road, in association with Hinchinbrook Creek, and at Yarato Road.	Figure 1, Figure 2

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Landscape features	Description	Figure reference
Buffer area (percent native vegetation cover)	<p>A 500 m buffer was applied to the Subject Land resulting in an overall buffer area of 2,950.86 ha.</p> <p><i>Native vegetation cover</i></p> <p>The native vegetation extent and cover of woody vegetation was determined via aerial photography interpretation based on canopy cover, local vegetation mapping (OEH 2013, OEH 2016) and knowledge of the Subject Land.</p> <p><i>Woody vegetation cover</i></p> <p>25 percent (%) of the buffer area was determined to support native woody vegetation with benchmark cover (736.02 ha).</p> <p><i>Non-woody vegetation cover</i></p> <p>Given the landscape and history of the locality, the grasslands present are unlikely to reach benchmark cover. As such, none of the buffer area was considered to support native grassland with benchmark cover (0 ha).</p> <p><i>Total native vegetation cover</i></p> <p>The total estimated woody and non-woody vegetation cover is 25% of the buffer area. This falls into the >10-30% category within the BAM-C.</p>	Figure 1
Site context	Linear based assessment.	-
Geological significance and soils	There are no karst, caves, crevices, cliffs or other areas of geological significance within the Subject Land. There are no high hazard soil areas.	-

2.2 Desktop assessment

A review of relevant literature, databases and existing vegetation mapping was undertaken to identify likely vegetation communities and threatened biodiversity with the potential to occur in the Subject Land. This information was reviewed prior to field surveys to inform initial survey effort and design and identify species for consideration.

Database searches within the locality (a 10 km radius around the Subject Land) were conducted to identify threatened TECs, flora and fauna with known occurrences or with the potential to occur on the Subject Land. A likelihood of occurrence analysis (Annex 2. Threatened species matrix, status and likelihood of occurrence) was then undertaken prior to field surveys for each species/TEC, based on preliminary information regarding habitat present within the Subject Land. The following resources were used for this purpose:

- Database searches:
 - NSW BioNet Atlas Database (DPIE 2021b) for spatial records of threatened species listed under the BC Act within a 10 km radius of the Subject Land.
 - EPBC Act (PMST) (DAWE 2021a) for ecological communities and threatened species identified as MNES known from, or with potential habitat within, a 10 km radius of the Subject Land.
 - A preliminary run of the BAM-C (using benchmark condition for previously mapped Plant Community Types [PCTs]) to identify candidate species credit species and predicted ecosystem credit species known or predicated to occur within the IBRA subregion.
- Vegetation mapping: existing vegetation mapping (OEH 2013, OEH 2016) was examined prior to the field survey to determine the vegetation communities likely to be present in the Subject Land
- EIS for the M12 Motorway (NSW Roads and Maritime Services 2019)

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- EIS (summary) for the Western Sydney Orbital (PPK Environment & Infrastructure Pty Ltd and Sinclair Knight Merz 2000).

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) and professional judgement. The categories are outlined in Table 4. Species considered further for impact assessment included:

- Those in the 'Known', 'High' or 'Moderate' categories and where impacts on the species could reasonably occur from the proposed modification
- Candidate species as identified by the BAM-C.

Table 4: Likelihood of occurrence criteria

Likelihood rating	Threatened flora criteria	Threatened and migratory fauna criteria
Known	The species was observed within the Subject Land.	The species was observed within the Subject Land.
High	It is likely that a species inhabits or utilises habitat within the Subject Land.	It is likely that a species inhabits or utilises habitat within the Subject Land.
Moderate	Potential habitat for a species occurs within the Subject Land. Adequate field survey would determine if there is a 'high' or 'low' likelihood of occurrence for the species within the Subject Land.	Potential habitat for a species occurs within the Subject Land and the species may occasionally utilise that habitat. Species unlikely to be wholly dependent on the habitat present within the Subject Land.
Low	It is unlikely that the species inhabits the Subject Land.	It is unlikely that the species inhabits the Subject Land. If present at the site, the species would likely be a transient visitor. The Subject Land contains only very common habitat for this species which the species would not rely on for its on-going local existence.
None	The habitat within the Subject Land is unsuitable for the species.	The habitat within the Subject Land is unsuitable for the species.

Species listed with a 'Low' or 'None' likelihood of occurrence are those for which there is limited, or no habitat present within the Subject Land.

The likelihood of occurrence analysis (Annex 2. Threatened species matrix, status and likelihood of occurrence) was then updated for each species, based on the PCTs mapped within the Subject Land, following the onsite habitat assessment.

2.3 Native vegetation and flora assessment

2.3.1 Threatened flora requiring survey

A total of 36 candidate threatened flora were identified by the BAM-C as species credit species and/or having a moderate to high likelihood of occurring in the Subject Land (Table 5 and Annex 2. Threatened species matrix, status and likelihood of occurrence). Of the candidate species identified, nine are species subject to serious and irreversible impacts (SAIL); these are *Allocasuarina glareicola*, Austral Pillwort (*Pilularia novae-hollandiae*), *Deyeuxia appressa*, *Gyrostemon thesioides*, Hairy Geebung (*Persoonia hirsuta*), *Hibbertia fumana*, *Hibbertia* sp. Bankstown, *Micromyrtus minutiflora*, and Thick Lip Spider Orchid (*Caladenia tessellata*).

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Table 5: Candidate flora species and habitat suitability assessment

Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
	<i>Allocasuarina glareicola</i>	Species	n/a	724; 725	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
Austral Pillwort	<i>Pilularia novae-hollandiae</i>	Species	South of Wagga Wagga	835; 1800	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	
Austral Toadflax	<i>Thesium australe</i>	Species	n/a	849; 850	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
Bargo Geebung	<i>Persoonia bargoensis</i>	Species	n/a	849	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	
Biconvex Paperbark	<i>Melaleuca biconvexa</i>	Species	n/a	724; 725; 1737	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
Brown Pomaderris	<i>Pomaderris brunnea</i>	Species	n/a	835; 1800	Yes	n/a	The Subject Land is considered too degraded to support	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	
Bynoe's Wattle	<i>Acacia bynoeana</i>	Species	n/a	724; 725; 849	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
Camden White Gum	<i>Eucalyptus benthamii</i>	Species	n/a	835; 849	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
	<i>Deyeuxia appressa</i>	Species	n/a	1800	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							topsoil, compacted ground, and fragmented character.	
	<i>Dillwynia tenuifolia</i>	Species	n/a	724; 725; 849	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
Dillwynia tenuifolia, Kemps Creek	<i>Dillwynia tenuifolia</i> - endangered population	Species	The endangered population occurs in the area bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street,	724; 725	No	n/a	n/a	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
			Kemps Creek in the Liverpool Local Government Area.					
Downy Wattle	<i>Acacia pubescens</i>	Species	n/a	724; 725	Yes	n/a	There is potential habitat within PCT 849 shrubland.	Targeted survey undertaken
	<i>Epacris purpurascens</i> var. <i>purpurascens</i>	Species	n/a	725	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
Gosford Wattle, Hurstville and Kogarah Local Government Areas	<i>Acacia prominens</i> - <i>endangered population</i>	Species	Occurs at a few sites along the railway line at Penshurst, at Carss	725	No	n/a	n/a	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
			Bush Park, Carss Park and there is an unconfirmed siting at Oatley Park, Oatley. This population is disjunct from other populations (Hunter Valley to Gosford region) and at the southern limit of the range of the species.					
	<i>Gyrostemon thesioides</i>	Species	n/a	724; 725; 1800	Yes	Other; Sandy, alluvial or colluvial soil within 50 m of a water course	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							ground, and fragmented character.	
Hairy Geebung	<i>Persoonia hirsuta</i>	Species	n/a	835	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
	<i>Hibbertia fumana</i>	Species	n/a	724; 725	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	
	<i>Hibbertia sp. Bankstown</i>	Species	n/a	725; 835	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
Juniper-leaved Grevillea	<i>Grevillea juniperina subsp. juniperina</i>	Species	n/a	724; 725; 849; 850	Yes	n/a	There is potential habitat within PCT 849 shrubland.	Targeted survey undertaken

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
<i>Marsdenia viridiflora</i> R. Br. subsp. <i>viridiflora</i> population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith IGAs	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - <i>endangered population</i>	Species	Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range.	724; 725; 835; 849; 850	Yes	n/a	There is potential habitat within PCT 849 shrubland.	Targeted survey undertaken
Matted Bush-pea	<i>Pultenaea pedunculata</i>	Species		724; 725; 849; 850	Yes	n/a	There is potential habitat within PCT 849 shrubland.	Targeted survey undertaken
	<i>Maundia triglochinosides</i>	Species	n/a	724; 1737;1800	Yes	Other; Riparian areas/drainage lines, water ponding, man-made dams and drainage channels up	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
						to 1 m deep Semi-permanent/ephemeral wet areas Swamps;Shallow swamps up to 1 m deep Water bodies; Shallow waterbodies up to 1 m deep	composition, disturbed topsoil, compacted ground, and fragmented character.	
	<i>Micromyrtus minutiflora</i>	Species	East of Nepean River	724; 725	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							composition, disturbed topsoil, compacted ground, and fragmented character.	
Netted Bottle Brush	<i>Callistemon linearifolius</i>	Species	n/a	724; 725; 835	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
Nodding Geebung	<i>Persoonia nutans</i>	Species	n/a	724; 725	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	
Pomaderris prunifolia in the Parramatta, Auburn, Strathfield and Bankstown LGAs	<i>Pomaderris prunifolia</i> - <i>endangered population</i>	Species	Known from only three sites within the listed LGAs, at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown.	725	No	n/a	n/a	No
	<i>Pimelea curviflora</i> var. <i>curviflora</i>	Species	n/a	724; 849	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							composition, disturbed topsoil, compacted ground, and fragmented character.	
	<i>Pultenaea parviflora</i>	Species	n/a	724; 725	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
Small-flower Grevillea	<i>Grevillea parviflora subsp. parviflora</i>	Species	n/a	724; 725	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	
Spiked Rice-flower	<i>Pimelea spicata</i>	Species	n/a	849; 850	Yes	n/a	There is potential habitat within PCT 849 shrubland. In addition, this species is known to occur in highly degraded areas that no longer support Cumberland Plain Woodland (TSSC 2016).	Targeted survey undertaken
Square Raspwort	<i>Haloragis exalata subsp. exalata</i>	Species	n/a	724; 725; 1737	Yes	Waterbodies ; Edges of coastal lakes after flooding has removed other vegetation, creek banks	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
						within flood zone, areas close to these features subject to human disturbance including road verges and powerline easements or within 100m	HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	
Sydney Plains Greenhood	<i>Pterostylis saxicola</i>	Species	n/a	849	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							composition, disturbed topsoil, compacted ground, and fragmented character.	
Tadgell's bluebell population, Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield LGAs	<i>Wahlenbergia multicaulis</i> - endangered population	Species	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). There are likely to be more sites than those listed here.	725; 835	No	n/a	n/a	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
Tall Knotweed	<i>Persicaria elatior</i>	Species	n/a	724; 725; 835; 1737;1800	Yes	Semi-permanent/ ephemeral wet areas; or within 50 m Swamps;or within 50 m Waterbodies ; including Wetlands, or within 50 m	There is potential habitat within PCT849 shrubland.	Targeted survey undertaken
Thick Lip Spider Orchid	<i>Caladenia tessellata</i>	Species	n/a	724; 725; 849; 850	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							ground, and fragmented character.	
White-flowered Wax Plant	<i>Cynanchum elegans</i>	Species	n/a	835; 849; 850	Yes	n/a	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	No
	<i>Zannichellia palustris</i>	Species	n/a	1737	Yes	Waterbodies ; Freshwater or slightly brackish estuarine areas (10%)	The Subject Land is considered too degraded to support suitable habitat for this plant. Factors contributing to its degraded nature include, previous clearing, presence of	No

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Step 1: Identify threatened species for assessment						Step 2: Assess habitat constraints		Step3: Further assessment of candidate species
Common name	Scientific name	Credit class	Site within species geographic constraints?	Species associated with site PCT?	Requires further assessment?	Habitat constraints	Site habitat condition suitability	
							HTW, modified PCT composition, disturbed topsoil, compacted ground, and fragmented character.	

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The requirement for targeted survey for each of these species to determine presence/absence from the Subject Land (and the subsequent requirement for credits to be generated) was determined by consideration of the following:

- For each candidate species, review of PCTs associated with each species (as per the Threatened Biodiversity Data Collection [TBDC]) and presence of those PCTs within each subregion for which the species was identified as a candidate species
- Presence of habitat constraints (as identified in the TBDC) within the impact area
- Quality/suitability of habitat present as determined during the initial field survey.

Chapter 5 of the BAM (DPIE 2020a) was referred to when assessing whether further assessment, including targeted survey, was required. Table 5 details the list of candidate and threatened flora species identified as requiring further assessment. Table 5 also includes the associated PCT for each species within the Subject Land (as identified in the TBDC) and identifies whether targeted surveys were required/undertaken. Where species presence could not be ruled out based on lack of associated PCTs or quality of habitat, a conservative approach was taken and targeted surveys conducted.

2.3.2 Methods – field survey

Niche ecologists Stephen Bloomfield, Isabel Lyons, Annabel Grundy and Kayla McGregor surveyed the Subject Land on 12-14 July, 7-10 September 2021, 23 September 2021 and 15 October 2021. The following survey tasks were completed for the flora survey:

- Plant community delineation and mapping, using a combination of BAM plots, as per the BAM requirements, and walking meanders
 - It is noted that, due to late design changes, four of the plots are no longer within the Subject Land; two BAM plots have been removed from the PCT 849_poor vegetation zone and two BAM plots from the PCT 849_low vegetation zone. As a result, the plot requirement for the PCT 849_poor vegetation zone, as per the BAM, will not be satisfied. However, the values recorded from all four plots will be applied throughout the BDAR and used within the BAM-C to determine the offset requirement for the proposed modification.
- Targeted flora surveys, utilising parallel field traverses, as detailed in NSW guideline for surveying threatened plants (DPIE 2020c). An estimated four person hours were spent undertaking targeted flora surveys
- Opportunistic observations of threatened flora, TECs, habitat quality and high threat and priority weeds.

