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Biodiversity Development Assessment Report

Light Horse Interchange Business Hub

165 Wallgrove Road (Part Lot 10 // DP 1061237) and 475 Ferrers Road (Part Lot 5 // DP 804051), Eastern Creek, NSW

Prepared for: Western Sydney Parklands Trust

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Glossary and abbreviations

Acronym	Description
BAM	Biodiversity Assessment Method
BC Act	NSW *Biodiversity Conservation Act 2016*
BCF	Biodiversity Conservation Fund
BDAR	Biodiversity Development Assessment Report
BSA	Biodiversity Stewardship Agreement
CEEC	Critically Endangered Ecological Community
CPW	Cumberland Plain Woodland in the Sydney Basin Bioregion
DEC	Former NSW Department of Environment and Conservation
ECA	Ecological Constraints Assessment
EEC	Endangered Ecological Community
EPBC	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
IBRA	Interim Biogeographic Regionalisation of Australia
LGA	Local Government Area
NPWS	NSW National Parks and Wildlife Services
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SAII	Serious and Irreversible Impacts
SSD	State Significant Development
TEC	Threatened Ecological Community
TSSC	Commonwealth Threatened Species Scientific Committee
VIS	Vegetation Integrity Score
WSPT	Western Sydney Parklands Trust

Executive Summary

Western Sydney Parklands Trust (WSPT) is proposing to develop the Light Horse Interchange Business Hub ('the project') across portions of two adjoining lots at 165 Wallgrove Road (Lot 10 // DP 1061237) and 475 Ferrers Road (Lot 5 // DP 804051), Eastern Creek. The proposed development forms an important component of the self-funded model for WSPT. Business hubs, such as this proposal, are located on the perimeter of the Western Sydney Parklands in areas of low conservation or recreation value and close to established employment areas and the metropolitan road network. As set out in the WSPT Plan of Management (POM) 2020 supplement (WSPT 2014), no more than two percent of the Western Sydney Parklands is proposed for business hubs to generate income to develop and manage the remainder of the Parklands. The business hubs remain in public ownership and are leased to industry, providing ongoing income for the WSPT to fund future land acquisition and ongoing regeneration of bushland within the Western Sydney Parklands. The Western Sydney Parklands is protecting and managing 1000 ha of bushland as well as revegetating a further 1000 ha of bushland to reconnect existing bushlands fragments and ensure the long-term viability of the bushland corridor.

The Light Horse Interchange site was identified as a potential business hub site in the WSPT Plan of Management (POM) 2020 Supplement in 2014 (WSPT 2014). As outlined within the WSPT POM 2020 Supplement, several principles have guided the selection of potential business hub sites from more than 30 locations including selection of sites with low environmental and recreational values and sites where development can be undertaken in a manner that will minimise the environmental impact of such development. The selection of the Light Horse Interchange site was based upon these principles, with vegetation within the site being heavily degraded and mostly regrowth following historic clearing as evidenced in the 1991 and 1955 aerial photography. The nomination of the Light Horse Interchange site as a potential business hub was also included within the updated WSPT Plan of Management 2030 (WSPT 2018, page 47), which was adopted by the Minister for the Environment and Heritage on 17 December 2018.

Secretary's Environmental Assessment Requirements ('SEARs'; SSD 9667) have been issued for the proposal, which require assessment of biodiversity impacts of the development in accordance with the NSW *Biodiversity Conservation Act 2016* (BC Act) and specifically the Biodiversity Assessment Method (BAM; OEH2017a). This Biodiversity Development Assessment Report (BDAR) has been prepared in accordance with the BAM to document impacts to biodiversity and has been prepared by an Accredited Assessor in accordance with the BC Act and NSW *Biodiversity Conservation Regulation 2017* (BC Reg). This format for this BDAR follows that of the different 'stages' outlined within the BAM including:

- Stage 1 – Biodiversity assessment. Includes sections 1 to 4 of this BDAR including the introduction, site context including landscape features, native vegetation and threatened species.
- Stage 2 – Impact assessment. Includes sections 5 to 7 of this BDAR which identify measures to avoid and minimise impacts, assessment of residual impacts to biodiversity, mitigation measures, offset requirements and credit calculations.

In accordance with the BAM, several features are assessed within the subject land and a 1,500 m buffer around the subject land. These landscape features are used to identify biodiversity

values that are important for the subject land and inform the habitat suitability of the subject land for threatened species.

Native vegetation was identified and mapped across 9.99 ha of the approximately 39.47 ha of the subject land. Areas which did not support native vegetation included areas identified as being 'cleared' or areas supporting 'exotic vegetation'. Generally, the 'cleared' areas were associated with existing buildings/infrastructure. Two Plant Community Types (PCTs) were identified within the subject land, namely:

- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats 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.

Both of the PCTs identified within the subject land comprise Threatened Ecological Communities under the BC Act, namely Cumberland Plain Woodland in the Sydney Basin Bioregion ('Cumberland Plain Woodland') and 'River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions' ('River-flat Eucalypt Forest'). Cumberland Plain Woodland is listed as a Critically Endangered Ecological Community (CEEC) under the BC Act and the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). River-flat Eucalypt Forest is listed as an Endangered Ecological Community (EEC) under the BC Act.

Habitat for threatened species has been assessed in accordance with section 6 of the BAM. One threatened species listed as Vulnerable under the BC Act, Southern Myotis (*Myotis macropus*), was recorded within the subject land and a species polygon has been determined for this species which includes all areas of native vegetation within 200 m Eastern Creek.

Cumberland Plain Woodland is a candidate community at risk for Serious And Irreversible Impacts (SAII) as defined under the BC Reg. Assessment of the proposed impacts to this community against the relevant criteria within the BAM identified that the proposed impacts to Cumberland Plain Woodland would represent would result in a 0.95% decrease in the area of the community within the 1,000 ha surrounding the subject land and a 0.22% decrease within the 10,000 ha surrounding the subject land. However, these calculations do not take into consideration the Cumberland Plain Woodland revegetation being undertaken by the WSPT including providing an additional 250 ha of bushland corridors (increasing from 1,356 ha in 2018 to 1,606 ha by 2030). Neither the 'River-flat Eucalypt Forest' or Southern Myotis are identified as candidate SAII entities.

In accordance with section 8 of the BAM, this BDAR outlines actions taken to avoid and minimise impacts through locating the project to avoid large stands on intact native vegetation. The selection of the Light Horse Interchange site was based upon the relatively low ecological values of this site as a result of historic vegetation clearing and ongoing disturbance associated with grazing. Following selection of the Light Horse Interchange site, several revisions of the final impact footprint were undertaken. These revisions have included reducing the project footprint to avoid approximately 2.2 ha of Alluvial Woodland (PCT 835) which includes a moderately dense midstorey of *Melaleuca decora*, which is uncommon with the Western Sydney Parklands. Smaller revisions to the subject land boundary have also been undertaken during project planning, reducing the total subject land and development footprint area to 39.01 ha from 40.71 ha. The final subject land and impact footprint has also been reduced

and located to avoid fragmentation and disconnection of bushland to retain large patches of bushland and ensure connectivity between these patches. A range of options have been explored for the site access including considerations of options to minimise impacts to native vegetation. Ultimately the nominated access from Ferrer's road was determined to be the only viable option. Consequently, the access from Ferrer's Road has been designed and located immediately adjacent to the existing M4 Western Motorway to avoid additional fragmentation of the vegetation along the Eastern Creek corridor and avoid larger changes to the flooding regimes of Eastern Creek Floodplain. Mitigation measures to avoid impacts to biodiversity are recommended within this BDAR and include pre-clearance protocols, vegetated riparian zones, the salvage and re-use of hollow-bearing trees and stormwater and construction environmental management plans for the proposed development.

The proposed development has been identified as including 'prescribed biodiversity impacts' as defined under clause 6.1 of the BC Reg which are impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. Prescribed impacts to biodiversity associated with the proposed business hub include impacts to water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities. Specifically, impacts to Eskdale Creek and its hydrological processes which support the 'River-flat Eucalypt Forest' Threatened Ecological Community (TEC). Proposed impacts to Eskdale Creek has been designed to avoid any impacts to Reedy Creek or Eastern Creek. The proposed design for the realignment of Eskdale Creek, including a swampy meadow/chain-of-ponds system, aims to recreate the geomorphology and to an extent the hydrology of the drainage system that is likely to have existed in this area prior to disturbance and channelization associated with historical disturbances to this drainage system. This proposed design for the realignment of Eskdale Creek is not specifically designed as water quality treatment device, but rather is designed to mitigate flows by engaging a broad flood plain area, lose water via evapotranspiration and recharge groundwater via infiltration. These factors will improve both the quality and quantity of water flowing to Reedy Creek and increase local biodiversity by integrating deep wetland, shallow marshland and riparian ecosystems along a continuum of waterway. Pre-DA meetings with the Natural Resource Access Regulator (NRAR) have indicated in-principle support for relocating parts of Eskdale Creek and further consultation following the detailed surveys conducted as part of this report, has confirmed in-principle acceptance of the relocation of Eskdale Creek by representatives of NRAR. The impacts to 'River-flat Eucalypt Forest' occurring along Eskdale Creek has been assessed as part of impacts associated with the clearing of this vegetation. This impact has been quantified through calculation of a Vegetation Integrity Score (VIS) for the area of the TEC along Eskdale Creek and assigning a future VIS of 0. Credit calculations to offset this impact area have been conducted in accordance with the BAM and consequently, the impacts are not in addition to vegetation clearing.

All residual impacts to biodiversity, after measures to avoid, minimise and mitigate impacts have been assessed using the BAM calculator and offset requirements, in terms of biodiversity credits, have been calculated in accordance with section 11.2 and Section 11.3 of the BAM to achieve the 'no net loss standard' as established by the BAM. A total of 261 ecosystem credits and 100 species credits are required to offset the impacts of the proposal. The measures proposed to address the offset obligation outlined above will be determined as the proposal approvals progress. However, WSPT intends to retire like-for-like biodiversity credits generated from existing Biobank sites (under the BioBanking Scheme), and potentially new Biodiversity Stewardship Agreements, to meet the offset requirements for the proposal.

Impacts to species and ecological communities listed under the EPBC Act, including the Grey-headed Flying-fox (*Pteropus poliocephalus*) and the 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' ecological community, have been assessed in accordance with the relevant significant impact guidelines (DotE 2013) under the EPBC Act and a referral to the Australian Government Minister for the Environment has been made. A determination has been made under section 75 of the EPBC Act that the proposed action is a controlled action, however it has also been determined that the project will be assessed for the purposes of the EPBC Act by the NSW Government as an accredited assessment, under Part 4, Division 4.7 of the *NSW Environmental Planning and Assessment Act* 1979 (State Significant Development). Supplementary SEARs including assessment requirements for Matters of National Environmental Significance (MNES) protected under the EPBC Act MNES were issued on 12 April 2019. This BDAR addresses the requirements of the supplementary SEARs including assessment of the MNES likely to be impacted and matters outlined in Schedule 4 of the Commonwealth *Environment Protection and Biodiversity Conservation Regulation* 2000 (EPBC Reg). This assessment has identified that the project is unlikely to significantly impact MNES and that offset requirements calculated under the BAM and the like-for-like rules set out in the BC Reg, would contribute to the ongoing viability of the specific MNES as required under the EPBC Act. No additional offsets, above those calculated under the BAM, would be required under the EPBC Act.

1 Introduction

This Biodiversity Development Assessment Report (BDAR) has been prepared for the proposed Light Horse Interchange Business Hub ('the project') across portions of two adjoining lots at 165 Wallgrove Road (Lot 10 // DP 1061237) and 475 Ferrers Road (Lot 5 // DP 804051), Eastern Creek (**Figure 1.1**). The proposed development forms an important component of the self-funded model for the Western Sydney Parklands Trust ('the WSPT'). Business hubs, such as this proposal, are located on the perimeter of the Western Sydney Parklands (the 'Parklands') in areas of low conservation or recreation value and close to established employment areas and the metropolitan road network. In total only 2 % of the Parklands can be used for business hubs with the objective to create revenues to maintain the remaining 98% of the Parklands. The business hubs remain in public ownership and are leased to industry, providing ongoing income for the WSPT to fund future land acquisition and ongoing regeneration of bushland within the Parklands.

The Light Horse Interchange site was identified as a potential business hub site in the WSPT Plan of Management (POM) 2020 Supplement in 2014 (WSPT 2014). The nomination of the Light Horse Interchange site as a potential business hub is also included within the updated WSPT Plan of Management 2030 (page 47), which was adopted by the Minister for the Environment and Heritage on 17 December 2018. As outlined within the WSPT POM 2020 Supplement, several principles have guided the selection of potential business hub sites from more than 30 locations including selection of sites with low environmental and recreational values and sites where development can be undertaken in a manner that will minimise the environmental impact of such development. The selection of the Light Horse Interchange site was based upon these principles, with vegetation within the site being heavily degraded and mostly regrowth following historic clearing as evidenced in the 1991 and 1955 aerial photography (**Figure 1.2** and **Figure 1.3**).

Secretary's Environmental Assessment Requirements ('SEARs'; SSD 9667) have been issued for the project and require an assessment of biodiversity impacts in accordance with the NSW *Biodiversity Conservation Act 2016* (BC Act), including the preparation of a BDAR. This BDAR has been prepared by Brian Towle, an Accredited Assessor (BAAS17057) under the NSW *Biodiversity Conservation Regulation 2017* (BC Reg), and is consistent with the Biodiversity Assessment Method (BAM; OEH 2017a).

On 1 April 2019, the Commonwealth Department of Environment and Energy (DoEE) determined that the proposed development will impact on Matters of National Environmental Significance (MNES), protected under the EPBC Act, namely the Grey-headed Flying-fox (*Pteropus poliocephalus*) and the 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' ecological community. Accordingly, the proposed development has been declared a controlled action and requires assessment and approval under the EPBC Act before it can proceed. Assessment of the project under the EPBC Act is to be undertaken by the NSW Government as an accredited assessment, under Part 4, Division 4.7 of the NSW *Environmental Planning and Assessment Act 1979* (State Significant Development). Supplementary SEARs addressing assessment requirements for MNES were issued on 12 April 2019. The supplementary SEARs require consideration of all protected matters considered likely to be significantly impacted and consideration of matters outlined in Schedule 4 of the Commonwealth's *Environment Protection and Biodiversity Conservation Regulation 2000* (EPBC Reg). This BDAR also addresses the requirements of the supplementary SEARs.

Sources of information for this report included:

- NSW Planning Portal (NSW Dept. of Planning and Environment 2018)
- BioNet Atlas of NSW Wildlife including BioNet Vegetation Classification (NSW Office of Environment and Heritage 2019a)
- Western Sydney native vegetation mapping (NPWS 2002; Tozer 2003 and OEH 2015a)
- The native vegetation of the Sydney metropolitan area v3.0 (OEH 2016b)
- The Biodiversity Investment Opportunities Map (IEH 2015b)
- The Groundwater Dependent Ecosystems Atlas (BOM 2019)
- NSW Hydro line spatial data (Department of Industry 2019)
- Ecological Constraints Assessment and Potential Offset Requirements for Light Horse Interchange, Lot 10 // DP1061237, Wallgrove Road, Eastern Creek (Ecoplanning 2017)

1.1 Location and site identification

This subject land for this BDAR covers a total area of approximately 39.47 ha comprising two adjoining lots at 165 Wallgrove Road (Lot 10 // DP 1061237) and 475 Ferrers Road (Lot 5 // DP 804051), Eastern Creek, NSW, 2766 (**Figure 1.1**). The proposed business hub would be accommodated on approximately 36 hectares of land in the western part of Lot 10 while parts of Lot 5 will be required to provide vehicle access to the proposed business hub.

The subject land is irregular in shape and generally slopes east and north-east towards the Eskdale Creek, Reedy Creek and Eastern Creek riparian corridors (**Figure 1.1**). The subject land currently supports large areas of cleared land with scattered vegetation utilised for grazing purposes, with more densely vegetated areas in the south-western corner and along Eastern Creek. Derelict buildings and structures associated with the former Wallgrove Army Base are located within the central part of the subject land.

The subject land is bound by the M4 Western Motorway to the north, the Westlink M7 Motorway and Wallgrove Road to the west and vegetated portions of the Parklands to the south and east (**Figure 1.1**).

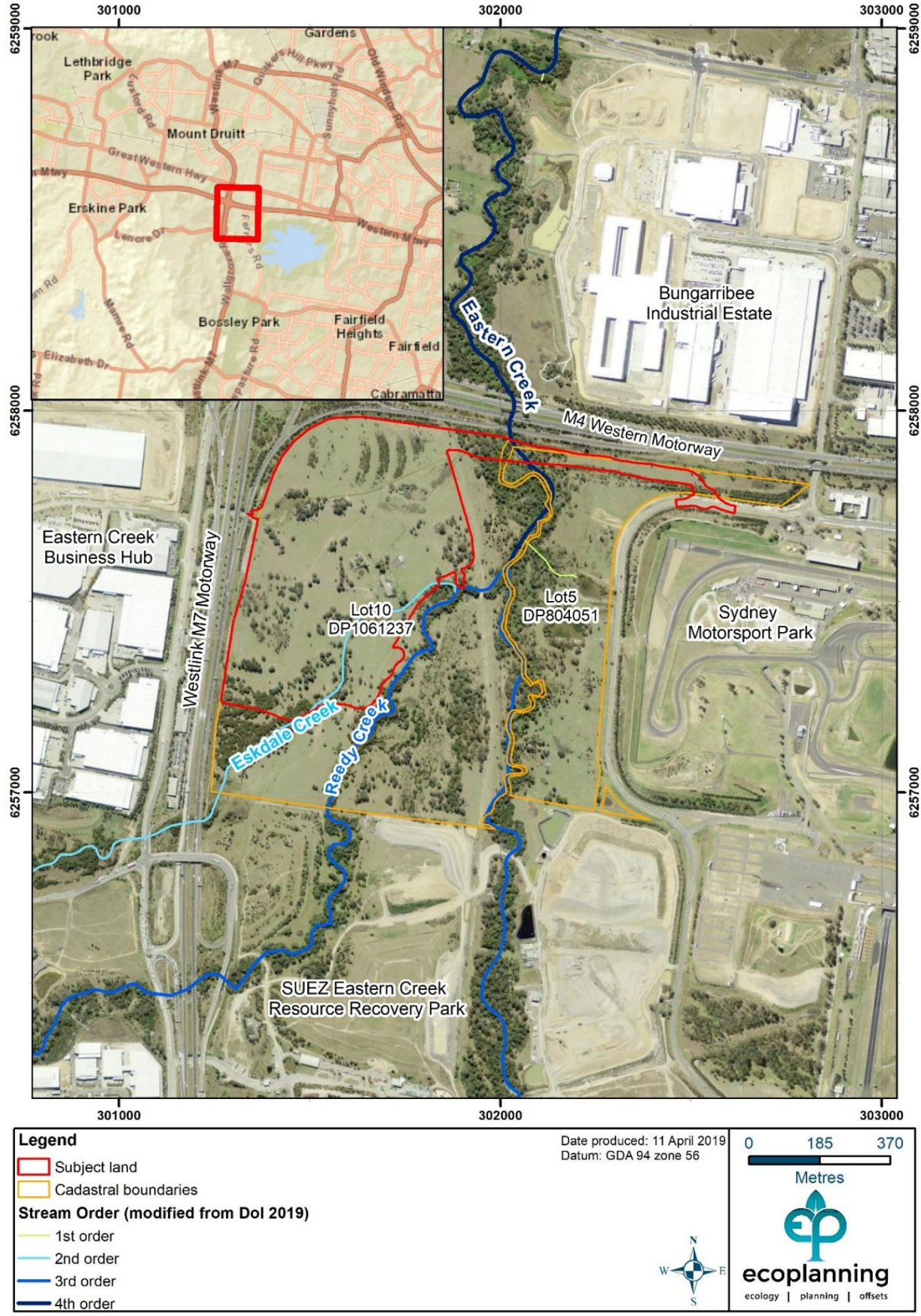

Figure 1.1: Subject land location.

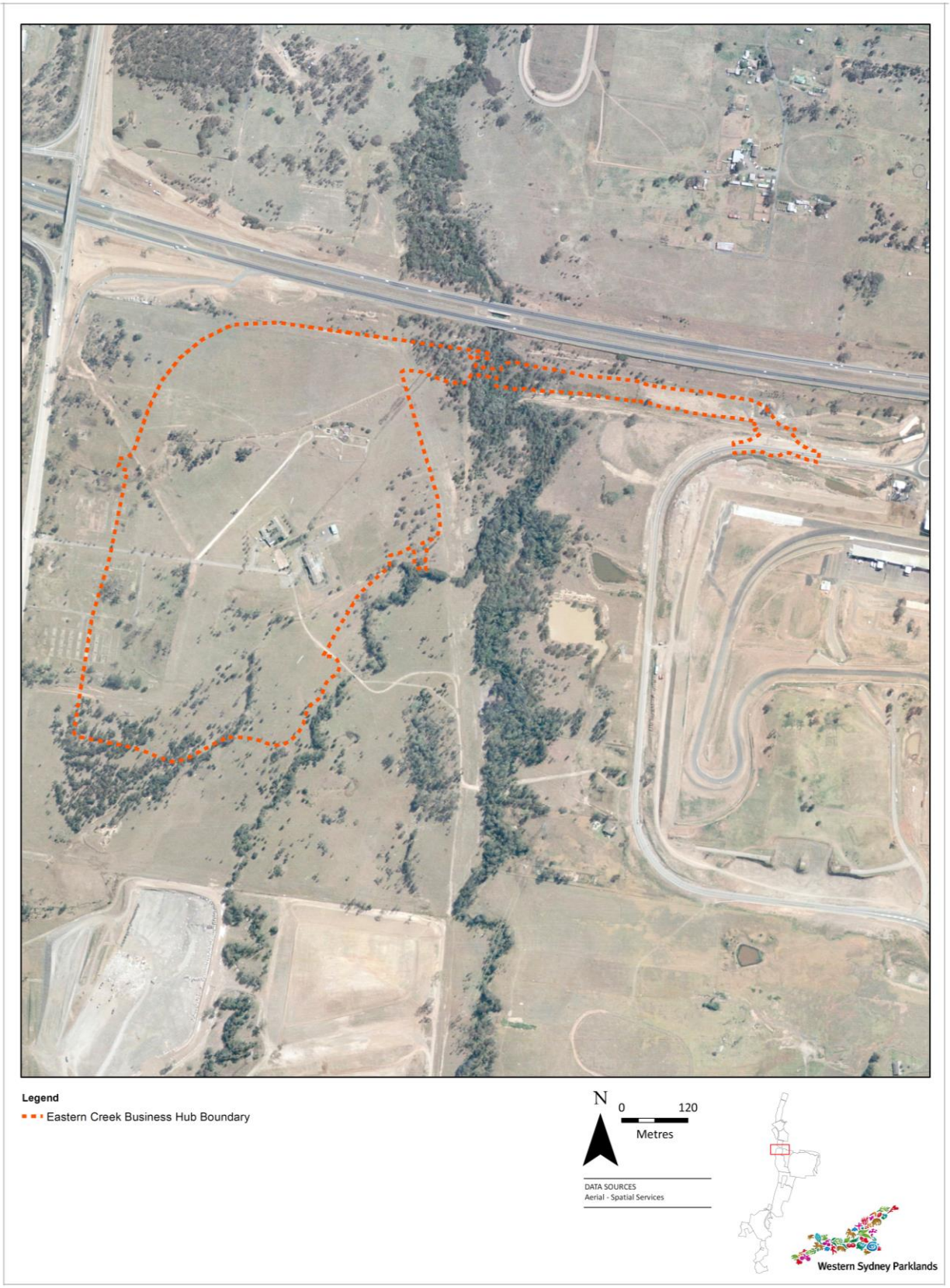

Figure 1.2: The subject land and 1991 aerial photography (map source: WSPT)

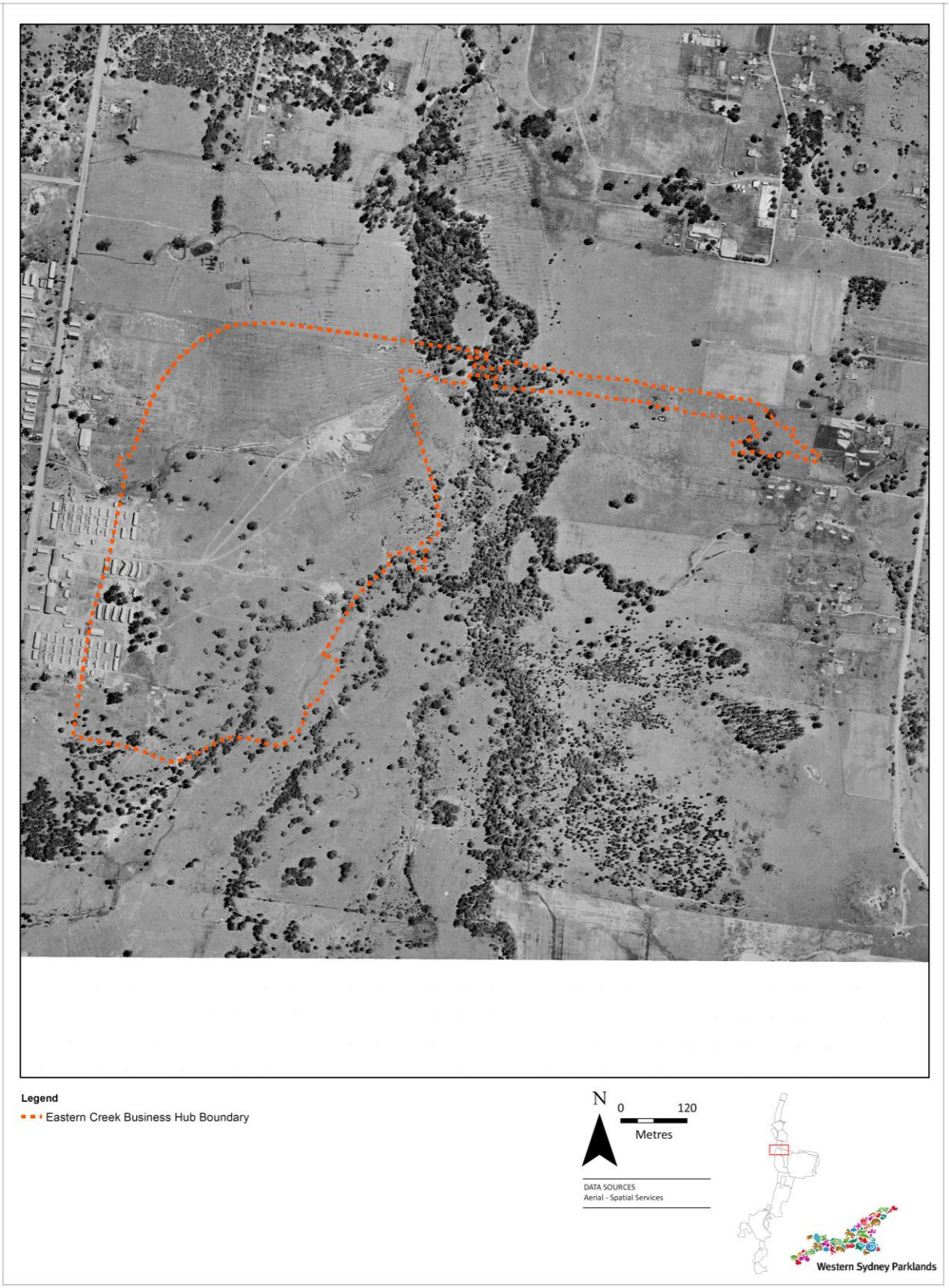

Figure 1.3: The subject land and 1955 aerial photography (data source: WSPT)

1.2 Proposed Development

The proposed development is a Concept Development Application, which outlines the staged redevelopment of the site as an industrial business hub. The current proposal includes the first stage of development, including demolition, bulk earthworks, infrastructure and subdivision. Further detailed approvals will be sought for the construction of individual buildings, ancillary facilities and associated site works.

The proposed development is shown in **Figure 1.4**. In accordance with Section 7.1 (3) of the BC Reg, '*if the proposed development involves the subdivision of land, the subdivision is taken to involve the clearing of native vegetation that, in the opinion of the relevant consent authority or other planning approval body, is required or likely to be required for the purposes for which the land is to be subdivided*'. For the purposes of this BDAR, the proposed development would include clearing of all vegetation within the subject land but would not involve clearing of any adjacent areas of native vegetation. The subject land includes the areas proposed for future industrial land-uses, including areas which will be directly and indirectly impacted during the construction phase.

The key features of the concept proposal in the context of this BDAR are summarised below:

- Clearing of existing native vegetation within the subject land to facilitate construction of approximately 157,000 sqm of industrial and light industrial floorspace with approximately 8,000 sqm of ancillary offices.
- The construction of a new bridge over Eastern Creek in the north-east of the subject land to allow primary access to the proposed business hub. A secondary access point for lighter vehicles via the existing Wallgrove Road entry/exit driveway in also proposed.
- Realignment of an approximately 300 m stretch of Eskdale Creek. The proposed realignment of Eskdale Creek is shown in **Figure 1.5** and would involve the creation of a swampy meadow/chain-of-ponds system to direct water from Eskdale Creek into Reedy Creek.

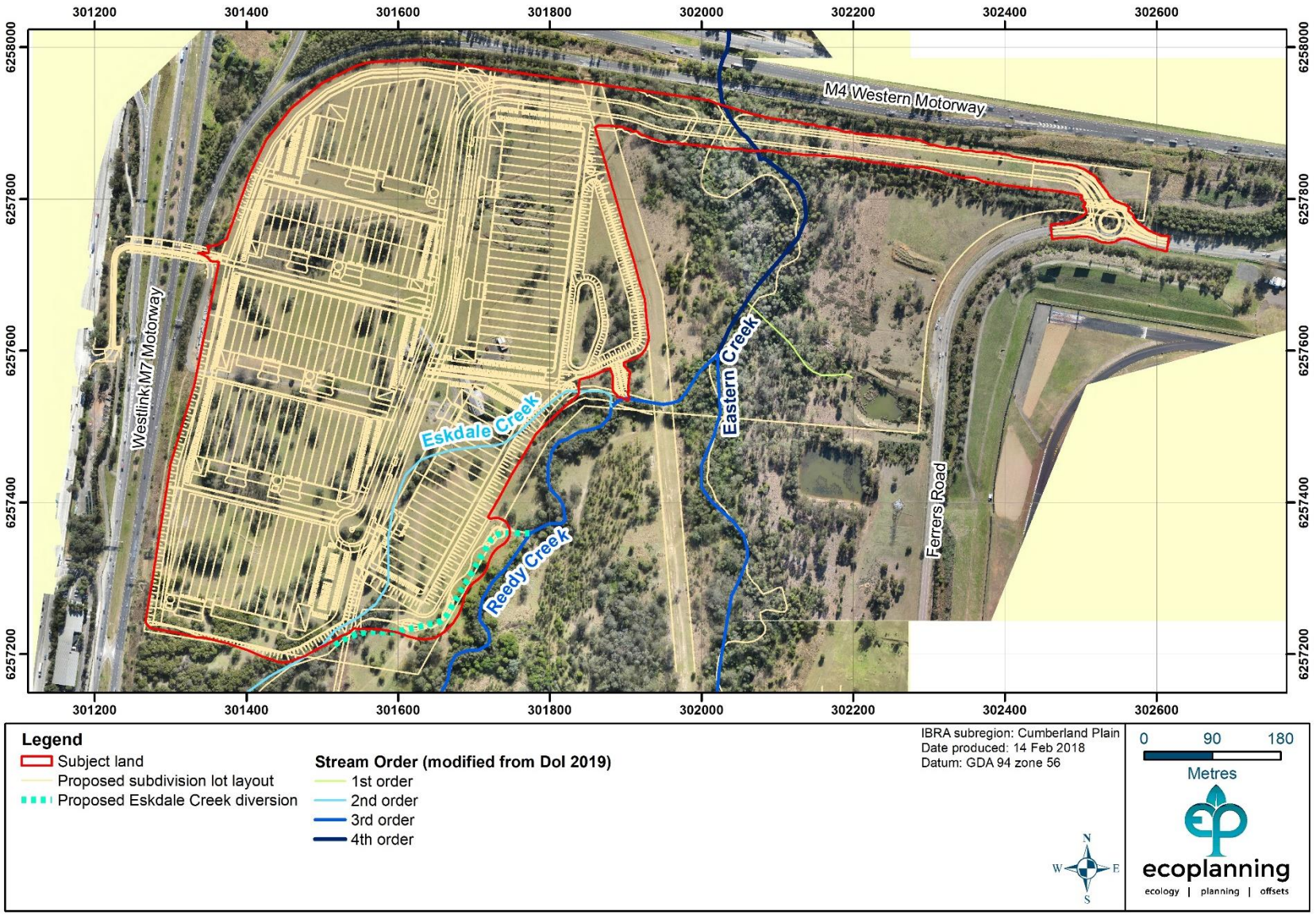

Figure 1.4: Proposed subdivision layout.

Figure 1.5: Proposed Eskdale Creek realignment.

2 Landscape context

2.1 Identify landscape features

In accordance with the BAM, several features are assessed within the subject land and a 1,500 m buffer around the subject land. These landscape features are used to identify biodiversity values that are important for the subject land and inform the habitat suitability of the subject land for threatened species. Other features, such as rivers, streams, estuaries and wetlands, habitat connectivity, karst areas or areas of outstanding biodiversity value are considered, where appropriate.

2.1.1 IBRA bioregions and IBRA subregions

The Interim Biogeographic Regionalisation of Australia (IBRA, DoEE 2012) represents a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna species present. The subject land is wholly located within the 'Cumberland' bioregion and the 'NSW Sydney Basin' subregion (IBRA version 7).