Vegetation mapped as occurring within the Subject Land and flora survey effort is shown on Figure 3, while alignment of the vegetation communities to a PCT is discussed in Section 2.3.3.

Ecological values of the Subject Land (including potential threatened species habitat) were appraised via survey and assessment of vegetation communities and their condition.

The BAM plot values and results of the targeted threatened species surveys were used within the BAM-C to generate credit requirements.

2.3.2.1 BAM plots

The BAM plot requirement was determined using the BAM (DPIE 2020a) and was based on the area of each PCT condition type to be impacted. Existing vegetation mapping was used to estimate the number of plots required prior to survey, which was then refined once on-site to account for variation in condition/community type not apparent from the mapping. The quality and type of PCTs present varied

markedly from that identified in the existing mapping, which resulted in significant time identifying and re-mapping the vegetation communities.

The number of plots conducted for each PCT and vegetation zone is provided in Table 6 and the location of the completed plots is shown on Figure 3. Details regarding PCT delineation and mapping are provided in Section 2.3.3.

Where the size and/or shape of the vegetation zones present did not permit the establishment of a standard 20 metre x 50 metre BAM plot, non-standard sized plots were conducted.

2.3.2.2 Threatened flora survey effort

Targeted threatened flora surveys were undertaken for six species within areas of suitable habitat (Table 5):

- Downy Wattle (*Acacia pubescens*)
- Juniper-leaved Grevillea (*Grevillea juniperina* subsp. *juniperina*)
- *Marsdenia viridiflora* subsp. *viridiflora* (endangered population)
- Matted Bush-pea (*Pultenaea pedunculata*)
- Spiked Rice-flower (*Pimelea spicata*)
- Tall Knotweed (*Persicaria elatior*).

The survey guidelines for threatened plants (DPIE 2020c) were consulted. Parallel transects and/or field traverses were undertaken targeting these plants. Given the area of suitable habitat for these plants generally occurred as small patches, general field traverses and the floristic component of the BAM plot (also 0.04 ha in size) conducted within the threatened plant's associated PCT was considered an appropriate level of survey effort.

The vegetation in the Subject Land is in a poor to moderate condition. Targeted flora searches were predominantly concentrated in the moderate condition vegetation where threatened flora are considered more likely to occur.

In regard to Spiked Rice-flower, the Subject Land was visited three times and the species' potential habitat surveyed.

The recommended timing and the actual timing of the targeted field surveys are listed in Table 7.

2.3.3 Plant community delineation and mapping

All vegetation within the Subject Land was validated via field survey with mapping updated to reflect vegetation observed and surveyed during field assessment. As mentioned previously, the quality and type of PCTs present varied markedly from that identified in the existing vegetation mapping. Vegetation occurring across the Subject Land aligned to seven PCTs (Table 6). Different condition classes were applied to vegetation where differences in structure and quality occurred. Vegetation zones were established for each combination of vegetation type and condition (Table 6). The vegetation formation, class and status relevant to each PCT is also provided in Table 6.

More detailed vegetation community descriptions including species used to aid in determining PCTs and justification for alignment to each of the nominated PCTs are provided in Annex 3. Plant community descriptions.

Table 6: PCTs present in the Subject Land

PCT ID	PCT name	Condition	NSW status	Commonwealth status	Vegetation formation (Keith 2004)	Vegetation class (Keith 2004)	PCT % cleared	Construction impact (ha)	Operational impact (ha)	BAM plots required for the subject land	BAM plots completed ⁶
PCT 724	Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Endangered	Critically Endangered	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Cumberland Dry Sclerophyll Forests	75	0.11	0	1	1
PCT 725	Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Moderate	Endangered	Critically Endangered <i>Vegetation present does not satisfy condition thresholds for Commonwealth listing (see section 2.3.6)</i>	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Cumberland Dry Sclerophyll Forests	95	0.08	0	1	1
PCT 835	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	Endangered	Critically Endangered	Forested Wetlands	Coastal Floodplain Wetlands	93	0.10	0.01	1	1
		Low		<i>Vegetation present does not satisfy condition thresholds for Commonwealth</i>				0.74	0.18	1	2

⁶ It is noted that, due to late design changes, four of the plots are no longer within the Subject Land. As a result, the plot requirement as per the BAM has not been satisfied. However, the values recorded from these plots has been applied throughout the BDAR and used within the BAM-C to determine the offset requirement for the proposed modification.

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PCT ID	PCT name	Condition	NSW status	Common-wealth status	Vegetation formation (Keith 2004)	Vegetation class (Keith 2004)	PCT % cleared	Construction impact (ha)	Operational impact (ha)	BAM plots required for the subject land	BAM plots completed ⁶
				<i>th listing (see section 2.3.6)</i>							
PCT 849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	Endangered	Critically Endangered	Grassy Woodlands	Coastal Valley Grassy Woodlands	93	2.37	0	2	0 ⁷
		Low						0.58	0	1	1 ⁸
PCT 850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Low	Endangered	Critically Endangered	Coastal Valley Grassy Woodlands	Coastal Valley Grassy Woodlands	88	0.70	0.08	1	2
		Moderate						0.13	0	1	1
PCT 1737	Typha rushland	Moderate	Endangered	-	Freshwater Wetlands	Coastal Freshwater Lagoons	70	0.09	0	1	1
		High						0.01	0.003	1	1
PCT 1800	Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Poor	Endangered	Endangered	Forested Wetlands	Coastal Floodplain Wetlands	60	0.56	0.14	1	1
		Low		<i>Vegetation present does not satisfy condition thresholds for Commonweal</i>				0.68	0.02	1	2
		Moderate						1.33	0.33	1	3

⁷ Prior to design changes two BAM plots had been completed in this vegetation zone.

⁸ Prior to design changes three BAM plots had been completed in this vegetation zone.

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PCT ID	PCT name	Condition	NSW status	Common-wealth status	Vegetation formation (Keith 2004)	Vegetation class (Keith 2004)	PCT % cleared	Construction impact (ha)	Operational impact (ha)	BAM plots required for the subject land	BAM plots completed ⁶
				<i>th listing (see section 2.3.6)</i>							
Total								7.48	0.763	14	17

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Table 7: Targeted flora species survey timing

Common name	Scientific name	Associated PCT	Recommended survey timing (DPIE)	Timing of current survey	Reference site visited?
Downy Wattle	<i>Acacia pubescens</i>	724; 725	All year	September, October	No. However, plant conspicuous and does not require flowers for identification.
Juniper-leaved Grevillea	<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	724; 725; 849; 850	All year	September, October	No. However, plant conspicuous and does not require flowers for identification.
	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	724; 725; 835; 849; 850	January, February, November, December	September, October	No. Despite DPIE (2021c) stating flowers are required for identification, it is considered that if it were present it would have been detected given the small and modified nature of the Subject Land.
Matted Bush-pea	<i>Pultenaea pedunculata</i>	724; 725; 849; 850	September-November	September, October	No. However, plant conspicuous and would have been detected during survey.
Spiked Rice-flower	<i>Pimelea spicata</i>	849; 850	All year	September, October – at least 4 weeks after a 58 mm rainfall event in late August.	Yes. Reference site (Western Sydney Parklands) visited and species flowering.
Tall Knotweed	<i>Persicaria elatior</i>	724; 725; 835; 1737; 1800	January, February, March, April, May, December	September, October	No

2.3.4 Site values

Flora

A total of 152 flora species were recorded across the 21⁹ plots; including 80 native species and 72 exotic species. Floristic plot data including cover and abundance of all species recorded is provided in Annex 4. Floristic plot data.

⁹ It is noted that, as a result of late design changes, only 17 plots are relevant to the Subject Land; however, the results and values of all 21 plots have been used within the BDAR and applied to the BAM-C.

Plot and transect values

Results of the floristic composition, structure and function data obtained during the field assessment is provided in Annex 5. BAM plot transect scores.

Site value scores

The site value assessment was carried out by entering plot data into the BAM-C. The data provides quantitative measures of composition, structure and function for each vegetation zone (Annex 5. BAM plot transect scores). The BAM-C compares the values recorded within the Subject Land with the benchmark for the vegetation class to provide the site value score. This score represents the overall condition of the vegetation compared to the benchmark value (out of 100).

The score from these inputs, coupled with data in the following section of this report, was used to determine the number of ecosystem credits that are required for the proposed modification.

Given the fragmented landscape, the patch size varied for the vegetation zones (as can be seen on Figure 2) and has been provided in Table 8. Where multiple vegetation zones occur for a PCT and condition, the larger of the patch sizes was entered into the BAM-C.

Given the mitigation measures to reduce the indirect impacts (refer to section 3.2.6), only the direct impact areas are required to be entered into the BAM-C for the purpose of calculating the ecosystem credits.

The current and future vegetation integrity (VI) scores from the BAM-C are detailed in Table 8. The future integrity scores for the direct impact zones are reduced to zero, as all vegetation and habitats within this zone would be removed.

Table 8: Vegetation zones with current and future VI scores

Vegetation zone	Vegetation zone ID	Impacted area (ha)	Patch size (ha)	Current VI score	Future VI score	Change in VI score
724_moderate	1	0.11	138	35	0	-35
725_moderate	2	0.08	1	25.4	0	-25.4
835_poor	10	0.1	2	2.1	0	-2.1
835_low	5	0.74	27	25.4	0	-25.4
849_poor	3	2.37	101	8.7	0	-8.7
849_low	8	0.58	62	19.3	0	-19.3
850_low	4	0.7	1	26.9	0	-26.9
850_moderate	9	0.13	4	41.5	0	-41.5
1737_moderate	11	0.09	138	34.5	0	-34.5
1737_high	6	0.01	138	60.8	0	-60.8
1800_poor	13	0.56	101	0.1	0	-0.1
1800_low	7	0.68	27	24.7	0	-24.7
1800_moderate	12	1.33	15	32.9	0	-32.9

2.3.5 High threat and priority weeds

During the field surveys 15 high threat weed species were recorded (Table 9). Four are listed as priority weeds for the Greater Sydney region (Table 9). Small-leaved Privet and Cobblers Pegs were the most common weeds across the Subject Land, with Panic Veldt Grass and Fireweed next most recorded.

Table 9: High threat and priority weeds recorded in the Subject Land

Scientific Name	Common Name	Priority Weed in Greater Sydney?
<i>Ageratina adenophora</i>	Crofton Weed	
<i>Asparagus asparagoides</i>	Bridal Creeper	Yes
<i>Bidens pilosa</i>	Cobblers Pegs	
<i>Chlorophytum comosum</i>	Spider Plant	
<i>Cyperus eragrostis</i>	Umbrella Sedge	
<i>Ehrharta erecta</i>	Panic Veldt Grass	
<i>Lantana camara</i>	Lantana	Yes
<i>Ligustrum lucidum</i>	Large-leaved Privet	
<i>Ligustrum sinense</i>	Small-leaved Privet	
<i>Lonicera japonica</i>	Japanese Honeysuckle	
<i>Olea europaea</i>	African Olive	Yes
<i>Rumex sagittata</i>	Turkey Rhubarb	
<i>Rumex acetosella</i>	Sorrel	
<i>Senecio madagascarensis</i>	Fireweed	Yes
<i>Tradescantia fluminensis</i>	Wandering Jew	

2.3.6 Threatened ecological communities

The seven PCTs recorded in the Subject Land align with six TECs listed under the BC and/or EPBC Acts (Figure 4). These are:

- Shale Gravel Transition Forest in the Sydney Basin Bioregion (SGTF) – listed as Endangered under the BC Act and Critically Endangered under the EPBC Act (named as Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest)
 - PCT 724 (moderate) conforms to this TEC under both the EPBC Act and BC Act.
- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (CRCIF) - listed as Endangered under the BC Act and Critically Endangered under the EPBC Act
 - PCT 725 (moderate) conforms to this TEC under the BC Act.
 - With reference to the Commonwealth conservation advice for this TEC (DoE 2015), PCT 725 (moderate) does not satisfy the condition thresholds provided to make it eligible for Commonwealth listing: the CRCIF patches in the Subject Land are not large enough, the patch is not contiguous with a native vegetation remnant and no mature trees or hollow bearing trees were recorded in the patch (refer to Annex 3).
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (RFEF) – listed as Endangered under the BC Act and Critically Endangered under the EPBC Act (named as River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria)
 - PCT 835 (poor, low) conforms to this TEC under the BC Act.

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- With reference to the Commonwealth conservation advice for this TEC (DAWE 2020), PCT 835 (poor, low) does not satisfy the condition thresholds provided to make it eligible for Commonwealth listing: the RFEF patches in the Subject Land are not large enough and/or non-native species comprise majority (more than 80%) of the total understorey vegetation cover and/or a canopy is absent in some areas (refer to Annex 3).
- Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) - listed as Endangered under the BC Act and Critically Endangered under the EPBC Act (named as Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest)
 - PCT 849 (poor, low), PCT 850 (low, moderate) conform to this TEC under the BC Act.
 - Most of the low and moderate condition vegetation zones of PCTs 849 and 850 conform to the critically endangered CPW TEC under the EPBC Act. With reference to the Commonwealth conservation advice for this TEC (DEWHA 2010), PCT 849 (poor condition) and some patches of the low and moderate vegetation zones of PCTs 849 and 850, depending on their location within the Subject Land (connectivity, etc.), do not satisfy the condition thresholds provided to make it eligible for Commonwealth listing: the key diagnostic features and condition thresholds require the patch of the TEC to consist of native trees with a minimum projected foliage cover of 10%, be at least 0.5 ha in size and comprise a perennial understorey made up of 50 percent of native species, among other criteria (refer to Annex 3).
- Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – listed as Endangered under the BC Act.
 - PCT 1737 (moderate, high) conforms to this TEC under the BC Act.
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (SOFF) – listed as Endangered under the BC Act and EPBC Act (Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community)
 - PCT 1800 (poor, low, moderate) conforms to this TEC under the BC Act.
 - With reference to the Commonwealth conservation advice for this TEC (DoEE 2018), PCT 1800 does not satisfy the condition thresholds provided to make it eligible for Commonwealth listing: the SOFF patches in the Subject Land are not large enough and/or non-native species comprise majority (more than 80%) of the total understorey vegetation cover and/or Swamp-oak does not dominate the canopy in some areas (refer to Annex 3).

A description and justification for each PCT/TEC association is provided in Annex 3.

2.3.7 Threatened flora

As detailed in section 2.3.2.2, surveys were undertaken for six threatened flora species predicted to occur within the Subject Land (Table 10).

Table 10: Candidate flora species targeted

Common name	Scientific name	Status
Candidate species (species credit species)		
Downy Wattle	<i>Acacia pubescens</i>	Surveyed. Not present.
Juniper-leaved Grevillea	<i>Grevillea juniperina subsp. juniperina</i>	Surveyed. Not present.
<i>Marsdenia viridiflora subsp. viridiflora</i> (endangered population)	<i>Marsdenia viridiflora subsp. viridiflora</i> (endangered population)	Surveyed. Not present.
Matted Bush-pea	<i>Pultenaea pedunculata</i>	Surveyed. Not present.
Spiked Rice-flower	<i>Pimelea spicata</i>	Surveyed. Not present.
Tall Knotweed	<i>Persicaria elatior</i>	Surveyed. Not present.

No threatened flora were identified in the Subject Land. As such, no flora species credits are required for the proposed modification.

2.4 Fauna assessment

2.4.1 Threatened fauna requiring survey

Targeted threatened fauna surveys are required for those species identified as having a moderate to high likelihood of occurrence (based on presence of suitable habitat/required habitat constraints) (Annex 2. Threatened species matrix, status and likelihood of occurrence) and those identified as candidate species by the BAM-C once the BAM plot data was entered.

Where species with a high likelihood of occurrence were not identified by the BAM-C as candidate species, they were added to vegetation zones within IBRA subregions where suitable habitat was identified during the habitat assessment.

A total of 28 threatened fauna species were identified by the BAM-C as species credit species and/or having a moderate to high likelihood of occurring in the Subject Land (Table 11, Annex 2. Threatened species matrix, status and likelihood of occurrence). Of the candidate species identified, one, Large-eared Pied Bat (*Chalinolobus dwyeri*), is a species subject to SAIL.

All ecosystem (predicted) credit species were assumed present within the Subject Land. Ecosystem credit species are listed in Table 12.

The requirement for targeted survey for each of these species to determine presence/absence from the Subject Land (and the subsequent requirement for credits to be generated) was determined following the process detailed in section 5.2 of the BAM (DPIE 2020a) with consideration of the following:

- For each candidate species, review of PCTs associated with each species (as per the TBDC) and presence of those PCTs within each subregion for which the species was identified as a candidate species
- Presence of habitat constraints (as identified in the TBDC) within the impact area
- Quality/suitability of habitat present as determined during the initial field survey
- Survey effort undertaken during the initial BAM site assessment/survey.

Our assessment of the requirement for further consideration/survey/inclusion in the BAM-C for each candidate fauna species is provided in Table 11. This assessment was informed by the field survey and fauna habitat present, as described in section 2.4.3.

Based on the outcome of this assessment, targeted surveys for threatened fauna were considered necessary and undertaken for five species (three species of microbat and two species of land snail).

Species were excluded from candidacy in the BAM-C for the following reasons:

- Excluded due to absence of required habitat (habitat constraints) regardless of the presence of the species associated PCTs
- Excluded due to the heavily degraded vegetation zones present, which lack suitable habitat for all candidate species
- Excluded based on the absence of mapped important areas (i.e. Swift Parrot, Regent Honeyeater)
- Excluded as having been surveyed, based on the absence of large stick nests suitable for large raptors within the impact area, which indicates no suitable breeding habitat within the impact area (i.e. White-bellied Sea Eagle, Eastern Osprey).

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Table 11: Candidate fauna species and habitat suitability assessment

Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assessment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
Birds										
Barking Owl	<i>Ninox connivens</i>	Species/ Ecosystem	Not listed	724; 725; 835; 849; 850; 1800	fragmented (between 11 and 30 % habitat retained)	25 - 100 ha	Yes	Hollow bearing trees; living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	The Subject Land is considered too degraded to support suitable habitat for this species. In addition, no suitable hollow-bearing trees are present within the Subject Land.	Not required.
Black-tailed Godwit	<i>Limosa</i>	Species/ Ecosystem	Not listed	1737	restricted (with 10% or less habitat retained)	< 5 ha	No	As per mapped areas	Subject Land not within Important Mapped Area for the species.	Not required.
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	Species/ Ecosystem	Not listed	724; 725; 1737	restricted (with 10% or less habitat retained)	< 5 ha	No	As per mapped areas	Subject Land not within Important Mapped Area for the species.	Not required.
Bush Stone-curlew	<i>Burhinus grallarius</i>	Species	Not listed	724; 725; 835; 849;	fragmented (between 11	< 5 ha	Yes	Fallen/standing dead timber including logs; Null	The Subject Land is considered too	Not required.

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assessment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
				850; 1737;1800	and 30 % habitat retained)				degraded to support suitable habitat for this species. In addition, the Subject Land lacks a suitable amount of fallen timber.	
Curlew Sandpiper	<i>Calidris ferruginea</i>	Species/ Ecosystem	Not listed	1737	restricted (with 10% or less habitat retained)	< 5 ha	No	As per mapped areas	Subject Land not within Important Mapped Area for the species.	Not required.
Eastern Osprey	<i>Pandion cristatus</i>	Species/ Ecosystem	Not listed	724; 725; 835; 1737;1800	restricted (with 10% or less habitat retained)	< 5 ha	Yes	Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting	No stick nests are present within the Subject Land.	Not required.
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	Species/ Ecosystem	Not listed	724; 725; 835; 849; 850	fragmented (between 11 and 30 % habitat retained)	< 5 ha	Yes	Hollow bearing trees; Eucalypt tree species with hollows greater than 9 cm diameter.	The Subject Land is considered too degraded to support suitable habitat for this species. In addition, no suitable hollow-bearing trees are	Not required.

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assessment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
									present within the Subject Land.	
Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai LGAs	<i>Callocephalon fimbriatum</i> - endangered population	Species	This endangered population is found in the Ku-ring-gai and Hornsby local government areas. The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south,	849; 850	< 5ha	< 5 ha	No. Subject Land not within Hornsby or Ku-ring-gai LGA.	Not listed	n/a	Not required.

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assess- ment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assessment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
			Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area.							
Glossy Black-Cockatoo	<i>Calyptrorhynchus lathamii</i>	Species/ Ecosystem	Not listed	724; 725; 835; 850	restricted (with 10% or less habitat retained)	< 5 ha	Yes	Presence of Allocasuarina and casuarina species, hollow bearing trees; living or dead tree with hollows greater than 15 cm diameter and	The Subject Land is considered too degraded to support suitable habitat for this species. In addition, no suitable hollow-bearing trees are	Not required.

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assess- ment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assess- ment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
								greater than 5 m above ground.	present within the Subject Land.	
Little Eagle	<i>Hieraaetus morphnoid es</i>	Species/ Ecosystem	Not listed	724; 725; 835; 849; 850; 1737;1800	fragmented (between 11 and 30 % habitat retained)	< 5 ha	Yes	Nest trees - live (occasionally dead) large old trees within vegetation.	The Subject Land is considered too degraded to support suitable habitat for this species. In addition, no large trees in suitable vegetation are present within the Subject Land.	Not required.
Masked Owl	<i>Tyto novaeholla ndiae</i>	Species/ Ecosystem	Not listed	724; 725; 835; 849; 850; 1800	fragmented (between 11 and 30 % habitat retained)	< 5 ha	Yes	Hollow bearing trees; living or dead trees with hollows greater than 20cm diameter.	The Subject Land is considered too degraded to support suitable habitat for this species. In addition, no suitable hollow- bearing trees are present within the Subject Land	Not required.

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assessment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
Powerful Owl	<i>Ninox strenua</i>	Species/ Ecosystem	Not listed	724; 725; 835; 849; 850; 1800	fragmented (between 11 and 30 % habitat retained)	< 5 ha	Yes	Hollow bearing trees; living or dead trees with hollow greater than 20cm diameter.	The Subject Land is considered too degraded to support suitable habitat for this species. In addition, no suitable hollow-bearing trees are present within the Subject Land	Not required.
Regent Honeyeater	<i>Anthochaera phrygia</i>	Species/ Ecosystem	Not listed	724; 725; 835; 849; 850; 1800	restricted (with 10% or less habitat retained)	< 5 ha	Yes	As per mapped areas	Subject Land not within Important Mapped Area.	Not required.
Square-tailed Kite	<i>Lophoictinia isura</i>	Species/ Ecosystem	Not listed	724; 725; 835; 849; 850; 1800	fragmented (between 11 and 30 % habitat retained)	< 5 ha	Yes	Nest trees	The Subject Land is considered too degraded to support suitable habitat for this species. In addition, no nest trees are present within the Subject Land.	Not required.

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assessment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assessment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
Swift Parrot	<i>Lathamus discolor</i>	Species/ Ecosystem	Not listed	724; 725; 835; 849; 850; 1800	restricted (with 10% or less habitat retained)	< 5 ha	Yes	As per mapped areas	Subject Land not within Important Mapped Area.	Not required.
Mammals										
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	Species	None listed	724; 725; 835; 849; 850	fragmented (between 11 and 30 % habitat retained)	< 5 ha	Yes	Not listed	The Subject Land is considered too degraded to support suitable habitat for this species. Subject Land lacks suitable foraging and sheltering habitat.	Not required.
Greater Glider	<i>Petauroides volans</i>	Species	None listed	724; 725; 835; 849; 850	varied (between 31 and 70% habitat retained)	5 - 24 ha	Yes	Hollow bearing trees	The Subject Land is considered too degraded to support suitable habitat for this species. In addition, no suitable hollow-bearing trees are present within the Subject Land	Not required.

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assess- ment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assess-ment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	Species/ Ecosystem	None listed	724; 725; 835; 849; 850; 1800	restricted (with 10% or less habitat retained)	< 5 ha	Yes	Breeding camps	No breeding camps are present within the Subject Land. Limited foraging habitat available.	Not required.
Koala	<i>Phascolarctos cinereus</i>	Species/ Ecosystem	None listed	724; 725; 835; 849; 850; 1800	restricted (with 10% or less habitat retained)	< 5 ha	Yes	Areas identified via survey as important habitat	The habitat present in the Subject Land is not considered important Koala habitat. The Subject Land is considered too degraded to support suitable habitat for this species.	Not required.
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	Species/ Ecosystem	None listed	724; 725; 835; 849; 850; 1800	restricted (with 10% or less habitat retained)	< 5 ha	Yes	Caves; Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;"	Bridges considered to provide potential habitat for this species.	Microbat habitat assess-ment under-taken.

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assess- ment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assess-ment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
								with numbers of individuals >500		
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Species	None listed	724; 725; 835; 849; 850; 1800	fragmented (between 11 and 30 % habitat retained)	< 5 ha	Yes	Cliffs; within 2 km of rocky areas containing caves, overhangs, escarpment, outcrops, or crevices, or within 2 km of old mines or tunnels.	No caves, overhangs, escarpment, outcrops, crevices, old mines or tunnels are likely to be within 2km of the Subject Land.	Not required.
Little Bent-winged Bat	<i>Miniopterus australis</i>	Species/ Ecosystem	None listed	724; 725; 835; 849; 850; 1800	restricted (with 10% or less habitat retained)	< 5 ha	Yes	Caves; cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature.	Bridges considered to provide potential habitat for this species.	Microbat habitat assessment under-taken.

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assess- ment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assess- ment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
Southern Myotis	<i>Myotis macropus</i>	Species	None listed	724; 725; 835; 849; 850; 1737;1800	restricted (with 10% or less habitat retained)	< 5 ha	Yes	Hollow bearing trees; within 200 m of riparian zone. Bridges, caves or artificial structures within 200 m of riparian zone. Waterbodies; this includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site.	Bridges considered to provide potential habitat for this species.	Microbat habitat assess- ment under- taken.
Squirrel Glider	<i>Petaurus norfolcensis</i>	Species	None listed	724; 725; 835; 849; 850; 1800	restricted (with 10% or less habitat retained)	< 5 ha	Yes	Not listed	The Subject Land is considered too degraded to support suitable habitat for this species. In addition, no suitable hollow- bearing trees are present within the Subject Land	Not required
Amphibians										

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assess- ment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assess- ment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
Giant Burrowing Frog	<i>Heleioporus australiacu s</i>	Species	None listed	724; 725	variegated (between 31 and 70% habitat retained)	5 - 24 ha	Yes	None listed	The Subject Land is considered too degraded to support suitable habitat for this frog.	Not required.
Green and Golden Bell Frog	<i>Litoria aurea</i>	Species	None listed	724; 725; 835; 849; 850; 1737;1800	restricted (with 10% or less habitat retained)	< 5 ha	Yes	Semi- permanent/ephemeral wet areas; within 1 km of wet area. Swamps; within 1 km of swam. Waterbodies; within 1km of waterbody	The Subject Land is considered too degraded to support suitable habitat for this frog. In addition, most recent record from 2019, 8.5km to the east on the eastern side of the Georges River (DPIE 2021c)	Not required.
Invertebrates										
Cumberland Plain Land Snail	<i>Meridolum corneoviren s</i>	Species	None listed	724; 725; 835; 849; 850	restricted (with 10% or less habitat retained)	< 5 ha	Yes	None listed	Potential habitat present in the better quality areas of PCT 849, PCT 850 and PCT 835.	Targeted survey under- taken.