2.1.2 NSW Landscape regions (Mitchell Landscapes)

The subject land occurs across two NSW Mitchell Landscapes, with the ‘Cumberland Plain’ landscape present across the upslope and western areas of the subject land and the ‘Hawkesbury - Nepean Channels and Floodplains’ landscape present in the eastern areas of the subject land in association with Eastern Creek. The Cumberland Plain Mitchell Landscape was entered into the BAM calculator as it is the Landscape in which the majority of the subject land occurs.

2.1.3 Rivers, streams and wetlands

Rivers and streams

Rivers, streams and wetlands located within the 1,500 m buffer of the subject land, including the associated riparian buffers calculated in accordance with Appendix 3 of the BAM, are shown in **Figure 2.1**. Three creeks are present within the subject land, namely Eastern Creek, Reedy Creek and Eskdale Creek (**Figure 2.1**). Review of state-wide topographic mapping and stream ordering following the Strahler system shows Eastern Creek as a 3rd order stream above the Reedy Creek confluence and becoming a 4th order stream downstream of the confluence. Reedy Creek is classified as a 3rd order stream and Eskdale Creek a 2nd order stream (**Figure 2.1**).

The mapping of Eskdale Creek on the Penrith 1:25 000 Topographic Map and the NSW *Water Management (General) Regulation 2018* hydro line spatial data (Department of Industry [DoI] 2019) indicates that Eskdale Creek forms a tributary of Eastern Creek which flows north-east and parallel to Reedy Creek, but which does not discharge into Reedy Creek. Field surveys conducted as part of this BDAR confirmed that Eskdale Creek currently flows into Reedy Creek and does not form a tributary of Eastern Creek. The modified alignment of Eskdale Creek compared to previous mapping (DoI 2019) and, the channel condition of Eskdale Creek and current landscape all suggest that the present alignment of Eskdale Creek is the result of a

historic realignment of Eskdale Creek. Above the current confluence with Reedy Creek, Eskdale Creek has a uniform appearance broadly similar to excavated drainage ditches in agricultural landscapes. Such works may have occurred within the subject land to drain or dry out the surrounding floodplain and improve its suitability for agricultural purposes. The alteration of the Eskdale Creek channel position is likely to have resulted in a significant change in the hydrology of Reedy Creek, particularity flow metrics which include annual flow volume, flow velocities, shear stress, bank full flows and floodplain engagement. This would account for the deep incision and channel widening evident along the lower reaches of Reedy Creek. Based upon the evidence of channelisation within the subject land and the surrounding vegetation, it is highly likely that historically, Eskdale Creek was not a waterway with a defined bed and bank, as it appears today, but rather a low lying, broad drainage depression that was covered in a woodland/forest vegetation matrix dominated by species that prefer 'wet feet' such *E. amplifolia* and *E. tereticornis* in the canopy, a midstorey dominated by Melaleuca spp. and ground layer of grass and sedge vegetation.

The location of Eskdale Creek as mapped by the DoI (2019) and the current flow path are shown in **Figure 1.5**. For the purposes of this BDAR, subsequent mapping and the assessment of riparian buffers is based upon the current flow path of Eskdale Creek as determined during field assessments.

Assessment of riparian vegetation and creek channel condition using the Rapid Riparian Appraisal (Findlay et al 2011) indicate that Eastern Creek is exposed to minimal and/or infrequent degradation caused by anthropogenic sources and could be considered as slightly disturbed when compared to reference waterways in minimally disturbed, forested catchments. Results of Rapid Riparian Appraisal along Reedy Creek indicate the reach of the waterway within the subject land is moderately degraded which reflects past and current land uses, particularly grazing and altered hydrology caused by an increase of upstream impervious surfaces and resulting stormwater flows. Results of Rapid Riparian Appraisal along Eskdale Creek indicate the current condition of Eskdale Creek represents a significant departure from what would be considered an undisturbed waterway in a natural state.

Water quality within the three Creeks was assessed from historical data provided by Blacktown City Council spanning 2008-2016 for Reedy Creek and Eskdale Creek and 2013-2016 for Eastern Creek. Blacktown City Council water quality monitoring sites were located approximately 2 km upstream of the subject land on Eastern Creek and adjacent to Wallgrove Road and slightly upstream of the subject land on Reedy Creek and Eskdale Creek. Median, mean and range for water quality parameters including pH, electrical conductivity, dissolved oxygen, turbidity, total nitrogen and total phosphorus were calculated from these data (**Appendix A**). Median calculated values for each potential stressor was used as per ANZECC – Volume 2 (2000) and compared to the default trigger values for south east Australia listed in ANZECC – Volume 1 (2000). Ambient water quality in the three creeks within the subject land was shown to have elevated total nitrogen and phosphorous, which is attributed to nutrient enrichment from upstream land use. Upstream land uses within Eskdale Creek and Reedy Creek Catchments are shown in **Figure 2.1**. Upstream land use within the Eskdale Creek catchment is predominately industrial with very limited areas supporting native vegetation with an intact structure. The upstream land uses within the Reedy Creek Catchment include a combination of industrial and semi-rural land uses with limited areas supporting native vegetation with an intact structure. Much of the upstream catchment of Reedy Creek forms part of the Western Sydney Employment Area established by the NSW government to provide

businesses in the region with land for industry and employment, including transport and logistics, warehousing and office space. Accordingly, much of the semi-rural land use within the Reedy Creek is intended for future development. The catchment of Eastern Creek upstream from the subject land includes a large area incorporating a variety of land uses with large areas of intact, native dominated vegetation present within the Parklands.

Assessment of Key Fish Habitat (KFH) type and class following the framework set out by DPI Fisheries (2013), shows at the time of assessment the reach of Eastern Creek adjacent to the subject land was classified as Type 1 – highly sensitive fish habitat, Class 1 – major key fish habitat. This result was determined due to the permanent flow and availability of deep pools and presence of large woody debris > 3m length and > 300 mm diameter. Reedy Creek within the subject land at the time of assessment was classified as Type 1 – highly sensitive fish habitat, Class 2 – moderate key fish habitat. This result was determined due to the semi-permanent availability of deep pools and presence of large woody debris > 3m length and > 300 mm diameter.

Eskdale Creek was not mapped as KFH and field inspection confirmed it was unlikely this waterway would sustain viable long-term populations of fish due to its highly degraded state, intermittent flow and lack of complex habitat.

Review of Freshwater Threatened Species Distribution Maps (DPI Fisheries 2016) showed no threatened fish species were recorded in Eastern Creek, Reedy Creek and Eskdale Creek and that these waterways are not considered as habitat for threatened fish.

Wetlands

The BAM defines a 'wetland' as an area *"…of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle.".* No important wetlands, as defined under the BAM, are present within the 1,500 m buffer of the subject land. The nearest important wetland, to the subject land is Bicentennial Park at Homebush (Environment Australia 2001), approximately 20 km east and in a different catchment to the subject land.

Based upon the definition of a 'local wetland' under the BAM, areas of woodland which occur along the stretches of Eastern, Reedy and Eskdale Creeks would constitute a local wetland as the '*land …is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle*'.

Review of the Atlas of Groundwater Dependent Ecosystems (GDEs) (Bureau of Meteorology [BOM] 2019) identified that 'High Potential terrestrial GDEs' are mapped in association with Eskdale, Reedy and Eastern Creek (**Figure 2.2**). Field validation of vegetation across subject land (see **section 3**) confirmed the presence of vegetation assemblages that typically occur in close proximity to minor watercourses (Tozer 2003). Neither Eastern Creek, Reedy Creek or Eskdale Creek are mapped as aquatic GDEs (BOM 2019).

Additionally, within the 1,500 m buffer, to the east of the subject land, there are several constructed dams which would represent artificial local wetlands (**Figure 2.1**).

2.1.4 Habitat connectivity

The subject land includes a small portion of a recognised regional corridor, which extends along the riparian corridor of Eastern Creek (OEH 2015b; **Figure 2.3**). The identified regional corridor extends from Edmondson Park in the south to Vineyard in the north and is described as including a mixture of riparian and non-riparian corridor areas. Northern sections of the corridor (including the subject land) are aligned with Eastern Creek (OEH 2015b), while southern sections of the corridor are aligned with Hinchinbrook and Cabramatta Creeks. Non-riparian components include bushland corridors within the Parklands (OEH 2015b).

The identified corridor includes several small and medium scale interruptions to vegetation cover along the corridor including the M4 Western Motorway corridor, the Westlink M7 Motorway, a number of smaller roads and electricity, water and gas easements.

2.1.5 Other landscapes features

No other landscape features including areas of geological significance (including karst, caves, crevices and cliffs) or soil hazard features have been identified within the subject land and 1,500 m buffer around this land.

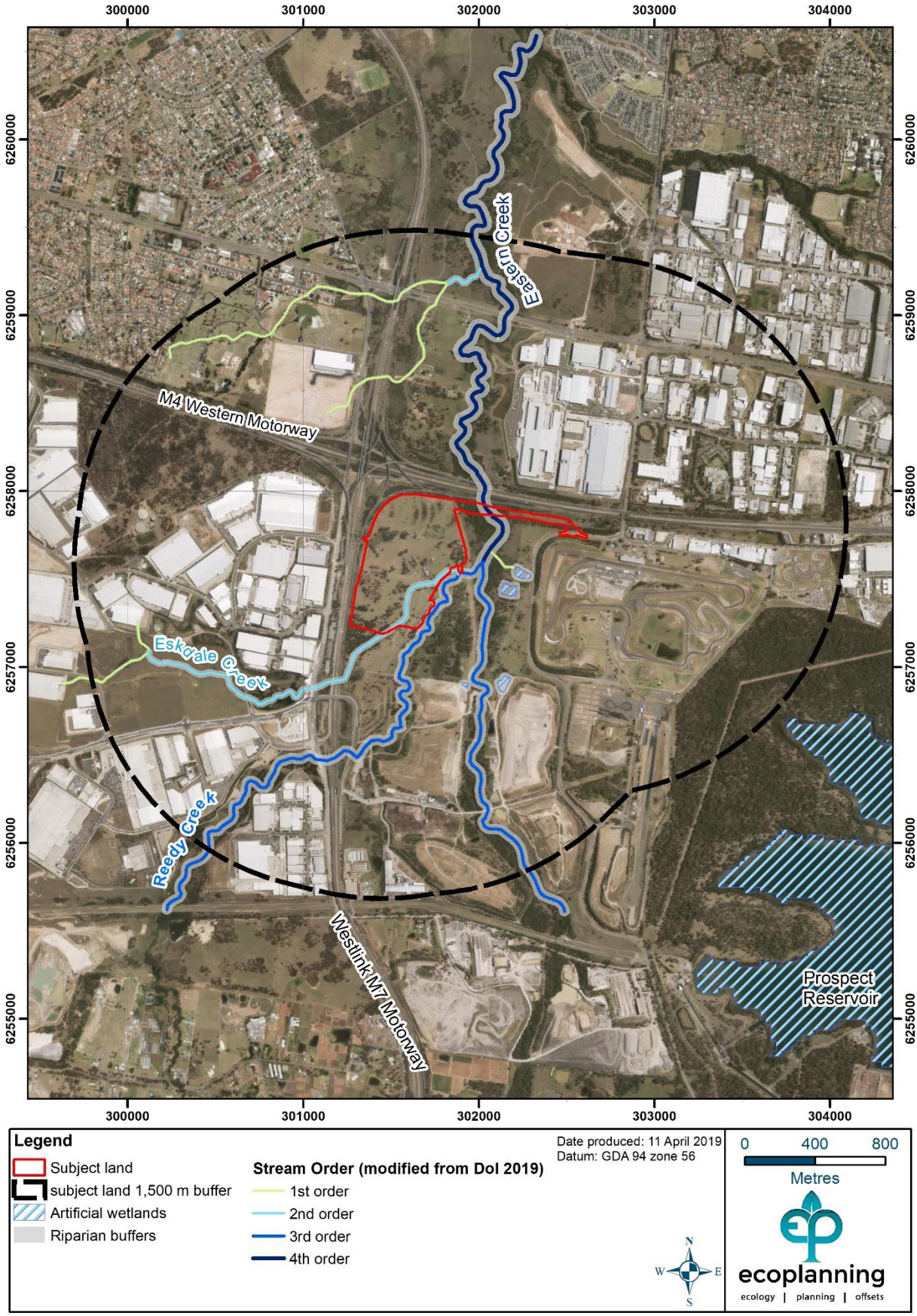

Figure 2.1: Location map – rivers, streams and wetlands.

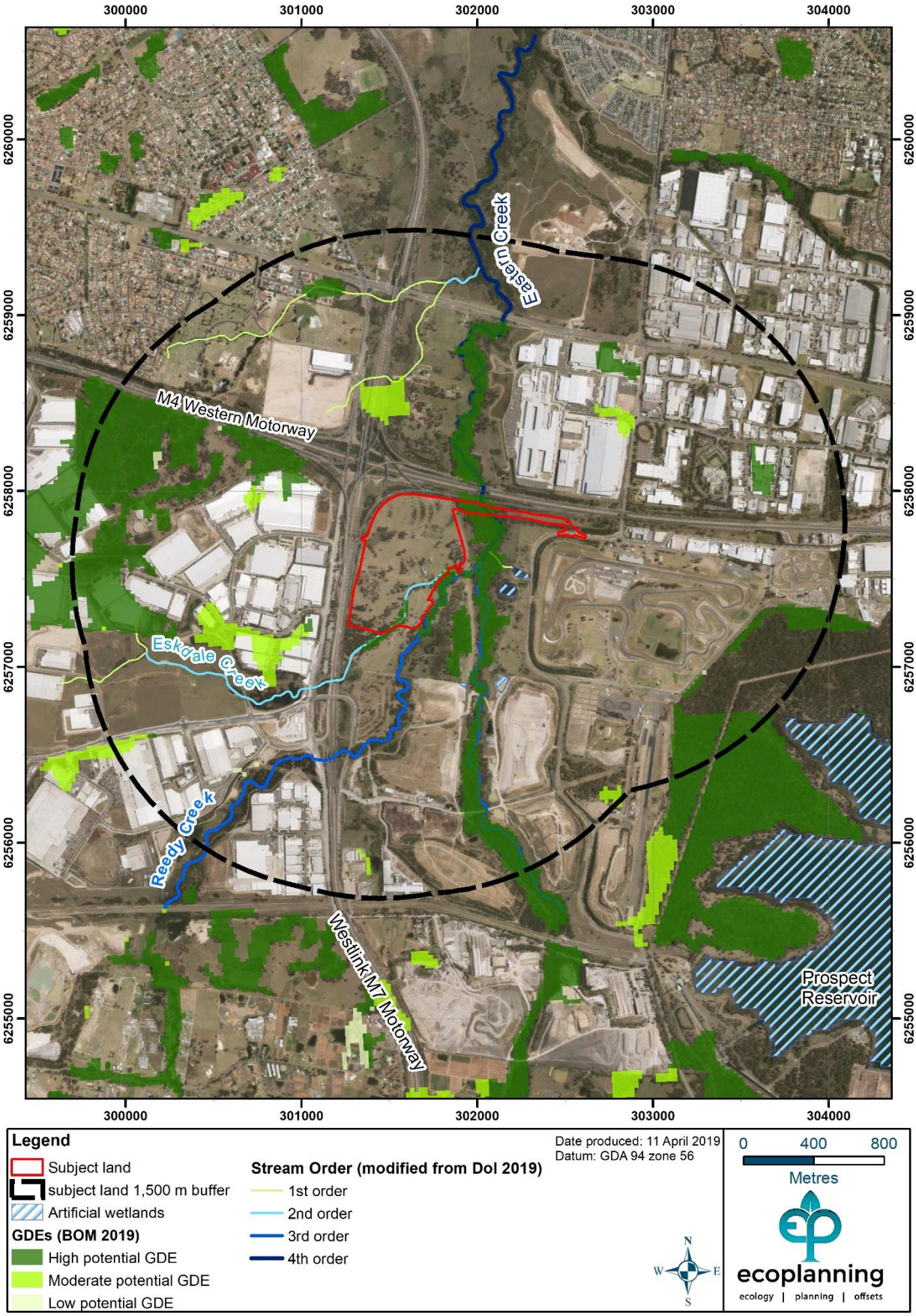

Figure 2.2: Groundwater Dependent Ecosystems within the subject land and 1 500 m buffer (BOM 2019).

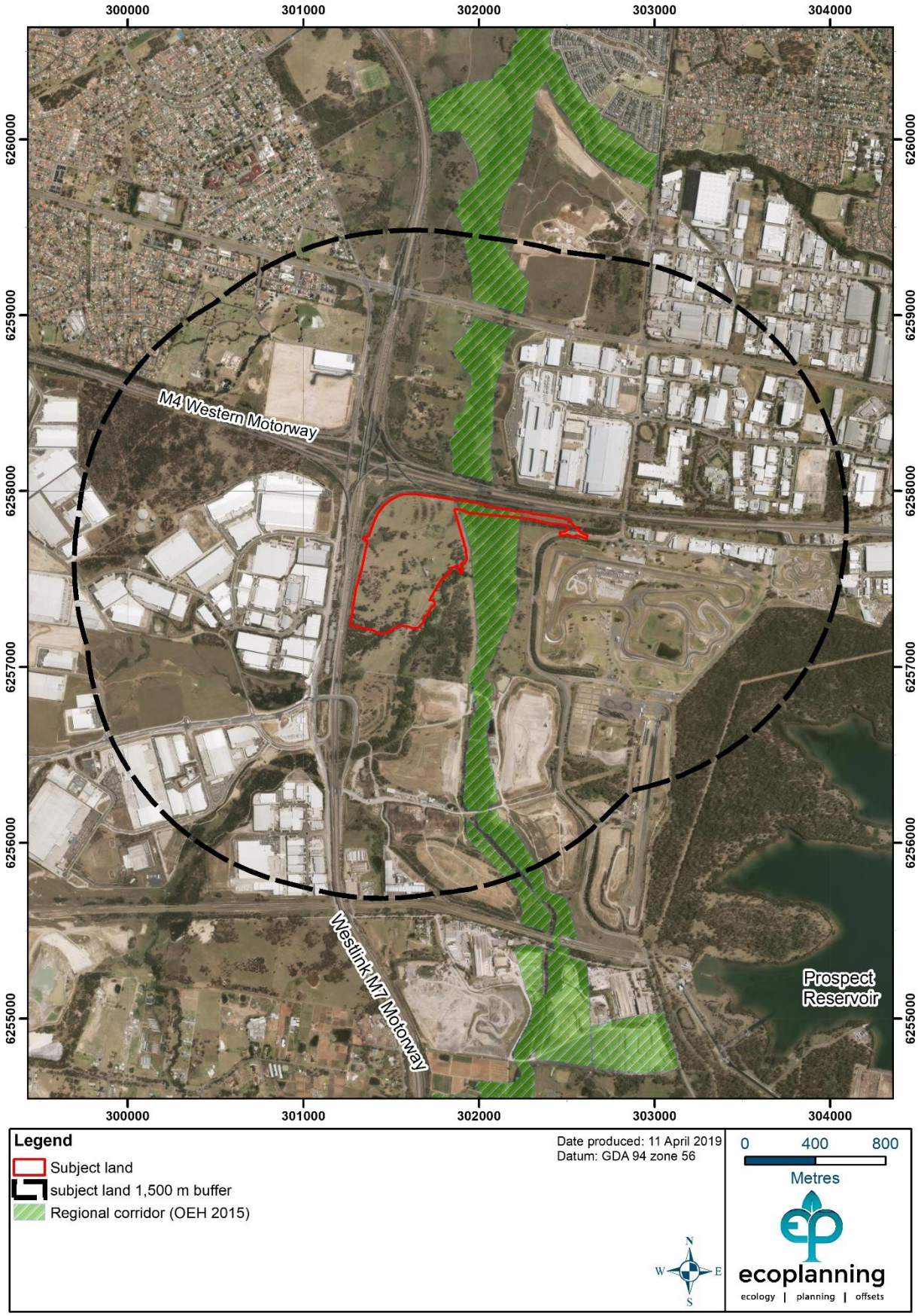

Figure 2.3: Regional corridors within the subject land (OEH 2015b).

2.2 Determining site context

2.2.1 Assessing native vegetation cover

In accordance with Section 4.3.2 of the BAM, native vegetation cover must be estimated for a 1,500 m buffer around the subject land to determine the landscape context. The extent of native vegetation on the subject land and immediate surrounds was mapped using the vegetation mapping for the Cumberland Plain (OEH 2015a) and the Sydney Metropolitan Area (OEH 2016b) with revisions made based upon recent aerial photograph interpretation (**Figure** 2.4).

Within the 1301.78 ha area which includes the subject land and a 1,500 m buffer, 219.0 ha was mapped as supporting native vegetation. This equates to a cover of native vegetation across 16.82% of the subject land and 1,500 m buffer, which is within the >10-30% class in accordance with the BAM.

2.2.2 Assessing patch size

Patch size as defined by the BAM as "*an area of native vegetation that*:

> *a) occurs on the development site or biodiversity stewardship site, and*
>
> *b) includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or ≤30m for non-woody ecosystems).*

Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site."

In assessing patch size, stands of native vegetation within 100 m (where in a moderate to good condition) but which are separated by hard barriers including permanent artificial structures, wide roads or other barriers have been treated as separate patches. These highly modified breaks in vegetation connectivity would significantly alter ecological function of these areas of native vegetation such that these areas warrant recognition as separate patches.

Patch size was calculated for the vegetation on the subject land using the field validated map of vegetation types and the updated native vegetation extent data layer prepared for the 1,500 m buffer (based on OEH 2015a and OEH 2016b). Patch size is required to be assessed as one of four classes per vegetation zone mapped, being <5 ha, 5-24 ha, 25-100 ha or >100 ha.

All vegetation within the subject land was identified as being separated by less than 100 m from other areas of similar native vegetation extending to the vegetated corridor which occurs in association with Eastern Creek. Based upon mapping of native vegetation beyond the subject land (OEH 2015a), the total area of this patch of native vegetation was calculated as being greater than 100 ha and within the >100 ha class.

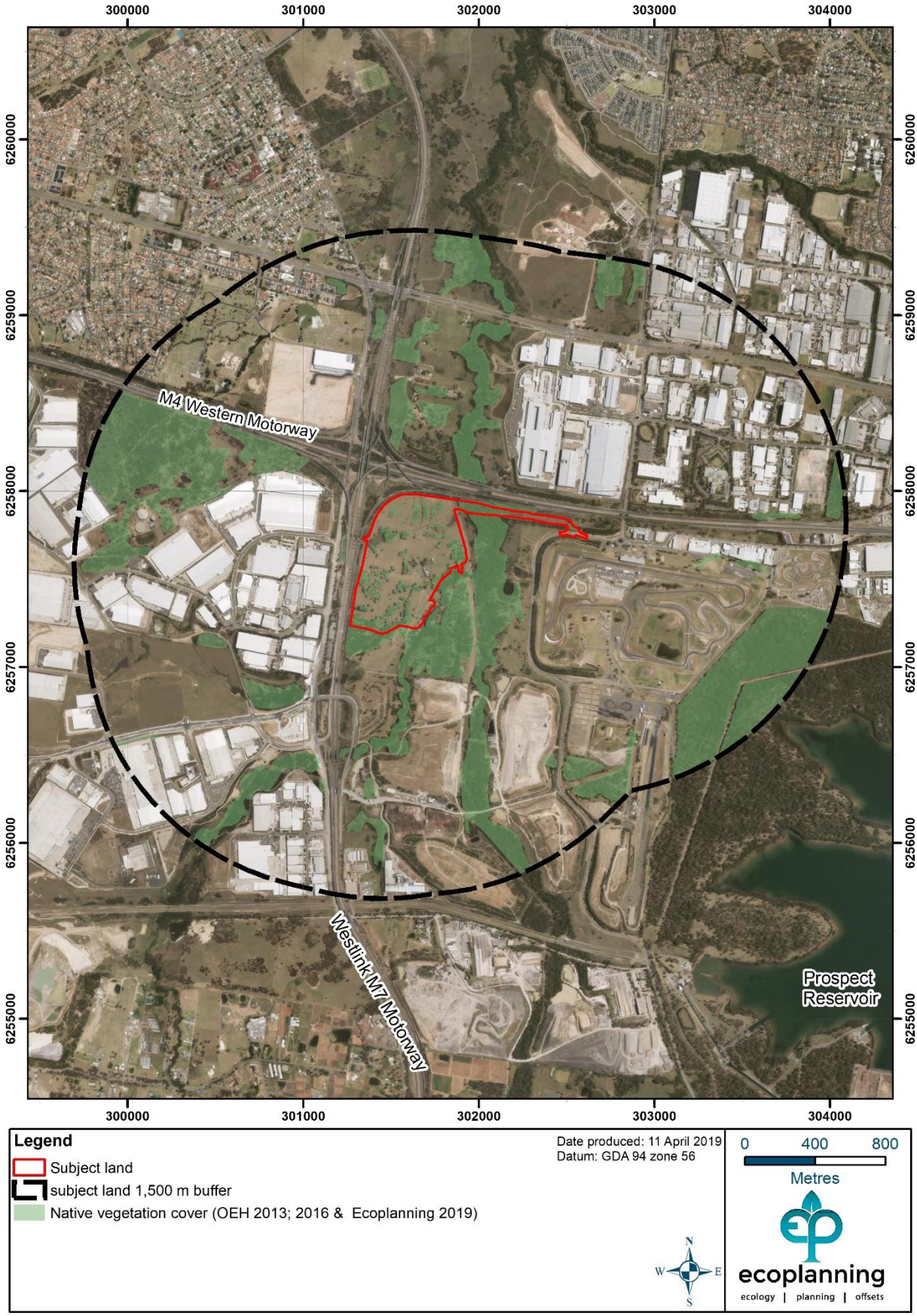

Figure 2.4: Native vegetation cover within the subject land and 1500 m buffer.

3 Native vegetation

3.1 Existing information on native vegetation

Review of previous vegetation mapping (OEH 2015a after NPWS 2002 and Tozer 2003) identified two native vegetation communities as having been previously mapped within the subject land, 'Shale Plains Woodland' and 'Alluvial Woodland' (**Figure 3.1)**. Both of these vegetation communities are listed Threatened Ecological Communities (TECs) listed under the BC Act with Shale Plains Woodland forming part of the Critically Endangered Ecological Communities (CEEC), *'Cumberland Plain Woodland in the Sydney Basin Bioregion'* under the BC Act and the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Alluvial Woodland forms part of the *'River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*' Endangered Ecological Community (EEC) listed under the BC Act. For the vast majority of the subject land, no native vegetation community was identified as being present by OEH (2015a; **Figure 3.1**). Much of the native vegetation within the subject land is regeneration following historic clearing as evidenced from 1955 and 1991 aerial photographs (**Figure 1.2** and **Figure 1.3**).

An Ecological Constraints Assessment (ECA) was prepared for the subject land by Ecoplanning (2017). As part of this ECA, native vegetation was mapped across a portion of the subject land with a greater cover of native vegetation identified compared to the regional vegetation mapping of OEH (2015a). The mapping of native vegetation by Ecoplanning (2017) confirmed the presence of native vegetation communities mapped by OEH (2015a) with 'Alluvial Woodland' identified as occurring adjacent to the watercourses in the subject land, including Eskdale, Reedy and Eastern Creeks, with 'Shale Plains Woodland' occurring with increasing distance from the watercourses.

Figure 3.1: Regional mapping of vegetation communities (OEH 2015a).

3.2 Vegetation extent

Native vegetation was identified and mapped across 9.99 ha of the approximately 39.47 ha of the subject land. Areas which did not support native vegetation included areas identified as being 'cleared' or areas supporting 'exotic vegetation'. Generally, the 'cleared' areas were associated with existing buildings/infrastructure and roads. Areas identified as supporting exotic vegetation consisted of dense thickets of *Rubus fruticosus** sp. agg. (Blackberry) or planted exotic *Cupressus* sp.* (Cypress species). Large areas of the subject land were identified as supporting 'exotic grasslands' as a result of previous vegetation clearing and grazing across the subject land. While areas of exotic grassland do not represent areas of native vegetation, these areas were identified as supporting occasional native grass and forb species and were assessed as a vegetation zone as per the BAM.

In accordance with Section 5.1 of the BAM, areas which are not native vegetation do not require further assessment, except where they represent habitat for threatened species. No further assessment of the vegetation within 'cleared' or 'exotic vegetation', excluding areas of 'exotic grasslands', has been undertaken.

3.3 Plant Community Types

3.3.1 Survey methodology

Identification and mapping of vegetation community and Plant Community Types (PCTs) was based upon validation of the preliminary mapping of PCTs within the subject land by Ecoplanning (2017). All vegetation polygons mapped by Ecoplanning (2017) were traversed whilst observing the vegetation structure and dominant species within each structural layer. The entire distribution of each vegetation polygon mapped by Ecoplanning (2017) was traversed to sample any spatial variation within each polygon, validate boundaries between PCTs and to record and variation in the broad condition state of vegetation polygons to identify and map vegetation zones.

Based upon traverses of each of the vegetation polygons and revisions to mapped boundaries, vegetation communities within the subject land were identified. The floristics of each of these vegetation communities were then sampled within plot-based floristic vegetation surveys consistent with Section 5.2.1.9 of the BAM. The location of floristic plots is shown in **Figure** 3.2. The plot locations also represented the location of vegetation integrity plots in accordance with Section 5.3 of the BAM. The location of floristic vegetation plots was based upon randomly sampling areas of each vegetation community whilst ensuring that the plot-based surveys included representative areas within each community, sampled the geographic range of each community and that where possible plots were not influenced by edge effects (i.e. located close to edges of vegetation extent) or ecotones with adjacent vegetation zones.

The identification of PCTs for each vegetation community was in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification. Determination of the most appropriate PCTs for vegetation communities within the subject lands used the BioNet Vegetation Classification database to filter PCT types within the Sydney Basin Bioregion which included the canopy species which had the greatest percent foliage cover and abundance as recorded within floristic plots. The data for each PCT including vegetation formation, descriptive attributes and distribution information were then reviewed to determine the most

appropriate PCT for each of the vegetation polygons sampled within the subject land. Observations of vegetation structure and composition made during traverses of the subject lands as well as previous floristic data for adjacent land (section 3.2) also informed the determination of most appropriate PCTs for the vegetation communities within the subject land. It is noted that identification of vegetation communities and PCTs was complicated by the fact that field observations were of disturbed, fragmented and previously cleared stands of vegetation. Consequently, the identification of vegetation communities was based upon observations of the communities in a highly modified state with some elements of native vegetation communities absent or highly modified. Given the highly modified nature of the vegetation within the subject land, no quantitative assessment of vegetation communities was undertaken.

3.3.2 Plant Community Types

Two PCTs were identified across the subject land, with the distribution of these communities related to the topographical position within the subject land (**Figure 3.2**). As with many native vegetation communities, the boundaries between the PCTs were occasionally difficult to identify, with broad ecotones between vegetation communities present and many flora species from all structural layers shared by adjacent vegetation communities. The boundaries were distinguished based upon changes in topography, vegetation structure and the dominance of primary canopy species. The two PCTs identified within the subject land are:

- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats 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.

The relationship between these PCTs, the vegetation mapping of OEH (2015) and TECs is summarised in **Table 3.1**.

Table 3.1: Corresponding vegetation communities, PCTs and TECs

Vegetation communities (OEH 2015a)	Plant Community Types (PCTs)	Threatened Ecological Communities (TECs)	BC Act	EPBC Act
Shale Plains Woodland (MU10)	PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion ('Cumberland Plain Woodland')	CE	CE
Alluvial Woodland (MU11)	PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions ('River-flat Eucalypt Forest)'	E	-

CE = Critically Endangered; E = Endangered

A summary of each of the PCTs within the subject land including areas of vegetation zones, the percent cleared for each PCT and Serious and Irreversible Impacts (SAII) candidate entities is included in Table 3.2. Descriptions of each of the PCTs within the subject land are outlined below.

Table 3.2: Details of PCTs within the subject land.

Plant Community Types (PCTs)	Vegetation Formation & class	Vegetation zones	Area (ha)	PCT percent cleared	Threatened Ecological Communities (TECs)	SAII candidate entity
PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Grassy Woodlands - Coastal Valley Grassy Woodlands	Under-scrubbed	1.33	93%	Cumberland Plain Woodland in the Sydney Basin Bioregion	Yes
		Revegetation	1.13			
PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Forested Wetlands - Coastal Floodplain Wetlands	Intact	2.12	93%	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	No
		Under-scrubbed	5.01			
		Plantings	0.40			
Exotic grassland	N/A	Exotic grassland	28.64	N/A	N/A	N/A
Exotic vegetation	N/A	Exotic vegetation	0.38	N/A	N/A	N/A
Total			**39.01**	**-**		

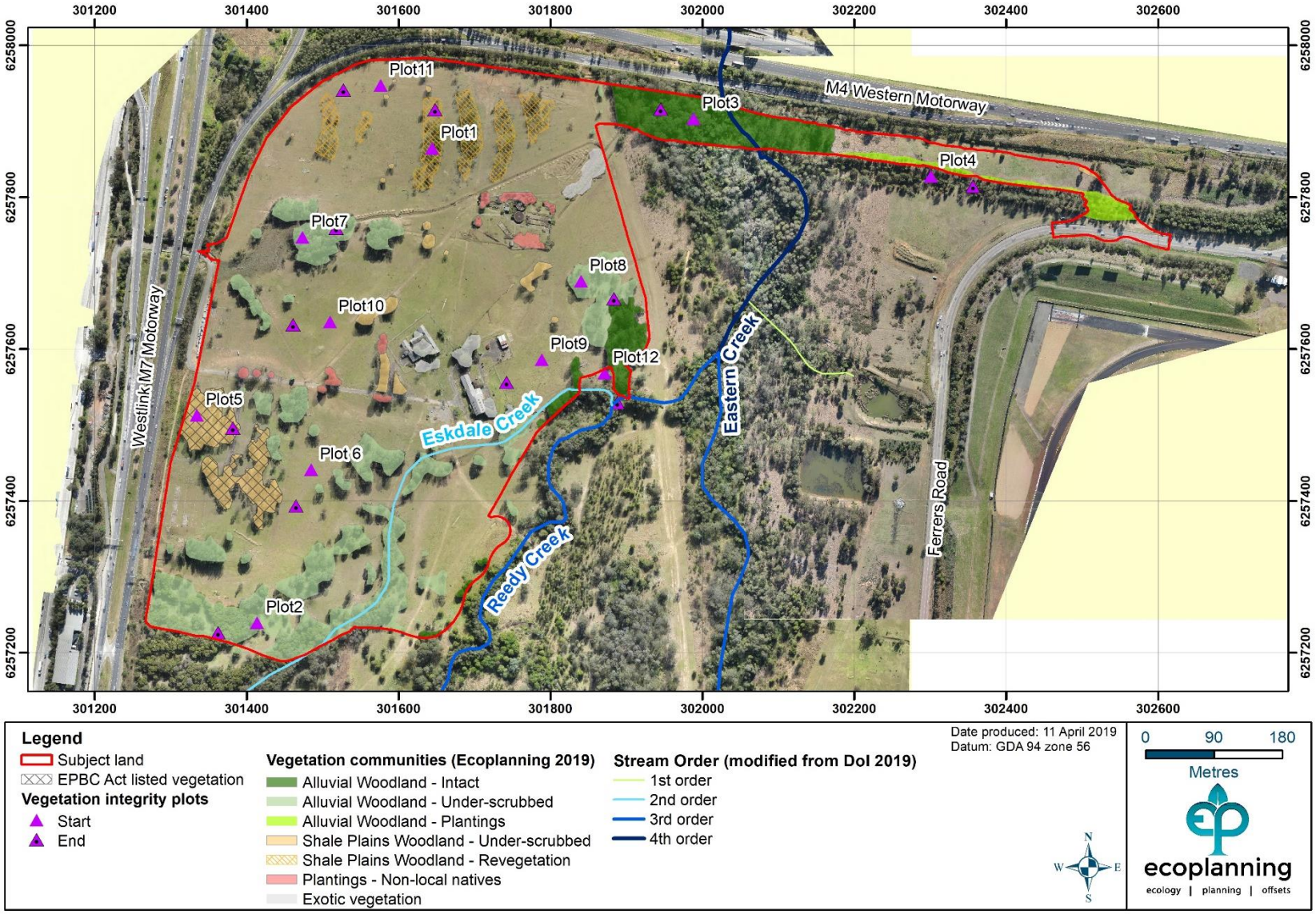

Figure 3.2: Plant Community Types within the subject land.

PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

Woodland vegetation across areas of lower elevation within the subject land and in proximity to Eskdale, Reedy and Eastern Creeks were identified as PCT 835 and the equivalent 'Alluvial woodland' as described by Tozer (2003) (**Figure 3.2**). This PCT consisted of a grassy woodland dominated by *Eucalyptus tereticornis* (Forest Red Gum) with *E. amplifolia* (Cabbage Gum), *Angophora subvelutina* (Broad-leaved Apple), *A. floribunda* (Rough-barked Apple) and *Casuarina glauca* (Swamp Oak) also present (**Plate 3.1**). Several smaller tree species including *Acacia decurrens* (Black Wattle), *A. parramattensis* (Parramatta Wattle), *Melaleuca linariifolia* (Flax-leaved Paperbark), *M. styphelioides* (Prickly-leaved Tea Tree) and *M. decora* formed a variable sub-canopy which ranged from absent to moderately dense across patches of this PCT. A variable shrub layer was also present within this PCT dominated by *Bursaria spinosa* subsp. *spinosa* (Blackthorn) and *Kunzea ambigua* (Tick Bush) with exotic shrub species present at low densities including *Olea europaea* subsp. *cuspidata** (African Olive), *Lycium ferocissimum** (Box Thorn), *Ligustrum lucidum* (Broad-leaved Privet) and *L. sinense* (Small-leaved Privet).

A grassy understorey was present throughout this PCT including a diverse array of grasses, forbs and sedges with *Themeda triandra* (Kangaroo Grass), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Bothriochloa macra* (Red Grass) and *Aristida* spp. all common. Exotic grasses and forbs were present throughout this vegetation community, with *Setaria parviflora** (Pigeon grass), *Paspalum dilatatum** (Paspalum), *Axonopus fissifolius** (Narrow-leaved Carpet Grass) most common. The boundary between this vegetation community and areas of PCT 849 ('Shale Plains Woodland') was not always distinct and it is likely that the boundary between these communities has changed overtime in response to modifications to the hydrological regime within the subject land as a result of altered run-off from surrounding developments and channel construction within the subject land. The current mapping of vegetation communities and PCTs within the subject land, identified 'Alluvial Woodland' as occurring across those areas of native vegetation at lower elevation, where *E. tereticornis* was the dominant canopy species (including dense regrowth) and where species which prefer damp conditions were occasionally present.

Three vegetation zones, areas of similar broad condition state, were identified for PCT 835, which included areas termed:

- Intact – areas with all structural layers present and native dominated. This vegetation zone occurred in association with Eastern and Reedy Creek (**Plate** 3.1).
- Under-scrubbed – areas in which shrub and sub-canopy layers were absent due to previous selective clearing and ongoing grazing (**Plate 3.2**).
- Plantings – areas of dense plantings of native species in association with an artificial channel in the east of the subject land (**Plate 3.3**).

Identification of the corresponding PCT was based on review of the BioNet Vegetation Classification and specifically PCTs which occur within the 'Sydney Basin – Cumberland Plain' IBRA subregion and included *E. tereticornis* as a dominant species. Based upon this search, five PCTs were reviewed, with PCT 835 identified as the most appropriate PCT based upon the floristic description and the landscape position identified as stream banks and alluvial flats

on the Cumberland Plain. Additionally, the reference for PCT 835 'Cumberland River Flat Forest' (Tindall et al 2004) was considered a good description of the vegetation community within the subject land.

'Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' (PCT 835) within the subject lands forms part of the 'River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions' EEC listed under the BC Act. This vegetation community is not identified as a potential SAII entity within Appendix 3 of the Guidance to assist a decision-maker to determine a serious and irreversible impact (OEH 2017b) and is therefore unlikely to meet the relevant SAII principles.

Plate 3.1: Intact PCT 835 within the subject land.

Plate 3.2: Under-scrubbed PCT 835 within the subject land.

Plate 3.3: Plantings of PCT 835 within the subject land and adjacent to a constructed channel.

PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion Forest

Areas of woodland vegetation in the higher elevation areas of the subject land were identified as PCT 849 and the equivalent 'Shale Plains Woodland' as described by Tozer (2003) (**Figure** 3.2). This PCT consisted of a grassy woodland dominated by *E. moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum). A sparse and variable shrub layer was present within this vegetation community and was dominated by *Bursaria spinosa* subsp. *spinosa* with the exotic shrubs *Olea europaea* subsp. *cuspidata** (African Olive) and *Lycium ferocissimum** (Box Thorn) also present at low densities. At the time of assessment, the of the understorey of this community was generally sparse with limited cover although several native grasses were common including *Microlaena stipoides* (Weeping Grass) and *Rytidosperma* sp. (Wallaby Grass). A number of exotic species were present, in particular around the margins where it adjoined exotic grasslands, including, *Hypochaeris radicata** (Catsear), *Eragrostis curvula** (African Lovegrass), *Paspalum dilatatum** (Paspalum) and *Briza subaristata**.

All areas of this PCT consisted of heavily grazed patches which had been under-scrubbed (clearing of shrub layer) and were heavily impacted by weed infestation and canopy thinning. Two vegetation zones, areas of similar broad condition state, were identified for this PCT including areas which were 'under-scrubbed' (selective clearing of the midstorey, **Plate 3.4**) and areas of 're-vegetation' in which recent planting of native midstorey species (*Acacia* spp.) has occurred (**Plate 3.5**). No canopy layer was present within the areas of PCT 849 identified as 're-vegetation'.

Identification of the corresponding PCT was based review of the BioNet Vegetation Classification database and specifically PCTs within the 'Grassy Woodland' vegetation formation which occur within the 'Sydney Basin – Cumberland Plain' IBRA subregion. Based upon this search four PCTs were reviewed with PCT 849 identified as the most appropriate PCT based upon the floristic description and the landscape position which is identified as gently inclined areas on the Cumberland Plain. Additionally, the reference for PCT 849, 'Cumberland Shale Plains Woodland' (Tozer et. al. 2006) was considered a good description of the vegetation community within the subject land.

Within the subject land all occurrences of PCT 849 and the equivalent Shale Plains Woodland form part of the 'Cumberland Plain Woodland in the Sydney Basin Bioregion' (Cumberland Plain Woodland) CEEC listed under the BC Act. This vegetation community is identified as a potential SAII entity within Appendix 3 of the 'Guidance to assist a decision-maker to determine a serious and irreversible impact' (OEH 2017b). Consideration of SAII are outlined in **Section 6.5.1**.

Of the areas supporting PCT 849 within the subject land, 0.97 ha was identified as being equivalent to '*Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest*' as listed under the EPBC Act. The listing of this ecological community under the EPBC Act (TSSC 2009) includes condition thresholds to identify when a patch of the community retains sufficient conservation values to be considered as a Matter of National Environmental Significance, as defined under the EPBC Act. For the subject land, 0.97 ha of PCT 849 in an 'under-scrubbed' condition class was identified as meeting the minimum condition thresholds as the patch size for these areas was greater than 0.5 ha and greater than 50% of the perennial understorey vegetation cover was made up of native species. The remaining areas of PCT 849 within the

subject land do not form part of the ecological community as listed under the EPBC Act as these areas occurred as either isolated paddock trees which did not meet the minimum patch size requirements or consisted of patches where upper tree layer species were not present. In accordance with the classification of the ecological community within the listing advice for (TSSC 2009), the 0.97 ha of the ecological community as listed under the EPBC Act was in Condition A. A referral to the Australian Government Minister for the Environment has been made to determine whether the proposed impacts would significantly impact the ecological community. A determination has been made under section 75 of the EPBC Act that the proposed action is a controlled action, however it has also been determined that the project will be assessed for the purposes of the EPBC Act by the NSW Government as an accredited assessment, under Part 4, Division 4.7 of the EP&A Act (State Significant Development). Consequently, this BDAR also forms the assessment under the EPBC Act.

Plate 3.4: Under-scrubbed PCT 849 within the subject land.

Plate 3.5: Re-vegetation of PCT 849 within the subject land.

Exotic vegetation

Exotic vegetation within the subject land included small areas of exotic shrubs (*Rubus fruticosus** sp. agg) or canopy species (*Cupressus* sp.*) and large areas of exotic grasslands. Areas of exotic grassland were dominated by exotic pasture grasses including *Paspalum dilatatum*, Setaria parviflora*, Axonopus fissifolius*, Briza subaristata*, Cenchrus clandestinus* (Kikuyu) and the cosmopolitan species, *Cynodon dactylon*† (Couch). There is debate, and doubt, over the status of *C. dactylon*† within Australia (Langdon 1954), with the species having been recorded as an introduced species as early as 1802-1804 by Brown, R. (Groves 2002), although some authors recognise both indigenous and introduced populations within Sydney (Harden 1993 in Groves 2002) and Australia (Jessop et al. 2006). Within the subject land *C. dactylon*† commonly occurred with an array of other introduced pasture grasses suggesting that it is an introduced species.

A number of exotic forbs and sub-shrubs were common within areas of exotic grassland including *Hypochaeris radicata**, *Modiola caroliniana** (Red-flowered Mallow), *Plantago lanceolata** (Plantain), *Sida rhombifolia** (Paddy's Lucerne) and *Solanum sisymbriifolium*.* Native grasses and forbs were present at low densities within the areas of exotic grassland including *Microlaena stipoides, Rytidosperma racemosum, Euchiton involucratus* (Star Cudweed), *Dichondra repens* (Kidney Weed) and *Oxalis perennans.*

Plate 3.6: Exotic grassland (foreground), exotic vegetation (*Rubus fruticosus* sp. agg., midground) and re-vegetation of PCT 849 (background) within the subject land.

3.4 Current and future vegetation integrity scores

As outlined above, each of the PCTs identified within the subject land were classified into vegetation zones in accordance with Section 5.3 of the BAM. The vegetation zones are based on the condition descriptions above with the area of each vegetation zones shown in **Table 3.2**.

Each vegetation zone identified within the subject land was surveyed and quantitative measures of the composition, structure and function attributes recorded in accordance with

Section 5.3.4 of the BAM. The locations of the plot-based vegetation integrity surveys are shown in **Figure 3.2**. The number of plots surveyed for each vegetation zone are equal to or greater than the required number of plots as outlined in Table 4 of the BAM and shown in **Table 3.3**. For each plot/transect, the vegetation composition, structure and function were assessed in accordance with the BAM and using the BAM Calculator a vegetation integrity score was calculated for each vegetation zone (**Appendix B**). Vegetation integrity scores for each vegetation zone are presented in **Table 3.3**. For the areas mapped as 'Exotic vegetation', data collected from the vegetation integrity plots for this vegetation type was entered into the BAM Calculator as a zone of both PCT 839 and 835 in order to calculate a VIS. This area was entered as a zone of PCT 839 and 835 as this represents the PCTs which would have most likely occurred in this area prior to the past disturbance. However, in the current heavily modified state, it is not possible to delineate those areas of exotic grassland which would have once supported PCT 835 and those which would have once supported PCT 849.

Vegetation integrity scores ranged from 23.7/100 to 85.5/100 for vegetation zones within areas of native vegetation, while the 'exotic vegetation' zone had a VIS of 5.4/100 (**Table 3.3**). The VISs for each zone represent a combination of scores for vegetation composition, structure and function. Across the subject land all vegetation zones had a low composition score, except for intact areas of PCT 835, which is attributed to the history of grazing and under-scrubbing across much of the subject land. Generally, those vegetation zones which contained plantings or re-vegetation also had low composition and function scores.

Future VISs were allocated for each vegetation zone. The project would involve the complete removal of all vegetation within the subject land and the default future VIS of 0 for each vegetation within the subject land was retained.

Table 3.3: Vegetation integrity scores for vegetation zones

Vegetation zone	Area impacted (ha)	Plots required	Plots surveyed	Veg integrity score
PCT 849 – Under-scrubbed	1.33	1	1 (Plot 5)	23.7
PCT 849 - Revegetation	1.13	1	1 (Plot 1)	31
PCT 835 – Intact	2.12	2	2 (Plot 3, 12)	85.5
PCT 835 – Under-scrubbed	5.01	3	3 (Plot 2, 7, 8)	48.7
PCT 835 – Plantings	0.40	1	1 (Plot 4)	29.5
Exotic grassland#	28.64	4	4 (Plot 6, 9, 10, 11)	9.5 (PCT849) 5.4 (PCT835)#
Exotic vegetation	0.38	-	-	
Total	**39.01**	**12**	**12**	**-**

Vegetation integrity plot data for the exotic grassland vegetation zone was entered into the BAM calculator as a zone of PCT 835 and PCT 849, as these represents the PCTs which would most likely have occurred in this area prior to the past disturbance.

4 Assessing habitat suitability for threatened species

The chapter outlines the process for determining the habitat suitability for threatened species within the subject lands in accordance with section 6 of the BAM.

Under the BAM, threatened species are separated into two classes, 'ecosystem' and 'species' credit species. Those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which a targeted survey has a low probability of detection, are identified as 'ecosystem' credit species. Targeted surveys are not required for ecosystem species and potential impacts to these species are assessed in conjunction with impacts to PCTs.

Threatened species where the likelihood of occurrence of a species or elements of suitable habitat for the species cannot be confidently predicted by vegetation surrogates and landscape features and can be reliably detected by survey are identified as 'species' credit species. A targeted survey or an expert report is required to confirm the presence or absence of these species on the subject land.

For some threatened species, they are identified as both ecosystem and species credit species, with different aspects of the habitat and life cycle representing different credit types. Commonly, threatened fauna species may have foraging habitat as an ecosystem credit, while their breeding habitat represents a species credit.

The following sections outline the process for determining the habitat suitability for threatened species within the subject lands, survey effort for threatened species and the results of targeted surveys for candidate threatened species.

4.1 Identify threatened species for assessment

Threatened species that require assessment are initially identified based upon the following criteria:

- the distribution of the species includes the IBRA subregion in which the subject land (Cumberland IBRA subregion).
- the study area is within any geographic constraints of the distribution of the species within the IBRA subregion.
- the species is associated with any of the PCTs identified within the study area
- the native vegetation cover within an assessment area including a 1500m buffer around the study area is equal to or greater than the minimum required for the species.
- the patch size that each vegetation zone is part of is equal to or greater than the minimum required for that species.
- the species is identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

The process for identifying threatened species which meet the above criteria is completed through the BAM Calculator. The PCTs identified within the study area, patch sizes and native

vegetation cover, as outlined in Section 3, were entered into the BAM Calculator and a preliminary list of threatened species were identified.

4.1.1 Ecosystem credit species

The ecosystem credit species predicted on the subject land are provided in **Appendix C**. All ecosystem credit species were maintained in the assessment. As outlined above, targeted surveys are not required for these ecosystem species and impacts to these species are assessed in conjunction with impacts to PCTs.

4.1.2 Species credit species

As outlined above, species credit species are predicted in the BAM Calculator following assessment of geographic and habitat features in the credit calculator, such as site location (IBRA subregion), PCTs and condition, patch size and the area of surrounding vegetation within the 1,500 m buffer of the study area. Some species require further assessment of habitat constraints and/or geographic limitations before being confirmed as candidate species for assessment. **Table 4.1** outlines the questions asked for these species, and whether the species is confirmed as a candidate species. On the basis of habitat constraints and geographic constraints, the Large-eared Pied Bat (*Chalinolobus dwyeri*) and the endangered populations of *Dillwynia tenuifolia* at Kemps Creek and *Wahlenbergia multicaulis* are not candidate species for the subject land and no further assessment of these entities is required.

Table 4.1: Assessment of habitat constraints and geographic limitations.

Scientific Name / Common Name	Habitat constraints / Geographic limitations	Maintained as candidate species
Burhinus grallarius Bush Stone-curlew	1. Fallen/standing dead timber including logs	Yes
Chalinolobus dwyeri Large-eared Pied Bat	1. Cliffs 2. Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels	No
Dillwynia tenuifolia - endangered population, Kemps Creek	1. The area bounded by western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool Local Government Area -	No
Litoria aurea Green and Golden Bell Frog	1. Semi-permanent/ephemeral wet areas 2. Within 1 km of wet areas|Swamps 3. Within 1 km of swamp|Waterbodies 4. Within 1 km of waterbody	Yes

Scientific Name / Common Name	Habitat constraints / Geographic limitations	Maintained as candidate species
Marsdenia viridiflora subsp. *viridiflora* - endangered population in Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs	1. Those LGAs named in the population listing	Yes
Myotis macropus Southern Myotis	1. Hollow bearing trees 2. Within 200 m of riparian zone 3. Bridges, caves or artificial structures within 200 m of riparian zone	Yes
Pilularia novae-hollandiae Austral Pillwort	1. Semi-permanent/ephemeral wet areas 2. Periodically waterlogged sites (including table drains and farm dams)	Yes
Pommerhelix duralensis Dural Woodland Snail	1. Leaf litter and shed bark or within 50 m of litter or bark [Rocky areas] 2. Rocks or within 50m of rocks [Fallen/standing dead timber including logs] 3. Including logs and bark or within 50 m of logs or bark	Yes
Wahlenbergia multicaulis - endangered population in the Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield LGAs.	1. Land situated in damp, disturbed sites	No – subject land not within listed LGAs

4.2 Identify candidate species credit species for further assessment

In accordance with Section 6.4.1.17 of the BAM, a predicted candidate species can be considered unlikely to occur within the subject land (or specific vegetation zones) where habitat is substantially degraded such that the species is unlikely to utilise area, or where an expert report identifies that the species is unlikely to be present within the subject land (or a vegetation zone within the subject land). The BAM operational manual (OEH 2018a) also identifies that the assessor may opt to undertake an onsite assessment to determine the presence of habitat constraints or microhabitats for the threatened species predicted to occur on the subject land. The absence of microhabitats for the threatened species may be used to further refine the list of candidate species on the subject land and potentially reduce the need for a survey. The BAM operational manual recommends undertaking this step where species have identified habitat constraints, habitat is significantly degraded and where vegetation is missing key structural elements. If an assessor considers that the microhabitat/s required by a species credit species are degraded such that they are unlikely to be able to support the target species,

the species can be removed from the candidate list and does not require further assessment on the subject land (or specific vegetation zones). The reasons for determining that a predicted species credit species is unlikely to have suitable habitat on the subject land (or specific vegetation zones) must be documented.

As discussed in Section 3, much of the vegetation within the subject land has been previously cleared and fragmented, has past and ongoing disturbances associated with grazing and has been impacted by edge effects including noise and light from the adjacent developments including the M5 and M7 Motorways. These disturbances have impacted the habitat suitability for some candidate threatened species, while for some candidate species the microhabitats required are not present within the subject land. **Table 4.2** outlines those threatened species which have been removed from the candidate species list based upon degraded habitat within the subject land or the absence of micro-habitats, including justification. **Table 4.3** identifies the candidate species confirmed for the subject land.

Table 4.2: Species removed from the candidate species list

Species	Justification*
FLORA	
Acacia bynoeana (Bynoe's Wattle)	Unsuitable micro-habitat within subject lands, this species occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches.
Caladenia tessellata (Thick Lip Spider Orchid)	Unsuitable micro-habitat within subject land, this species is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW becoming more common to the south in coastal parts of Victoria. Generally found in coastal heaths, heathy woodland and open-forest on well drained sand to clay loam soils (Backhouse 2018).
Hibbertia sp. *Bankstown* (syn. *H. puberula* subsp. *glabrescens*)	Unsuitable micro-habitat within subject land, the species is currently known to occur in only one population on tertiary alluvial soil along Airport Creek at Bankstown Airport. Habitat is in Castlereagh Ironbark Forest although some remnant vegetation at and near the site suggests Castlereagh Scribbly Gum Woodland is equally valid.
Persoonia bargoensis (Bargo Geebung)	Unsuitable micro-habitat within subject land, the species occurs in woodland or dry sclerophyll forest on sandstone and on heavier well drained, loamy, gravelly soils of the Wianamatta Shale and Hawkesbury Sandstone. Much of the vegetation the species occurs within would be recognised as the Shale/Sandstone Transition Forest. The known range of this species occurs to the south of the subject land extending south from Picton.
Persoonia hirsuta (Hairy Geebung)	Unsuitable micro-habitat within subject land, this species is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.
Pterostylis saxicola (Sydney Plains Greenhood)	Degraded habitat within subject land, the species is restricted to Western Sydney between Freemans Reach in the north and Picton in the south. Most commonly found growing in small pockets of shallow

Species	Justification*
	soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. This species, as are many orchid species, are preferentially grazed and are unlikely to persist in heavily grazed grasslands such as those in the subject land. There is a very old record (1804) for this species less than 1 km from the northern edge of the subject land, however the specific location of is questionable given the age of the record.
Thesium australe (Austral Toadflax)	No suitable habitat for this species. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. Records from the Sydney basin are from 1803. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.
FAUNA	
Anthochaera phrygia (Regent Honeyeater) (Breeding)	No suitable breeding habitat within the subject land. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. Under the BAM, breeding habitat and important habitat areas for this species have been mapped on the NSW Government Biodiversity Values Map and Offset Tool. The subject land is not identified as breeding or important habitat for this species.
Callocephalon fimbriatum (Gang-gang Cockatoo) (Breeding)	No suitable breeding micro-habitats within the subject land. In the spring and summer breeding season, the species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.
Cercartetus nanus (Eastern Pygmy-possum)	Unsuitable and degraded habitat within the subject land. This species is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred.
Lathamus discolor (Swift Parrot) (Breeding)	No suitable breeding habitat within subject land. This species breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. Under the BAM, breeding habitat and important habitat areas for this species have been mapped on the NSW Government Biodiversity Values Map and

Species	Justification*
	Offset Tool. The subject land is not identified as breeding or important habitat for this species.
Miniopterus australis (Little Bentwing-bat) (Breeding)	No suitable breeding habitat (caves) within the subject land. Only five nursery sites /maternity colonies are known in Australia. In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (*Miniopterus schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear its young.
Miniopterus schreibersii oceanensis (Eastern Bentwing-bat) (Breeding)	No suitable breeding habitat within the subject land. The species forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes.
Ninox connivens Barking Owl (Breeding)	No suitable breeding habitat within the subject land. This species nests in a large open hollow, often vertical or sloping, in the trunk or sometimes a spout of a Eucalypt or Melaleuca. Breeding hollows are 2-35 m above the ground with a diameter of 20-46 cm and depth of 20-300 cm. No suitable hollow bearing tress were recorded within the subject land.
Ninox strenua (Powerful Owl) (Breeding)	No suitable breeding habitat within the subject land. This species nests in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him. No suitable hollow bearing tress were recorded within the subject land.
Pandion cristatus (Eastern Osprey) (Breeding)	No suitable breeding habitat within the subject land. This species nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.
Petaurus norfolcensis (Squirrel Glider)	Habitat within the subject land is degraded. This species inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Requires abundant tree hollows for refuge and nest sites. Also, requires connected areas of vegetation with gaps of less than 50 m to enable movement between areas of vegetation. Habitat within the subject land is degraded and unsuitable for this species.
Phascolarctos cinereus (Koala) (Breeding)	Habitat within the subject land is unsuitable and degraded for Koala breeding habitat. The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. The subject land has been fragmented and isolated from any nearby records by previous vegetation clearing and urban and industrial development.

Species	Justification*
Pommerhelix duralensis (Dural Woodland Snail)	No suitable micro-habitats within the subject land. The species is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes. Found in an area of north-western Sydney between Rouse Hill - Cattai and Wiseman's Ferry, west from Berowra Creek.
Tyto novaehollandiae (Masked Owl) (Breeding)	No suitable breeding habitat within the subject land. Breeds in old hollow eucalypts, live or dead but commonly live, with hollows greater than 40 cm wide and greater than 100 cm deep. Hollow entrances are at least 3 m above ground, in trees of at least 90 cm diameter at breast height. No suitable hollow bearing trees were recorded within the subject land.

Table 4.3: Candidate threatened species and their sensitivity class and biodiversity risk weighting

Scientific Name	Common Name	Sensitivity Class	Biodiversity Risk Weighting
FLORA			
Acacia pubescens	Downy Wattle	High	2
Callistemon linearifolius	Netted Bottle Brush	High	2
Cynanchum elegans	White-flowered Wax Plant	High	2
Dillwynia tenuifolia		Moderate	1.5
Eucalyptus benthamii	Camden White Gum	High	2
Grevillea juniperina subsp. *juniperina*	Juniper-leaved Grevillea	High	2
Marsdenia viridiflora subsp. *viridiflora* endangered population including occurrences in the Blacktown LGA		High	2
Persicaria elatior	Tall Knotweed	Moderate	1.5
Pilularia novae-hollandiae	Austral Pillwort	Very high	3
Pimelea curviflora var. *curviflora*		High	2
Pimelea spicata	Spiked Rice-flower	High	2
Pomaderris brunnea	Brown Pomaderris	High	2
Pultenaea pedunculata	Matted Bush-pea	High	2
FAUNA			
Burhinus grallarius	Bush Stone-curlew	High	2
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	High	2
Hieraaetus morphnoides	Little Eagle (Breeding)	Moderate	1.5
Litoria aurea	Green and Golden Bell Frog	High	2
Lophoictinia isura	Square-tailed Kite	Moderate	1.5
Meridolum corneovirens	Cumberland Plain Land Snail	High	2
Myotis macropus	Southern Myotis	High	2
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	High	2

4.3 Determine presence or absence of candidate threatened species

Those candidate species credit species for which the habitat suitability of the subject land cannot be ruled out based upon habitat or geographic constraints or habitat degradation, require targeted surveys to determine their presence or absence from the subject land. Targeted surveys for species credit species must be undertaken in accordance within section 6.5 of the BAM, including undertaking surveys during the nominated survey period specified for each candidate species and in accordance with OEH threatened species survey guidelines. The following sections outline the surveys undertaken, and survey requirements, for the candidate species identified for the subject land.

4.3.1 Targeted surveys – flora

Targeted surveys for candidate threatened flora species were conducted in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH 2016a). Targeted surveys for threatened flora were undertaken on 6 and 20 August 2018, 30 November 2018 and 12 December 2018 by Brian Towle (Senior Ecologist), Thomas Hickman (Ecologist) and Bruce Mullins (Principal Ecologist). Previous surveys across the subject land and adjacent areas, were also undertaken on the 16 August 2017 (Thomas Hickman).

Targeted surveys initially involved identification of areas of potential habitat for candidate threatened flora species within the subject land. Areas of potential habitat were then surveyed along parallel field-traverses with approximately 10 m separation, consistent with the requirements of OEH (2016a) for the smallest lifeforms (herbs ferns, forbs and climbers) on the list of candidate threatened flora species. Survey effort for threatened flora is shown on **Figure 4.1**.

The nominated survey period for candidate threatened flora species is shown in **Table 4.4**. The timing of the flora surveys (6 & 20 August, 30 November and 12 December 2018) is in accordance with the survey requirements for all candidate threatened flora species, although it is noted that limited survey was undertaken during the nominated survey period for *Pultenaea pedunculata*. Despite the timing of surveys largely not coinciding with the identified survey period for *P. pedunculata* (limited to its flowering period of September to November; **Table 4.4**), identification of this prostrate, mat or carpet forming shrub is possible outside of its flowering period.

One of the candidate threatened flora species, *Pimelea curviflora* var. *curviflora* (listed as Vulnerable under the BC Act and EPBC Act) was recorded adjacent to, but outside of, the subject land. A single individual of this species was observed within a fenced area (grazing excluded) adjacent to Eastern Creek. As per Section 6.4.1.29 of the BAM a species polygon has been determined for the single *Pimelea curviflora* var. *curviflora* which includes a 30 m buffer around the single record of the species (**Figure 4.2**). The species polygon for *Pimelea curviflora* var. *curviflora* does not intersect with the subject land and no further assessment of this species is required.

No other candidate threatened flora species were recorded within the subject land. A full list of flora species recorded within the subject land is included in **Appendix D**.

Table 4.4: Nominated survey periods for candidate threatened flora species.

Candidate species	Survey period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acacia pubescens (Downy Wattle)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Callistemon linearifolius (Netted Bottle Brush)	Y	Y	Y						Y	Y	Y	Y
Cynanchum elegans (White-flowered Wax Plant)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dillwynia tenuifolia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Grevillea juniperina subsp. *juniperina* (Juniper-leaved Grevillea)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Marsdenia viridiflora subsp. *viridiflora* (endangered population including occurrences in the Blacktown LGA)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Persicaria elatior (Tall Knotweed)	Y	Y	Y	Y	Y							Y
Pilularia novae-hollandiae (Austral Pillwort)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pimelea curviflora var. *curviflora*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pimelea spicata (Spiked Rice-flower)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pomaderris brunnea (Brown Pomaderris)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pultenaea pedunculata (Matted Bush-pea)									Y	Y	Y	

Blue columns indicate the survey months

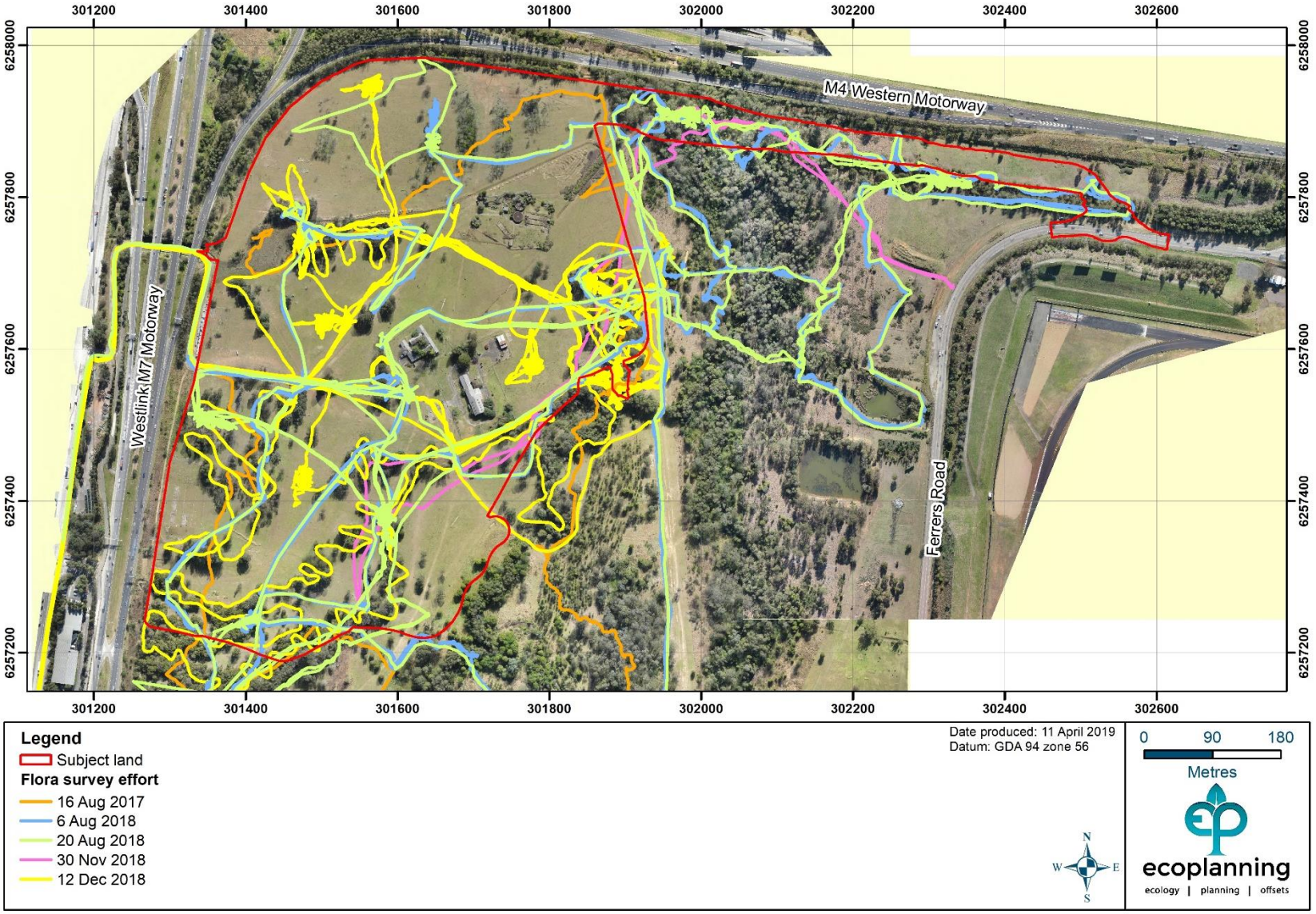

Figure 4.1: Survey effort for threatened flora species.