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Step 1: Identify threatened species for assessment								Step 2: Assess habitat constraints		Step3: Further assess- ment of candidate species?
Common name	Scientific name	Credit class	Site within species geographic constraints?	Associated site PCTs?	Vegetation cover required	Required patch size	Requires further assessment?	Habitat constraints (as per the TBDC)	Site habitat condition suitability	
Dural Land Snail	<i>Pommerhelia duralensis</i>	Species	None listed	724; 725; 849; 850	restricted (with 10% or less habitat retained)	< 5 ha	Yes	None listed	Potential habitat present in the better quality areas of PCT 849, PCT 850 and PCT 835.	Targeted survey undertaken.

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Table 12: Predicted (ecosystem credit) threatened species

Common Name	Scientific Name	BC Act*	Associated Plant Community Type
Australasian Bittern	<i>Botaurus poiciloptilus</i>	E	PCT 835 Cumberland riverflat forest PCT 1737 Typha rushland
Australian Painted Snipe	<i>Rostratula australis</i>	E	PCT 1737 Typha rushland
Barking Owl	<i>Ninox connivens</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Black Bittern	<i>Ixobrychus flavicollis</i>	V	PCT 835 Cumberland riverflat forest PCT 1737 Typha rushland PCT 1800 Cumberland Swamp Oak riparian forest
Black Falcon	<i>Falco subniger</i>	V	PCT 1737 Typha rushland
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	E	PCT 1737 Typha rushland
Black-tailed Godwit	<i>Limosa</i>	V	PCT 1737 Typha rushland
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	V	PCT 1737 Typha rushland
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Comb-crested Jacana	<i>Irediparra gallinacea</i>	V	PCT 1737 Typha rushland
Curlew Sandpiper	<i>Calidris ferruginea</i>	E	PCT 1737 Typha rushland
Diamond Firetail	<i>Stagonopleura guttata</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest

Common Name	Scientific Name	BC Act*	Associated Plant Community Type
Dusky Woodswallow	<i>Artamus cyanopterus</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Eastern Coastal Free-tailed Bat	<i>Micronomus norfolkensis</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Eastern Osprey	<i>Pandion cristatus</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 835 Cumberland riverflat forest PCT 1737 Typha rushland PCT 1800 Cumberland Swamp Oak riparian forest
Flame Robin	<i>Petroica phoenicea</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Freckled Duck	<i>Stictonetta naevosa</i>	V	PCT 1737 Typha rushland
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	EP	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	EP	PCT 724 Castlereagh shale - gravel transition forest
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest

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Common Name	Scientific Name	BC Act *	Associated Plant Community Type
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Hooded Robin (south-eastern form)	<i>Melanodryas cucullata</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Koala	<i>Phascolarctos cinereus</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Little Bent-winged Bat	<i>Miniopterus australis</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Little Eagle	<i>Hieraaetus morphnoides</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Little Lorikeet	<i>Glossopsitta pusilla</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest

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Common Name	Scientific Name	BC Act *	Associated Plant Community Type
Masked Owl	<i>Tyto novaehollandiae</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Painted Honeyeater	<i>Grantiella picta</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Powerful Owl	<i>Ninox strenua</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Regent Honeyeater	<i>Anthochaera phrygia</i>	CE	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Rosenberg's Goanna	<i>Varanus rosenbergi</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest
Scarlet Robin	<i>Petroica boodang</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Speckled Warbler	<i>Chthonicola sagittata</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Spotted Harrier	<i>Circus assimilis</i>	V	PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 1737 Typha rushland

Common Name	Scientific Name	BC Act *	Associated Plant Community Type
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Square-tailed Kite	<i>Lophoictinia isura</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Swift Parrot	<i>Lathamus discolor</i>	E	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Turquoise Parrot	<i>Neophema pulchella</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
Varied Sittella	<i>Daphoenositta chrysoptera</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1737 Typha rushland PCT 1800 Cumberland Swamp Oak riparian forest
White-fronted Chat	<i>Epthianura albifrons</i>	EP	PCT 1737 Typha rushland

Common Name	Scientific Name	BC Act*	Associated Plant Community Type
White-throated Needletail	<i>Hirundapus caudacutus</i>	-	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1737 Typha rushland PCT 1800 Cumberland Swamp Oak riparian forest
Yellow-bellied Glider	<i>Petaurus australis</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	V	PCT 724 Castlereagh shale - gravel transition forest PCT 725 Castlereagh Ironbark forest PCT 849 Cumberland shale plains woodland PCT 850 Cumberland shale hills woodland PCT 835 Cumberland riverflat forest PCT 1800 Cumberland Swamp Oak riparian forest

* E – Endangered; V – Vulnerable; CE – Critically Endangered, EP – Endangered Population

Due to the following factors, the Subject Land is considered unlikely to provide significant habitat for any listed threatened fauna species:

- The small size of the impact area
- High level of existing disturbance within a highly developed area
- Lack of habitat features providing roost sites/breeding sites and shelter
- The lack of habitat constraints for candidate species as listed in the TBDC (DPIE 2021c).

2.4.2 Methods – field survey

Niche ecologists Stephen Bloomfield, Isabel Lyons, Annabel Grundy and Kayla McGregor surveyed the Subject Land on 12-14 July, 7-10 September 2021, 23 September 2021 and 15 October 2021. The following survey tasks were completed for the fauna survey (Figure 5):

- Habitat assessment – identification of important habitat features
- Targeted microbat habitat assessment of the bridges
- Recording and mapping of hollow-bearing trees (HBTs) within the Subject Land
- Aquatic habitat assessment (described further in Annex 1. Aquatic Ecology Report)
- Opportunistic observations made throughout the survey team's time on site.

No nocturnal surveys were conducted as part of the field survey as the field survey timing was outside the recommended survey period for microbats. However, an Echometer 2 directional handheld device was used when undertaking diurnal habitat assessments of the bridges (refer to section 2.4.2.1).

Weather conditions were cool to mild, with the occasional warmer day. The survey period was very dry with little to no rainfall. Climatic conditions experienced during the survey period are presented in Table 13.

Table 13: Climatic conditions during survey period*

Conditions	Survey	Wind direction and max. speed (km/h)	Min. temperature (°C)	Max. temperature (°C)	Rain (mm)
12/07/2021	Opportunistic observations	NNE 22 km/h	3.9	17.3	0
13/07/2021	Opportunistic observations	NW 22 km/h	5.3	19	0
14/07/2021	Opportunistic observations	N 26 km/h	8.6	16.7	0.2
7/09/2021	Opportunistic observations, terrestrial and aquatic habitat assessment	SW 37 km/h	3.1	23.6	0
8/09/2021	Opportunistic observations, terrestrial and aquatic habitat assessment	N 17 km/h	6.2	22.6	0
9/09/2021	Opportunistic observations, terrestrial and aquatic habitat assessment	NNW 31 km/h	4	27.2	0
10/09/2021	Opportunistic observations, terrestrial and aquatic habitat assessment	WSW 41 km/h	11.7	25.3	0
23/09/2021	Microbat habitat assessment, opportunistic observations, terrestrial and aquatic habitat assessment	SSW 17 km/h	6.2	27	0
15/10/2021	Opportunistic observations	NNW 50 km/h	12.6	22	5.4

*Data taken from the Horsley Park Equestrian Centre automatic weather station (067119) (BoM 2021).

2.4.2.1 Habitat assessment

The following key habitat features were surveyed for to assist in determining the likely presence of threatened species:

- Type, condition and diversity of vegetation communities present
- Presence of roosting/breeding/shelter resources such as:
 - large stick nests suitable for raptors
 - hollow-bearing trees and stags
 - rock ledges, shelters, caves, outcrops, gibber plains
 - cave substitutes, such as culverts and bridges (see below)
 - logs and leaf litter.
- Permanent and ephemeral aquatic habitat (described further in Annex 1. Aquatic Ecology Report).

Microbat habitat assessment

Each of the 23 bridges to be widened as part of the proposed modification was assessed for their potential to be used as a roost site by threatened microbats. Two threatened bats known to occur within the locality, Southern Myotis and Large Bentwing Bat, are known to utilise bridge structures.

To determine whether bats are using the bridges regularly for roosting habitat, a diurnal search of the undercarriage of the bridge was undertaken on 7, 8 and 9 September 2021 (see Annex 6. Microbat habitat assessment) in accordance with survey guidelines (OEH 2018). This involved inspecting the underside of the bridge with a hand held torch, searching for roosting microbats and potential bat roosts (i.e. suitable holes, cracks, crevices, roughened concrete, parapets, scuppers, mud nests.), or indicative signs of their presence,

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such as ammonia-like odours (urine), presence of parasitic flies, discolouration or staining of concrete, and guano (i.e. bat excrement). Where the undercarriage was too high above the ground to allow searching by the naked eye, binoculars were used.

Where bridges with a moderate or higher potential for use by microbats was identified, a targeted investigation using an Echometer 2 directional handheld device was used during the day. This anabat can detect social calls emitted by microbats up to a distance of 20 m.

Of the 23 bridges inspected, 20 were of low value to threatened microbats, in particular Southern Myotis and Large Bentwing Bat, for the following reasons:

- The bridge's exposure to disturbance (traffic - noise, light; human disturbance)
- Unsuitable roost points (clogged scuppers, smooth concrete, wide/shallow expansion joints)
- Limited 'dark' places.

The remaining three bridges were considered to be moderate potential habitat, however a lack of detection of social calls during the targeted investigation resulted in these bridges being revised down to low potential habitat. It is recommended, however, that these three bridges be subject to a safeguard whereby works in the vicinity of the three bridges are temporarily ceased should microbats be observed exiting the bridge or nearby location during construction. A qualified ecologist should be engaged to undertake further investigation if this occurs. Additionally, Transport's Microbat Management Guidelines (Transport 2021) should be consulted and a Bat Management Plan prepared (refer to section 3.2.6).

No dusk surveys were conducted, nor was deployment of any other anabat detectors left over night. Given the seasonal timing of the field survey, microbats were unlikely to be exiting the bridge for nightly foraging as they are generally in torpor at that time of year. In addition, the timing of the survey did not align with the requirements prescribed for threatened bats within published guidelines or the notes within the TBDC. While this is the case, given the timing of the habitat assessment (September – being on the shoulder of the recommended survey period for threatened candidate microbat species) and an average daily temperature during this period of between 25 – 27 °C (mild), it is postulated that torpor bouts for roosting bats would be reduced throughout this period, with increased normothermic and active periods coinciding with periods of mild weather (Turbill 2008, Geiser and Körtner 2010). Therefore, cave-roosting species (or species that utilise artificial surrogates) are likely to be detected interacting (social buzzes)/co-roosting on the shoulder of their 'active' period. It should be acknowledged that this method does not comprise a targeted microbat survey.

The assessment was undertaken to delineate any potential roosting habitat, and will be used to inform mitigation and avoidance measures within a Biodiversity Management Plan (BMP).

2.4.2.2 Threatened fauna survey effort

Targeted threatened fauna surveys were undertaken for five species within areas of suitable roosting/breeding habitat within the Subject Land (Table 14):

- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Little Bent-winged Bat (*Miniopterus australis*)
- Southern Myotis (*Myotis macropus*)
- Cumberland Plain Land Snail (*Meridolum corneovirens*)
- Dural Land Snail (*Pommerhelix duralensis*).

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A microbat assessment was undertaken to determine the potential for the bridges in the Subject Land to be used as a roost site by Large Bent-winged Bat, Little Bent-winged Bat and Southern Myotis (refer to sections 2.4.2.1 above and 2.4.3).

Searches for the snails (live specimens and shells) were conducted in the better-quality areas of the PCTs associated with these species i.e. the better parts of CPW within the Subject Land. Searches in accumulations of leaf litter around the base of eucalypt trees and under other natural/urban refuse was conducted.

2.4.3 Fauna and fauna habitats

Fauna species recorded in the Subject Land are listed in Annex 7. Fauna species list. A total of 30 native species were recorded during field surveys, comprising 20 native birds, five reptiles and three frog species (Annex 7. Fauna species list). This is by no means a comprehensive list of fauna that would utilise the Subject Land and includes only those species opportunistically detected while undertaking various site surveys.

No threatened fauna species were recorded during the field surveys.

Native vegetation

The native vegetation present consists largely of regenerated/planted native vegetation that is heavily infested by weeds in many locations. Maintained or rank grassland areas are present in association with the construction ancillary facilities.

None of the native vegetation present is considered to provide quality fauna habitat. Common to abundant animals that reside in the groundcover and that are tolerant of disturbance and exposure are expected to be the only species that would utilise such habitats (i.e. skinks).

Minimal fallen timber and leaf litter is present, however, flood-borne debris is common in association with the creek lines.

Hollow-bearing trees

Two hollow-bearing trees were recorded during the survey (Annex 8. Hollow-bearing tree register) (Figure 5). One tree, however, is not within the Subject Land, but adjacent to an access way off Mavis Street at Rooty Hill and would not be directly or indirectly impacted by the proposed modification. The other tree is a dead stag, and suspected to contain small hollows, present in the Zone C-3 construction ancillary facility at Eastern Creek. It is unknown if this tree would be retained. However, it is not considered to provide habitat for any species credit species. While microbats may utilise this tree as a roost site, apart from Southern Myotis, all are ecosystem credit species. In regard to Southern Myotis, the tree does not occur within 200 metres of a suitable water body as per the TBDC and thus does not constitute potential breeding habitat (and the requirement for consideration as a species credit species) for the species.

Artificial structures (bridges)

Twenty-three bridges are proposed for widening as part of the proposed modification. Structures such as bridges are known to provide habitat for microbats. The majority of the bridges are exposed to disturbance from traffic (light, noise) and human interaction. The concrete surface of the under carriages of the bridges is typically smooth, and limited 'dark' places are present. While expansion joints are abundant these are usually wide/shallow enough to see into. It is noted that scuppers are numerous and the potential for these to be used by microbats ranges from low to moderate.

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Three bridges were considered to provide potential (moderate likelihood) habitat for microbats given the presence of suitable roost points and their location in respect to adjacent foraging resources and limited disturbance.