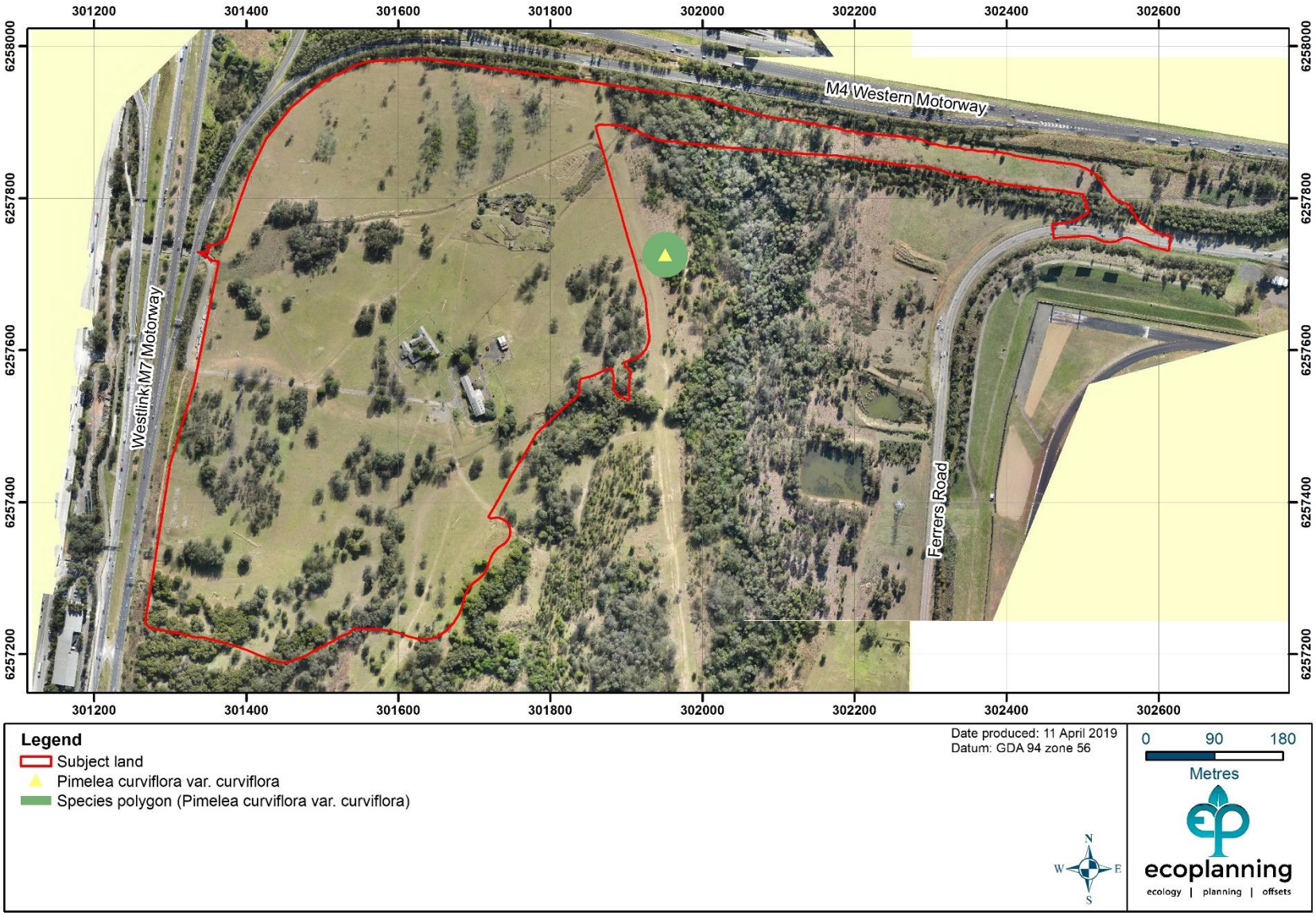

Figure 4.2: *Pimelea curviflora* var. *curviflora* species polygon.

4.3.2 Targeted surveys – fauna

Targeted surveys for candidate threatened fauna species are outlined for each of the candidate threatened fauna species below.

Green and Golden Bell Frog (Litoria aurea)

Targeted surveys for the Green and Golden Bell Frog included a combination of call-playback, nocturnal searches, and diurnal habitat assessments. Call playback and nocturnal searches were undertaken over three nights on the 3, 4 and 17 December 2018 by Brian Towle (Senior Ecologist) and Bruce Mullins (Principal Ecologist) over approximately 10 person hours. Diurnal habitat assessments were undertaken on the 6 and 20 August 2018 (in conjunction with targeted flora surveys and vegetation plots). The locations of nocturnal searches are shown in **Figure 4.3**. The timing of these surveys coincides with the allowable survey periods identified for Green and Golden Bell Frogs under the BAM (**Table 4.6**). The surveys were also timed to occur in warm weather following rainfall and when the species was known to be active at Sydney Olympic Park (Green and Golden Bell Frogs were observed calling on 02/12/2018, Tina Hsu, Ecology Project Officer, Sydney Olympic Park Authority pers. comm. 2018). Weather conditions during the survey period, as recorded at Prospect Dam weather station (station 067019) located approximately 4 km south-east of the subject land, is shown in **Table** 4.5.

No Green and Golden Bell Frogs were observed within the subject land during nocturnal searches or heard calling following call playback. Six frog species were observed calling within the subject land and adjacent areas, Peron's Tree Frog (*Litoria peronii*), Smooth Toadlet (*Uperoleia laevigata*), Common Eastern Froglet (*Crinia signifera*), Eastern Dwarf Tree Frog (*Litoria fallax*), Brown-striped Frog (*Limnodynastes peronii*) and Verreaux's Frog (*Litoria verreauxii*).

Table 4.5: Weather conditions during targeted surveys.

Date	Temperature (°C)*		Rain (mm)
	Min (°C)	Max	
22/11/2018	15.5	25.0	3.0
23/11/2018	13.0	23.5	0
24/11/2018	15.0	26.0	0
25/11/2018	12.2	25.2	0
26/11/2018	12.2	25.0	0
27/11/2018	14.8	25.0	0
28/11/2018	15.0	19.2	14
29/11/2018	14.2	23.3	52
30/11/2018	11.8	26.0	0
01/12/2018	15.3	29.8	0
02/12/2018	15.0	33.6	0
03/12/2018	14.0	31.3	0
04/12/2018	16.9	-	0

Date	Temperature (°C)*		Rain (mm)
	Min (°C)	Max	
05/12/2018	15.8	21.3	0
06/12/2018	15.1	25.8	0
07/12/2018	12.1	30.2	0
08/12/2018	16.4	30.5	0
09/12/2018	13.5	30.7	0
10/12/2018	19.9	27.8	0
11/12/2018	19.3	24.0	0
12/12/2018	17.0	25.0	0
13/12/2018	18.8	29.2	1.0
14/12/2018	17.8	24.6	34.0
15/12/2018	19.8	31.0	21.0
16/12/2018	18.2	31.8	15.0
17/12/2018	18.5	27.8	0

* Temperature data recorded from Parramatta North (station 066124) due to missing data from the Prospect weather station.

Southern Myotis (Myotis macropus)

One Microchiropteran bat species, the Southern Myotis (*Myotis macropus*), was identified as a candidate species for the subject land. Targeted surveys for the Southern Myotis involved two acoustic detectors (Anabats) for a total of 10 nights (total survey effort of 20 nights from 23 November to 2 December 2018, inclusive). Weather during this period is shown in **Table** 4.5 with survey locations shown in **Figure 4.3**. The total survey effort of 20 nights exceeds the minimum survey requirements of 16 nights as included in the '*Species credit threatened bats survey guide for the BAM*' (OEH 2018b) and is during the allowable survey period for the Southern Myotis (October to March; **Table 4.6**).

Generally, limited activity of microbats was detected from the acoustic recorders although a total of nine microbat species were identified from calls recorded from the subject land (**Appendix E**). One of the calls recorded from the subject land was identified as most likely being the Southern Myotis, although due to the quality of the call recording it could not be definitely attributed to this species. Additional calls were recorded which may also be the Southern Myotis, although due to the quality of the calls, they could not be separated from the similar calls of a Long-eared Bat (*Nyctophilus sp.*). Based upon the single call which was identified as most likely being the Southern Myotis and the nearby records of the species (Southern Myotis has been recorded within 0.73 km of the subject land in 2016), a precautionary approach has been undertaken and it has been assumed that these calls are of the Southern Myotis. A species polygon has been prepared for the Southern Myotis in accordance with Section 6.4.1.26 of the BAM and the *'Species credit threatened bats survey guide for the BAM'* OEH (2018b). In accordance with OEH (2018b), the species polygon for the Southern Myotis includes all habitat on the subject land within 200 m of a waterbody with pools/stretches 3 m or wider. Only Eastern Creek was identified as including pools/stretches

wider than 3 m and the species polygon includes a 200 m buffer of Eastern Creek. A total of 2.63 ha of habitat for the Southern Myotis was identified within the subject land (**Figure 4.3**).

Diurnal birds – raptors

Three raptor species were identified as candidate threatened fauna species for the subject land, White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Little Eagle (*Hieraaetus morphnoides*) and the Square-tailed Kite (*Lophoictinia isura*). The three raptor candidate species are listed as ecosystem credit species (for foraging habitat) and species credit species (for breeding habitat). Breeding habitat for all these raptor species is a conspicuous, large nest made of sticks.

Targeted surveys for breeding habitat for these species involved searches for large stick-nests within canopy trees throughout the subject land. These searches were undertaken in conjunction with targeted surveys for threatened flora on 6 and 20 August 2018, 30 November 2018 and 12 December 2018. The surveys undertaken coincided with the allowable survey periods for all three of the raptor candidate threatened fauna species (**Table 4.6**).

Numerous stick nests were observed within the subject land, however, observations of these nests identified that many of them were being actively used by Australian Ravens (*Corvus coronoides*) and all were too small to be used by any of the candidate threatened raptor species. Additionally, observations during the breeding seasons for each of the raptor species did not observe any bird species using any stick nests within the subject land.

Cumberland Plain Land Snail

Targeted surveys for the Cumberland Plain Land Snail were undertaken in conjunction with targeted surveys for threatened flora species as shown in **Figure 4.1**. In areas of potential habitat for this species, including under logs and rubbish and amongst leaf and bark accumulations around bases of trees, the soil surface was gently raked by hand to search for shells or alive individuals of this species. The timing of survey coincides with the allowable survey period for this species (**Table 4.6**), with this species able to be surveyed year-round.

Generally, potential habitat for this species was limited with very few logs or areas with leaf and bark accumulation within the subject land. No individuals of this species were recorded within the subject land.

Grey-headed Flying-fox (Pteropus poliocephalus)

Grey-headed Flying-foxes roost within communal 'camps', which are large congregations of many individuals of this species, where individuals hang from branches with limited protection. Many of these camps act as maternity camps where annual breeding and rearing of young takes place (DEC 2004). Camps are typically located near water, such as lakes, rivers or the coast and commonly include rainforest patches, stands of Melaleuca, mangroves and riparian vegetation, but colonies also use highly modified vegetation in urban and suburban areas (van der Ree et al. 2005).

As part of the 'National Flying-fox Monitoring Program' maps of known camps of this species have been prepared, with no known camp mapped within the subject land (DoEE 2018). The nearest known camp of this species is located approximately 5.5 km south-east of the subject

land at Wetherill Park, with between 500-2,500 individuals of this species recorded from this camp in May 2017 (DoEE 2018).

The method for surveying for the presence of unrecorded day roosts included diurnal observations across the subject land. Flying-fox camps are easily recognised from a distance due to the distinctive audible calls that are heard most frequently in the early morning or under sunny conditions. Other signs include their distinctive odour and droppings.

No camps for this species were observed within the subject land. While not all surveys were completed during the allowable survey period for the Grey-headed Flying-fox under the BAM (October to December; **Table 4.6**), the nominated survey period for this species is designed to allow for the identification of females with dependent young within a camp. The surveys completed are considered sufficient to confirm the absence of any camps of this species within the subject land and the absence of breeding habitat for the species.

Bush Stone-curlew (Burhinus grallarius)

The Bush Stone-curlew (*Burhinus grallarius*) was identified as a candidate species for the subject land. Targeted surveys for this species included call-playback, spotlighting and daytime habitat searches.

Call playback for the Bush Stone-curlew consisted of playing calls for approximately 30 seconds, followed by 4.5 minutes of listening with the 5-minute cycle repeated three times. Call playback for this species was undertaken over 2 nights in Summer (3 and 17 December 2018) with spotlighting for this species undertaken in conjunction with surveys for the Green and Golden Bell Frog. Additionally, daytime searches which can flush individuals of the species, were undertaken in conjunction with the spotlighting surveys. The surveys undertaken for this species coincide with the year-round survey period for this species nominated within the BAM Calculator. No Bush Stone-curlew were recorded during the targeted surveys.

Table 4.6: Nominated survey period for candidate threatened fauna species.

Candidate species	Survey period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bush Stone-curlew *(Burhinus grallarius)*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
White-bellied Sea-Eagle (*Haliaeetus leucogaster*) – Breeding							Y	Y	Y	Y	Y	Y
Hieraaetus morphnoides (Little Eagle) - Breeding)								Y	Y	Y		
Litoria aurea (Green and Golden Bell Frog)	Y	Y	Y								Y	Y
Lophoictinia isura (Square-tailed Kite)	Y								Y	Y	Y	Y

Candidate species	Survey period (BAM Calculator)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Meridolum corneovirens (Cumberland Plain Land Snail)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Myotis macropus (Southern Myotis)	Y	Y	Y								Y	Y
Pteropus poliocephalus (Grey-headed Flying-fox) (Breeding)										Y	Y	Y

BLUE columns indicate survey months

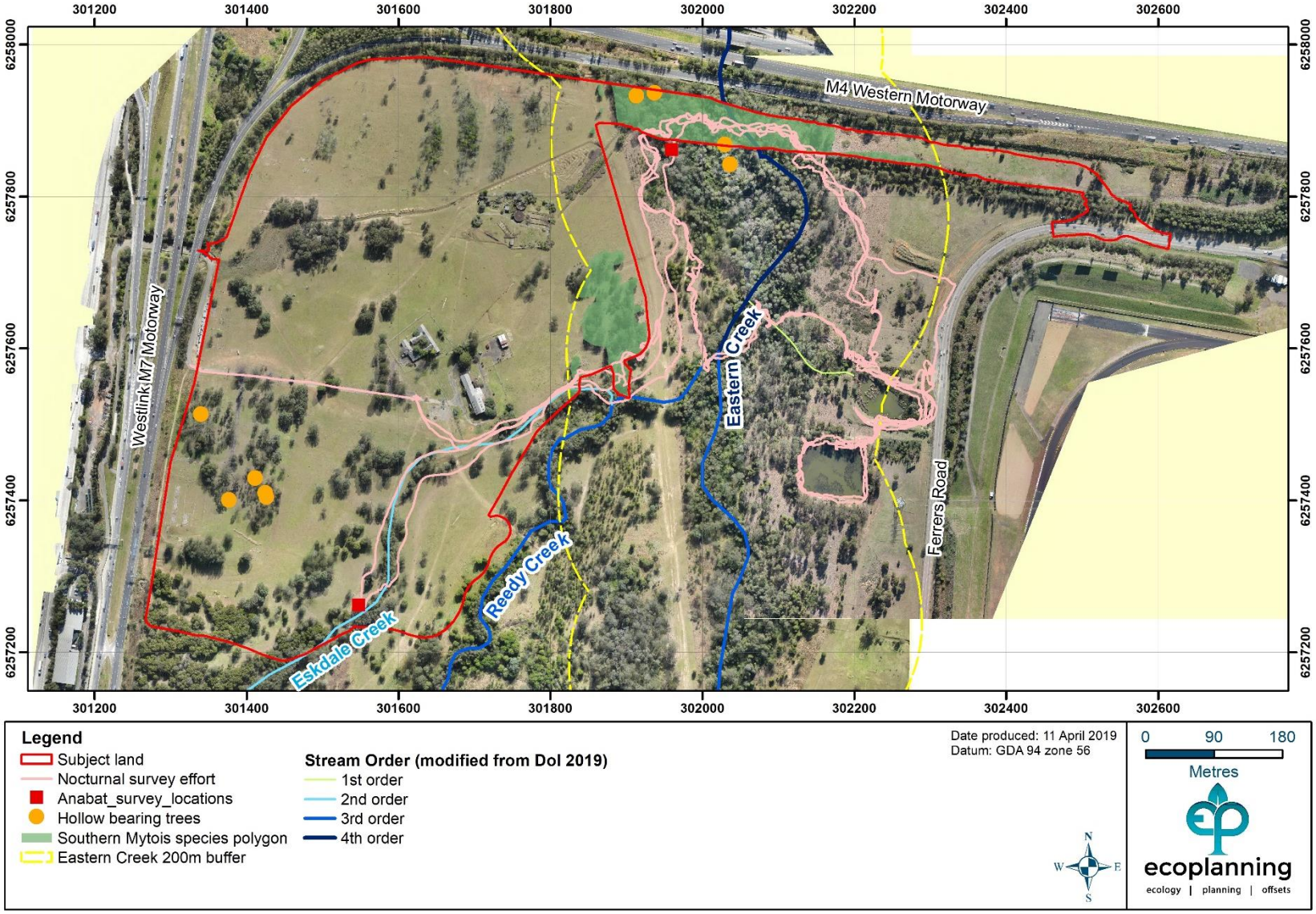

Figure 4.3: Threatened fauna surveys and Southern Myotis species polygon.

5 Avoiding and minimising impacts on biodiversity values

5.1 Avoiding and minimising impacts on native vegetation and habitat during project planning

In accordance with section 8.1.1.6 of the BAM, actions taken to avoid and minimise impacts through locating the proposal must be documented and justified in the BDAR.

The impacts associated with the project, including the clearing of native vegetation, have been situated within specific areas of the Parklands in order to avoid and minimise impacts to better condition, largely intact and more connected areas of native vegetation including in association with Eastern Creek.

As detailed in **Section 1** of this report, the location of the WSPT business hubs was determined through the application of six guiding principles, one of which is to avoid or minimise the impact on biodiversity values. The Light Horse Interchange site met the requirements of the six guiding principles, and specifically to minimise impacts on the environmental values as the subject land is located on previously cleared land that was developed as a RAAF base and then used for cattle grazing.

Following selection of the Light Horse Interchange site, several revisions of the final impact footprint were undertaken. Under the initial plan, the impact footprint extended further south including an approximately 2.2 **Figure 5.1**). However, following advice from Ecoplanning, further consideration and Pre-DA discussions with DPI, WSPT decided to avoid this large patch of native vegetation. This patch was also avoided as the 2.2 ha of Alluvial Woodland (PCT 835) includes a moderately dense midstorey of the long-lived and relatively slow growing *Melaleuca decora*, which is uncommon within the Parklands. The avoided bushland would become part of the land management program across the Parklands that is funded by the Business Hubs. Smaller revisions to the subject land boundary have also been undertaken during project planning, reducing the total subject land and development footprint area to 39.01 ha from 40.71 ha. The final subject land and impact footprint has been reduced and located to avoid fragmentation and disconnection of bushland to retain large patches of bushland and ensure connectivity between these patches. Through the upfront investigation and planning, the impact footprint has been reduced by WSPT as much as practicable whilst maintaining the economic feasibility of the development.

The potential impacts within the subject land are predominately located within previously cleared areas. This degradation of habitat within the subject land is quantified in the VIS calculated for vegetation zones within the subject land. The majority of the impacts to native vegetation (7.87 ha) occur to vegetation zones with low VI Scores (29-48.7), interspersed within 29.02 ha of exotic vegetation including exotic grasslands. It is noted that the project footprint would impact on 2.12 ha of relatively intact woodland (VI score of 85.5/100) associated with Eastern Creek as part of the proposed site access and crossing of Eastern Creek. During project planning, WSPT explored a range of access options for the subject land (**Figure 5.1**). However, the access from Ferrer's Road was considered the only viable option. A summary of the analysis follows:

Option 1 – Utilise existing M7 underpass.

- Geometrical Constraints:
    - Inability for B-doubles to navigate the narrow width/tight bends.
    - Under path width generally not conducive to maintain two-way B-double flows.

Option 2 – Access from Ferrer's Road.

- Deemed the most suitable access option and best outcome.
- The alignment of access from Ferrer's Road has been located immediately adjacent the M4 Western Motorway to reduce creating more flood conditions by imitating the existing M4 barrier. This also avoids additional fragmentation of the vegetation along the Eastern Creek corridor.

Option 3 – Access from south through Suez site.

- Insufficient width for additional lane required on Wallgrove Road, geometrical constraints at the intersection of the existing Suez access road/underpass and safety considerations.
- Capacity constraints to accommodate the traffic generation, including excessive queuing.
- Would require impact to additional areas of area of Alluvial Woodland (and the equivalent PCT 835) which include a moderately dense midstorey of *Melaleuca decora.* A dense midstorey of *Melaleuca decora* is uncommon within the Parklands and the 2.2 ha of this vegetation (**Figure 5.1**)which has been avoided is relatively mature and has a high degree of resilience. Avoiding an access road through this vegetation prevents the isolation of this area of vegetation from adjacent areas of retained vegetation within the Parklands.

Whilst the access from Ferrer's Road would include impacts to the relatively intact woodland associated with Eastern Creek which has a high VIS (85.5/100), large areas (~18.9 ha) of vegetation in the same vegetation zone (i.e. of a similar condition) have been avoided within the Parklands immediately upstream of this impact. Further, the overall impacts are considered relatively minor in the context of the role of the project in helping to achieve the strategic directions of the WSPT, as outlined within the WSPT Plan of Management 2030. The strategic direction for the Parklands as a whole includes providing an additional 250 ha of bushland corridors (increasing from 1,356 ha in 2018 to 1,606 ha by 2030), including a 25% improvement in the health of Eastern Creek. The long-term target is 2,000 hectares of bushland.

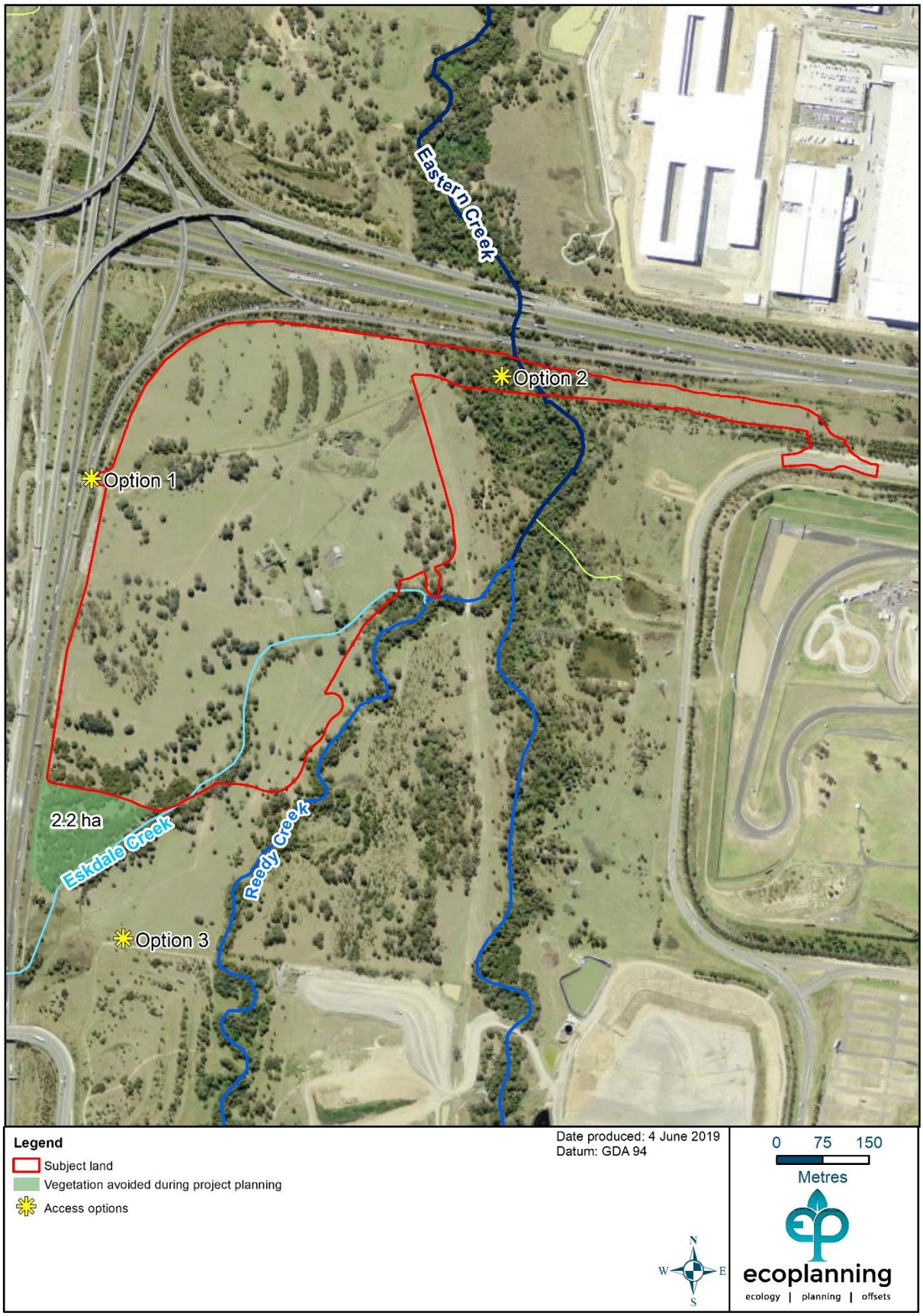

Figure 5.1: Preliminary impact footprints and access options investigated during project planning

5.2 Avoiding and minimising prescribed biodiversity impacts during project planning

Prescribed biodiversity impacts are defined under clause 6.1 of the BC Reg and include impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. Prescribed biodiversity impacts are outlined within **Table 5.1** including their relevance to the subject land and the proposal. Prescribed impacts to biodiversity associated with the proposed business hub include impacts to water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities. Specifically, impacts to Eskdale Creek and its hydrological processes which support the River-flat Eucalypt Forest TEC.

The proposed works have been located so as to avoid and minimise impacts to Eastern Creek and Reedy Creek, along which the condition of riparian vegetation and creek channel using the Rapid Riparian Appraisal (Findlay et al 2011) was assessed as ‘very good’ and ' good', respectively. Impacts to waterbodies and hydrological processes have been limited to the stretches of Eskdale Creek which have been assessed as being in a 'poor' to 'fair' condition and which have been identified as having a modified flow path and disturbed channel condition. As discussed in **Section 2.1.3**, the stretch of Eskdale Creek proposed to be realigned is in a highly modified condition and has a modified flow path, which suggest that the current alignment of Eskdale Creek is the result of a historic diversion. Such works may have occurred to drain/dry out the surrounding floodplain and improve its suitability for agricultural purposes.

Pre-DA meetings with the Natural Resource Access Regulator (NRAR) on 26 April have indicated in-principle support for relocating parts of Eskdale Creek. A further meeting was conducted with NRAR representatives on the 12 December 2018, following the detailed surveys conducted as part of this report, during which NRAR confirmed continued in-principle acceptance of the relocation of the second order Eskdale Creek.

The stretch of Eskdale Creek proposed for diversion supports only small patches of highly degraded River-Flat Eucalypt Forest (a threatened ecological community) and has not been identified as sustaining any threatened species (see **Section 1**). The degraded nature of the River-Flat Eucalypt Forest has been quantified as part of the VIS calculated for this vegetation zone (see **Section 3**) with this vegetation zone having a VIS of 48.7 out of 100 (PCT 835 – Under-scrubbed). Assessment of impacts to the TEC 'River-Flat Eucalypt Forest' as part of the proposed diversion of Eskdale Creek have been assessed as part of the assessment of vegetation clearing in **Section 3.4** and the biodiversity credit calculations in **Section 7**. Assessment of prescribed biodiversity impacts are discussed in **Section 6.2** and measures to mitigate these impacts are discussed in **Section 6.3**.

The proposal also involves impacts to human made structures, however these have not been identified as habitat for any threatened species. There is potential for non-threatened fauna species to utilise these structures and mitigation measures have been recommended in order to minimise impacts on these species. Details regarding these mitigation measures are included in **Section 6.3**.

Table 5.1: Prescribed biodiversity impacts.

Prescribed biodiversity impacts	Presence within the subject land
(a) the impacts of development on the following habitat of threatened species or ecological communities: (i) karst, caves, crevices, cliffs and other geological features of significance, (ii) rocks, (iii) human made structures, (iv) non-native vegetation,	No areas of karst, caves, crevices, cliffs and other geological features of significance, rocks, human made structures or areas of non-native vegetation which support threatened species or ecological communities are present within the subject land. The derelict buildings within the subject land have been inspected and no threatened fauna have been identified as occupying these structures.
b) the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range,	The subject land has not been identified as providing connectivity between areas of habitat for threatened species that facilitates the movement of that threatened species across its range. The proposed works would involve construction of a bridge and accessway through the identified Eastern Creek corridor (see **section 2.1.4**). The impacts to this corridor and habitat connectivity would be not greater than the numerous roads which currently traverse this corridor including the immediately adjacent M4 Western Motorway.
(c) the impacts of development on movement of threatened species that maintains their lifecycle,	The subject land has not been identified as providing movement of threatened species that maintains their lifecycle.
(d) the impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining or other development),	Potential impacts – A detailed assessment of impacts associated with the realignment of the existing channel of Eskdale Creek is included in **Section 6.2**.
(e) the impacts of wind turbine strikes on protected animals,	Not applicable.
f) the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.	Not applicable. The greatest risk of vehicle strike within the subject land is associated with the adjacent M5 and M7 Motorways, however the subject land is already fenced and separated from the adjacent motorways.

6 Assessing and offsetting impacts

6.1 Assessment of impacts

6.1.1 Assessment of impacts to native vegetation and habitat, TECs, and threatened species habitats

Impacts to native vegetation are anticipated through the direct clearing of the approximately 9.99 ha of native vegetation, with a further 29.02 ha of vegetation clearing impacting on areas identified as supporting exotic vegetation including exotic grasslands. The direct clearing and subsequent development of the subject land would represent a permanent impact, or loss, of this native vegetation and habitat. As outlined in Section 3.5 of this BDAR, and in accordance with Section 9.1.2.5 of the BAM, the future VIS for all vegetation within the subject land has been assigned 0. All hollow bearing trees within the subject land, including approximately seven hollow-bearing trees (**Figure 4.3**), would be cleared as part of the proposal. It is recommended that hollow bearing trees are salvaged as part of the project and utilised in the Eskdale Creek realignment works to create standing hollow bearing stags or used to increase fallen woody debris within other woodland areas within the Parklands.

6.1.2 Assessing indirect impacts on native vegetation and habitat, TECs and threatened species habitats

It is difficult to quantify indirect impacts associated with the proposal. Indirect impacts may include noise and/or dust associated with the construction phase of the project and downstream impacts during the operational phase of the project.

Given the location of the subject land adjacent to existing motorways, Eastern Creek Raceway and the Eastern Creek Resource Recovery Park, it is considered unlikely that the proposal would have inadvertent impacts which would reduce viability of any adjacent native vegetation or habitat due to edge effects, noise, dust or light spill, or disturbance to breeding habitats. The proposal is considered unlikely to cause any increase in trampling of flora, rubbish dumping, firewood or bush rock collection or introduce any pests, weeds or pathogens to adjacent areas of native vegetation and habitat. The management of adjacent vegetation in accordance with the WSPT POMs would further reduce the likelihood of any of these indirect impacts occurring to areas of native vegetation and habitat outside the subject land.

Changes to the drainage and hydrology of the subject land have the potential to impact on downstream habitats through erosion, sedimentation or bank scour. These impacts are difficult to quantify, however mitigation measures including the inclusion of appropriately buffered Vegetated Riparian Zones (VRZ) and detailed designed of the proposed Eskdale Creek realignment would aim to minimise any downstream indirect impacts.

Further details regarding mitigation measures which would aim to avoid any indirect impacts are included in **Section 6.3**.

6.2 Assessing prescribed impacts

As outlined within **Section 5.2,** prescribed biodiversity impacts are impacts in addition to vegetation clearing and for the proposed business hub include impacts to water quality, water

bodies and hydrological processes that sustain threatened species and TECs. This impact would occur as part of the proposed realignment of Eskdale Creek. However, the TEC which could potentially be impacted, 'River-flat Eucalypt Forest' along Eskdale Creek, has already been assessed as part of impacts associated with the clearing of this vegetation. This impact has been quantified through calculation of a VIS for the area of the TEC along Eskdale Creek (48.7/100) and future a VIS of 0 has been assigned. Credit calculations to offset this impact area included in **Section 7**. Consequently, the impacts are not in addition to vegetation clearing. Nonetheless an assessment of the impacts in accordance with Section 9.2.1.7 of the BAM is provided in **Section 6.2.1** of this BDAR.