Aquatic habitat

Eighteen waterways identified in the Subject Land are shown on Figure 2. Six of these waterways are named: Angus, Reedy, Ropes, Hinchinbrook, Cabramatta and Maxwells Creeks. Reedy Creek, Hinchinbrook Creek and one of its tributaries, Cabramatta and Maxwells Creeks are mapped as Key Fish Habitat (DPI 2021).

The creeklines present were all observed to contain water, however flow was non-evident to negligible. The water present was generally shallow and clear. The creeks exhibited signs of channel erosion in places; however, the channel and banks were mostly stable. The riparian vegetation across the Subject Land is typically modified, dominated by exotic vegetation, and provides little function for the waterway. Native canopy is provided by *Casuarina glauca* and/or *Eucalypt spp.* at many sites, however the under storey is comprised of mostly exotic grasses and annuals. The banks of the creeks underneath the bridges were generally bare or vegetated by exotic groundcovers. Emergent macrophytes, such as Cumbungi (*Typha orientalis*), were also present at few select locations. Flood borne debris and rubbish was common, while snags were also observed at some locations.

While the creeklines, particularly the named (major) waterways, are likely to provide some aquatic habitat (including some macrophytes) for tolerant aquatic fauna, it is unlikely they would support sensitive species protected under the NSW *Fisheries Management Act 1994* and/or EPBC Act.

An aquatic ecology assessment has been undertaken and is provided in Annex 1. Aquatic Ecology Report.

2.4.4 Threatened fauna

As detailed in section 2.4.2.2 surveys were undertaken for five threatened fauna species predicted to occur within the Subject Land (Table 14).

Table 14: Candidate fauna species targeted

Common name	Scientific name	Status
Candidate species (species credit species)		
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	Microbat habitat assessment of bridges conducted. Highly unlikely to be present.
Little Bent-winged Bat	<i>Miniopterus australis</i>	Microbat habitat assessment of bridges conducted. Highly unlikely to be present.
Southern Myotis	<i>Myotis macropus</i>	Microbat habitat assessment of bridges conducted. Highly unlikely to be present in bridges. However, as species is a full credit species, and targeted surveys were not undertaken for this species, all foraging habitat (associated PCTs in the TBDC) must be offset
Cumberland Plain Land Snail	<i>Meridolum corneovirens</i>	Surveyed. Not present.
Dural Land Snail	<i>Pommerhelix duralensis</i>	Surveyed. Not present.

While mobile species such as threatened birds and the Grey-headed Flying-fox (*Pteropus poliocephalus*) would more than likely forage within the Subject Land, the lack of their necessary habitat constraints (e.g. prescribed hollow-bearing trees, stick nests, Flying-fox camps) precludes these species from utilising it for breeding purposes. It is very unlikely that any threatened fauna species utilise the Subject Land for more than occasional foraging.

No threatened fauna were identified in the Subject Land. However, given the timing of the field survey, Southern Myotis is assumed to utilise the Subject Land for foraging purposes only; for the purpose of the BAM Southern Myotis is considered present. In order to determine the area of potential habitat for the species, the TBDC states that 'all habitat on the subject land where the subject land is within 200m of a waterbody with pools/ stretches 3 m or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies on the subject land must be mapped. Use aerial imagery to map waterbodies with pools/ stretches 3m or wider on or within 200m of the subject land. Species polygon boundaries should align with PCTs on the subject land to which the species is associated that are within 200 m of waterbodies mapped.'

Based on the above guidance, suitable waterbodies within, and up to 200 m of, the Subject Land were mapped (Figure 8). All vegetation zones, apart from the poor condition states, were mapped as the Southern Myotis species polygon in accordance with the BAM (Figure 8). The following vegetation zones within the Subject Land are considered suitable habitat for the Southern Myotis and have been entered into the BAM-C:

- 0.03 hectares of PCT 725_moderate
- 0.5 hectares of PCT 835_low
- 0.22 hectares of PCT 849_low
- 0.18 hectares of PCT 850_low
- 0.01 hectares of PCT 1737_high
- 0.26 hectares of PCT 1800_low
- 1.11 hectares of PCT 1800_moderate.

A total of 2.31 hectares of potential foraging habitat for the Southern Myotis is therefore required to be offset as a result of the of the proposed modification. A species polygon for Southern Myotis, in accordance with section 5.2.5 of the BAM, has been prepared (Figure 8).

It is recommended that field survey in accordance with the bat survey guidelines (OEH 2018) and TBDC be undertaken in spring to determine whether Southern Myotis is using the Subject Land for its foraging purposes.

2.5 Matters of National Environmental Significance

The PMST identified nine TECs, 36 threatened flora species, 17 threatened fauna species and 23 threatened migratory species listed on the EPBC Act.

Of the TECs present in the Subject Land, some areas of the CPW present meet the condition thresholds to make it eligible for national protection. As such, one TEC (CPW) listed on the EPBC Act occurs within the Subject Land and would be impacted.

An assessment using the significant impact guidelines provided under the EPBC Act for a critically endangered ecological community has been undertaken in Annex 9. EPBC Act Significant Impact Criteria Assessment. The assessment concluded that, given the scale of the proposed widening and the modified nature of the habitat to be disturbed, a significant impact on the CEEC CPW TEC is unlikely to occur.

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Four threatened plants listed under the EPBC Act had a moderate or higher likelihood of occurrence in the Subject Land, these being:

- Spiked Rice-flower (*Pimelea spicata*) (endangered)
- Downy Wattle (*Acacia pubescens*) (vulnerable)
- Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*) (vulnerable)
- *Pultenaea parviflora* (vulnerable).

Targeted surveys conducted as part of the field survey did not detect any of the threatened species listed above, nor any other threatened species listed under the EPBC Act. Therefore, no further assessment in regard to threatened flora listed under the EPBC Act is required.

None of the migratory species listed under the EPBC Act have a moderate or higher likelihood of occurrence in the Subject Land. Therefore, no targeted surveys or further assessment in regard to migratory species is required.

The proposed modification is not considered to have a significant impact on any MNES. As such, referral of the proposed action to the Commonwealth Minister for the Environment is not required.

2.6 Planted native vegetation habitat assessment

In accordance with Table 28 (Appendix L) of the BAM a habitat assessment of the median strip of the Westlink M7 has been undertaken in regard to its suitability for use by threatened species. It is noted that, due to safety concerns for the survey personnel, the Westlink M7 median was not surveyed on foot. This area was qualitatively surveyed from the shared path and while driving back to and from other survey sites. The perceived lack of biodiversity value within the median strip supports this method.

The median strip of the Westlink M7 within the Subject Land consists predominantly of exotic grassland, however stands of eucalypts and linear strips of shrubs occur in various areas, while fig trees are present in association with the Australian Light Horse Sculpture Parade. This vegetation has all been planted as part of the landscaping of the Westlink M7.

The grassland areas consist of predominantly exotic grasses, herbs and forbs and are continuously slashed/mown as part of regular maintenance for the Westlink M7. Linear stands of shrubs (*Callistemon spp.*, *Melaleuca spp.*) reach a height of two metres. The eucalypt stands consist of semi-mature Forest Red Gum, Grey box and/or Spotted Gum that reach 8-10 metres in height. The stands are typically less than 500 square metres in size; however, one stand measures 800 square metres. These stands are mainly cleared underneath and the groundcover is subject to maintenance.

Given their relatively young age, none of the trees present contain hollows; nor did any exhibit signs of occupation (i.e. nests).

No other key habitat features are present within the median (i.e. rock outcrops, fallen timber, significant accumulations of leaf litter, aquatic environments).

The median strip is highly modified, fragmented and isolated from other areas of habitat. The Westlink M7 is also a busy motorway that would deter ground-dwelling fauna from crossing from one side to the other.

The habitats present are not considered suitable for use by any threatened species credit species (flora or fauna) that have been previously recorded, or are considered to have habitat, in the locality (Table 5, Table 11 and Annex 2. Threatened species matrix, status and likelihood of occurrence). In addition, no

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incidental sightings or evidence (e.g. scats, stick nests) of threatened species credit species (fauna) using, inhabiting or being part of the planted native vegetation was recorded. While some of the vegetation would technically conform to a PCT that is associated with threatened flora (i.e. Spiked Rice-flower), the degraded habitat, disturbed soil profile and maintenance regime is likely to preclude the presence of any threatened flora species.

As no threatened species were observed, indicated or considered likely to use the planted native vegetation as habitat, section 8.4 of the BAM (mitigate and manage impacts on biodiversity values) does not need to be addressed as part of the streamlined module.

The proposed widening within the planted native vegetation areas (i.e. the median strip and exotic grassland areas) does not require offsetting for any ecosystem or species credits.

3. Impact Assessment

3.1 Avoid and minimise impacts

In accordance with the BAM, proponents must demonstrate the measures employed to avoid, mitigate and offset impacts of a project on biodiversity values. This section of the report outlines the avoidance, management and mitigation measures that have incorporated into the proposed modification design or would employ during construction, operation or completion of the proposed modification to reduce impacts on biodiversity values.

3.1.1 Avoidance measures

Efforts to avoid and minimise impacts through proposed modification location and design are detailed below.

Location and design

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 biodiversity 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 M7 lease area for the construction ancillary facilities and access routes
- Implementation of silt fences, temporary diversions and bunding controls next to bridge and creek sites.

The construction ancillary facilities have been located at sites that:

- Are more than 50 metres from a waterway, except for the bridge sites in riparian areas
- Are within or adjacent to land where construction work is being carried out
- Require minimal vegetation clearing beyond that already required for the proposed widening.

Given the relative lack of available land next to the existing carriageway within Westlink M7 land, the larger construction ancillary facilities would be located on leased vacant, farmland, parkland, commercial office space or industrial land near the Westlink M7. It is also proposed to use some construction ancillary facilities approved under the M12 Motorway project which are located near the Westlink M7 at Cecil Hills. This would minimise the need for extra construction ancillary facilities which would reduce potential environmental impacts.

Locating the proposed modification within areas that are predominantly cleared and disturbed, as well as utilising the approved M12 ancillary facilities, minimises further fragmentation of adjoining bushland, minimises disturbance to waterways and maintains connectivity of surrounding bushland areas, where present.

A preliminary vegetation mapping exercise was undertaken by Niche, whereby the focus was on identifying areas that contained TECs that were likely to conform to the national listing under the EPBC Act as well as any other significant/sensitive environments. This survey identified better condition areas of vegetation and TECs to avoid.

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It was also proposed to clear the areas on the slow-lane side of the bridges for their inspection and maintenance. This approach was abandoned due to the additional clearing required in sensitive environments (i.e. TECs).

The proposal would also employ a microbat management plan (MMP) (section 3.2.8) to minimise potential impacts to roosting habitat during the proposed widening.

Prescribed impacts

Prescribed impacts relevant to the proposed modification and relevant avoidance and mitigation measures are detailed in Section 3.2.3.

3.2 Impact summary

An assessment of the potential impact of the proposed modification on biodiversity is provided below. It considers direct and indirect impacts as defined in the BAM (DPIE 2020a).

The proposed modification would affect biodiversity, including threatened biodiversity, through both direct and indirect impacts. The areas subject to direct and indirect impact are discussed below.

3.2.1 Direct impacts

As discussed in section 1.4, the area of direct impact has been defined as the area that would need to be cleared to accommodate the proposed modification. The area of direct impacts is presented in Figure 2.

The primary direct impacts are the removal of native vegetation, albeit degraded, including: 0.11 ha of PCT 724, 0.08 ha of PCT 725, 0.9 ha of PCT 835, 5.31 ha of PCT 849, 0.84 ha of PCT 850, 0.1 ha of PCT 1737 and 3.29 ha of PCT 1800. This vegetation provides potential foraging resources for insectivorous, frugivorous and nectivorous fauna. Assessment of direct impacts is presented in Table 15.

These direct impacts cannot be further avoided or mitigated. As per the BAM (DPIE 2020a), section 4 details the biodiversity credits required to offset the unavoidable impacts of the proposed modification.

3.2.2 Indirect impacts

The area of indirect impact is limited to TEC areas present immediately adjacent to most areas of the Subject Land. It should be noted that the TEC patches are isolated and are generally of a low to moderate condition. Assessment of potential indirect impacts is presented in Table 15.

Table 15: Assessment of direct and indirect impacts

Impact	Likelihood and extent of impact as a result of the proposed modification
Direct impacts	
Removal or modification of native vegetation	Known: Approximately 7.48 ha of native vegetation (highly modified and invaded by introduced species) would be removed.
Loss of individuals of a threatened species	None: No threatened flora or fauna were identified or considered likely to occur within the area of direct impact. No threatened species are likely to be harmed as part of the proposed modification.
Removal or modification of threatened species habitat other than native vegetation (micro-habitat features)	None: No threatened species habitat (excluding native vegetation) was identified on the Subject Land.
Death through trampling or vehicle strike	Low: The proposed modification is unlikely to cause death through trampling or vehicle strike.

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Impact	Likelihood and extent of impact as a result of the proposed modification
Death through poisoning	Low: No poisons are proposed to be used as part of the proposed modification. Harmful substances used in construction or weed management would all be controlled as per required Australian Standards.
Fragmentation	Low: Approximately 7.48 ha of modified native vegetation would be permanently removed. Given that about half (5.32 ha) of this is grassland, and the remainder regrowth, it is not considered to contribute to fragmentation of remnant native vegetation in the locality.
Indirect impacts	
Predation by domestic and/or feral animals	Low: The proposed modification is not likely to increase the presence of domestic or feral animals in the local area.
Loss of shade/shelter	<p>Low: The proposed modification would result in the removal of 7.48 ha of vegetation. However, the vegetation consists of relatively small, fragmented areas in relatively poor condition, providing minimal habitat only.</p> <p>It is noted that the widening of 23 bridges would increase shade. While this may provide additional shelter for local ground dwelling fauna, it has the potential to stifle the regeneration of native vegetation.</p>
Loss of individuals through starvation	Low: Removal of the habitat on the Subject Land is not considered likely to cause loss of individuals through starvation. It is likely to be used seasonally/occasionally as a foraging resource by insectivorous, frugivorous and nectivorous species occupying a much larger territory and relying on other resources throughout the rest of the year.
Loss of individuals through exposure	Low: Habitat to be removed in the Subject Land is dominated by grassland and semi-mature regrowth. Therefore, the proposed modification is not considered likely to cause a loss of individuals through exposure.
Edge effects (noise, light, traffic)	<p>Low: The Subject Land currently experiences impacts from noise and light due to the high volume of traffic using the Westlink M7.</p> <p>The proposed modification is not considered likely to further adversely affect any threatened animals that may utilise the Subject Land.</p>
Traffic impacts	Low: Any locally occurring fauna that may be traversing the locality are already well accustomed and tolerant to high volumes of traffic on the existing Westlink M7. The addition of an inside lane to each carriageway is not expected to significantly increase traffic impact on any threatened species.
Deleterious hydrological changes	Low: The proposed modification would alter runoff flows throughout the Subject Land. Any impacts beyond the Subject Land during or after construction are expected to be marginal and would be managed by standard sediment and erosion controls during construction and the incorporation of stormwater drainage to existing stormwater Westlink M7 infrastructure into the proposed modification design.

Impact	Likelihood and extent of impact as a result of the proposed modification
Contamination of groundwater, surface water and creeks present	None: Runoff and wastewater from the Westlink M7 would be retained within the approved project's existing sedimentation ponds. While contaminants may be transported into the wider hydrological system of the area it is unlikely to increase the current levels significantly. Where construction activities lower the water table by more than 1 m, there is potential for inland acid sulfate soils to be encountered; however, this is considered to be extremely low. Further, the proposed modification is not likely to result in changes to water quantity, water quality, aquifer structure or land use to the extent that there may be impacts to GDEs.
Weed invasion	Low: The Subject Land is already highly weed-infested. The proposed modification is considered unlikely to significantly increase weed invasion.
Increased human activity within or directly adjacent to sensitive habitat areas	Low: The sensitive habitat areas are already impacted by human activity. The proposed modification would not further accommodate human activity beyond what is currently taking place.

3.2.3 Prescribed impacts

The potential for the prescribed impacts identified in Chapter 6 of the BAM (DPIE 2020a) has been considered in Table 16. The following prescribed impacts are relevant to the proposed modification:

- Hydrological process sustaining/interacting with rivers, streams or wetlands
- Vehicle strikes on threatened species.

Prescribed impacts would be managed and mitigated via the measures detailed in section 3.2.6.

3.2.4 Potential serious and irreversible impacts (SAII)

The BC Act and the *Local Land Services Act 2013* (LLS Act) imposes various obligations on decision-makers in relation to impacts on biodiversity values that are at risk of SAII. These obligations generally require a decision-maker to determine whether the residual impacts of a proposed development on biodiversity values (that is, the impacts that would remain after any proposed avoid or mitigate measures have been taken) are serious and irreversible (DPIE 2021b).

Two of the TEC's recorded in the Subject Land are identified on the list of threatened entities for which the potential for SAII must be considered (DPIE (2020a):

- CRCIF
- CPW.

The location of CRCIF and CPW at risk of SAII in the Subject Land is shown on Figure 6.

No threatened species at risk of SAII are known or considered likely to occur in the Subject Land.

Table 16: Prescribed impacts

Feature	Present	Description of feature characteristics and location	Potential impact	Threatened species or community using or dependent on feature
Karst, caves, crevices, cliffs or other geologically significant feature	<input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No	N/A	None	N/A
Rocks	<input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No	N/A	None	N/A
Human-made structure	<input checked="" type="checkbox"/> Yes / <input type="checkbox"/> No	Bridges	Noise and vibration during construction to potentially roosting microbat	Bridges are not considered suitable habitat for roosting microbats.
Non-native vegetation	<input checked="" type="checkbox"/> Yes / <input type="checkbox"/> No	Introduced plant species dominate the grassland areas, particularly the median strip, and are prevalent within the riparian zones.	None	No threatened species are considered to utilise the exotic vegetation present.
Corridors	<input checked="" type="checkbox"/> Yes / <input type="checkbox"/> No	A minor portion of the survey area located north of Hoxton Park Road, in association with Hinchinbrook Creek, and at Yarato Road intersects with the regional corridor mapped in the Biodiversity Investment Opportunities Map (OEH 2015).	None	RFEF and SOFF TECs are present at these locations. No threatened species are considered to be reliant on these areas for their life-cycle requirements. The minor disturbance of the regional corridor at these locations is unlikely to significantly affect the movement patterns of those animals and pollinator vectors using this portion of the regional corridor.
Hydrological process sustaining/interacting with rivers, streams or wetlands	<input checked="" type="checkbox"/> Yes / <input type="checkbox"/> No	Numerous named and unnamed creek lines flow through the Subject Land.	Disturbance of overland and underground flows may affect flow of creeks.	None identified
Wind farm development	<input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No	N/A	N/A	N/A

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Feature	Present	Description of feature characteristics and location	Potential impact	Threatened species or community using or dependent on feature
Vehicle strikes on threatened species	<input checked="" type="checkbox"/> Yes / <input type="checkbox"/> No	Plant, machinery and vehicles using Westlink M7 when in operation and construction ancillary facilities/access routes during construction.	Mortality or injury as a result of vehicle strike.	Threatened species unlikely to be utilising habitat.
Other	<input type="checkbox"/> Yes / <input checked="" type="checkbox"/> No	N/A	No additional prescribed impacts identified.	N/A

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The BC Act and the BC Reg provide a framework to guide the consent authority in making a determination in relation to SAIL. The framework consists of a series of principles defined in the BC Reg and supporting guidance, provided for under section 6.5 of the BC Act, to interpret these principles (DPIE 2019b). Criteria to interpret the principles is included in Table 1 of *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2019b). Namely, an impact is considered serious and irreversible under Part 6.7 of the BC Reg if it:

1. Would cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline.
2. Would further reduce the population size of the species that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or would further degrade or disrupt an ecological community that is already observed, inferred or reasonably suspected to be severely degraded or disturbed.
3. Impacts on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.
4. Impacts on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

Under the BAM (DPIE 2020a), an assessor must provide information on a range of factors affecting the vulnerability of the species to SAIL. These criteria are addressed in detail for CRCIF and CPW in Annex 10. Consideration of serious and irreversible impacts, and are summarised below.

Summary of SAIL on CRCIF

- The proposed widening has been designed to reduce the impact on locally occurring TECs 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.
- The proposed modification is expected to impact 0.08 ha of CRCIF. This is about 0.01% of the remaining CRCIF in NSW.
- The area of CRCIF to be impacted has little to no structural integrity, has low floristic diversity and its ecological processes have been disrupted such that the community's functioning is reduced.
- PCT 725 (moderate) has a VI of 25.4. Benchmark data for this TEC is around 93.3¹⁰.
- The proposed widening would result in the removal of 0.08 ha of isolated patches of wooded CRCIF from the Subject Land, and a highly fragmented landscape; however, this clearance of vegetation is unlikely to result in an adverse impact on the movement of pollinator vectors and other dispersal mechanisms operating within the CRCIF present within the locality. These patches are generally isolated and do not form an important part of the TEC in the locality. Other larger, contiguous areas of the TEC present in the locality and surrounding region would not be reliant on the 0.08 ha of CRCIF proposed to be removed for its long-term survival.

¹⁰ This score is derived from the BAM-C and uses benchmark data provided in the BioNet Vegetation Information System database (DPIE 2021d) for PCT 725. Presence of tree regeneration (<5cm diameter), absence of stem class sizes (apart from large trees), zero HBT and zero High Threat Weed is used, however it is noted that these attributes are not provided within BioNet Vegetation Information System database (DPIE 2021d).

Summary of SAI on CPW

- As described above, the proposed modification has been designed to reduce the impact on locally occurring TECs 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.
- The proposed modification is expected to impact 3.78 ha of CPW (consisting of poor [2.37 ha], low [1.28 ha] and moderate [0.13 ha] condition states). This is about 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); however, the vegetation mapping project used for comparison does not recognise such a variant (it includes wooded areas only). 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 represents 0.01% of the remaining CPW in NSW.
- The area of CPW to be impacted (62% grassland) has little to no structural integrity, has low floristic diversity and its ecological processes have been disrupted such that the community's functioning is reduced.
- The poor, low and moderate vegetation zones of CPW have a VI of 8.7, 23.1¹¹ and 41.5, respectively. Benchmark data for this TEC is around 94.4¹².
- The proposed modification would result in the removal of 1.41 ha of isolated patches of wooded CPW from the Subject Land, and a highly fragmented landscape; however, this clearance of vegetation would not result in an adverse impact on the movement of pollinator vectors and other dispersal mechanisms operating within the CPW present within the locality.

3.2.5 Key Threatening Processes

The 39 Key Threatening Processes (KTPs) that are listed on the BC Act and/or EPBC Act, as of June 2022, are shown in Table 17.

The only KTP that would occur as a result of the proposed modification is the permanent removal of 7.48 ha of non-planted native vegetation. The majority of this vegetation is highly modified, subject to edge effects and impacted heavily by weed invasion. Intact and better condition areas of native vegetation have been avoided as part of the proposed modification.

A dead stag, suspected to contain small hollows, is present in the Zone C-3 construction ancillary facility at Eastern Creek. As it is unknown if this tree would be retained, the removal of hollow-bearing trees KTP may potentially be exacerbated by the proposed modification.

The majority of the remaining KTPs are either avoided through mitigation or are not relevant to the proposed modification.

¹¹ This is an average of the low condition states of PCT 849 and PCT 850. The actual VI for PCT 849 (low) and PCT 850 (low) is 19.3 and 26.9, respectively.

¹² This score is derived from the BAM-C and uses benchmark data provided in the BioNet Vegetation Information System database (DPIE 2021d) for PCT 849. Presence of tree regeneration (<5cm diameter), absence of stem class sizes (apart from large trees), zero HBT and zero High Threat Weed is used, however it is noted that these attributes are not provided within the BioNet Vegetation Information System database (DPIE 2021d).

Table 17: Key threatening processes

Key Threatening Process	BC Act	EPBC Act equivalent	Exacerbated due to Project
Aggressive exclusion of birds by noisy miners (<i>Manorina melanoccephala</i>)	✓	✓	No
Alteration of habitat following subsidence due to longwall mining	✓	x	N/A
Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands.	✓	x	No (avoided through mitigation). The proposed works will not alter the natural flow of any watercourses.
Bushrock removal	✓	x	No
Clearing of native vegetation	✓	✓	Yes - clearing of 7.48 ha of highly modified native (non-planted) vegetation.
Competition and grazing by the feral European rabbit	✓	✓	No
Competition and habitat degradation by feral goats	✓	✓	No
Competition from feral honey bees	✓	x	No
Death or injury to marine species following capture in shark control programs on ocean beaches	✓	x	N/A
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments	✓	✓	N/A
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners	✓	x	No
Habitat degradation and loss by Feral Horses (brumbies, wild horses), <i>Equus caballus</i>	✓	x	No
Herbivory and environmental degradation caused by feral deer	✓	x	No
High frequency fire	✓	x	No
Human-caused climate change	✓	✓	Negligible
Importation of red imported fire ants into NSW	✓	✓	No
Infection by <i>Psittacine circoviral</i> (beak & feather) disease affecting endangered psittacine species	✓	✓	No
Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis	✓	✓	No
Infection of native plants by <i>Phytophthora cinnamomi</i>	✓	✓	No
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	✓	x	No
Introduction of the large earth bumblebee (<i>Bombus terrestris</i>)	✓	x	No
Invasion and establishment of exotic vines and scramblers	✓	x	No (avoided through mitigation)

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Key Threatening Process	BC Act	EPBC Act equivalent	Exacerbated due to Project
Invasion and establishment of Scotch broom	✓	x	No
Invasion and establishment of the Cane Toad	✓	✓	No
Invasion by escaped garden plants, including aquatics	✓	✓	No (avoided through mitigation)
Invasion of native plant communities by African Olive (<i>Olea europaea</i> L. subsp. <i>cuspidata</i>)	✓	x	No (avoided through mitigation)
Invasion of native plant communities by bitou bush & boneseed	✓	x	No (avoided through mitigation)
Invasion of native plant communities by exotic perennial grasses	✓	(only Northern Australia)	No (avoided through mitigation)
Invasion of the yellow crazy ant (<i>Anoplolepis gracilipes</i>)	✓	(only Christmas Island)	No
Invasion, establishment and spread of Lantana (<i>Lantana camara</i>)	✓	x	No (avoided through mitigation)
Loss and/or degradation of sites used for hill-topping by butterflies	✓	x	No
Loss of hollow-bearing trees	✓	x	Potentially. Retention of tree unknown.
Novel biota and their impact on biodiversity	x	✓	No (avoided through mitigation)
Predation and hybridisation of feral dogs	✓	✓	No
Predation by feral cats	✓	✓	No
Predation by the European Red Fox	✓	✓	No
Predation by the Plague Minnow (<i>Gambusia holbrooki</i>)	✓	x	No
Predation, habitat degradation, competition and disease transmission by Feral Pigs (<i>Sus scrofa</i>)	✓	✓	No
Removal of dead wood and dead trees	✓	x	No (avoided throughout Subject Land)

3.2.6 Mitigation measures (construction and post construction)

Management and mitigation measures to be implemented during the construction and operational phases of the proposed modification are detailed in Table 18. These would be documented within the BMP or relevant management plans to be developed for construction of the proposed modification.

3.2.7 Adaptive management strategy (for major Projects only)

The mitigation measures provided in Table 18 are considered adequate to protect the terrestrial and aquatic environment against potential, uncertain impacts. Therefore, it is considered that an adaptive management strategy is not required.