The clearing of human made structures which support threatened species also represents a prescribed impact. The derelict buildings (human made structures) within the subject land have not been identified as supporting threatened species, however given the derelict, condemned and contaminated nature of the structures, limited surveys have been undertaken within the buildings. There is a low possibility that the only threatened fauna species recorded within the subject land, the Southern Myotis, may utilise these structures on occasion. However, given their location greater than 200 m from suitable foraging habitat (Eastern Creek), and that the species generally roosts within 200 m of foraging habitat (OEH 2018b), the use of these structures by this species is unlikely. Nonetheless, mitigation measures have been recommended to avoid impacts to any fauna (threatened and non-threatened) which may be utilising the derelict buildings within the subject land.

6.2.1 Water quality, water bodies and hydrological processes

The following assessment address the requirements of Section 9.2.1.7 of the BAM for impacts to water quality, water bodies and hydrological processes that sustain threatened species and TECs which requires the BDAR to

(a) identify water bodies with potential to be habitat for threatened species or threatened ecological communities that are likely to be impacted by the proposal

The proposed impacts are limited to Eskdale Creek and the 'River-Flat Eucalypt Forest' which occurs in association with this watercourse. The proposed diversion has been designed in order to avoid any impacts to Reedy Creek or Eastern Creek. Based upon the broad open topography, the wide occurrences of PCT 835 and evidence of channelisation, it is likely that historically Eskdale Creek was a wide, shallow drainage depression that did not have a defined bed and bank. It is likely that only in recent times has channelisation occurred due to vegetation clearing, land use change and channel alteration. Consequently, it is proposed that an alternative approach to the realignment of Eskdale Creek is considered whereby instead of the standard approach of constructing a waterway with a defined bed and bank, a swampy meadow/chain-of-ponds system is constructed. This system would recreate the geomorphology and to an extent the hydrology of the drainage system that is likely to have existed in this area. This proposed design for the realignment of Eskdale Creek is not specifically designed as water quality treatment device, but rather is designed to mitigate flows by engaging a broad flood plain area, lose water via evapotranspiration and recharge groundwater via infiltration. These factors will improve both the quality and quantity of water flowing to Reedy Creek and increase local biodiversity by integrating deep wetland, shallow marshland and riparian ecosystems along a continuum of waterway. The concept for the proposed realignment is shown in **Figure 6.1**.

(b) identify the threatened species and threatened ecological communities likely to use the habitat

The areas of Eskdale Creek proposed to be impacted support very degraded stands of PCT 835 which is equivalent to the 'River-flat Eucalypt Forest' TEC. Impacts to this vegetation and ecological community have already been assessed as part of direct impacts associated with clearing of the area of the community which occurs along Eskdale Creek. No other threatened species have been identified as likely to utilise the highly degraded habitat along the portion of Eskdale Creek in which impacts are proposed.

(c) identify hydrological processes that sustain threatened species or threatened ecological communities and the species and communities that are dependent on them

The hydrological processes which sustain the 'River-flat Eucalypt Forest' along Eskdale Creek would include periodical flooding, surface flows and possibly interactions with groundwater. The proposed works would not result in substantial negative changes in water quality or hydrological processes downstream of the diversion of Eskdale Creek.

(d) describe, with reference to relevant literature and other reliable published sources of information, the importance within the bioregion of the water body or hydrological process to these species or ecological communities

The importance within the bioregion of Eskdale Creek and the 'River-flat Eucalypt Forest' is considered very limited. As previously outlined, the 'River-flat Eucalypt Forest' which occurs in association with Eskdale Creek has been previously cleared, thinned, grazed and under-scrubbed. The current condition of Eskdale Creek also represents a significant departure from what would be considered an undisturbed waterway in a natural state including a modified riparian buffer and severe bank slump.

A total of 8604.1 ha of PCT 835 and 'River-flat Eucalypt Forest' is mapped as occurring within the Cumberland Plain IBRA subregion (OEH 2015b), with 180 ha within NPWS estates. The proposed impacts would include 7.53 ha of PCT 835 and 'River-flat Eucalypt Forest', although less than 1 ha of this occurs in association with the proposed realignment of Eskdale Creek.

(e) describe the nature, extent and duration of known short and long-term impacts on water bodies and hydrological processes

The proposed impacts to water bodies and hydrological processes would include the complete loss of the hydrological processes along portions of Eskdale Creek. As outlined in **Section 2.1.3**, ambient water quality in the three creeks within the subject land was shown to have elevated total nitrogen and phosphorous which is attributed to nutrient enrichment from upstream land use. The proposed development, including the realignment of Eskdale Creek, is unlikely to cause water quality to decline to the extent that the persistence of the 'River-Flat Eucalypt Forest' TEC beyond the subject land would be impacted. Mitigation measures and recommendations are included within this BDAR including the preparation of a Stormwater Management Plan and creation of appropriately buffered vegetated riparian zones, would aim to avoid any detrimental impacts to water quality as part of the proposed development.

The importation of fill for the development footprint would also result in a small increase in flood inundation levels within the subject land adjacent to Eastern and Reedy Creek. The modelled changes in flooding as a result of the proposed LIBH are shown in **Figure 6.2** which identifies

that for the 100 year flood extent, there would be increases in peak flood levels between 0.02 m and >0.2 m across areas of bushland adjacent to Eastern Creek, Reedy Creek and Eskdale Creek. The areas which have been identified as having an increase in peak flood levels (**Figure 6.2**) do not extend beyond the Lot 10 // DP 1061237 and Lot 5 // DP 804051. Specifically, the areas which would have an increased peak flood level are limited to vegetated areas supporting woodland/forest vegetation within the riparian corridors of Eastern Creek, Reedy Creek and Eskdale Creek (**Figure 6.2**).

As discussed in **Section 3**, the vegetation of the riparian corridors of Eastern Creek, Reedy Creek and Eskdale Creek support vegetation equivalent to PCT 835 and the 'River-flat Forest' TEC. This ecological community generally occupies central parts of floodplains and occurs on alluvial soils on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains (NSW Scientific Committee 2004). On the Cumberland Plain this vegetation community occurs in proximity to minor watercourses and the floodplains of larger watercourses including the Hawkesbury-Nepean River (Tozer 2003). The areas with an increased peak flood level have also been identified as local wetlands which are defined as areas of "*…land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle.*"

The species which together comprise PCT 835 and the equivalent River-flat Forest ecological community are adapted to, and in some cases, are dependent upon, periodic flooding. Consequently, the proposed changes to peak flood levels are unlikely to cause a widespread shift from the existing ecological community, which is adapted to periodic flooding, to another distinct ecological community. The proposed changes to peak flood levels may cause localised changes in species composition as some species benefit from changes in flood levels while other species decline. However, these changes are anticipated to be localised in extent and would not occur across the entire extent of the ecological community. Increased flooding and engagement of the Eastern Creek floodplain within the Lot 10 // DP 1061237 and Lot 5 // DP 804051 has potential to improve biodiversity by increasing waterlogging and periods of inundation across the floodplain. Anecdotal evidence from Blacktown LGA indicates that in some cases more frequent inundation has reduced weed cover and led to the expansion of native species including *Carex* species.

(g) predict the consequences of the impacts for the bioregional persistence of the suite of threatened species and communities likely to use these areas as habitat, with reference to relevant literature and other published sources of information

The proposed impacts to water quality, water bodies and hydrological processes associated with the diversion of a portion of Eskdale Creek is unlikely to impact the bioregional persistence of any threatened species or ecological communities beyond the impacts to 'River-flat Eucalypt Forest' within the subject land which have been assessed as part of impacts associated with vegetation clearing.

(h) predict the nature, extent and duration of short and long-term impacts on the habitat and life cycle of species using the natural features of any water dependent plant community

The proposed impacts to water bodies and hydrological processes would include the complete loss of the hydrological processes along portions of Eskdale Creek. No negative impacts to 'River-Flat Eucalypt Forest' are predicted beyond the subject land for this BDAR.

(i) justify predictions of impact on any water dependent plant communities, with appropriate modelling and with reference to relevant literature and other published sources of information

Predictions of impacts on water dependent plant communities (PCT 835 and 'River-flat Eucalypt Forest') have assumed complete clearing of the occurrences of this community within the subject land. The proposed diversion of Eskdale Creek has been designed in order to avoid any impacts to downstream retained occurrences of PCT 835 and 'River-flat Eucalypt Forest' along Reedy Creek or Eastern Creek. The proposed design for the realignment of Eskdale Creek is designed to mitigate flows by engaging a broad flood plain area, lose water via evapotranspiration and recharge groundwater via infiltration. These factors will improve both the quality and quantity of water flowing to Reedy Creek and increase local biodiversity by integrating deep wetland, shallow marshland and riparian ecosystems along a continuum of waterway.

(j) predict the cumulative impacts of the project together with existing mining operations mining underneath the same water dependent plant communities

No current, or proposed, mining operations impact upon Eskdale Creek.

(k) based on predictions of impacts on water dependant plant communities and the species they support, calculate the maximum predicted offset liability in accordance with the Upland Swamp Policy

The proposed impacts would not impact upon an 'Upland Swamp' as this clause is not relevant to the subject land.

(l) justify any prediction of 'nil' or 'negligible' environmental consequences for any impact on water dependent plant communities and the species they support.

No 'nil' or 'neglible' environmental consequences have been predicted. This BDAR has assumed a complete loss of biodiversity values along the portion of Eskdale Creek to be impacted and offset requirements to achieve 'no-net-loss' in accordance with the BAM are included in **Section 7**.

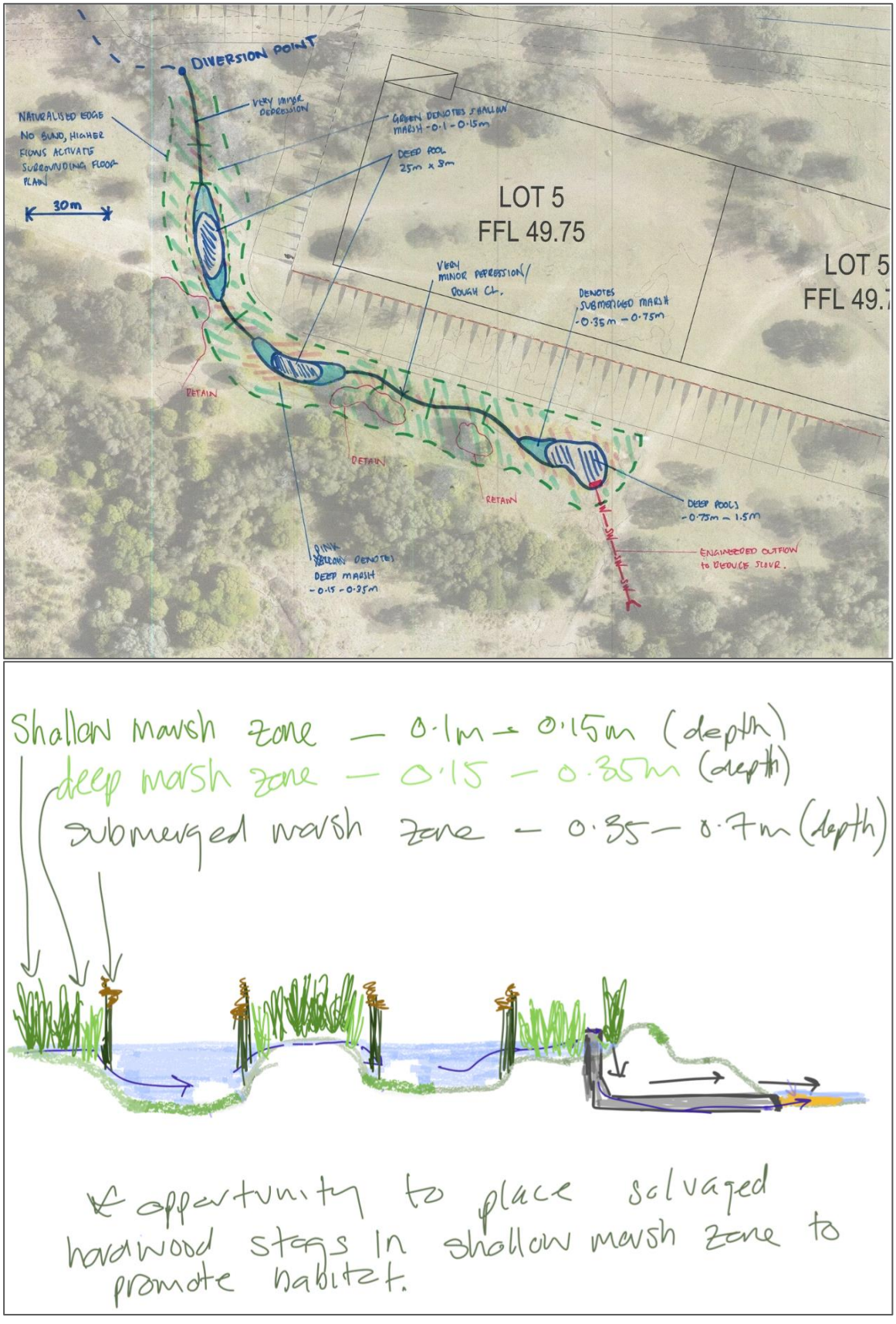

Figure 6.1: Concept design for the proposed realignment of Eskdale Creek (Source: CT Environmental and Henry & Hymas).

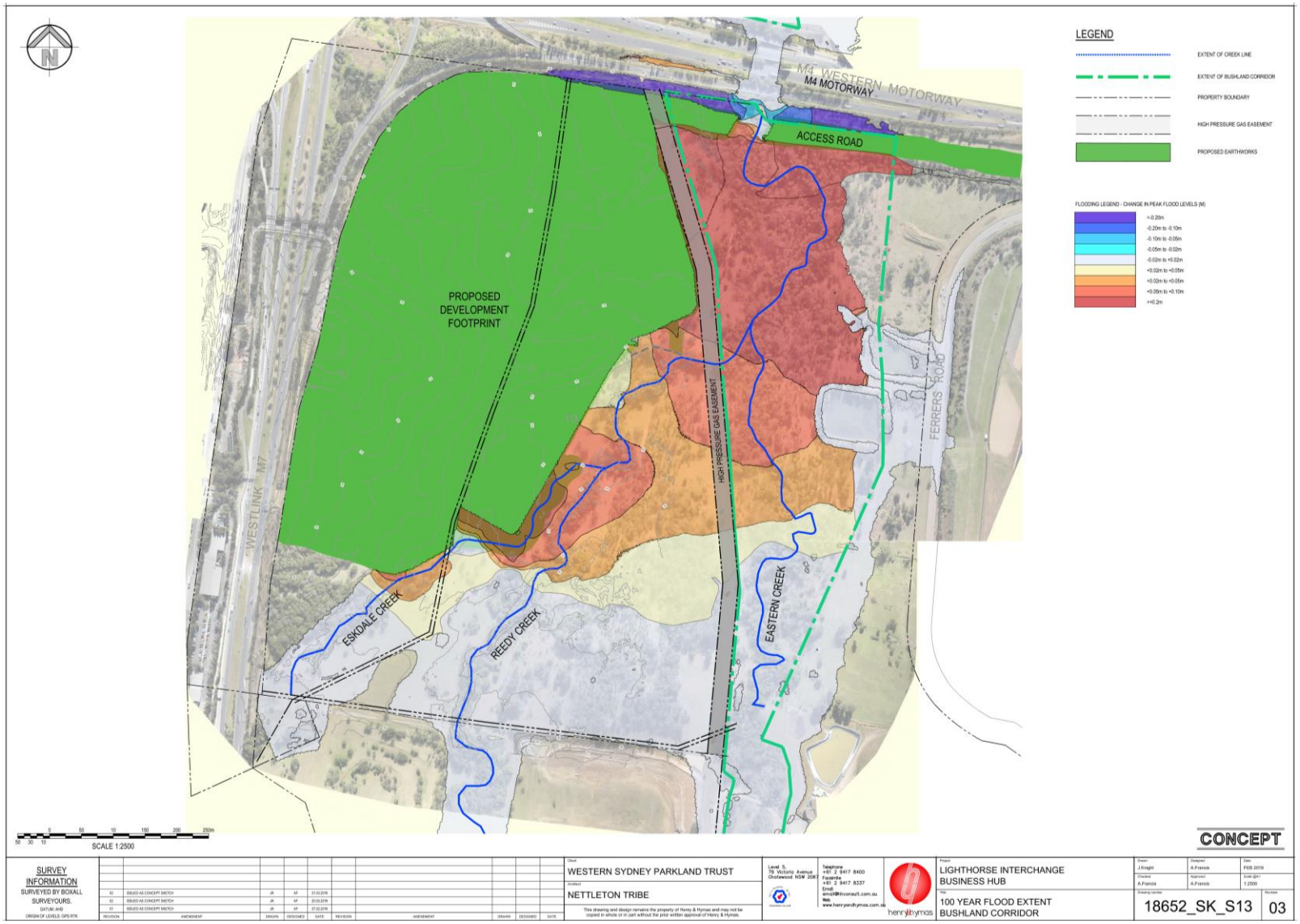

Figure 6.2: Change in peak flood levels across the 100-year flood extent (source: Henry & Hymas)

6.3 Mitigating and managing impacts on biodiversity values

As described in **Section 5.1** of this BDRA, the overall proposal footprint has located to minimise impacts to native vegetation, habitat and biodiversity values. Several measures have been recommended and will be implemented to mitigate and manage direct and indirect impacts where possible, including preparation of a Construction Environmental Management Plan (CEMP), appropriate pre-clearance protocols, the salvage and re-use of hollow-bearing trees and coarse woody debris, preparation of a Stormwater Management Plan (SWMP) and establishment of appropriate vegetated riparian zones. Details of these measures are outlined below.

6.3.1 Pre-clearance protocols

One threatened fauna species (Southern Myotis) and several non-threatened fauna species, such as birds, and amphibians, have been recorded within the subject land. Appropriate pre-clearance protocols are to be put in place at the time of vegetation clearing and building demolition to mitigate and avoid potential harm or injury to these individuals. These protocols should include, as a minimum, soft-felling techniques and clearing supervision where habitat trees (including hollow-bearing trees and stags) are to be removed and pre-clearance surveys, staged demolition and supervision of building demolition.

Soft-felling techniques as part vegetation clearing encourage fauna to relocate outside of the disturbance footprint prior to habitat clearing or alternatively provide an opportunity to move fauna during vegetation clearing works. Soft-felling techniques should be adaptive depending on site-specific conditions but typically would include:

- marking all habitat trees to be cleared;
- removal of ground-layer and mid-storey vegetation (under-scrubbing) around the habitat trees;
- tapping/nudging of habitat trees by heavy machinery 24 hrs prior to the proposed removal of the habitat trees;
- 'Slow drop' of habitat trees, involving the gentle lowering of habitat trees with hollows intact;
- inspection of lowered habitat trees and capture and release of any fauna species present. Injured fauna are to be taken to WIRES or a veterinary clinic.

Pre-clearance surveys, staged demolition and supervision of building demolition aims to identify if fauna species (and in particular threatened species) are occupying buildings immediately prior to demolition and to conduct demolition works in a staged manner which allows fauna to relocate themselves or with assistance from a supervising ecologist.

6.3.2 Stormwater Management Plan (SWMP)

A Stormwater Management Plan (SWMP) should be developed which incorporates effective Water Sensitive Urban Design (WSUD). The SWMP should provide a framework for strategic management of stormwater across the development site and employ the principles of WSUD with a focus on reducing pollutant export and storm flows while improving the visual aesthetics of the subject land and surrounding landscapes. The SWMP should include pollutant export

modelling to determine how effective treatments are at meeting reduction targets. It is recommended the SWMP consider the inclusion hydrodynamic modelling of flow and shear stress if stormwater discharge to Reedy Creek is a preferred option to investigate the risk of discharge eroding the creek bed and bank.

6.3.3 Salvage and re-use of hollow-bearing trees

Hollow bearing trees are trees with cavities formed in the trunk or branches and are usually more characteristic of older, mature to over mature trees. Hollow availability, particularly in partially cleared landscapes, can limit the density of numerous fauna species including bats, mammals and breeding birds. Consequently, all hollow-bearing trees proposed to be cleared within the subject land should be salvaged for adaptive re-use within the proposed Eskdale Creek realignment. Cleared hollow-bearing trees should be stood upright with their base buried to create hollow bearing stags, or alternatively should be used to increase coarse woody debris within the vegetated riparian corridors of Reedy or Eastern Creeks.

6.3.4 Vegetated Riparian Zones (VRZ)

To protect riparian vegetation and KFH and comply with requirements of the NSW *Water Management Act 2000* appropriate Vegetated Riparian Zones (VRZs) are to be established along Eastern Creek, Reedy Creek and Eskdale Creek. The VRZs will protect and enhance habitat for flora and fauna, including the identified corridor extending along Eastern Creek, while also protecting the hydrological processes of these creeks. The VRZs should also consider implementation of native aquatic and emergent vegetation and snags to enhance aquatic habitats as recommended by 'Policy and Guidelines for Fish Habitat Conservation and Management' (NSWDPI 2013).

6.3.5 Construction Environmental Management Plan (CEMP)

To avoid potential indirect offsite impacts to both aquatic and riparian ecosystems during the construction phase of the proposed development, an appropriate erosion and sedimentation control plan should be in place following best practice protocols such as Landcom (2004). It is recommended that this is included in a site-specific CEMP prior to any construction works commencing.

6.4 Adaptive management for uncertain impacts

Impacts associated with the proposal are largely certain and associated with the direct impacts as a result of vegetation clearing as documented within Section 6.1. Uncertain impacts associated with the proposal would be limited to potential impacts to downstream environments on land owned and managed by WSPT, although these impacts can be mitigated through appropriate mitigation measures. During the construction phase of the project, the works would be undertaken in accordance with any licence issued under by the NSW Environment Protection Authority or the controls under the NSW *Protection of the Environment Operations Act 1997*.

Excluding the need for a SWMP and CEMP, no additional adaptive management measures are proposed.

6.5 Thresholds for the assessment and offsetting of impacts of development

6.5.1 Serious and irreversible impacts (SAII)

Section 6.7 of the BC Reg defines Serious And Irreversible Impacts (SAII) as impacts likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

(a) it will 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, or
(b) it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or
(c) it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
(d) the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.

The Guidance to assist a decision-maker to determine a SAII (OEH 2017b) and the BioNet database identify potential SAII entities. One of the ecological communities identified as being impacted by the project, Cumberland Plain Woodland is identified as a potential SAII entity due to a rapid rate of decline and a very small population size. The following section addresses Section 10.2.2 of the BAM and provides additional information about the impacts of the proposal on Cumberland Plain Woodland.

No other species or ecological communities within the subject land are identified as potential SAII entities in either the guidance (OEH 2017b) or the BioNet Database.

Cumberland Plain Woodland SAII Assessment

Section 10.2.2.1 requires, '*the assessor to provide the following further information in the BDAR or BCAR about potential ecological communities*:

(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII

The actions and measures taken to avoid direct and indirect impacts on Cumberland Plain Woodland, and native vegetation more broadly, are outlined in **Section 5** of this report. Specifically, the proposal has been located within an area of the Parklands which predominately supports previously cleared areas containing exotic grasslands and smaller areas of degraded vegetation including under-scrubbed native vegetation. The impacts associated with the project, including the clearing of native vegetation, have been situated within specific areas of the Parklands in order to avoid impacts to better condition, largely intact and more connected areas of native vegetation including in association with Eastern Creek.

(b) the area (ha) and condition of the TEC to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone

The area of Cumberland Plain Woodland which would be impacted by the proposal is 2.46 ha which comprises 1.33 ha of under-scrubbed woodland and 1.13 ha of plantings (vegetation zone termed 'revegetation'). Both vegetation zones comprising Cumberland Plain Woodland were heavily degraded as represented in the VISs calculated for these zones (23.7/100 and 31/100 for the under-scrubbed and revegetation zones, respectively; **Table 6.1)**. In particular, the composition (number of native species present within each growth form) and structure (the foliage cover of growth forms) of the Cumberland Plain Woodland within the subject land has been heavily modified by a long history of disturbance including previous clearing and grazing.

Table 6.1: Vegetation integrity scores for Cumberland Plain Woodland.

Plant Community Types (PCTs)	Vegetation zones	Area (ha)	Vegetation Integrity Score (VIS)			
			Composition condition score	Structure condition score	function condition score	Final VIS
PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Under-scrubbed	1.33	25.4	5.3	98.6	23.7
	Revegetation	1.13	13.8	36.8	58.9	31
Total		**2.46**	**-**	**-**	**-**	**-**

(c) a description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact

No assessment against impact thresholds for Cumberland Plain Woodland, in accordance with Section 10.2.2.1 (c) of the BAM, can be undertaken as no thresholds have been identified for this ecological community.

(d) the extent and overall condition of the potential TEC within an area of 1000ha, and then 10,000ha, surrounding the proposed development footprint

In accordance with Section 10.2.2.1 (d) of the BAM, the extent and overall condition of Cumberland Plain within an area of 1,000 ha and 10,000 ha, surrounding the subject land has been calculated. The extent of Cumberland Plain Woodland was calculated using polygons mapped as part of the native vegetation mapping of the Western Cumberland Plain (OEH 2015a) and Sydney Metropolitan Area (OEH 2016b). A total of 973.4 ha of Cumberland Plain Woodland has been mapped within the 10,000 ha surrounding the subject land with 223.0 ha mapped within the 1,000 ha surrounding the subject land which represents 69.9% and 74.8 % of the total native vegetation mapped within the 10,000 ha and 1,000 ha assessment circles, respectively (**Figure 6.3; Table 6.2**). The proposal would result in a 1.1 % decrease in the area of Cumberland Plain Woodland within the 1,000 ha surrounding the subject land and a 0.25 % decrease within the 10,000 ha surrounding the subject land.

It is noted that for the area cover by the Sydney Metropolitan Area vegetation mapping (OEH 2016b), the mapped polygons generally exclude areas of vegetation less than 0.1 ha and areas of Cumberland Plain Woodland with urban land use covering 70 % of the polygon and evidence of exotic species were also excluded. For the vegetation mapping of the Western Cumberland Plain (OEH 2015a), areas of native vegetation less than 0.5 ha were generally excluded. Further, neither analysis (OEH 2015a or 2016b) included an assessment of Cumberland Plain Woodland found in a derived state, i.e., regrowth without a tree canopy. Consequently, the area of Cumberland Plain Woodland calculated for the 1,000 ha and 10,000 ha surrounding the subject land may represent an underestimation of the total area of the ecological community.

The overall condition of the Cumberland Plain woodland surrounding the subject land is summarised in **Table 6.2**. Generally, more intact areas of Cumberland Plain Woodland (areas with condition code of 'A' and 'B' [OEH 2015a] or disturbance severity codes of '1 – Isolated disturbance' or '2 – Restricted disturbance' [OEH 2016b)) accounted for 65% of the Cumberland Plain within the 10,000 ha assessment circle and 84.84% of the Cumberland Plain Woodland within the 1,000 ha assessment circle. Large and relatively intact stands of Cumberland Plain Woodland have been mapped within Prospect Nature Reserve and within the Parklands.

(e) an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration

(f) an estimate of the area of the potential TEC that is in the reserve system within the IBRA region and the IBRA subregion

In accordance with sections 10.2.2.1(e) and (f) of the BAM, the extent of Cumberland Plain within the Cumberland IBRA subregion and within the reserve system is presented in **Table** 6.3. As part of the *Biodiversity Investment Opportunities Map* (OEH 2015b), the extent of Cumberland Plain Woodland within and outside NPWS estate was calculated for the 'Cumberland' IBRA subregion (extent of two PCTs which together comprise Cumberland Plain Woodland was calculated). A total of 7,732.3 ha of Cumberland Plain Woodland was identified within the Cumberland IBRA subregion with 1,139.1 ha (14.73 %) occurring within NPWS estate. The distribution of Cumberland Plain Woodland is generally confined to the Cumberland IBRA subregion with limited occurrences within adjoining subregions.

(g) the development, clearing or biodiversity certification proposal's impact on:

(i) abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns

(ii) characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants

(iii) the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC

The proposal would result in direct removal of 2.46 ha of Cumberland Plain Woodland comprising previously under-scrubbed and grazed vegetation and small areas of revegetation. The proposed works would not impact on abiotic factors (including groundwater, fire/flooding regimes, vegetation harvesting etc.) which would threaten any patches of the ecological community outside the subject land. Additionally, the proposal would not alter any functionally important species. The proposal would not result in any reduction in the quality or integrity of any patches of the ecological community outside the subject land through impacts such as assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants.

(h) direct or indirect fragmentation and isolation of an important area of the potential TEC

The proposal would impact upon relatively small and degraded stands of Cumberland Plain Woodland which have been fragmented and isolated by the adjoining dual carriage motorways (M5 and M7 motorways). The proposal would result in a small increase in the fragmentation of the ecological community (through clearing of a small stand of the community) but would not isolate an important area of the ecological community.

(i) the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.

Section 10.2.2.1 (i) of the BAM requires identification of measures proposed to contribute to the recovery of SAII candidate entity in the IBRA subregion. The proposed development forms an important component of the self-funded model for the WSPT. Business hubs, such as this proposal, are located on the perimeter of the Parklands in areas of low conservation or recreation value and close to established employment areas and the metropolitan road network. The business hubs remain in public ownership and are leased to industry, providing ongoing income for the WSPT to fund future land acquisition and ongoing regeneration of bushland within the Parklands. The Parklands comprise a large urban parkland system covering an area of approximately 5,280 hectares and spanning an area of 27 kilometres between Quakers Hill in the north and Leppington in the south. The Parklands aim to provide an extensive vegetated link that will contain approximately 2000 hectares of good condition bushland and will provide important links and stepping-stone pathways for native animals. OEH (2015b) identified the Parklands as an important north–south corridor within the Cumberland IBRA subregion and will provide important linkages between Prospect Nature Reserve, Kemps Creek Nature Reserve, Western Sydney Regional Park (Abbotsbury Woodland).

Table 6.2: Area of Cumberland Plain Woodland surrounding the subject land.

Map unit	Condition / disturbance code	Area (ha)	
		10,000 ha assessment circle	1,000 ha assessment circle
Shale Plains Woodland (OEH 2015a)	A	182.12	31.20
	B	73.51	11.59
	Cmi	2.25	0.00
	TX	157.14	27.78
	TXR	22.62	0.00
Shale Hills Woodland (OEH 2015a)	A	56.28	10.49
	B	16.02	5.34
	TX	28.60	6.03
	TXR	8.07	0.00
Cumberland Shale Hills Woodland (GW02; OEH 2016b)	1 – Isolated disturbance	0.317038	0.00
	2 – Restricted disturbance	8.272681	0.00
	3 – Broad disturbance	7.29407	0.00
	4 – Extensive disturbance	1.229754	0.00
Cumberland Shale Plains Woodland (GW03; OEH 2016b)	1 – Isolated disturbance	20.062915	0.00
	2 – Restricted disturbance	279.366138	130.57
	3 – Broad disturbance	80.455185	0.00
	4 – Extensive disturbance	29.79871	0.00
Total		**973.39***	**222.99***

* Rounding errors may apply

Table 6.3: Area of Cumberland Plain Woodland within the Cumberland IBRA subregion (OEH 2015b).

Plant Community Type	Area (ha)		Total
	Within NPWS estate	Outside NPWS estate	
849: Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	965.8	3,084.6	**4,050.4**
850: Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	173.3	3,508.6	**3,681.9**
Cumberland Plain Woodland -Total	**1,139.1**	**6,593.2**	**7,732.3**

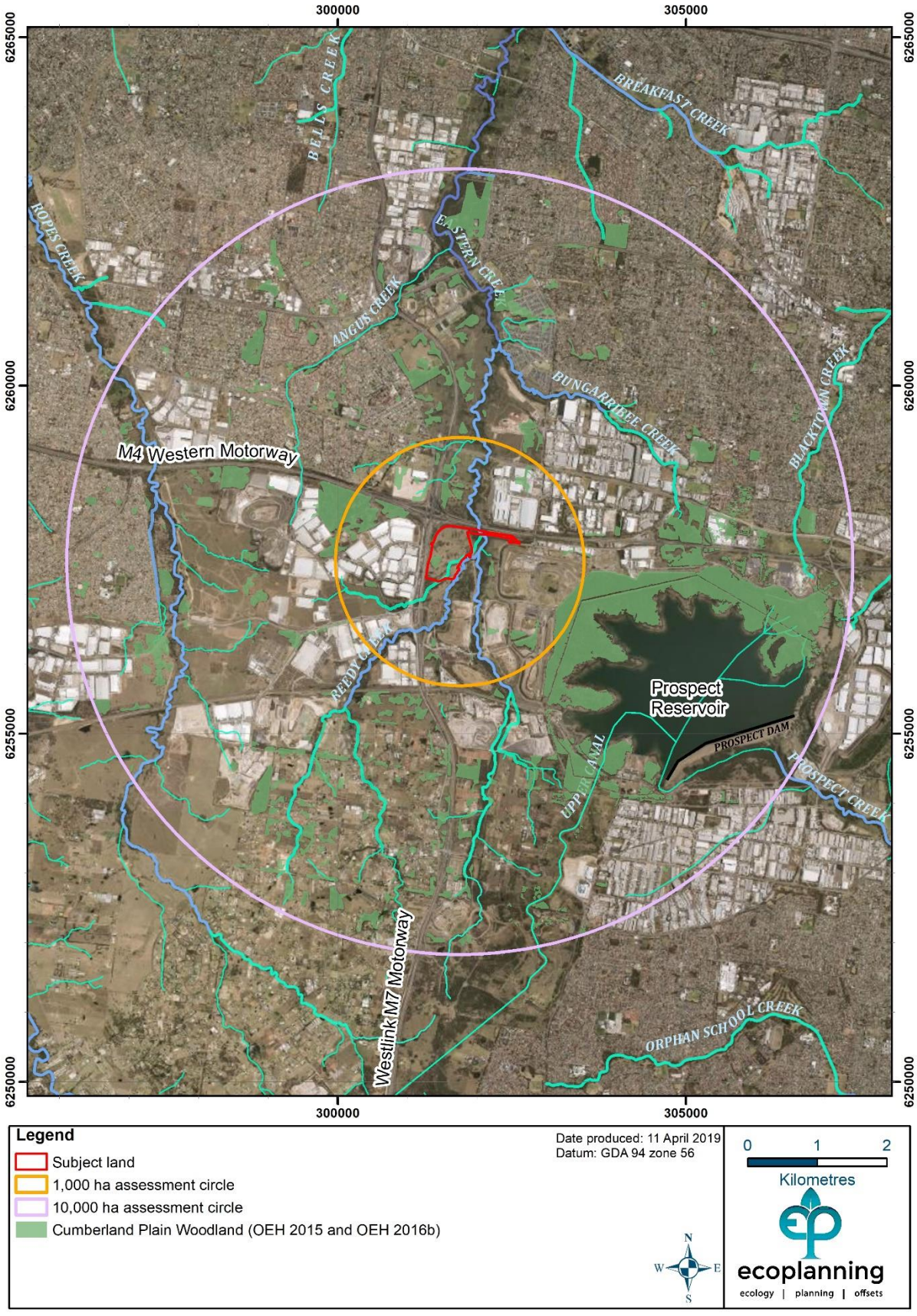

Figure 6.3: Mapped extent of Cumberland Plain Woodland surrounding the subject land (OEH 2015a; 2016b).

6.5.2 Impacts which require an offset

Section 10.3.1 of the BAM outlines that the following vegetation zones require offsets:

- Vegetation zones that have a VIS ≥15 where the PCT is representative of an endangered or critically endangered ecological community.
- A vegetation zone that has a VIS of ≥17 where the PCT is associated with threatened species habitat or is a vulnerable ecological community.
- A vegetation zone that has a VIS ≥20.

All vegetation zones within the subject land are representative an EEC or CEEC and therefore all vegetation zones with VISs of greater than 15 require offsets. This includes all vegetation zones except for areas of 'exotic grassland'.

6.6 Impacts which do not require offsets

As outlined above, impacts to those areas identified as 'Exotic vegetation' do not require offsetting.

7 Credit calculations

7.1 Credit calculations and classes

A biodiversity offset requirement for residual impacts of a proposed development, must be calculated in accordance with section 11.2 and section 11.3 of the BAM. The following section outlines the credit requirements for the Project in order to achieve the 'no net loss standard' as established by the BAM.

7.1.1 Ecosystem credits

The ecosystem credits required to offset the residual impacts of the project are provided in **Table 7.1**. A total of 261 credits are required to offset the development.

Table 7.1: Ecosystem credit offset requirements.

Vegetation zone	Vegetation integrity loss	Area	Credit requirement
PCT 849 – Re-vegetation	31	1.1	22
PCT 849 – Under-scrubbed	23.7	1.3	20
PCT 835 – Under-scrubbed	48.7	5	122
PCT 835 – Intact	85.5	2.1	91
PCT 835 – Plantings	29.5	0.4	6

The following offset rules apply:

For PCT 732:

- Any PCT in the *'Southern Tableland Grassy Woodlands*' vegetation class (including PCT's 303, 312, 350, 654, 680, 703, 705, 731, 732, 1103, 1330, 1334, 1501) AND > 50% - <70% cleared group (including Tier 6 or higher).
- In the following IBRA subregions: Hill End, Bathurst, Capertee Uplands, Inland Slopes, Orange and Wollemi, or any subregion within 100 km of the subject land.
- Containing hollow-bearing trees

For PCT 1093:

Any PCT in the *'Southern Tableland Grassy Woodlands*' vegetation class (including PCT's 303, 312, 350, 654, 680, 703, 705, 731, 732, 1103, 1330, 1334, 1501) AND > 50% - <70% cleared group (including Tier 6 or higher).

In the following IBRA subregions: Hill End, Bathurst, Capertee Uplands, Inland Slopes, Orange and Wollemi, or any subregion within 100 km of the subject land.

Containing hollow-bearing trees

7.1.2 Species credits

A total of 100 Southern Myotis (*Myotis macropus*) species credits are required to offset the project. These credits can be traded only with credits for this species, but they can generated anywhere within NSW.

7.2 Securing biodiversity credits

The measures proposed to address the offset obligation outlined above will be determined as the project approvals progress, noting that the credit requirements will need to be met prior to commencement of the project. It is the intention of WSPT to meet the offset requirements of the project through retirement of existing biodiversity credits generated under the BioBanking Scheme and the generation of suitable biodiversity credits by entering into a Biodiversity Stewardship Agreement. All credit requirements are to be met using like-for-like biodiversity credits as defined under Section 6.3 of the BC Reg. The variation rules, under section 6.4 of the BC Reg, are not proposed to be used to meet any component of the biodiversity credit requirement.

8 EPBC Act Assessment and supplementary SEARs

On 1 April 2019, the Commonwealth Department of Environment and Energy (DoEE) determined that the proposed development will impact on Matters of National Environmental Significance (MNES), protected under the EPBC Act, namely the Grey-headed Flying-fox and Cumberland Plains Woodland. Accordingly, the proposed development has been declared a controlled action and requires assessment and approval under the EPBC Act before it can proceed.

Assessment of the project under the EPBC Act is to be undertaken by the NSW Government as an accredited assessment, under Part 4, Division 4.7 of the NSW Environmental Planning and Assessment Act 1979 (State Significant Development). Supplementary SEARs addressing assessment requirements for MNES were issued on 12 April 2019. The supplementary SEARs require consideration of all protected matters considered likely to be significantly impacted and consideration of matters outlined in Schedule 4 of the *Environment Protection and Biodiversity Conservation Regulation 2000* (EPBC Reg). These matters have been considered as part of the referral made to DoEE on 13 February 2019 and are included in **Appendix F** and relevant sections addressing the supplementary SEARs are provided below.

It is noted that a reduction in the overall project footprint occurred between the referral being made to the DoEE and completion of this BDAR, such that some estimates of area of vegetation clearing were over-estimated within the EPBC Act referral (**Appendix F**). All area calculations included within this BDAR have been updated and are based upon the final project footprint.

8.1 Key Issues – Biodiversity

Details of the ecological communities and targeted surveys for threatened species are included within **Section 3.3** and **Section 4** of this BDAR. One ecological community listed under the EPBC Act has been identified within the subject land, *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* (hereafter referred to as Cumberland Plain Woodland). No other listed ecological communities are present within the subject land.

Threatened species known or likely to occur within the subject land, as identified from the protected matters search tool (most recent search completed 17 January 2019, **Appendix F**) were subject to targeted surveys as detailed within **Section 4** and **Appendix F**. One threatened flora species, *Pimelea curviflora* var. *curviflora* (listed as Vulnerable under the BC Act and EPBC Act) was recorded adjacent to, but outside of, the subject land. A single individual of this species was observed within a fenced area (grazing excluded) adjacent to Eastern Creek. No *Pimelea curviflora* var. *curviflora* would be impacted by the proposal and no further assessment of this species is required.

Targeted surveys for threatened fauna were undertaken across the subject land including active searches for invertebrates, diurnal bird surveys, diurnal searches for large stick nest of threatened raptor species, acoustic surveys for threatened microbat species and active searches and call playback for amphibians. Opportunistic surveys for fauna and fauna habitat

assessment was also conducted in conjunction with targeted flora surveys. Further details are provided in **Section 4** of this BDAR. Threatened fauna species listed under the EPBC Act which were targeted during field surveys, or considered as part of general habitat assessments, included the Green and Golden Bell Frog (*Litoria aurea*), Swift Parrot (*Lathamus discolor*), Regent Honeyeater (*Anthochaera phrygia*), Greater Glider (*Petauroides volans*), Large-eared Pied Bat (*Chalinolobus dwyeri*) and Koala (*Phascolarctos cinereus*). See **Appendix G** for further details regarding surveys and habitat availability for these species. No threatened fauna species listed under the EPBC Act were recorded during the targeted surveys. Based upon the surveys conducted and the habitat present available within the subject land, only one threatened fauna species listed under the EPBC Act is considered likely to utilise the subject land, the Grey-headed Flying-fox.

Specific details of the occurrence of Cumberland Plain Woodland and habitat for the Grey-headed Flying-fox within the subject land is discussed below.

8.1.1 Cumberland Plain Woodland

Areas of woodland vegetation in the higher elevation areas of the subject land were identified as comprising part of the Cumberland Plain Woodland ecological community (**Figure 3.2**). This vegetation consisted of a grassy woodland dominated by *Eucalyptus moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum). The area of Cumberland Plain Woodland which meets the definition of the ecological community under the EPBC Act and would be impacted by the proposal is 0.97 ha. A further 1.49 ha of vegetation within the subject land has been identified as being equivalent to the ecological community, however, this vegetation was significantly degraded and does not form part of the ecological community listed under the EPBC Act. These patches occurred as either isolated paddock trees which did not meet the minimum patch size requirements or consisted of patches where upper tree layer species were not present.

All vegetation zones comprising Cumberland Plain Woodland were heavily degraded as represented in the VIS calculated for these zones (23.7/100 and 31/100 for the under-scrubbed and revegetation zones, respectively). In particular, the composition (number of native species present within each growth form) and structure (the foliage cover of growth forms) of the Cumberland Plain Woodland within the subject land has been heavily modified by a long history of disturbance including previous clearing and grazing.

The significance of the relevant impacts to Cumberland Plain Woodland are discussed in detail in **Section 6.5.1.** The proposal would involve clearing and direct removal of the 0.97 ha of Cumberland Plain Woodland (as defined under the EPBC Act listing of the ecological community) within the subject land. The proposal would not involve any impacts to abiotic (non-living) factors (such as water, nutrients, or soil), or impacts to species composition or vegetation integrity for any patches of the ecological community outside the subject land.

The proposal would impact upon relatively small and degraded stands of Cumberland Plain Woodland which have been fragmented and isolated by the adjoining dual carriage motorways (M4 Western Motorway and Westlink M7 Motorway). The proposal would result in a small increase in the fragmentation of the ecological community (through clearing of a small stand of the community) but would not isolate an important area of the ecological community.

The significance of the Cumberland Plain Woodland which would be impacted by the proposal, (including patches of Cumberland Plain Woodland which do not meet the definition of the ecological community as they are too degraded) has been assessed in in **Section 6.5.1** of this BDAR. The extent of Cumberland Plain Woodland surrounding the subject land was calculated using polygons mapped as part of the native vegetation mapping of the Western Cumberland Plain (OEH 2015a) and Sydney Metropolitan Area (OEH 2016b). A total of 973.4 ha of Cumberland Plain Woodland has been mapped within the 10,000 ha surrounding the subject land with 223.0 ha mapped within the 1,000 ha surrounding the subject land which represents 69.9% and 74.8 % of the total native vegetation mapped within the 10,000 ha and 1,000 ha assessment circles, respectively. Based upon this assessment the proposal would result in a 1.1 % decrease in the area of Cumberland Plain Woodland within the 1,000 ha surrounding the subject land and a 0.25 % decrease within the 10,000 ha surrounding the subject land. It is noted that for the area cover by the Sydney Metropolitan Area vegetation mapping (OEH 2016b), the mapped polygons generally exclude areas of vegetation less than 0.1 ha and areas of Cumberland Plain Woodland with urban land use covering 70 % of the polygon and evidence of exotic species were also excluded. For the vegetation mapping of the Western Cumberland Plain (OEH 2015a), areas of native vegetation less than 0.5 ha were generally excluded. Further, neither analysis (OEH 2015a or 2016b) included an assessment of Cumberland Plain Woodland found in a derived state, i.e., regrowth without a tree canopy. Consequently, the area of Cumberland Plain Woodland calculated for the 1,000 ha and 10,000 ha surrounding the subject land may represent an underestimation of the total area of the ecological community.

The overall condition of the Cumberland Plain woodland surrounding the subject land was also assessed based upon regional vegetation mapping (OEH 2015a and 2016b). Generally, more intact areas of Cumberland Plain Woodland (areas with condition code of 'A' and 'B' [OEH 2015a] or disturbance severity codes of '1 – Isolated disturbance' or '2 – Restricted disturbance' [OEH 2016b)) accounted for 65% of the Cumberland Plain within the 10,000 ha assessment circle and 84.84% of the Cumberland Plain Woodland within the 1,000 ha assessment circle. Large and relatively intact stands of Cumberland Plain Woodland have been mapped within Prospect Nature Reserve and within the Parklands.

Analysis of these impacts to Cumberland Plain Woodland has concluded that the proposal is unlikely to significantly impact the recovery of the Cumberland Plain Woodland ecological community as it would impact less than 1.1 % of the Cumberland Plain Woodland within the surrounding the subject land and less 0.25 % within the 10,000 ha surrounding the subject land. Further, the Cumberland Plain Woodland proposed to be removed consists of degraded stands of vegetation which have been isolated by historic vegetation clearing. Finally, the impacts to Cumberland Plain Woodland would be fully offset in accordance with the 'no net loss' and 'like-for-like' principles included with the BAM and the project would contribute to the ongoing strategic direction of WSPT to protect the environment and provide an additional 250 ha of bushland corridors to 1,606 ha (30%) by 2030.

8.1.2 Grey-headed Flying-fox

Grey-headed Flying-foxes roost within communal 'camps', which are large congregations of many individuals of this species, where individuals hang from branches with limited protection. Many of these camps act as maternity camps where annual breeding and rearing of young takes place (DEC 2004). Camps are typically located near water, such as lakes, rivers or the

coast and commonly include rainforest patches, stands of Melaleuca, mangroves and riparian vegetation, but colonies also use highly modified vegetation in urban and suburban areas (van der Ree et al. 2005).

As part of the 'National Flying-fox Monitoring Program' maps of known camps of this species have been prepared, with no known camp mapped within the subject land (DoEE 2018). The nearest known camp of this species is located approximately 5.5 km south-east of the subject land at Wetherill Park, with between 500-2,500 individuals of this species recorded from this camp in May 2017 (DoEE 2018).

No camps for this species were observed within the subject land. While not all surveys were completed during the allowable survey period for the Grey-headed Flying-fox under the BAM (October to December; Table 4.5), the nominated survey period for this species is designed to allow for the identification of females with dependent young within a camp. The surveys completed are considered sufficient to confirm the absence of any camps of this species within the subject land and the absence of breeding habitat for the species.

As no camps are present within the subject land, impacts to the Grey-headed Flying-fox are limited to loss of foraging habitat as a result of vegetation clearing. The proposal would result in the removal of 9.99 ha of native vegetation (including planted vegetation) representing potential foraging habitat for the Grey-headed Flying-fox. Given the location of a camp within 5.5 km of the subject land, and that 75% of foraging forays are made within 20 kilometres of the camp (Van Dyck and Strahan 2008), the location of the subject land would suggest that regular foraging forays would be made by the species across the locality.

The diet of Grey-headed flying foxes comprises primarily nectar and pollen from blossom in the canopy of various vegetation types and pulp from the fleshy fruits of rainforest trees and lianas, with leaves and exudates from leaf-mining insects, such as psyllids also utilised as secondary dietary components. Eby and Law (2008) compiled a preliminary list of diet plants from published documents, unpublished reports and theses, the field records of the authors and observations of others as reported to the authors. A total of 59 species were reported as components of the blossom diet of the species and 46 species components of the fruit diet. Of the 59 blossom diet species only three species were recorded within the subject land, *Angophora floribunda, Eucalyptus moluccana* and *Eucalyptus tereticornis* and no fruit diet species. Of the blossom species recorded within the subject land *Eucalyptus moluccana* and *Eucalyptus tereticornis* were identified as having high blossom productivity and reliability scores (Eby and Law 2008).

Although the subject land includes individual species which can be important foraging resources for this species, similar or better condition potential foraging habitat is available to this species in habitat surrounding the subject land including within adjacent areas of the Parklands and Prospect Nature Reserve. A total of 1,392.6 ha of native vegetation has been identified within the 10,000 ha area surrounding the subject land (OEH 2015a; OEH 2016b) all of which is likely to represent equal, or better quality foraging habitat for the Grey-headed Flying-fox. This estimation does not include exotic vegetation and gardens in which this species can also forage. Nonetheless, based upon the reduction in native vegetation within the 10,000 ha area surrounding the subject land, the proposal would result in the removal of 0.7% of the foraging resources available to the species within this area. This small reduction in foraging resources available to the Grey-headed Flying-fox is unlikely to significantly impact

the species or place it an increased risk of extinction. Furthermore, the impacts of the proposal to forging resources for this species would be fully offset in accordance with the 'no net loss' and 'like-for-like' principles included within the BAM and the project would contribute to the ongoing strategic direction of WSPT to protect the environment and provide an additional 250 ha of bushland corridors to 1,606 ha (30%) by 2030.

8.1.3 Avoidance, mitigation and offsetting

Details regarding avoidance of mitigation of impacts to native vegetation representing foraging habitat for the Grey-headed Flying-fox and Cumberland Plain Woodland is included within **Section 5** and **Section 6.3** of this BDAR.

The impacts associated with the project, including the clearing of native vegetation, have been situated within specific areas of the Parklands in order to avoid and minimise impacts to better condition, largely intact and more connected areas of native vegetation including in association with Eastern Creek.

As per the Trust's Plan of Management, 2% of the Parklands is to be used for Business Hubs to generate revenue to fund the open space recreation and environmental management. Several sites were assessed across the Parklands and a number of locations were identified to support this requirement. These sites are identified in the Plan of Management 2030 (page 479) and the subject land is one such business hub. This Plan was adopted by the Minister for the Environment and Heritage on 17 December 2018.

Following selection of the Light Horse Interchange site several revisions of the final impact footprint were undertaken. Under the initial plan, the impact footprint extended further south including an approximately 2.2 ha of native vegetation (**Figure 5.1**). However, following advice from Ecoplanning, further consideration and Pre-DA discussions with DPI, WSPT decided to avoid this large patch of native vegetation. The final subject land and impact footprint has been reduced and located to avoid fragmentation and disconnection of bushland to retain large patches of bushland and ensure connectivity between these patches. Hence, the subject land project footprint has been located in the north-west corner of the broader Light Horse Interchange site adjacent to the M4 Western Motorway.

The potential impacts within the subject land are predominately located within previously cleared areas. This degradation of habitat within the subject land is quantified in the VISs calculated for vegetation zones within the subject land. The majority of the impacts to native vegetation (7.87 ha) occur to vegetation zones with low VI Scores (29-48.7), interspersed within 29.02 ha of exotic vegetation including exotic grasslands. It is noted that the project footprint would impact on 2.12 ha of relatively intact woodland associated with Eastern Creek as part of the proposed site access and crossing of Eastern Creek. During project planning, WSPT explored a range of access options for the subject land (option 1 Wallgrove Road, option 2 Ferrers Road and option 3 from the Eastern Creek Waste Management Centre to the south of the site (**Figure 5.1**). However, the access from Ferrer's Road was considered the only viable option as other options required either land acquisition or easement creation over land not owned by WSPT, had geometric constraints associated with tight bends and narrow widths and would require new signalised intersections on Wallgrove Road.

Finally, the overall impacts is considered relatively minor in the context of the role of the project in helping to achieve the strategic directions of the WSPT, as outlined within the WSPT Plan

of Management 2030. The strategic direction for the Parklands as a whole includes providing an additional 250 ha of bushland corridors (increasing from 1,356 in 2018 to 1,606 ha by 2030), including a 25% improvement in the health of Eastern Creek. The long-term target is 2,000 hectares of bushland.

8.1.4 Proposed offsetting

For the purposes of approval under the EPBC Act, it is a requirement that offsets directly contribute to the ongoing viability of the specific protected matter impacted by a proposed action and deliver an overall conservation outcome that improves or maintains the viability of the MNES i.e. 'like for like'. In applying the BAM, residual impacts on EPBC Act listed threatened ecological communities must be offset with PCTs that are ascribed to the specific EPBC listed ecological community. PCTs from a different vegetation class will not generally be acceptable as offsets for EPBC listed communities.

Offset requirements for Cumberland Plain Woodland and Grey-headed Flying-fox have been calculated in accordance with the BAM in **Section 7** of this BDAR. Under the BAM, impacts to Cumberland Plain Woodland can only be offset with PCTs which form part of the Cumberland Plain Woodland ecological community (PCT 849 or PCT 850). Consequently, meeting the offset requirements for Cumberland Plain Woodland under the BAM would also meet the offset requirements under the EPBC Act.

Under the BAM, impacts to foraging habitat for the Grey-headed Flying-fox are assessed and offset as an ecosystem credit and are offset through like-for-like PCTs. For the current proposal, impacts to the Grey-headed Flying-fox would be offset through impacts to Cumberland Plain Woodland (PCT 849) and Alluvial Woodland (PCT 835). The PCTs which can be used as offsets for PCT 849 and PCT 835 are limited to those PCTs which form part of the Cumberland Plain Woodland and River-Flat Eucalypt Forest TECs. While this includes a large suite of PCTs (see **Section 7**), all of these PCTs would represent potential foraging habitat for the wide ranging Grey-headed Flying-fox.

The offset requirements of the proposed works calculated under the BAM and the like-for-like rules set out in the BC Reg, would also contribute to the ongoing viability of the specific MNES (Cumberland Plain Woodland and the Grey-headed Flying-fox) as required under the EPBC Act. No additional offsets, above those calculated under the BAM, would be required under the EPBC Act.

8.1.5 Commonwealth land

The subject land is not commonwealth land, nor is it located near commonwealth land.

8.1.6 Other approvals and conditions

This BDAR, in conjunction with the overarching Environmental Impacts Statement (EIS) represents the required environmental assessment of the proposal under the NSW Planning system. The proposal is classified as a State significant development (SSD) under Clause 5 in Schedule 2 of NSW State Environment Planning Policy (State and Regional Development) 2011 ('the SRD SEPP'). The NSW Minister for Planning is the consent authority for the proposal under Section 8A of the SRD SEPP.

8.1.7 Environmental record of person proposing to take the action

The WSPT has a record of responsible environmental management. As part of its ongoing strategic direction to protect the environment, since 2017 the WSPT have expanded their bushland corridor by 300 ha to 1,356 ha. Details of the environmental management and environmental achievements of WSPT are outlined within the WSPT Plan of Management 2030 (WSPT 2018) and include planting 352,580 indigenous seedlings within the park and investment of over $8.5 M for improved biodiversity and environmental conservation. Additionally, the WSPT draft Plan of Management 2030 outlines the following aims:

- WSPT aims to provide an additional 250 ha of bushland corridors to 1,606 ha (30%) by 2030.
- WSPT has been looking into more sustainable practices, with an aim to decrease potable water use and increase renewable energy for the ongoing parkland operations.
- WSPT has started capturing data on the Parklands waterways and is looking to improve waterway health.
- WSPT are working with Blacktown City Council to improve stormwater inflows to Eastern Creek, including floodplain rehabilitation and recontouring (within Precinct 1 of WSPT, north of Nurragingy reserve)

No past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources have been made against WSPT.

8.1.8 Information sources

The information sources used as part of the preparation of this BDAR are included in **Section 9**. All the information sources used have high reliability and do not have any large uncertainties relevant to the information used within this report.

8.2 General requirements

8.2.1 Project description

General information including the precise location, and description of the proposal are included within **Section 1** of this BDAR. The proposal does not include any works or impacts outside the subject land as identified within **Figure 1.1** and **Figure 1.4**. The proposal is independent to any other actions that have been, or are being, taken or that have been approved in the region.

There are no aspects of how the works are to be undertaken or design parameters that are specifically relevant to potential impacts to Cumberland Plain Woodland or the Grey-headed Flying-fox. Both entities would be impacted by clearing of native vegetation and habitat loss.

8.2.2 Impacts

The impacts of the proposal are discussed in detail in **Section 6** of this BDAR including proposed safeguards and mitigation measures. Impacts associated with the proposal are long-term permanent impacts and are largely associated with vegetation clearing and habitat loss which represents a 'known' or 'predictable' impact. Specific impacts are discussed separately for Cumberland Plain Woodlands and Grey-headed Flying-fox in **Section 8.1**.

8.3 Avoidance, mitigation and offsetting

Details regarding avoidance, mitigation and offsetting for the proposal are outlined within **Sections 5**, **Section 6.3** and **Section 7** of this BDAR, respectively. Site selection and an overall reduction in the project footprint has been undertaken in order to avoid better quality intact areas of native vegetation. A range of safeguards and mitigation measures are proposed and include undertaking or preparation of the following:

- Pre-clearance protocols
- Stormwater Management Plan
- Salvage and re-use of hollow-bearing trees
- Vegetated Riparian Zones
- Construction and Environmental Management Plans

Details of the proposed offsets are included within **Section 7** and **Section 8.1.4.** The offset requirements of the proposed works calculated under the BAM and the like-for-like rules set out in the BC Reg, would also contribute to the ongoing viability of the specific MNES (Cumberland Plain Woodland and the Grey-headed Flying-fox) as required under the EPBC Act. As the proposed offset under the BAM would contribute to the ongoing viability of the specific protected matters impacted by the proposal (Cumberland Plain Woodland and Grey-headed Flying-fox) and deliver an overall conservation outcome that improves or maintains the viability of these matters, no additional offsets above those calculated under the BAM, would be required under the EPBC Act.

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Appendix A Historical water quality data

Table 9.1: Summary of historical water quality data at Eastern Creek, Ready Creek and Eskdale Creek for the following parameters: Electrical conductivity (EC), pH, dissolved 0xygen (DO), turbidity, total nitrogen (TN) and total phosphorous (TP). Also shown are the default ANZECC water quality guidelines for lowland rivers in south east Australia. Non-compliance of median value to guideline in red.

		EC (µs/cm)	*pH*	*DO (% saturation)*	*Turbidity (NTU)*	*TN (mg/L)*	*TP (mg/L)*
ANZECC water quality guideline		**125 – 2200**	**6.5 – 8.0**	**85 - 110**	**6 - 50**	**0.35**	**0.025**
Eastern Creek (2013 – 2016)	Median	1953	7.29	37.5	15	1.34	0.33
	Mean	2211.3	7.23	39.8	111.9	1.59	0.43
	Range	4 – 6042	4.58 - 8.05	4.70 - 92.2	2.70 - 2700	0.30 - 5.90	0.01 - 2.63
Reedy Creek (2008 – 2016)	Median	1327	7.33	67	39.5	0.23	17.5
	Mean	1505	7.12	67.4	160	0.4	122
	Range	11.0 – 4420	4.77 - 8.26	29.5 - 124	0.30 - 1426	0.03 - 2.26	1.40 - 560
Eskdale Creek (2008 -2016)	Median	1026	7.12	68.9	21.5	0.59	0.03
	Mean	1264	7.09	63.3	95.1	0.58	0.04
	Range	207.7 - 3799	4.83 - 8.09	8.5 – 100.6	1.7 – 589.2	0.1 - 1.2	0.005 - 0.28

Appendix B Vegetation integrity plot data

Plot No.	PCT	Area (ha)	Patch size	Condition class	Zone	Easting	Northing	Bearing	Composition					
									Tree	Shrub	Grass	Forb	Fern	Other
1	849	1.21	101	Revegetation	56	301645	6257864	0	1	1	4	4	0	0
2	835	5.24	101	Under-scrubbed	56	301414	6257239	250	1	2	8	7	1	3
3	835	2.58	101	Intact	56	301979	6257898	180	4	5	4	3	0	3
4	835	0.50	101	Plantings	56	302301	6257827	95	2	1	2	6	0	1
5	849	1.49	101	Under-scrubbed	56	301334	6257512	100	1	1	4	6	0	2
6	835	29.31	101	Exotic grassland	56	301485	6257441	187	0	0	8	6	0	0
7	835	5.24	101	Under-scrubbed	56	301470	6257750	65	2	0	10	11	0	1
8	835	5.24	101	Under-scrubbed	56	301840	6257689	106	2	0	10	15	0	1
9	835	29.31	101	Exotic grassland	56	301789	6257586	225	0	0	3	6	0	0
10	835	29.31	101	Exotic grassland	56	301509	6257635	253	0	0	8	7	0	0
11	835	29.31	101	Exotic grassland	56	301577	6257951	247	1	0	6	6	0	0
12	835	2.58	101	Intact	56	301871	6257568	155	4	3	13	13	1	3

Plot No.	Structure						Function										
	Tree	Shrub	Grass	Forb	Fern	Other	Large trees	Hollow trees	Litter cover	Fallen logs	Tree stem 5-10	Tree stem 10-20	Tree stem 20-30	Tree stem 30-50	Tree stem 50-80	Tree regen	High threat exotic
1	3	0.1	43	0.5	0	0	0	0	40	56	1	1	0	0	0	1	1.5
2	1	30.5	1.2	1.2	0.1	0.3	0	0	90	0	0	0	0	1	0	0	0.6
3	36.9	41.9	28.5	1.2	0	0.9	2	0	75	3	1	1	1	1	1	1	22.8
4	18	5	5.3	0.8	0	0.1	0	0	13	3	1	1	1	0	0	1	5.4
5	12	0.3	6.8	1	0	0.6	3	1	48	37	1	1	1	0	3	1	1.7
6	0	0	5.9	0.6	0	0	0	0	7	0	0	0	0	0	0	0	26.7
7	5.1	0	25.5	2	0	0.5	1	0	60	16	1	1	1	1	0	0	6.7
8	15.1	0	31.9	2.8	0	0.1	1	0	41	0	1	1	0	1	1	1	36.2
9	0	0	15.1	5.5	0	0	0	0	3	0	0	0	0	0	0	0	45.6
10	0	0	20.6	0.9	0	0	0	0	3.2	0	0	0	0	0	0	0	15.6
11	0.1	0	11.3	1	0	0	0	0	12.4	11	0	0	0	0	0	0	35
12	39.5	10.3	45.4	1.8	0.2	1.6	0	0	54	22	1	1	1	1	1	1	30.7

Appendix C Ecosystem credit species predicted within the subject land

Species / common name	NSW listing status* (BC Act)	National listing status* (EPBC Act)
Anthochaera phrygia Regent Honeyeater (Foraging)	CE	CE
Artamus cyanopterus Dusky Woodswallow	V	-
Botaurus poiciloptilus Australasian Bittern	E	E
Callocephalon fimbriatum Gang-gang Cockatoo (Foraging)	V	-
Chthonicola sagittata Speckled Warbler	V	-
Circus assimilis Spotted Harrier	V	-
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	V	-
Daphoenositta chrysoptera Varied Sittella	V	-
Dasyurus maculatus Spotted-tailed Quoll	V	E
Glossopsitta pusilla Little Lorikeet	V	-
Grantiella picta Painted Honeyeater	V	V
Haliaeetus leucogaster White-bellied Sea-Eagle (Foraging)	V	-
Hieraaetus morphnoides Little Eagle (Foraging)	V	-
Ixobrychus flavicollis Black Bittern	V	-
Lathamus discolor Swift Parrot (Foraging)	E	CE
Lophoictinia isura Square-tailed Kite (Foraging)	V	-
Melanodryas cucullata Hooded Robin (south-eastern form)	V	-
Melithreptus gularis Black-chinned Honeyeater (eastern subspecies)	V	-
Miniopterus australis Little Bentwing-bat (Foraging)	V	-
Miniopterus schreibersii oceanensis Eastern Bentwing-bat (Foraging)	V	-
Mormopterus norfolkensis Eastern Freetail-bat	V	-

Species / common name	NSW listing status* (BC Act)	National listing status* (EPBC Act)
Neophema pulchella Turquoise Parrot	V	-
Ninox connivens Barking Owl (Foraging)	V	-
Ninox strenua Powerful Owl (Foraging)	V	-
Pandion cristatus Eastern Osprey (Foraging)	V	-
Petroica boodang Scarlet Robin	V	-
Petroica phoenicea Flame Robin	V	-
Phascolarctos cinereus Koala (Foraging)	V	V
Pteropus poliocephalus Grey-headed Flying-fox (Foraging)	V	V
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	V	-
Stagonopleura guttata Diamond Firetail	V	-
Tyto novaehollandiae Masked Owl (Foraging)	V	-

* CE – Critically Endangered; E – Endangered; V – Vulnerable

Appendix D Flora species list

Family	Species	Growth form (BAM; OEH 2019)	Common Name	Foliage cover (%)											
				Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12
Acanthaceae	*Brunoniella australis*	Forb (FG)	Blue Trumpet			1									0.3
Amaranthaceae	*Gomphrena celosioides*	Exotic	Gomphrena Weed										0.1		
	Alternanthera denticulata	Forb (FG)	Lesser Joyweed												0.1
Anthericaceae	*Tricoryne elatior*	Forb (FG)	Yellow Autumn-lily						0.1				0.1		
Apiaceae	*Cyclospermum leptophyllum*	Exotic	Slender Celery									0.1		0.1	
Apiaceae	*Centella asiatica*	Forb (FG)	Indian Pennywort				0.1			0.1	0.5			0.1	0.3
Apocynaceae	*Gomphocarpus fruticosus*	Exotic	Narrow-leaved Cotton Bush					0.1							
Asparagaceae	*Asparagus asparagoides*	High Threat Exotic	Bridal Creeper			0.1									
Asteraceae	*Aster subulatus*	Exotic	Wild Aster				0.1								
	Bidens pilosa	Exotic	Cobbler's Pegs												0.1
	Cirsium vulgare	Exotic	Scotch thistle	0.1			0.1			0.1	0.1	0.1		0.1	
	Conyza sp.	Exotic	Fleabane	0.1	0.1		0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cotula australis	Forb (FG)	Common Cotula	0.1	0.1			0.1			0.1	0.1			
	Eclipta platyglossa	Forb (FG)								0.1					
	Euchiton involucratus	Forb (FG)	Star Cudweed								0.1	5	0.1	0.5	
	Euchiton sphaericus	Forb (FG)							0.1						
	Facelis retusa	Exotic	Annual trampweed		0.1										
	Gamochaeta calviceps	Exotic	Cudweed						0.1						0.1
	Gamochaeta sp.	Exotic		0.1			1					0.3		0.1	
	Hypochaeris albiflora	Exotic	White Flatweed						0.1	0.1	0.1	0.1	0.1	0.1	
	Hypochaeris radicata	Exotic	Catsear	0.1	0.1		0.5	0.3	1	0.1	0.5	0.1	0.5	10	
	Lactuca serriola	Exotic	Prickly Lettuce								0.1				