Table 18: Mitigation measures

Mitigation measure	Responsibility
Pre-construction	
Preparation of a BMP (includes management of native vegetation, weeds, fauna habitat, etc.) and MMP	Construction contractor
Ecologist to inspect the drainage lines and creek lines and relocate amphibians prior to and during vegetation clearing.	Construction contractor
Staff/contractor training and site briefing, to communicate environmental features to be protected and measures to be implemented.	Construction contractor
Establishment of fencing between woodland areas and the construction area to demarcate the Subject Land boundary ('No Go' zone), particularly at construction ancillary facilities and bridge widening areas in riparian zones. Fencing to be maintained throughout the construction phase. Exclusion zones will be set up at the limit of clearing in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Construction contractor
Ensure the 'No Go' zone exclusion zone is established before works commence to prevent accidental encroachment. Include appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' in the proposed modification's Construction Environmental Management Plan (CEMP) or similar.	Construction contractor
Construction	
Installation of erosion and sediment controls to minimise sediment laden run-off from entering drainage lines and waterways. Standard erosion and sediment control measures would be used with consideration to the guidelines in the publication "Managing Urban Stormwater: Soils and Construction Volumes 1 and 2d" (the Blue Book).	Construction contractor
Regular maintenance of erosion and sediment controls during construction and until excavated areas are revegetated or stabilised.	Construction contractor
Implementation of the BMP (includes hygiene protocols to minimise the spread of weeds and pathogens by staff/machines/vehicles into areas of retained native vegetation and waterways) and MMP.	Construction contractor/Ecologist
Pest and weed prevention measures for construction activities and management of any priority pests or weeds within the Subject Land. Weed material removed must be disposed of appropriately (green waste or general waste for priority weeds). Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Construction contractor
Directing artificial lighting into the Subject Land to minimise light spill.	Construction contractor
Dust suppression where relevant through the Subject Land.	Construction contractor
Minimise dust generation by minimising the extent and time that bare soil is exposed.	Construction contractor

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Mitigation measure	Responsibility
Habitat will be replaced or re-instated in accordance with <i>Guide 5: Re-use of woody debris and bushrock</i> and <i>Guide 8: Nest boxes</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Construction contractor
Implement an unexpected species find procedure, particularly in regard to the bridge widenings. Should microbats be observed exiting the structures, or flying in the general vicinity during construction works (particularly in the daytime), works in the vicinity of the sighting must stop immediately. The site should be reassessed by an ecologist prior to construction resuming.	Construction contractor/Ecologist
Any large woody debris to be retained within the retained portions of the Subject Land to provide refuge habitat for invertebrates and reptiles (<i>Guide 5: Re-use of woody debris and bushrock</i>).	Construction contractor/Ecologist
Post construction	
Landscape planting focusing on naturally occurring endemic tree and shrub species, in accordance with the updated Landscape Plan for the Westlink M7.	Construction contractor
Management and removal of all waste from the Subject Land.	Construction contractor
During operation	
Monitoring and maintenance of all established erosion and sedimentation controls.	Construction contractor
Existing Westlink M7 Operational Environmental Management Plan to be consulted	Construction contractor

3.2.8 Biodiversity Management Plan

As part of the proposed modification, a BMP is recommended to be prepared to inform and manage various activities throughout the construction of the proposed modification in order to protect and manage important biodiversity values present within the Subject Land. Key commitments covered by the BMP should include:

- Environmental site inductions
- Demarcation of clearing areas and 'No Go' zones
- Methods of vegetation removal
- Protocols for tree clearing including pre-clearing surveys and mitigation measures for any fauna encountered
- Erosion and sediment controls
- Rehabilitation methods and appropriate species
- Weed prevention measures and management of any priority weeds within the Subject Land
- Regular scheduled litter removal

Some of the above management plans may be covered in separate documents to the BMP, as part of the wider suite of management plans for construction of the proposed modification.

The BMP would incorporate a MMP. The MMP is to be prepared prior to the commencement of the proposed widening.

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The MMP is a plan created by a microbat specialist to avoid, mitigate and/or minimise the impacts of a project on microbats present in a structure, and aims to:

- Provide details of permanent compensatory breeding/ roosting habitat to be provided within the Subject Land (if applicable)
- Provide advice for construction personnel on how to manage microbat conflicts during construction
- Reduce potential for microbat injury or mortality
- Minimise disturbances to breeding microbats
- Provide management techniques.

3.3 Offsetting strategy

All direct impact areas, as shown in Figure 2, would be offset via the BOS, as required under the BAM. The offset credit requirement for the proposed modification is detailed in the following section (section 4).

As per the BAM, the offset obligation for this proposed modification is required to be discharged through one of the three options as provided by the BOS:

- Establishment of a Biodiversity Stewardship Site and retirement of required credits
- Purchase and retirement of credits from the market
- Payment into the Biodiversity Conservation Fund for the value of the credits.

It is understood the offset obligation must be met and credits retired prior to construction of the proposed modification. Transport would reserve the right to discharge their offset obligation through one of these options upon approval of the proposed modification.

In regard to indirect impacts the BAM Operational Manual Stage 2 section 2.4.1 states:

Where indirect impacts on biodiversity cannot be avoided or adequately minimised (e.g. via mitigation measures or if mitigation fails), the proponent should consider retiring biodiversity credits to offset the proposed impact. Although the BAM does not determine a credit obligation for indirect impacts, the consent authority has the discretion to increase the number of biodiversity credits to be retired.

The indirect impact areas are not proposed to be offset as they are likely to be adequately minimised through mitigation measures, as outlined below:

- The indirect impacts would be relatively minor, primarily constituting some weed intrusion, which would be managed by a regular schedule of weed management as part of the existing maintenance schedule within the Westlink M7 lease area, and the BMP to be recommended to be prepared for construction of the proposed modification.
- The interference on the movement of fauna would be minimal given the only species likely to be currently using the Subject Land's vegetation are highly tolerant of urban and disturbed environments.
- A BMP is recommended to be prepared prior to construction of the proposed modification and would be implemented to mitigate the indirect impacts, which includes the measures detailed in section 3.2.6.

4. Quantifying Offset Requirements

The BAM identifies the BAM-C as the appropriate tool for quantifying the offsets required in both Ecosystem Credit and Species Credit terms. A calculation of the nature and extent of offset credits required due to biodiversity impacts associated with the proposed modification has been undertaken using the BAM-C.

The case has been finalised and submitted via the online BAM-C.

No threatened biodiversity listed on the EPBC Act are required to be offset for the proposed modification, as the proposed modification is considered unlikely to result in a significant impact on any threatened biodiversity listed on the EPBC Act (see Annex 9. EPBC Act Significant Impact Criteria Assessment).

4.1 Summary of ecosystem credits required

The results of the BAM-C ecosystem offset credit requirements, including current, future and change in VI scores are shown in Table 19.

Table 19: Ecosystem credit requirement

PCT (best fit)_zone	Vegetation Zone ID	Impact area (ha)	Current VI score	Future VI score	Change in VI Score	Biodiversity risk weighting	Required credits
724 Castlereagh shale - gravel transition forest_moderate	1	0.11	35	0	-35	2	2
725 Castlereagh Ironbark forest_moderate	2	0.08	25.4	0	-25.4	2	1
835 Cumberland riverflat forest_poor	10	0.10	2.1	0	-2.1	2	0
835 Cumberland riverflat forest_low	5	0.74	25.4	0	-25.4	2	9
849 Cumberland shale plains woodland_poor	3	2.37	8.7	0	-8.7	2.5	0
849 Cumberland shale plains woodland_low	8	0.58	19.3	0	-19.3	2.5	7
850 Cumberland shale hills woodland_low	4	0.70	26.9	0	-26.9	2.5	12
850 Cumberland shale hills woodland_moderate	9	0.13	41.5	0	-41.5	2.5	3
1737 Typha rushland_moderate	11	0.09	34.5	0	-34.5	2	2
1737 Typha rushland_high	6	0.01	60.8	0	-60.8	2	1

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PCT (best fit)_zone	Vegetation Zone ID	Impact area (ha)	Current VI score	Future VI score	Change in VI Score	Biodiversity risk weighting	Required credits
1800 Cumberland Swamp Oak riparian forest_poor	13	0.56	0.1	0	-0.1	2	0
1800 Cumberland Swamp Oak riparian forest_low	7	0.68	24.7	0	-24.7	2	8
1800 Cumberland Swamp Oak riparian forest_moderate	12	1.33	32.9	0	-32.9	2	22
Total		7.48					67

Figure 7 identifies the impacts of the proposed modification and those areas requiring to be offset. In accordance with the BAM (DPIE 2020a), areas to be offset are PCT's with a VI score:

- ≥ 15 where the PCT is an Endangered Ecological Community (EEC) or CEEC
- ≥ 17 where the PCT is associated with threatened species habitat or is a Vulnerable Ecological Community
- ≥ 20 where the PCT is not represented with a TEC or associated with threatened species habitat.

Areas not requiring to be offset include any other areas where the VI scores are less than those detailed above. Three vegetation zones within the Subject Land (10, 3 and 13) had VI scores well below the thresholds listed above and thus did not generate a credit requirement (see highlighted rows in Table 19).

Impacts to native vegetation communities within the Subject Land generate a requirement for 67 ecosystem credits. These 67 ecosystem credits also cover the credit requirement for ecosystem credit species. The full BAM-C biodiversity credit report is provided in Annex 11. Ecosystem and species credits required (BAM-C Credit report).

4.2 Summary of species credits required

The results of the BAM-C species offset credit requirements are shown in Table 20. Southern Myotis, assumed to be present within the Subject Land and likely to be impacted by the proposed modification, generates a requirement for a total of 33 species credits. The full BAM-C biodiversity credit report is provided in Annex 11. Ecosystem and species credits required (BAM-C Credit report).

Table 20: Species credit requirement

Species	Habitat impacted	Credits required
Southern Myotis	2.31	33

It is recommended that field survey in accordance with the bat survey guidelines (OEH 2018) and TBDC be undertaken in spring to determine whether Southern Myotis is using the Subject Land for its foraging purposes. A robust survey would assist in refining the offset obligation for this species; there may be potential for zero offset liability regarding Southern Myotis.

The proposed modification would not impact any flora species credit species. As such, no flora species credits are required to offset the proposed modification.

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5. Summary

This BDAR has been prepared to quantify biodiversity impacts of the proposed widening of the Westlink M7 between the Westlink M7/M5 Motorway (M5) interchange, Prestons, and Richmond Road, Oakhurst. Transport has aimed to avoid and minimise environmental impacts from the proposed modification as detailed in section 3.1. The preparation of a BMP has been recommended for the construction of the proposed modification, which would detail implementation of the mitigation measures provided in section 3.2.6.

The impacts of the proposed modification on biodiversity are summarised as follows:

- Direct removal of 7.48 ha of modified native vegetation containing seven PCTs, aligning to six TECs
- Removal of 2.31 ha of foraging habitat for the Southern Myotis
- Removal of fauna habitat (native vegetation and drainage lines)
- Disturbance to sections of 18 creeklines ranging from smaller 1st order unnamed creeks through to larger 5th order streams (Cabramatta Creek).

One hollow-bearing tree is likely to require removal as part of the proposed modification. This tree is unlikely to be used by native fauna, and would not be used by any species credit species of fauna.

An assessment of significance under the EPBC Act was required for the CEEC CPW, which concluded a significant impact as a result of the proposed modification was unlikely. No flora or fauna listed under the EPBC Act are considered affected species. Therefore, there is no requirement for an EPBC Act referral regarding Commonwealth threatened species, communities or populations.

Native vegetation communities identified within the Subject Land generate a requirement of 67 ecosystem credits:

- 2 credits for PCT 724
- 1 credit for PCT 725
- 9 credits for PCT 835
- 7 credits for PCT 849
- 15 for PCT 850
- 3 credits for PCT 1737
- 30 credits for PCT 1800.

These 67 ecosystem credits also cover the credit requirement for ecosystem credit species.

A total of 33 species credits for Southern Myotis are required to offset impacts to its foraging habitat as a result of the proposed modification.

No flora species credits are required to offset the proposed modification.