Family	Species	Growth form (BAM; OEH 2019)	Common Name	Foliage cover (%)											
				Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12
	Senecio madagascariensis	High Threat Exotic	Fireweed	1	0.1	0.1	0.5	0.1	0.1	0.1	0.1	0.1			0.1
	Senecio pterophorus	Exotic				0.1	0.1								
	Sigesbeckia orientalis subsp. orientalis	Forb (FG)	Indian Weed												0.1
	Solenogyne bellioides	Forb (FG)						0.1							
	Soliva sessilis	Exotic	Bindyi	0.2			0.5		0.1			0.1			
	Sonchus asper	Exotic	Prickly Sowthistle						0.1				0.1		
	Sonchus oleraceus	Exotic	Common Sowthistle	0.1	0.1		0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Taraxacum officinale	Exotic	Dandelion	0.1			0.1		0.1	1	0.1				0.1
	Xanthium spinosum	High Threat Exotic	Bathurst Burr							0.1	0.1				
Boraginaceae	*Echium plantagineum*	Exotic	Patterson's curse	0.1											
	Heliotropium amplexicaule	Exotic	Blue Heliotrope										0.1		
Brassicaceae	*Brassicaceae sp.*	Exotic									0.1				
	Cardamine hirsuta	Exotic	Common Bittercress				0.1								
	Lepidium bonariense	Exotic										0.1	0.1		
	Rorippa sp.	Exotic					0.1								
Campanulaceae	*Wahlenbergia gracilis*	Forb (FG)	Sprawling Bluebell						0.1			0.1	0.1	0.1	
	Wahlenbergia sp.	Forb (FG)								0.1					
	Wahlenbergia communis	Forb (FG)	Tufted Bluebell												0.1
Caryophyllaceae	*Cerastium glomeratum*	Exotic	Mouse-ear Chickweed				0.3								
	Paronychia brasiliana	Exotic	Chilean Whitlow Wort	0.1			0.1		0.1	0.1	0.1	0.1	0.1	0.1	
	Polycarpon tetraphyllum	Exotic	Four-leaved Allseed					0.1							
	Stellaria media	Exotic	Common Chickweed	0.1	0.1						0.1				
Casuarinaceae	*Casuarina glauca*	Tree (TG)	Swamp Oak			20	15								4
Chenopodiaceae	*Dysphania cristata*	Forb (FG)	Crested Goosefoot									0.1			
	Einadia hastata	Forb (FG)	Berry Saltbush				0.1				0.1				

Family	Species	Growth form (BAM; OEH 2019)	Common Name	Foliage cover (%)											
				Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12
	Einadia nutans	Forb (FG)	Climbing Saltbush		0.5			0.1			0.1				
	Einadia polygonoides	Forb (FG)					0.1								
	Einadia trigonos	Forb (FG)	Fishweed		0.1					0.1	0.1	0.1			
Commelinaceae	*Commelina cyanea*	Forb (FG)			0.1					0.1	0.1				0.2
	Tradescantia fluminensis	High Threat Exotic	Wandering Jew			2									
Convulvulaceae	*Dichondra repens*	Forb (FG)	Kidney Weed	0.1	0.2		0.3	0.3		1	1				0.1
Cyperaceae	*Carex inversa*	Grass & grasslike						1.5	0.1	0.1	0.1	0.1	0.1		
	Cyperus brevifolius	Exotic	Mullumbimby Couch										0.1		
	Cyperus eragrostis	High Threat Exotic	Umbrella Sedge				2			0.1	0.1				0.2
	Cyperus gracilis	Grass & grasslike	Slender Flat-sedge								0.1				
	Eleocharis sp.	Grass & grasslike													0.1
Euphorbiaceae	*Euphorbia drummondii*	Forb (FG)	Caustic Weed	0.1											
	Phyllanthus virgatus	Forb (FG)							0.1	0.1	0.1		0.3	0.1	0.1
Fabaceae - Faboideae	*Desmodium varians*	Other (OG)	Slender Tick-trefoil		0.1	0.1	0.1								1
	Dillwynia sieberi	Shrub (SG)													0.2
	Glycine tabacina	Other (OG)			0.1			0.3		0.5	0.1				0.1
	Glycine clandestina	Other (OG)	Twining glycine		0.1	0.5		0.3							
	Lotus angustissimus	Exotic	Slender Birds-foot Trefoil	0.1					0.1		0.1	0.1	0.1	0.1	
	Lotus subbiflorus	Exotic	Hairy Birds-foot Trefoil				0.3								
	Trifolium campestre	Exotic	Hop Clover							0.1					
	Trifolium repens	Exotic	White Clover				0.1								
	Trifolium sp.	Exotic	Clover							0.1					
	Zornia dyctiocarpa var. *dyctiocarpa*	Forb (FG)	Zornia										0.1		
Fabaceae - Mimosoideae	*Acacia brownii*	Shrub (SG)	heath wattle	0.1											
	Acacia decurrens	Tree (TG)	black wattle	3											0.5

Family	Species	Growth form (BAM; OEH 2019)	Common Name	Foliage cover (%)											
				Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12
	Acacia parramattensis	Tree (TG)	Parramatta Wattle			0.4								0.1	
	Acacia sp.	Tree (TG)	Wattle		0.1										
Gentianaceae	*Centaurium erythraea*	Exotic	Common centary						0.1						
Geraniaceae	*Geranium solanderi*	Forb (FG)	Native Geranium							0.1					
Hypericaceae	*Hypericum perforatum*	High Threat Exotic	St. Johns Wort				0.3			0.1	0.1				
Juncaceae	*Juncus acutus* subsp. *acutus*	Exotic	Sharp Rush				2								
	Juncus capillaceus	Exotic							0.1						
	Juncus usitatus	Grass & grasslike								0.1	0.1			0.1	
Linaceae	*Linum trigynum*	Exotic	French flax								0.1				
Lobeliaceae	*Lobelia purpurascens*	Forb (FG)	Whiteroot	0.1											0.1
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Grass & grasslike	wattle mat-rush		0.1				0.1				0.1		
	Lomandra longifolia	Grass & grasslike	Spiny-headed Mat-rush			1									
Malvaceae	*Modiola caroliniana*	Exotic	Red-flowered Mallow	0.1			1	0.1		0.1	0.1		0.1	0.1	
	Sida rhombifolia	Exotic	Paddy's Lucerne	0.1	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Myrtaceae	*Angophora floribunda*	Tree (TG)	Rough-barked Apple							5					
	Angophora subvelutina	*Tree (TG)*	broad-leaved apple		8										15
	Eucalyptus amplifolia	Tree (TG)	Cabbage Gum			15	3								20
	Eucalyptus moluccana	Tree (TG)	Coast Grey Box					12			0.1				
	Eucalyptus tereticornis	Tree (TG)	Forest Red Gum		1	1.5				0.1	15				
	Kunzea ambigua	Shrub (SG)	Tick Bush			0.3									
	Melaleuca decora	Shrub (SG)			30										
	Melaleuca linariifolia	Shrub (SG)	Flax-leaved Paperbark			1									
	Melaleuca styphelioides	Shrub (SG)	Prickly-leaved Tea Tree			0.5	5								
Oleaceae	*Ligustrum lucidum*	High Threat Exotic	Large-leaved Privet			0.3									
	Ligustrum sinense	High Threat Exotic	Small-leaved Privet			0.3					0.1				0.2

Family	Species	Growth form (BAM; OEH 2019)	Common Name	Foliage cover (%)											
				Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12
	Olea europaea subsp. *cuspidata*	Exotic	African Olive					0.5							
Oxalidaceae	*Oxalis exilis*	Forb (FG)								0.1	0.1	0.1		0.1	
	Oxalis perennans	Forb (FG)		0.2	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Oxalis sp.	Forb (FG)					0.3								
Papaveraceae	*Argemone ochroleuca*	Exotic	Mexican Poppy									0.1			
Phormiaceae	*Dianella caerulea*	Forb (FG)	Blue Flax-lily		0.1	0.1									
Pittosporaceae	*Bursaria spinosa*	Shrub (SG)	Native Blackthorn		0.5	40		0.3							10
Plantaginaceae	*Plantago debilis*	Forb (FG)									0.1				
	Plantago gaudichaudii	Forb (FG)	Narrow plantain					0.3							
	Plantago lanceolata	Exotic	Plantain	0.1			0.5	0.5	0.1	0.1	0.5		0.1	0.1	0.1
	Plantago myosuros subsp. *myosuros*	Exotic										0.1		0.1	
	Veronica plebeia	Forb (FG)	Trailing Speedwell												0.1
Poaceae	*Aristida ramosa*	Grass & grasslike	Purple Wiregrass			0.5							0.1		
	Aristida vagans	Grass & grasslike	Threeawn Speargrass	0.5	0.1				0.1						0.2
	Axonopus fissifolius	High Threat Exotic	Narrow-leaved Carpet Grass						10	0.1	10	0.1	5	10	5
	Bothriochloa macra	Grass & grasslike	Red Grass						0.1	2	0.5		0.1	1	2
	Briza minor	Exotic	Shivery Grass									0.1	0.1		
	Briza subaristata	High Threat Exotic							0.5	1	5	0.3	0.1	5	
	Bromus catharticus	Exotic	Prairie Grass		0.1					0.1	0.1				
	Cenchrus clandestinus	High Threat Exotic	Kikuyu Grass							0.1	0.1	5			
	Cynodon dactylon	Native/Exotic†	Couch	2		2	5	2	5	2	20	10	15	5	5
	Dichelachne micrantha	Grass & grasslike	Shorthair Plumegrass											0.1	
	Digitaria diffusa	Grass & grasslike	Open Summer-grass		0.1										
	Echinopogon ovatus	Grass & grasslike	Forest Hedgehog Grass		0.1					1	0.5				0.5

Family	Species	Growth form (BAM; OEH 2019)	Common Name	Foliage cover (%)											
				Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12
	Eleusine tristachya	Exotic	Goose Grass						0.1			0.1			
	Anthosachne multiflora	Grass & grasslike	Philip Island Wheatgrass												0.1
	Eragrostis brownii	Grass & grasslike	Brown's Lovegrass	0.1					0.1				0.1		0.1
	Eragrostis curvula	High Threat Exotic	African Lovegrass						1	0.1	0.5	0.1	0.5		
	Eragrostis leptostachya	Grass & grasslike	Paddock Lovegrass	0.5	0.1										0.1
	Lolium rigidum	Exotic	Wimmera Ryegrass							0.1	0.1				
	Microlaena stipoides	Grass & grasslike	Weeping Grass	40	2	25	0.3	3	0.3	10	5	5	5	5	35
	Oplismenus aemulus	Grass & grasslike	Australian Basket Grass		0.2					0.1					1
	Paspalidium distans	Grass & grasslike			0.1										0.2
	Paspalum dilatatum	High Threat Exotic	Paspalum	0.5			0.1	0.1	15	5	20	40	10	20	25
	Rytidosperma longifolium	Grass & grasslike	Long-leaved Wallaby Grass							0.1	0.1				
	Rytidosperma racemosum	Grass & grasslike								10	5				
	Rytidosperma spp.	Grass & grasslike						0.3							0.2
	Setaria parviflora	Exotic		0.1	0.1		0.1		20	0.1	5	3	30	5	10
	Sporobolus africanus	Grass & grasslike	Parramatta Grass												0.1
	Sporobolus creber	Grass & grasslike	Western Rat-tail Grass						0.1	0.1	0.5		0.1	0.1	
	Themeda triandra	Grass & grasslike	Kangaroo Grass												1
Polygonaceae	*Persicaria decipiens*	Forb (FG)	slender knotweed				0.1								
	Polygonum aviculare	Exotic	Wireweed								0.1				
	Rumex brownii	Forb (FG)	Swamp Dock							0.1					
	Rumex conglomeratus	Exotic	Clustered Dock				0.1								
Portulacaceae	*Portulaca oleracea*	Forb (FG)	Pigweed						0.1		0.1		0.1		
Primulaceae	*Lysimachia arvensis*	Exotic	Scarlet Pimpernel				0.1		0.1	0.1	0.1	0.1		0.1	
Pteridaceae	*Cheilanthes sieberi*	Fern (EG)	poison rock fern		0.1										0.2

Family	Species	Growth form (BAM; OEH 2019)	Common Name	Foliage cover (%)											
				Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12
Ranunculaceae	*Clematis glycinoides*	Other (OG)	Headache Vine			0.3									0.1
Rosaceae	*Rubus fruticosus sp. agg.*	High Threat Exotic	Blackberry complex		0.1	20									0.1
	Rubus parvifolius	Shrub (SG)	Native Raspberry			0.1									
Rubiaceae	*Asperula conferta*	Forb (FG)	Common Woodruff							0.1	0.1				0.1
	Opercularia diphylla	Forb (FG)	Stinkweed			0.1									
	Richardia stellaris	Exotic		0.1	0.1			0.1	0.1	0.1	0.1		0.1	0.1	
Scrophulariaceae	*Eremophila debilis*	Shrub (SG)	Winter Apple												0.1
Solanaceae	*Lycium ferocissimum*	High Threat Exotic	African Boxthorn		0.5		0.5	1	0.1		0.1				
	Solanum nigrum	Exotic	Black-berry Nightshade		0.1						0.1				
	Solanum prinophyllum	Forb (FG)	Forest nightshade								0.1				0.1
	Solanum pseudocapsicum	Exotic	Madeira Winter Cherry			1									0.1
	Solanum sisymbriifolium	Exotic		0.1	0.1		0.1	0.1	0.2	0.1	0.1	0.2	0.3	0.1	0.1
	Solanum sp.	Exotic								0.1	0.1				
Verbenaceae	*Verbena bonariensis*	Exotic	Purpletop				0.1	0.1							
	Verbena sp.	Exotic	Purpletop							0.1	0.1	0.1		0.1	

Appendix E Fauna species list

Common name	Scientific name	BC Act status	Record type
Amphibians			
Common Eastern Froglet	*Crinia signifera*		Heard call
Brown-striped Frog	*Limnodynastes peronii*		Heard call
Eastern Dwarf Tree Frog	*Litoria fallax*		Heard call
Peron's Tree Frog	*Litoria peronii*		Heard call
Verreaux's Frog	*Litoria verreauxii*		Heard call
Smooth Toadlet	*Uperoleia laevigata*		Heard call
Aves (birds)			
Yellow Thornbill	*Acanthiza nana*		Observed and Heard call
Pacific Black Duck	*Anas superciliosa*		Observed and Heard call
Red Wattlebird	*Anthochaera carunculata*		Heard call
Fan-tailed Cuckoo	*Cacomantis flabelliformis*		Observed
Yellow-faced Honeyeater	*Caligavis chrysops*		Observed and Heard call
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		Observed and Heard call
Australian Raven	*Corvus coronoides*		Observed and Heard call
Australian Magpie	*Cracticus tibicen*		Observed
Grey Butcherbird	*Cracticus torquatus*		Heard call
White-faced Heron	*Egretta novaehollandiae*		Observed
Musk Lorikeet	*Glossopsitta concinna*		Observed and Heard call
Magpie-lark	*Grallina cyanoleuca*		Observed and Heard call
Welcome Swallow	*Hirundo neoxena*		Observed
Superb Fairy-wren	*Malurus cyaneus*		Observed and Heard call
Noisy Miner	*Manorina melanocephala*		Observed and Heard call
Bell Miner	*Manorina melanophrys*		Heard call
Crested Pigeon	*Ocyphaps lophotes*		Heard call
Golden Whistler	*Pachycephala pectoralis*		Observed and Heard call
Spotted Pardalote	*Pardalotus punctatus*		Heard call
House Sparrow*	*Passer domesticus*		Observed
Fairy Martin	*Petrochelidon ariel*		Observed
Eastern Rosella	*Platycercus eximius*		Observed and Heard call
Purple Swamphen	*Porphyrio*		Observed
Grey Fantail	*Rhipidura albiscapa*		Heard call
Willie Wagtail	*Rhipidura leucophrys*		Heard call
Common Myna*	*Sturnus tristis*		Observed and Heard call

Common name	Scientific name	BC Act status	Record type
Common Starling*	*Sturnus vulgaris*		Observed and Heard call
Rainbow Lorikeet	*Trichoglossus haematodus*		Heard call
Silvereye	*Zosterops lateralis*		Observed and Heard call
Mammals			
White-striped freetail Bat	*Austronomus australis*		Acoustic recording
European cattle*	*Bos taurus*		Observed
Gould's Wattled Bat	*Chalinolobus gouldii*		Acoustic recording
Chocolate Wattled Bat	*Chalinolobus morio*		Acoustic recording
Donkey*	*Equus asinus*		Observed
Horse*	*Equus caballus*		Observed
Eastern Grey Kangaroo	*Macropus giganteus*		Observed
Large-footed Myotis	*Myotis macropus*	V	Acoustic recording
Long-eared Bat	*Nyctophilus sp*		Acoustic recording
Rabbit*	*Oryctolagus cuniculus*		Observed + Scats
Eastern Freetail Bat	*Ozimops ridei*		Acoustic recording
Eastern broad-nosed Bat	*Scotorepens orion*		Acoustic recording
Little Forest Bat	*Vespadelus vulturnus*		Acoustic recording
Fox*	*Vulpes*		Observed

V - Vulnerable

Appendix F EPBC Act Referral

Results of Protected Matters Search Tool for 5 km around the subject land (latest search performed 17 January 2019).

Species	EPBC Act Status	Potential to be impacted
Ecological Communities		
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	E	None – ecological community does not occur within the subject land.
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	E	None – ecological community does not occur within the subject land.
Cooks River/Castlereagh Ironbark Forest of the Sydny Basin Bioregion	CE	None – ecological community does not occur within the subject land.
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	CE	Potential – clearing of 0.97 ha of the ecological community, as defined under the EPBC Act, is proposed.
Western Sydney Dry Rainforest and Moist Woodland on Shale	CE	None – ecological community does not occur within the subject land.
FLORA		
Acacia bynoeana (Bynoe's Wattle)	V	No - unsuitable habitat within subject lands, this species occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches.
Acacia pubescens Downy Wattle	V	No - suitable habitat present within subject land, although species not detected during targeted surveys.
Allocasuarina glareicola	E	No – unsuitable habitat. Species grows in Grows in Castlereagh woodland on lateritic soil in NW of the Cumberland Plain and at Voyager Point.
Cynanchum elegans White-flowered Wax Plant	E	No – species not detected during targeted surveys.
Genoplesium baueri Yellow Gnat-orchid	E	No – unsuitable habitat. This species is associated with a variety of habitats on sandstone geologies.

Species	EPBC Act Status	Potential to be impacted
Haloragis exalata subsp. exalata Wingless Raspwort	V	No – species not detected during targeted surveys.
Micromyrtus minutiflora	V	No – species not detected during targeted survey.
Persoonia hirsuta Hairy Geebung	E	No - unsuitable habitat within subject land. This species is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.
Persoonia nutans Nodding Geebung	E	No – species not detected during targeted survey.
Pimelea curviflora var. curviflora	V	No – species not detected during targeted survey. Species was recorded outside of the subject land.
Pimelea spicata Spiked Rice-flower	E	No – species not detected during targeted survey.
Pomaderris brunnea Rufous Pomaderris	V	No – species not detected during targeted survey.
Pterostylis gibbosa Illawarra Greenhood	E	No – subject land is not within the known range of this species. The species is only known to occupy two distinct areas, on the Illawarra Coastal Plain and the Hunter Valley.
Pterostylis saxicola Sydney Plains Greenhood	E	No - Habitat within subject land is degraded. This species is restricted to Western Sydney between Freemans Reach in the north and Picton in the south. Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. This species, as are many orchid species, are preferentially grazed and are unlikely to persist in heavily grazed grasslands such as those in the subject land. There is a very old record (1804) for this species less than 1 km from the northern edge of the subject land, however the specific location of is questionable given the age of the record.
Pultenaea parviflora	V	No – species not detected during targeted survey.
Syzygium paniculatum Magenta Lilly Pilly	V	No – unsuitable habitat within the subject land. This species is associated with rainforest (in particular littoral rainforest) and wet sclerophyll forests.

Species	EPBC Act Status	Potential to be impacted
Thesium australe Austral Toadflax	V	No – unsuitable habitat for this species. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. Records from the Sydney basin are from 1803. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.
FAUNA		
Birds		
Anthochaera phrygia (Regent Honeyeater)	CE	No - the site has been considered unlikely to provide foraging habitat for the species as records of this species within a 5 km radius of the site (OEH 2019) are all over 60 years old, although records approximately 25 years old are present within a 10 km radius of the subject land. This species is rare in Western Sydney and has three known key breeding regions being north-east Victoria, in the NSW Capertee Valley and the Bundarra – Barraba region. In NSW the species is mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some coastal areas, non-breeding flocks are seen feeding in flowering coastal Swamp Mahogany and Spotted Gum forests (OEH 2018a), neither of which are present on the site. Although this species is a generalist forager, it feeds mainly on nectar from a small number of key eucalypt species, none of which are present at the site. Despite old records of this species from within a 5 km radius of the site, the extremely low numbers remaining of this species in the wild, and given that the site does not support any key foraging species and is not located near any key breeding areas, the likelihood of this species using the subject site for foraging is considered very low.
Botaurus poiciloptilus Australasian Bittern	E	Unlikely – This species inhabits temperate freshwater wetlands and occasionally estuarine reedbeds. The species favours permanent shallow wetlands, or edges of pools and waterways, with tall, dense vegetation such as sedges, rushes and reeds on muddy or peaty substrate.
Calidris ferruginea Curlew Sandpiper	CE	No – This species generally occupies littoral and estuarine habitats, and in NSW is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.

Species	EPBC Act Status	Potential to be impacted
Dasyornis brachypterus Eastern Bristlebird	E	No – the distribution of the species has contracted to three disjunct areas of south-eastern Australia, none of which include the Cumberland Plain. Habitat for this species is characterised by dense, low vegetation including heath and open woodland with a heathy understorey.
Grantiella picta Painted Honeyeater	V	Unlikely - the species is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland.
Lathamus discolor Swift Parrot	CE	No – this species has been recorded approximately 3.5 km from the site and the most recent record is from 2001 (OEH 2019). Given this species breeds in Tasmania, no potential breeding habitat is present. This species migrates to mainland Australia between March and October in areas where eucalypts are flowering profusely or where there are abundant lerp infestations (OEH 2018b). One of the favoured lerp infested species are present at the site (*Eucalyptus moluccana*) and the winter flowering *Eucalyptus tereticornis* is also present on the site. This species forages extensively and travels very large distances during foraging. It is considered unlikely that the site would represent a key foraging resource for this species.
Numenius madagascariensis Eastern Curlew	CE	No - the Eastern Curlew has a primarily coastal distribution. It generally occupies coastal lakes, inlets, bays and estuarine habitats, and in NSW is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts.
Rostratula australis Australian Painted Snipe	E	Unlikely – this species typically occurs in association with the fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.
MAMMALS		
Chalinolobus dwyeri Large-eared Pied Bat	V	No – Not detected during targeted surveys. Further, the nearest record of the species is approximately 9 km northwest of the subject land and from 2000 (OEH 2019). This species requires a combination of sandstone cliffs/escarpments to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum

Species	EPBC Act Status	Potential to be impacted
		woodlands or river/rainforest corridors which are used for foraging.
Dasyurus maculatus maculatus Spotted-tail Quoll	E	Unlikely – this species typically occupies heavily forested landscapes or open areas in proximity to large areas of forested habitat. The species is unlikely to occur within the fragmented and isolated areas of woodland within the Central Cumberland Plain.
Petauroides volans Greater Glider	V	No – this species is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The Greater Glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species (Kavanagh 1984). This species has also been shown to have relatively low persistence in small forest fragments, and disperse poorly across vegetation that is not native forest. Modelling suggests that they require native forest patches of at least 160 km^2 to maintain viable populations (Eyre 2002). A search of OEH Wildlife Atlas did not identify any Greater Glider records within a 10 km radius of the subject land with the nearest recorded approximately 24 km to the north-east.
Petrogale penicillata Brush-tailed Rock-wallaby	V	No – the species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.
Phascolarctos cinereus Koala	V	No - There are no records of this species within a 5 km radius of the site (OEH 2019) with the nearest record approximately 7.5 km to the north west at Blackett in 1990 (OEH 2019). None of the potential feed tree species for Koala within the subject land had scratch marks from arboreal fauna and scat searches failed to detect any scats of Koala or other arboreal species. Based on the EPBC Koala Habitat Assessment Tool the site would not be considered habitat critical to the survival of the Koala due to low Koala occurrence, low habitat connectivity and low recovery value.
Pseudomys novaehollandiae New Holland Mouse	V	Unlikely – records for this species from the Sydney Basin are generally restricted to large connected areas of vegetation on the Hornsby and Woronora Plateaus.
Pteropus poliocephalus Grey-headed Flying-fox	V	Potential - No camps for this species were observed within the subject land. Nonetheless, given that a known camp of this species is located approximately 5.5 km

Species	EPBC Act Status	Potential to be impacted
		south-east of the subject land at Wetherill Park, the species is likely to forage within the subject land.
Frogs		
Heleioporus australiacus Giant Burrowing Frog	V	No – suitable habitat for the species, associated with sandstone geologies, is not present within the subject land.
Litoria aurea Green and Golden Bell Frog	V	No – species not detected during targeted surveys timed to occur in warm weather following rainfall and when the species was known to be active at Sydney Olympic Park.
Litoria raniformis Southern Bell Frog,	V	No – subject land is outside the known range of this species.
Fish		
Macquaria australasica Macquarie Perch	E	Review of Freshwater Threatened Species Distribution Maps (DPI Fisheries 2016) showed no Macquarie Perch have been recorded in Eastern Creek, Reedy Creek and Eskdale Creek and that these waterways are not considered as habitat.
Prototroctes maraena Australian Grayling	V	Review of Freshwater Threatened Species Distribution Maps (DPI Fisheries 2016) showed no Australian Grayling have been recorded in Eastern Creek, Reedy Creek and Eskdale Creek and that these waterways are not considered as habitat.
MIGRATORY		
Cuculus optatus Oriental Cuckoo	Mi	Unlikely – species not detected during targeted surveys and only small areas of habitat available for this wide ranging species.
Hirundapus caudacutus White-throated Needletail	Mi	Unlikely – species not detected during targeted surveys and only small areas of habitat available for this wide ranging species.
Monarcha melanopsis Black-faced Monarch	Mi	Unlikely – species not detected during targeted surveys and only small areas of habitat available for this wide ranging species.
Motacilla flava Yellow Wagtail	Mi	Unlikely – species not detected during targeted surveys and only small areas of habitat available for this wide ranging species.
Myiagra cyanoleuca Satin Flycatcher	Mi	Unlikely – species not detected during targeted surveys and only small areas of habitat available for this wide ranging species.

Species	EPBC Act Status	Potential to be impacted
Rhipidura rufifrons Rufous Fantail	Mi	Unlikely – species not detected during targeted surveys and only small areas of habitat available for this wide ranging species.
Migratory Marine*	Mi	No – the subject land does not include any habitat for listed migratory marine species.
Migratory Wetland Species*	Mi	No – the subject land does not include any habitat for listed migratory wetland species.
Marine Species	Marine	No – the subject land does not include any habitat for listed marine species.

Title of Proposal - Lighthorse Interchange Business Hub, Eastern Creek

Section 1 - Summary of your proposed action

Provide a summary of your proposed action, including any consultations undertaken.

1.1 Project Industry Type

Commercial Development

1.2 Provide a detailed description of the proposed action, including all proposed activities.

The Light Horse Interchange Business Hub (the 'Business Hub') is proposed to accommodate industrial and light industrial land use activities within an attractive landscaped setting that benefits from excellent access to the metropolitan road network. The Western Sydney Parklands Trust (WSPT) proposes development of an industrial business hub adjacent to the Light Horse Interchange at Eastern Creek. The proposed development forms an important component of the self-funded model for the Trust. Business hubs, such as this proposal, are located on the perimeter of the Parklands in areas of low conservation or recreation value and close to established employment areas and the metropolitan road network. The business hubs remain in public ownership and are leased to industry, providing ongoing income for the WSPT to fund future land acquisition and ongoing regeneration of bushland within the Western Parklands. The proposed Light Horse Interchange Business Hub is entirely consistent and compatible with the WSPT criteria for a business hub. It comprises a discrete parcel of land which is separated from the broader parklands. It has low conservation or recreation value and is surrounded by established and developing employment-generating land use activities to the north and west. The site also benefits from excellent access to the Sydney metropolitan road network. The proposed business hub will deliver economic benefits and employment generation for Western Sydney and the Greater Sydney Region.

The proposal is being developed as a Concept Development Application (DA). A detailed proposal has been prepared to facilitate delivery of the first stage of development, including demolition, bulk earthworks, infrastructure and subdivision. Further detailed approvals will be sought for the construction of individual buildings, ancillary facilities and associated site works.

The proposed development includes 6 industrial lots including approximately 157,000 sqm of industrial and light industrial floorspace with approximately 8,000 sqm of ancillary offices to accommodate a range of activities, including advanced manufacturing, freight and logistics and warehouse and distribution facilities.

The detailed proposal includes the following site works:
- Demolition and remediation: removal of existing buildings and structures and completion of any site remediation works required to ensure the site is suitable for its intended use as a business hub.
- Bulk earthworks: cut and fill details for the future building pad sites to facilitate the future development of the site as an industrial business hub.
- Infrastructure: provision of roads, utility services, stormwater works and flood mitigation

measures required to facilitate the future development of the site as a business hub.
- Subdivision: creation of development lots, public roads, easements/restrictions, etc to facilitate the leasing and development of individual lots to accommodate industrial and light industrial land use activities, including freight and logistics and warehouse and distribution centres.

1.3 What is the extent and location of your proposed action? Use the polygon tool on the map below to mark the location of your proposed action.

Area	Point	Latitude	Longitude
Lighthorse Interchange	1	-33.799805250824	150.85657387934
Lighthorse Interchange	2	-33.799805250824	150.85657387934
Lighthorse Interchange	3	-33.799912236955	150.85756093225
Lighthorse Interchange	4	-33.801124737084	150.86931973658
Lighthorse Interchange	5	-33.801552674205	150.86923390589
Lighthorse Interchange	6	-33.801588335535	150.8687618371
Lighthorse Interchange	7	-33.801552674205	150.86833268366
Lighthorse Interchange	8	-33.800482827391	150.85979253015
Lighthorse Interchange	9	-33.80073245951	150.85996419153
Lighthorse Interchange	10	-33.8026938294	150.86035042963
Lighthorse Interchange	11	-33.803977610805	150.86039334497
Lighthorse Interchange	12	-33.804583834218	150.85949212274
Lighthorse Interchange	13	-33.806224181922	150.85859090052
Lighthorse Interchange	14	-33.80608154424	150.85743218622
Lighthorse Interchange	15	-33.807543569213	150.85584431848
Lighthorse Interchange	16	-33.807222639042	150.85301190576
Lighthorse Interchange	17	-33.806580775088	150.85305482111
Lighthorse Interchange	18	-33.805546650813	150.85331231317
Lighthorse Interchange	19	-33.804013271125	150.85365563593
Lighthorse Interchange	20	-33.803050437277	150.85391312799
Lighthorse Interchange	21	-33.802158914797	150.85417062006
Lighthorse Interchange	22	-33.801588335535	150.85434228144
Lighthorse Interchange	23	-33.801196060086	150.85451394281
Lighthorse Interchange	24	-33.800233194543	150.8553722497
Lighthorse Interchange	25	-33.799947898968	150.8557584878
Lighthorse Interchange	26	-33.799840912883	150.85610181055
Lighthorse Interchange	27	-33.799805250824	150.85657387934

1.5 Provide a brief physical description of the property on which the proposed action will take place and the location of the proposed action (e.g. proximity to major towns, or for

off-shore actions, shortest distance to mainland).

The subject land is approximately 13 kilometres west of Parramatta Central Business District (CBD) and six kilometres south of Blacktown CBD. It is within the southern part of the Blacktown local government area (LGA), approximately 1.3 kilometres north of the Fairfield LGA boundary.

This subject land for this development covers a total area of approximately 41.56 ha comprising part of two adjoining lots at 165 Wallgrove Road (Lot 10 // DP 1061237) and 475 Ferrers Road (Lot 5 // DP 804051), Eastern Creek. The proposed business hub would be accommodated on land in the western part of Lot 10 while parts of Lot 5 will be required to provide vehicle access to the proposed business hub.

The subject land is irregular in shape and generally slopes east and north-east towards the Eskdale Creek, Reedy Creek and Eastern Creek riparian corridors. The subject land currently supports large areas of cleared land with historic clearing and disturbances having occurred across the subject land since its use for defence purposes since the 1940s. An army camp was located at the subject land until the 1980s with continued use of the buildings and antenna at the site until the 1990s. The site has been used for grazing purposes for the last 10 years. The subject land supports scattered areas of native woodland vegetation, with more densely vegetated areas in the south-western corner and along Eastern Creek. Derelict buildings and structures associated with the former Wallgrove Army Base are located within the central part of the subject land.

The subject land is bound by the M4 Western Motorway to the north, the Westlink M7 Motorway and Wallgrove Road to the west and vegetated portions of the Western Sydney Parklands to the south and east.

1.6 What is the size of the proposed action area development footprint (or work area) including disturbance footprint and avoidance footprint (if relevant)?

41.56 hectares

1.7 Is the proposed action a street address or lot?

Lot

1.7.2 Describe the lot number and title. Part of Lot 10 // DP 1061237 and Part of Lot 5 // DP 804051

1.8 Primary Jurisdiction.

New South Wales

1.9 Has the person proposing to take the action received any Australian Government grant funding to undertake this project?