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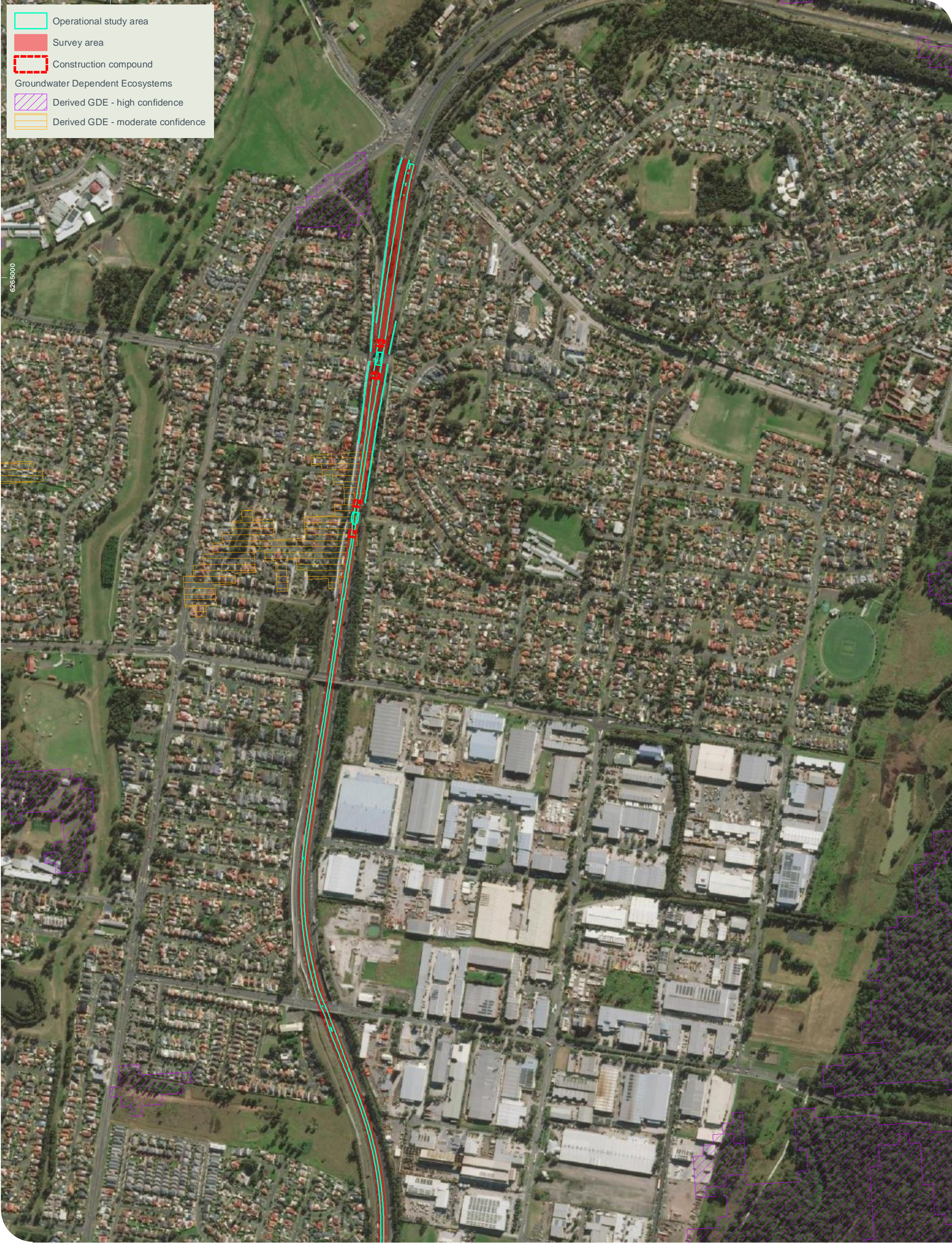
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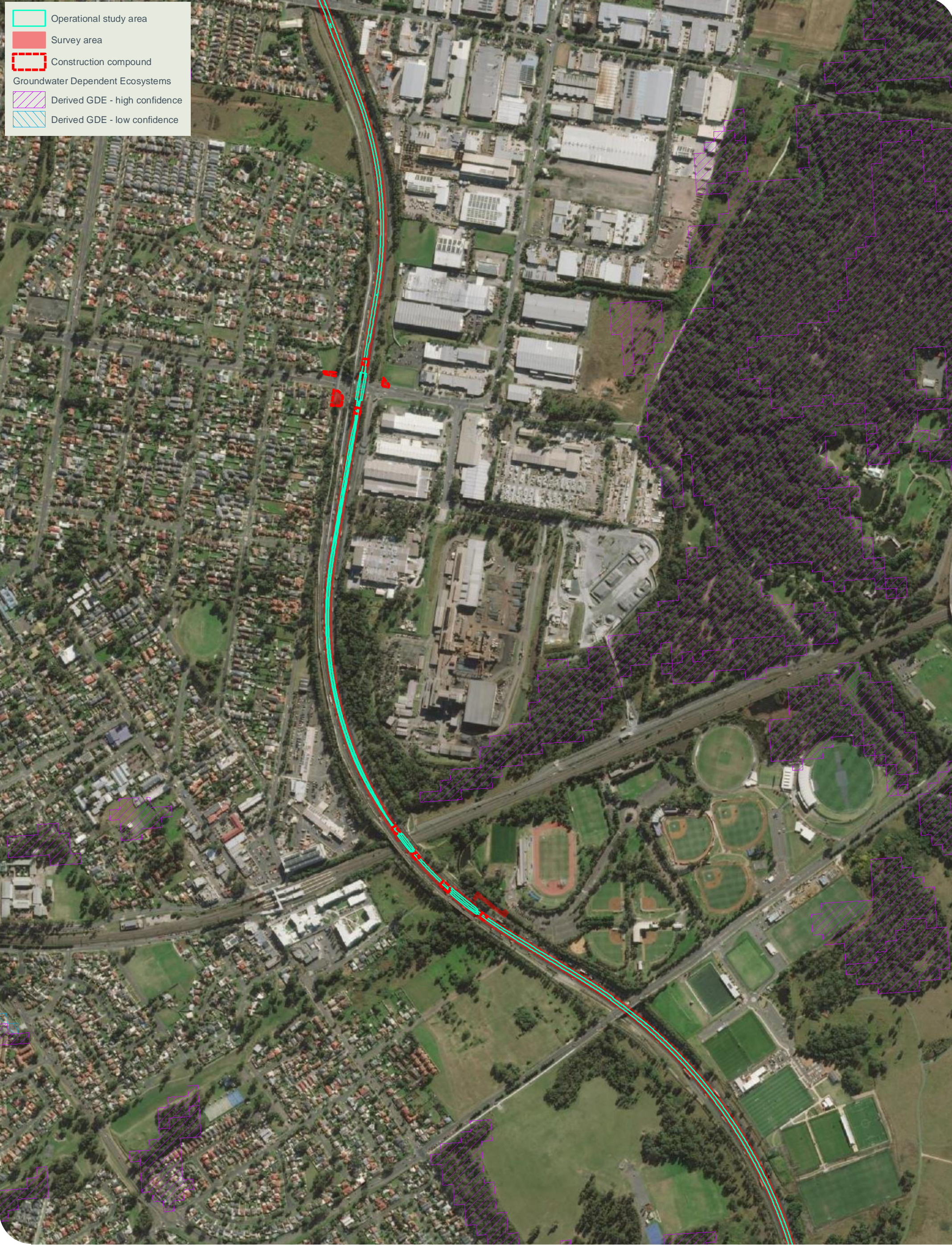
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Operational study area

Survey area

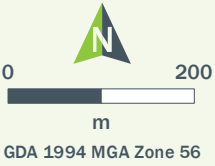
Construction compound

Groundwater Dependent Ecosystems

Derived GDE - high confidence

Derived GDE - moderate confidence

Derived GDE - low confidence



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Niche Proj. #: 6450
Client: AECOM

Site Map
M7 Widening

Figure 2d

Operational study area

Survey area

Construction compound

Groundwater Dependent Ecosystems

Derived GDE - high confidence

Derived GDE - moderate confidence

Derived GDE - low confidence

62.5



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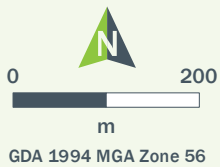
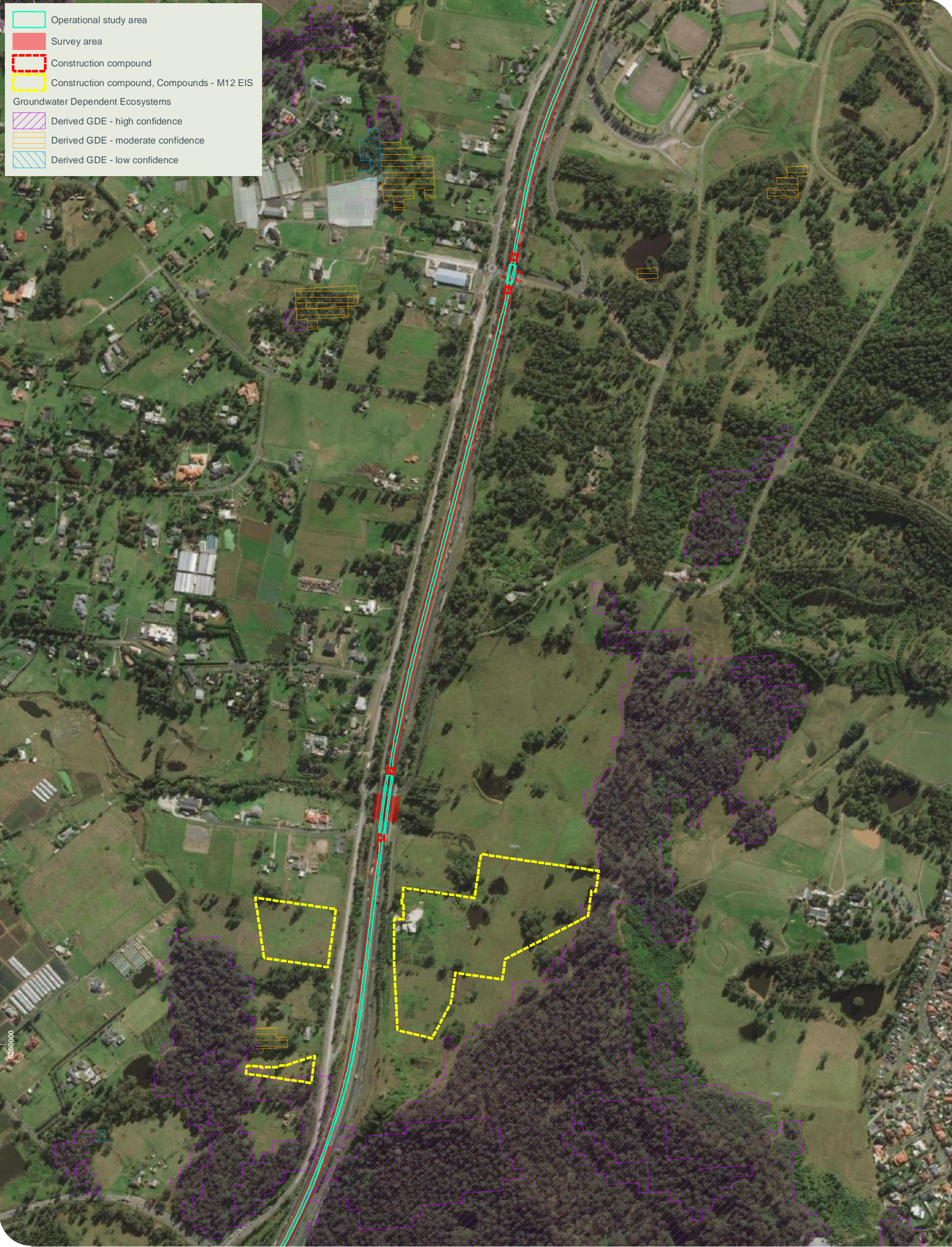
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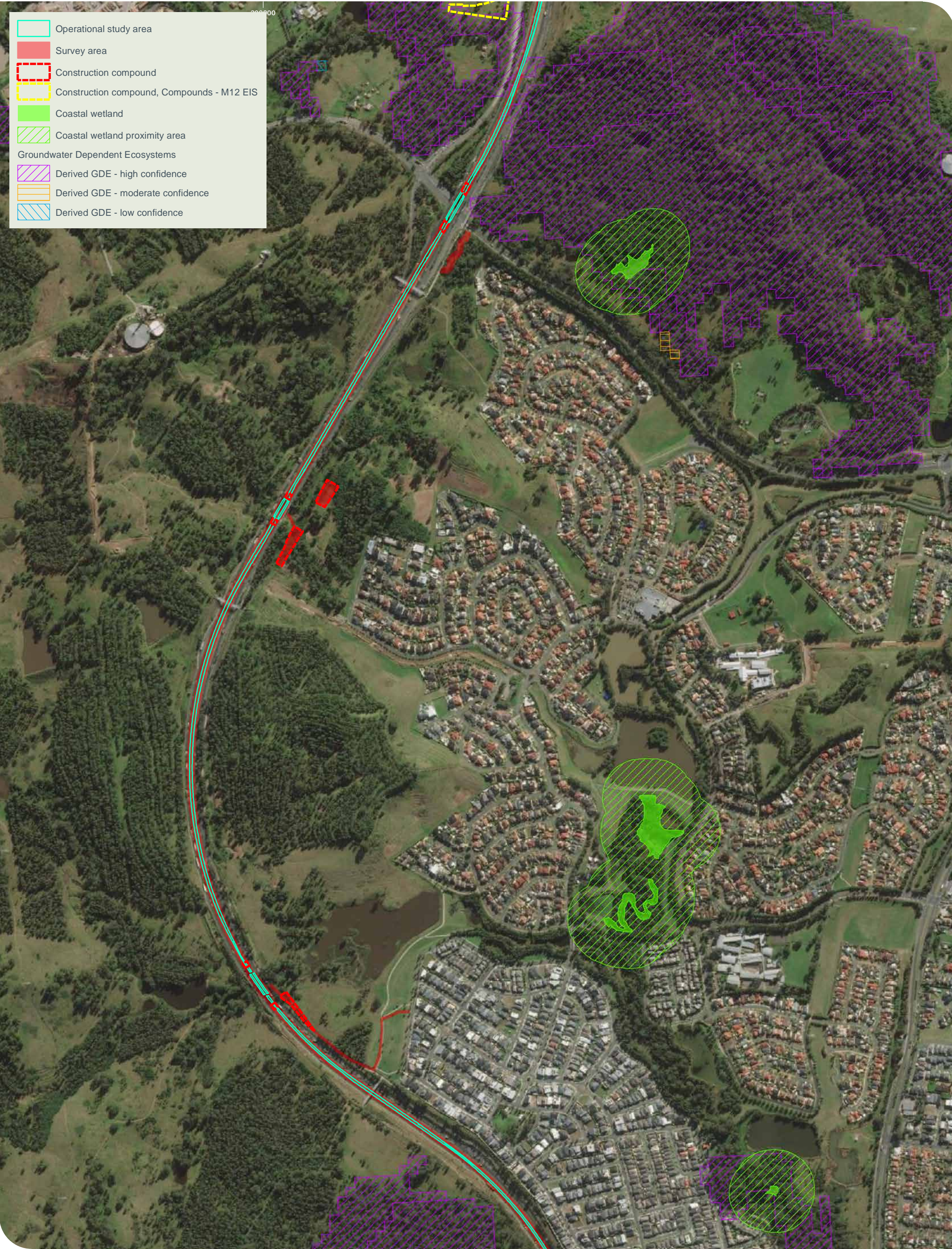
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Site Map
M7 Widening

Figure 2f



Operational study area

Survey area

Construction compound

Coastal wetland

Coastal wetland proximity area

Groundwater Dependent Ecosystems

Derived GDE - high confidence

Derived GDE - moderate confidence



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Site Map

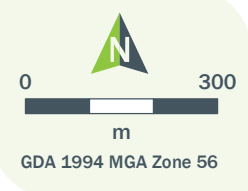
M7 Widening

Figure 2h

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

v2.0

Drawn by: YH File: T:\spatial\projects\6450\6450_Confidential_Maps\Map.mxd Last updated: 7/25/2022 12:39:21 PM



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

Site Map
M7 Widening

Figure 2i