No

1.10 Is the proposed action subject to local government planning approval?

No

1.11 Provide an estimated start and estimated end date for the proposed action.

Start date 03/2020

End date 02/2021

1.12 Provide details of the context, planning framework and State and/or Local government requirements.

The proposed development has an estimated capital investment value of $212,934,203 and is classified as a State significant development (SSD) under Clause 5 in Schedule 2 of NSW State Environment Planning Policy (State and Regional Development) 2011 (‘the SRD SEPP’). The NSW Minister for Planning is the consent authority for the proposal under Section 8A of the SRD SEPP.

Impacts to biodiversity are being assessed in accordance with the 'Biodiversity Assessment Methodology' ('BAM'; OEH 2017). The BAM, established under Section 6.7 of the NSW *Biodiversity Conservation Act 2016* (BC Act), assesses the impacts of developments on threatened species, ecological communities and their habitats as required under the BC Act. The process of applying the BAM for a proposed development must be fully documented in a Biodiversity Development Assessment Report (BDAR). A BDAR is being prepared for the proposal to document the predicted impacts to biodiversity and is being prepared by an Accredited Assessor in accordance with the BC Act and NSW Biodiversity Conservation Regulation 2017 (BC Reg).

1.13 Describe any public consultation that has been, is being or will be undertaken, including with Indigenous stakeholders.

As outlined within the *Parklands Plan of Management 2020 Supplement, s*takeholder and community consultation has been a priority during all stages of business hub selection and development. In this way, the Trust has engaged with residents, business and civic groups, as well as the three local councils and the broader community. As stated in the *Plan of Management 2020*, to take the business hubs forward the Trust established Consultative Committees with Liverpool, Fairfield and Blacktown City Councils in 2011 to explore locations and land uses for the business hubs.

Specific to the proposed action, the proponent has engaged with State and local planning and servicing authorities during the preliminary investigations phase, including:

- NSW Department of Planning and Environment

- Blacktown City Council

- NSW Department of Primary Industries (Water NSW)

- Jemena

- NSW Roads and Maritime Services

- Westlink M7 Motorway

- Transport for NSW

Further consultation will be undertaken with the above stakeholders and additional stakeholders during the preparation of the Environmental Impact Statement.

In addition to the above consultation WSPT have sent letters to:

- Office of Environment and Heritage (OEH)
- Transport for New South Wales (TfNSW)
- Environment Protection Authority (EPA)
- Department of Industry
- Sydney Water
- Rural Fire Service
- Fire and Rescue NSW

- Surrounding neighbours

Further, WSPT have engaged a heritage consultant to engage with the aboriginal stakeholders, which is ongoing.

1.14 Describe any environmental impact assessments that have been or will be carried out under Commonwealth, State or Territory legislation including relevant impacts of the project.

As outlined above, the proposal is being assessed in accordance with the NSW *Biodiversity Conservation Act 2016* (BC Act) and a Biodiversity Development Assessment Report (BDAR) is being prepared in accordance with the Biodiversity Assessment Method (BAM). The site supports the Critically Endangered Ecological Community CEEC) Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPW). A total of 0.97 ha of this ecological community was present within the subject land and was in Condition A based upon the following attributes:

- The patch size is greater than 0.5 ha (patch size is 0.97 ha)

- Greater than 50% of the perennial understorey vegetation cover is made up of natives (native species comprised approximately 55% of the perennial understorey vegetation)

A further 1.73 ha of vegetation within the subject land has been identified as being CPW, however, this vegetation was significantly degraded and does not form part of the ecological community listed under the EPBC Act. These patches occurred as either isolated paddock trees which did not meet the minimum patch size requirements or consisted of patches where upper tree layer species were not present. A further 8.36 ha of native vegetation

comprising River-flat Eucalypt Forest, an Endangered Ecological Community listed under the BC Act, was also identified and mapped within the subject land.

Survey of the subject land has been undertaken to document native, exotic and introduced flora and fauna species. Plot based surveys (as per the BAM) and targeted survey for threatened flora were completed on 6 and 20 August 2018, 30 November 2018 and 12 December 2018 by Brian Towle (Senior Ecologist), Thomas Hickman (Ecologist) and Bruce Mullins (Principal Ecologist). A total of 11 florisitc plots (20 x 50 m) were surveyed across the subject land. These plots were surveyed in accordance with the requirements of the BAM and exceeded the minimum survey requirements outlined within the BAM. The targeted surveys for threatened flora coincided with the nominated survey period for all threatened flora predicted to occur within the subject land. No threatened flora were recorded within the subject land and based upon the historic disturbances and ongoing grazing of the subject land it was considered unlikely that any would occur.

Targeted surveys for threatened fauna were undertaken across the subject land including active searches for invertebrates, diurnal bird surveys, diurnal searches for large stick nest of threatened raptor species, acoustic surveys for threatened microbat species and active searches and call playback for amphibians. Opportunistic surveys for fauna and fauna habitat assessment were also conducted in conjunction with targeted flora surveys. Acoustic surveys for microbats involved two acoustic detectors (Anabats) for a total of 10 nights (total survey effort of 20 nights from 23 November to 2 December 2018, inclusive). Targeted surveys for amphibians included a combination of call-playback, nocturnal searches, and diurnal habitat assessments. Call playback and nocturnal searches for the Green and Golden Bell Frog (GGBF) (*Litoria aurea*) were undertaken over three nights on the 3, 4 and 17 December 2018 by Brian Towle (Senior Ecologist) and Bruce Mullins (Principal Ecologist) over approximately 10 person hours. The timing of these surveys coincides with the allowable survey periods identified for the GGBF under the BAM and EPBC Act survey guidelines and were also timed to occur in warm weather following rainfall and when the species was known to be active at Sydney Olympic Park (Green and Golden Bell Frogs were observed calling on 02/12/2018, Tina Hsu, Ecology Project Officer, Sydney Olympic Park Authority pers. comm. 2018).

Targeted surveys for Grey-headed Flying-fox (GHFF) (*Pteropus poliocephalus*) were undertaken in accordance with the BAM which focuses on the identification of any breeeding habitat or camps for this species. The method for surveying for the presence of unrecorded day roosts included diurnal observations across the subject land. Flying-fox camps are easily recognised from a distance due to the distinctive audible calls that are heard most frequently in the early morning or under sunny conditions. Other signs include their distinctive odour and droppings. No camps for this species were observed within the subject land. Nonetheless, given that a known camp of this species is located approximately 5.5 km south-east of the subject land at Wetherill Park, the species is likely to forage within the subject land.

No threatened fauna species listed under the EPBC Act were recorded during the targeted surveys, although it is noted that the Grey-headed Flying-fox is likely to utilise the subject land for foraging on an intermittent basis.

The potential for threatened fauna species listed under the EPBC Act to utilise the subject land was assessed. The following sections outline the results of these assessments.

The Koala Habitat Assessment Tool (DotE 2014) was completed given the presence of Koala feed tree species on site (*Eucalyptus tereticornis* and *E. amplifolia*) and to further support the conclusion that the Koala is unlikely to occur on the site. There are no records of this species within a 5 km radius of the site (OEH 2019) with the nearest record approximately 7.5 km to the north west at Blackett in 1990 (OEH 2019). None of the potential feed tree species for Koala had scratch marks from arboreal fauna and scat searches failed to detect any scats of Koala or other arboreal species.

Based on the EPBC Koala Habitat Assessment Tool the site would not be considered habitat critical to the survival of the Koala given:

Koala Occurrence – Low (0): No evidence of Koalas within 5 km of the site within the past 2 or 5 years.

Vegetation composition – High (+2): Has forest or woodland with 2 or more known koala food tree species present.

Habitat connectivity – Low (0): The site is poorly connected and isolated from surrounding areas of native vegeation by large roads and industrial land uses including the M4 Western Motorway corridor, the Westlink M7 Motorway and Eastern Creek Raceway. The subject land is partially connected to the south along Eastern Creek, however this connectivity is not contiguous and is intersected by a number of roads and easements. The subject land is not part of a contiguous landscape > 300 ha.

Key existing threats – Medium (+1): Areas which score 0 for Koala occurrence and are likely to have some degree dog or vehicle threat present.

Recovery value – Low (0): Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1 of the Koala referral guidelines, as the site is within a highly fragmented landscape and there are no records of this species from within a 5 km radius of the site.

TOTAL = 3

Therefore, based on the tool the site would not be considered habitat critical to the survival of the Koala. Therefore the proposed development is unlikely to adversely affect habitat critical to the survival of the Koala or interfere substantially with the recovery of the koala through the introduction or exacerbation of key threats in areas of habitat critical to the survival of the Koala.

The nearest record of Large-eared Pied Bat (*Chalinobolus dwyeri*) is approximately 9 km north-west of the subject land and from 2000 (OEH 2019). This species requires a combination of sandstone cliffs/escarpments to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging (Pennay, pers. comm., 2010). It has also been found in disused Fairy Martin (Hirundo ariel) nests (Schulz, 1998). This species has been recorded foraging in a range of vegetation types, including dry and wet sclerophyll forest, grassy woodland, Callitris dominated forest, tall open eucalypt forest with a rainforest subcanopy, sub-alpine woodland and sandstone outcrop country (Hoye & Dwyer 1995; Pennay 2002; DECC 2007). There is no potential roosting habitat

for this species at the site and only limited potential foraging habitat is present. This species was not detected onsite during acoustic surveys conducted for over 20 surveys nights. Therefore, the subject is unlikely to represent a significant foraging resource for this species.

The Greater Glider (*Petauroides volans*) is an EPBC listed species. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The Greater Glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species (Kavanagh 1984). This species has also been shown to have relatively low persistence in small forest fragments, and disperse poorly across vegetation that is not native forest. Modelling suggests that they require native forest patches of at least 160 km2 to maintain viable populations (Eyre 2002). A search of OEH Wildlife Atlas did not identify any Greater Glider records within a 10 km radius of the subject land with the nearest recorded approximately 24 km to the north-east. Further, the site does not support the preferred habitat of this species of montane, moist eucalypt forests with relatively old trees and abundant hollows. It is considered unlikely that the site would provide habitat for this species given the vegetation type present, that the vegetation at the site exists as a fairly fragmented stand and there are no records of this species within a 10 km radius of the site.

The site has been considered unlikely to provide foraging habitat for the Regent Honeyeater (*Anthochaera phrygia*) as records of this species within a 5 km radius of the site (OEH 2019) are all over 60 years old, although records approximately 25 years old are present within a 10 km radius of the subject land. This species is rare in Western Sydney and has three known key breeding regions being north-east Victoria, in the NSW Capertee Valley and the Bundarra – Barraba region. In NSW the species is mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some coastal areas, non-breeding flocks are seen feeding in flowering coastal Swamp Mahogany and Spotted Gum forests (OEH 2018a), neither of which are present on the site. Although this species is a generalist forager, it feeds mainly on nectar from a small number of key eucalypt species none of which are present at the site. Despite old records of this species from within a 5 km radius of the site, the extremely low numbers remaining of this species in the wild, and given that the site does not support any key foraging species and is not located near any key breeding areas, the likelihood of this species using the subject site for foraging is considered very low.

Swift Parrot (*Lathamus discolor*) has been recorded approximately 3.5 km from the site and the most recent record is from 2001 (OEH 2019). Given this species breeds in Tasmania, no potential breeding habitat is present. This species migrates to mainland Australia between March and October in areas where eucalypts are flowering profusely or where there are abundant lerp infestations (OEH 2018b). One of the favoured lerp infested species are present at the site (*Eucalyptus moluccana*) and the winter flowering *Eucalyptus tereticornis* (Forest Red Gum) is also present on the site (DIPNR 2004). This species forages extensively and travels very large distances during foraging. It is considered unlikely that the site would represent a key foraging resource for this species.

The Green and Golden Bell Frog (GGBF) (*Litoria aurea*) has been recorded within 1 km of the subject land, although this record is from 1967 and with poor accuracy associated with the record. Other records from the locality include records from Prospect Nature Reserve and the Horsley Park area, although these records are similarly from the 1960s and with poor accuracy. A key population of this species is known to occur in Riverstone approximately 13 km north of

the subject land. However, waterbodies suitable for use by this species are absent from the subject land. The stretches of Eskdale Creek within the subject land, and the adjacent areas of Reedy Creek and Eastern Creek support fast flowing water chich does not represent suitable breeding habitat for this species. Potential breeding habitat was identified within ponds to the east of the subject land (approximately 200 m) and targeted surveys were undertakn for this species across these ponds. Call playback and nocturnal searches for the GGBF were undertaken over three nights on the 3, 4 and 17 December 2018 by Brian Towle (Senior Ecologist) and Bruce Mullins (Principal Ecologist) over approximately 10 person hours. The timing of these surveys coincides with the allowable survey periods identified for the GGBF under the BAM and EPBC Act survey guidelines and surveys were also timed to occur in warm weather following rainfall and when the species was known to be active at Sydney Olympic Park (Green and Golden Bell Frogs were observed calling on 02/12/2018, Tina Hsu, Ecology Project Officer, Sydney Olympic Park Authority pers. comm. 2018). No GGBF were detected during these surveys. No suitable habitat for other threatened amphibians, including the Giant Burrowing Frog (*Heleioporus australiacus)* which is confined to the sandstone geology and *Litoria raniformis* (Southern Bell Frog) which has not been previously recorded within the Sydney Basin Bioregion (OEH 2019), was identified within the subject land.

No other threatened fauna species listed under the EPBC Act were considered likely to utilise the subject land.

1.15 Is this action part of a staged development (or a component of a larger project)?

No

1.16 Is the proposed action related to other actions or proposals in the region?

No

Section 2 - Matters of National Environmental Significance

Describe the affected area and the likely impacts of the proposal, emphasising the relevant matters protected by the EPBC Act. Refer to relevant maps as appropriate. The interactive map tool can help determine whether matters of national environmental significance or other matters protected by the EPBC Act are likely to occur in your area of interest. Consideration of likely impacts should include both direct and indirect impacts.

Your assessment of likely impacts should consider whether a bioregional plan is relevant to your proposal. The following resources can assist you in your assessment of likely impacts:

• Profiles of relevant species/communities (where available), that will assist in the identification of whether there is likely to be a significant impact on them if the proposal proceeds;

• Significant Impact Guidelines 1.1 – Matters of National Environmental Significance;

• Significant Impact Guideline 1.2 – Actions on, or impacting upon, Commonwealth land and Actions by Commonwealth Agencies.

2.1 Is the proposed action likely to have ANY direct or indirect impact on the values of any World Heritage properties?

No

2.2 Is the proposed action likely to have ANY direct or indirect impact on the values of any National Heritage places?

No

2.3 Is the proposed action likely to have ANY direct or indirect impact on the ecological character of a Ramsar wetland?

No

2.4 Is the proposed action likely to have ANY direct or indirect impact on the members of any listed species or any threatened ecological community, or their habitat?

Yes

2.4.1 Impact table

Species	Impact
Cumberland Plain Woodland and Shale Gravel Transitional Woodland	The proposed development would involve the direct removal and clearing 0.97 ha of Cumberland Plains Woodland (CPW). The

Species	Impact
	CPW within the subject site is largely in a modified condition state, with moderate levels of exotic cover, under-scrubbing and other disturbance present.
Grey-headed Flying-fox (Pteropus poliocephalus)	The proposal will result in the removal of 11.35 ha of native vegetation (including planted non-local native vegetation) representing potential foraging habitat for the Grey-headed Flying-fox (GHFF) although no camp sites were recorded within the subject land. This species is highly mobile, forages widely and abundant potential foraging habitat is present for this species throughout the region. A search of the National Flying-fox monitoring viewer was undertaken (DoEE 2018). The nearest known GHFF camps are located approximately 5.5 km south-east of the subject land at Wetherill Park, with between 500-2,500 individuals of this species recorded from this camp in May 2017 (DoEE 2018). Although the site provides winter and spring flowering eucalypts which are important for this species, similar or better condition potential foraging habitat is available to this species in habitat surrounding the site. It is unlikely that the proposed impacts to potential foraging habitat would have a significant impact on this species.

2.4.2 Do you consider this impact to be significant?

No

2.5 Is the proposed action likely to have ANY direct or indirect impact on the members of any listed migratory species, or their habitat?

No

2.6 Is the proposed action to be undertaken in a marine environment (outside Commonwealth marine areas)?

No

2.7 Is the proposed action to be taken on or near Commonwealth land?

No

2.8 Is the proposed action taking place in the Great Barrier Reef Marine Park?

No

2.9 Is the proposed action likely to have ANY direct or indirect impact on a water resource related to coal/gas/mining?

No

2.10 Is the proposed action a nuclear action?

No

2.11 Is the proposed action to be taken by the Commonwealth agency?

No

2.12 Is the proposed action to be undertaken in a Commonwealth Heritage Place Overseas?

No

2.13 Is the proposed action likely to have ANY direct or indirect impact on any part of the environment in the Commonwealth marine area?

No

Section 3 - Description of the project area

Provide a description of the project area and the affected area, including information about the following features (where relevant to the project area and/or affected area, and to the extent not otherwise addressed in Section 2).

3.1 Describe the flora and fauna relevant to the project area.

A total of 149 flora species were recorded within the subject land including 75 native species and 74 exotic species (of which 15 species are identified as 'High Threat Exotics' OEH 2017). No threatened flora species listed under the EPBC Act were recorded within the subject land. Based on the list of EPBC Act species identified as potentially occurring on the site from the NSW Bionet Atlas Search and Protected Matters Search Tool and results of targeted surveys, no listed threatened flora species are likely to be present.

Two vegetation communities / Plant Commnity Types (PCTs) were identified across the subject land, with the distribution of these communities related to the topographical position within the subject land. The two PCTs identified within the subject land are:

- 'Shale Plains Woodland' and the equivalent PCT 'Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion' (PCT 849) both of which are equivalent to 'Cumberland Plain Woodland and Shale Gravel Transition Forest' as listed under the EPBC Act.

- 'Alluvial Woodland' and the equivalent PCT 'Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion' (PCT 835). This vegetation community does not form part of any listed ecological community under the EPBC Act. This community is equivalent to '*River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions'* as listed under the BC Act.

The areas of Cumberland Plain Woodland and Shale Gravel Transtion Areas of woodland vegetation in the higher elevation areas of the subject land were identified as PCT 849 and the equivalent 'Shale Plains Woodland' as described by Tozer (2003). This PCT consisted of a grassy woodland dominated by *E. moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum). A sparse and variable shrub layer was present within this vegetation community and was dominated by *Bursaria spinosa* subsp. *spinosa* with the exotic shrubs *Olea europaea* subsp. *cuspidata* (African Olive) and *Lycium ferocissimum* (African Box Thorn) also present at low densities. At the time of assessment, the understorey of this community was generally sparse with limited cover although a number of native grasses were common including *Microlaena stipoides* (Weeping Grass) and *Rytidosperma sp*. (Wallaby Grass). A number of exotic species were present including, *Hypochaeris radicata** (Catsear), *Eragrostis curvula** (African Lovegrass), *Paspalum dilatatum** (Paspalum) and *Briza subaristata**. All areas of this PCT consisted of heavily grazed patches which had been under-scrubbed (clearing of shrub layer) and were heavily impacted by weed infestation and canopy thinning. Two vegetation zones, areas of similar broad condition state, were identified for this PCT including areas which were

'under-scrubbed' (selective clearing of the midstorey) and areas of 'revegetation' in which recent planting of native midstorey species has been undertaken where exotic grasslands previously occurred.

Woodland vegetation across areas of lower elevation within the subject land and in proximity to Eskdale, Reedy and Eastern Creek were identified as PCT 835 and the equivalent 'Alluvial woodland' as described by Tozer (2003). This PCT consisted of a grassy woodland dominated by *Eucalyptus tereticornis* (Forest Red Gum) with *E. amplifolia* (Cabbage Gum), *Angophora subvelutina* (Broad-leaved Apple), *A. floribunda* (Rough-barked Apple) and *Casuarina glauca* (Swamp Oak) also present . A number of smaller tree species including *Acacia decurrens* (Black Wattle), *A. parramattensis* (Parramatta Wattle), *Melaleuca linariifolia* (Flax-leaved Paperbark), *M. styphelioides* (Prickly-leaved Tea Tree) and *M. decora* formed a variable sub-canopy which ranged from absent to moderately dense across patches of this PCT. A variable shrub layer was also present within this PCT dominated by *Bursaria spinosa* subsp. *spinosa* (Blackthorn) and *Kunzea ambigua* (Tick Bush) with exotic shrub species present at low densities including *Olea europaea* subsp. *cuspidata** (African Olive), *Lycium ferocissimum** (African Box Thorn), *Ligustrum lucidum* (Broad-leaved Privet) and *L. sinense* (Small-leaved Privet). A grassy understorey was present throughout this PCT including a diverse array of grasses, forbs and sedges with *Themeda triandra* (Kangaroo Grass), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Bothriochloa macra* (Red Grass) and *Aristida* spp. all common. Exotic grasses and forbs were present throughout this vegetation community, with *Setaria parviflora** (Pigeon grass), *Paspalum dilatatum** (Paspalum) and *Axonopus fissifolius** (Narrow-leaved Carpet Grass) most common. Three vegetation zones, areas of similar broad condition state, were identified for PCT835 which included areas termed:

- **Intact** – areas with all structural layers present and native dominated. This vegetation zone occurred in association with Eastern and Reedy Creek.

- **Under-scrubbed** – areas in which shrub and sub-canopy layers were absent due to previous selective clearing and ongoing grazing.

- **Plantings** – areas of dense plantings of native species in association with an artificial channel in the east of the subject land.

Exotic vegetation within the subject land included small areas of exotic shrubs (*Rubus fruticosus sp. agg*) or canopy species (*Cupressus sp.*) and large areas of exotic grasslands. Areas of exotic grassland were dominated by exotic pasture grasses including *Paspalum dilatatum**, *Setaria parviflora**, *Axonopus fissifolius**, *Briza subaristata**, *Cenchrus clandestinus* (Kikuyu) and the cosmopolitan species, *Cynodon dactylon*† (Couch). A number of exotic forbs and sub-shrubs were common within areas of exotic grassland including *Hypochaeris radicata**, *Modiola caroliniana** (Red-flowered Mallow), *Plantago lanceolata** (Plantain), *Sida rhombifolia** (Paddy's Lucerne) and *Solanum sisymbriifolium**. Native grasses and forbs were present at low densities within the areas of exotic grassland including *Microlaena stipoides*, *Rytidosperma racemosum*, *Euchiton involucratus* (Star Cudweed), *Dichondra repens* (Kidney Weed) and *Oxalis perennans*.

A range of fauna habitat features are present throughout the subject land including open woodland with hollow-bearing trees, grassland areas and Anthropocentric structures (e.g. derelict buildings). A total of 49 fauna species (41 native and eight introduced) were recorded within the subject land during opportunistic observations and targeted surveys including six

amphibians, 14 mammals and 29 bird species. A list of fauna species recorded is attached to this referral. No threatened or migratory species listed under the EPBC Act were recorded within the subject land. Based on the list of EPBC Act species identified as potentially occurring on the site from the NSW Bionet Atlas Search and Protected Matters Search Tool and results of previous survey, the only EPBC listed threatened species likely to use the site is the Grey-headed Flying-fox (GHFF). Based upon surveys results, the GHFF is likely to forage across the subject land although no camps or breeding habitat is present.

One threatened fauna species listed under the BC Act (Large-footed Myotis, *Myotis macropus)* was recorded within the subject land and impact assessment and offset requirements have been calculated in accordance with the BAM.

3.2 Describe the hydrology relevant to the project area (including water flows).

The subject land includes the following three creek lines:

- Eskdale Creek is a 2nd order watercourse which flows through the south-east of the subject land. The catchment for Eskdale creek upstream of the subject land is relatively small and predominately includes industrial lands to the west of the subject land and the Westlink M7 Motorway. Eskdale Creek has been modified historically with the current channel size and location the result of historic excavations. It is thought that where Eskdale Creek once occurred as a broad open area of swampy gound, excavation and channelisation are though to have been undertaken to create a narrow defined channel to improve the suitability of the subject land for agricultural purposes. Further, vegetation cover along much of Eskdale Creek has been removed as part of historic vegetation clearing during former use of the subject land by the Department of Defence.

- Reedy Creek is a 3rd order watercourse that runs in a north easterly direction along the south-eastern edge of the subject land. The catchment area of Reedy Creek upstream of the subject land includes predominately cleared agriucltural and industrial land in the suburb of Horsley Park. With the exception of proposed disharges into Reedy Creek from modified portions of Eskdale Creek and from onsite detention basins, Reedy Creek is largely located outside the disturbance footprint & subject land for the proposal.

- Eastern Creek is a 4th order watercourse downstream of its junction with Reedy Creek. The catchment area of Eastern Creek upstream of the subject land includes a combination of cleared agricultural lands within the suburb of Horsley Park and and areas supporting native vegetation within areas of the Western Sydney Parklands. Proposed impacts to the riparian corridor of Eastern Creek would be limited to a single crossing as part of the access to the proposed Business Hub.

The proposed bulk earthworks would involve diversion of a portion of Eskdale Creek within the

subject land. The proposed diversion of Eskdale Creek has been planned in consultation with the NSW Office of Water (now Natural Resources Access Regulator) and has been designed to re-create a more natural hydrological regime, with the current channel size and location of Eskdale Creek though to be the result of historic excavations to increase the suitability of the subject land for grazing purposes.

3.3 Describe the soil and vegetation characteristics relevant to the project area.

Regional-scale soil landscape mapping indicates that the 'South Creek' soil landscape occurs across the vast majority of the subject land with small areas of the 'Blacktown' Soil Landscape occurring in the very western and eastern edges of the subject land (Bannerman and Hazelton 1990).

The Blacktown soil landscape is described as a residual soil occurring on gently undulating rises on Wianamatta Group shales which occurs extensively on the Cumberland lowlands. The 'South Creek' soil landscape occurs in association with the 'Blacktown' soil landscape and is an alluvial soil landscape derived from derived from Wianamatta Group shales which occurs floodplains, valley flats and drainage depressions of the channels on the Cumberland Plain (Bannerman and Hazelton 1990).

The development site consists of a mixture of cleared and/or exotic vegetation, with areas of remnant or regenerating native vegetation, including scattered paddock trees and mostly underscrubbed woodland / open-forest (Specht et al. 1974) with a mixed exotic/native understorey. More intact areas of riparian vegetation are present in association with Eastern Creek which is largely outside the subject land. Plots were undertaken in grassland areas to confirm the presence of exotic pasture and absence of any derived native grassland.

3.4 Describe any outstanding natural features and/or any other important or unique values relevant to the project area.

N/A

3.5 Describe the status of native vegetation relevant to the project area.

The site supports the Critically Endangered Ecological Community (CEEC) Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPW). A total of 0.93 ha of this ecological community was present within the subject land and was in Condition A based upon the following attributes:
- The patch size is greater than 0.5 ha (patch size is 0.97 ha)
- greater than 50% of the perennial understorey vegetation cover is made up of natives (native species comprised approximately 55% of the perennial understorey vegetation)

A further 1.73 ha of vegetation within the subject land has been identified as being CPW, however this vegetation was significantly degraded and does not form part of the ecological community listed under the EPBC Act. These patches occurred as either isolated paddock trees which did not meet the minimum patch size requirements or consisted of patches

where upper tree layer species were not present. A further 8.36 ha of native vegetation comprising River-flat Eucalypt Forest, an Endangered Ecological Community listed under the BC Act was also identified and mapped within the subject land.

3.6 Describe the gradient (or depth range if action is to be taken in a marine area) relevant to the project area.

The subject land is gently inclined from a high point of approximately 53 metres above sea level along the middle of the western boundary of the subject land, falling to approximately 41 metres above sea level on the northern boundary of the subject land adjacent to Eastern Creek.

3.7 Describe the current condition of the environment relevant to the project area.

The subject land consists of a mixture of cleared and/or exotic vegetation, with some areas of remnant or regenerating native vegetation, including scattered paddock trees and mostly under-scrubbed woodland / open-forest (Specht et al. 1974) with a mixed exotic/native understorey. More intact areas of native vegetation occur in association with the Eastern Creek Corridor which occurs to the east of the subject land. Derelict buildings and structures associated with the former Wallgrove Army Base are located within the central part of the development site.

3.8 Describe any Commonwealth Heritage Places or other places recognised as having heritage values relevant to the project area.

N/A

3.9 Describe any Indigenous heritage values relevant to the project area.

N/A

3.10 Describe the tenure of the action area (e.g. freehold, leasehold) relevant to the project area.

The subject land is currently and will remain in the Ownership of the Wester Sydney Parklands Trust (NSW Government). The proposed Business Hub will be leased to a developer under a long-term lease agreement.

3.11 Describe any existing or any proposed uses relevant to the project area.

The subject land is predominantly undeveloped with large areas of cleared land and scattered vegetation, with more densely vegetated areas in the south-western corner and along Eastern Creek. Derelict buildings and structures associated with the former Wallgrove Army Base are located within the central part of the development site.

A 24 metre wide high-pressure gas main easement runs north-south to the east of the development site (and within the Lot 10 boundary). A 6 metre wide trunk sewer main easement is located within the central part of the development site and also runs in a north-south direction.

The development site is surrounded by a variety of land use activities and significant transport and utilities infrastructure as summarised below:

- **North:** the undeveloped land immediately north of the M4 Western Motorway also forms part of the Western Sydney Parklands. The adjoining development to the east and west comprise employment generating land use activities including the Bungarribee industrial estate to the east and the Calibre industrial business park to the west.

- **East:** the Sydney Motorsport Park and Sydney Dragway are immediately east of Ferrers Road, comprising a permanent race track and other motor-related activities, including driver safety and education. Prospect Reservoir is located further east and accommodates Sydney's potable water supply. The reservoir and adjoining nature reserve form part of the Western Sydney Parklands.

- **South**: the SUEZ Eastern Creek Resource Recovery Park is located to the south of the development site, including separation, recycling and re-use of waste materials and landfill operations. Austral Bricks is located further south of the Sydney Water pipeline within the Fairfield LGA.

- **West:** the land to the west of the Westlink M7 Motorway and Wallgrove Road has been developed as the Eastern Creek Business Park including large-scale warehouses, freight and logistics and light industrial activities with ancillary offices.

The existing and likely future development within the immediate locality includes employment-generating activities that benefit from direct access to the metropolitan road network, including the north-south Westlink M7 Motorway and the east-west M4 Western Motorway

Section 4 - Measures to avoid or reduce impacts

Provide a description of measures that will be implemented to avoid, reduce, manage or offset any relevant impacts of the action. Include, if appropriate, any relevant reports or technical advice relating to the feasibility and effectiveness of the proposed measures.

Examples of relevant measures to avoid or reduce impacts may include the timing of works, avoidance of important habitat, specific design measures, or adoption of specific work practices.

4.1 Describe the measures you will undertake to avoid or reduce impact from your proposed action.

Impacts of the proposed action have been avoided and reduced through site selection. The potential impacts are largely located within previously cleared areas supporting exotic grasslands and smaller areas of degraded vegetation including under-scrubbed vegetation. This degradation of habitat within the subject land is quantified in the vegetation integrity scores calculated for vegetation zones within the subject land.

4.2 For matters protected by the EPBC Act that may be affected by the proposed action, describe the proposed environmental outcomes to be achieved.

The proposed impacts to approximately 0.97 ha of Cumberland Plain Woodland and Shale Gravel Transition Woodland (CPW), as listed under the EPBC Act, will be offset in accordance with the requirements of the Biodiversity Assessment Method (BAM; OEH 2017). In accordance with the BAM, impacts will be offset on a 'like-for-like' basis with credits to be sourced from other land supporting equivalent CPW.

Section 5 – Conclusion on the likelihood of significant impacts

A checkbox tick identifies each of the matters of National Environmental Significance you identified in section 2 of this application as likely to be a significant impact.

Review the matters you have identified below. If a matter ticked below has been incorrectly identified you will need to return to Section 2 to edit.

5.1.1 World Heritage Properties

No

5.1.2 National Heritage Places

No

5.1.3 Wetlands of International Importance (declared Ramsar Wetlands)

No

5.1.4 Listed threatened species or any threatened ecological community

No

5.1.5 Listed migratory species

No

5.1.6 Commonwealth marine environment

No

5.1.7 Protection of the environment from actions involving Commonwealth land

No

5.1.8 Great Barrier Reef Marine Park

No

5.1.9 A water resource, in relation to coal/gas/mining

No

5.1.10 Protection of the environment from nuclear actions

No

5.1.11 Protection of the environment from Commonwealth actions

No

5.1.12 Commonwealth Heritage places overseas

No

5.2 If no significant matters are identified, provide the key reasons why you think the proposed action is not likely to have a significant impact on a matter protected under the EPBC Act and therefore not a controlled action.

The proposed action will result in the direct removal and clearing of a small area (0.97 ha) of vegetation which forms part of the Critically Endangered Ecological Community (CEEC) *Cumberland Plain Woodlands and Shale Gravel Transition Forests* (CPW). The area of CPW which would be impacted by the proposal is a small area which is already fragmented and isolated as a result of historic vegetation clearing and ongoing disturbances associated with grazing. The proposal would result in the direct removal and clearing of the 0.97 ha of CPW within the subject land but would not modify or destroy other areas of the community beyond the subject land. With the exception of the small area of CPW proposed to be directly impacted there would be no additional impacts to the community such as impacts to abiotic factors necessary for the survival of the community, impacts to species composition of an occurrence of the ecological community or the decline in the quality or integrity of an occurrence of the ecological community. The impacts to the small, degraded, fragmented and partially isolated stand of CPW would not interfere substanially with the recovery of the ecological community. Further, proposed impacts will be offset in accordance with the NSW Biodiversity Assessment Method (BAM; OEH 2017) which would aim to improve and maintain larger more intact areas of the ecological community.

Section 6 – Environmental record of the person proposing to take the action

Provide details of any proceedings under Commonwealth, State or Territory law against the person proposing to take the action that pertain to the protection of the environment or the conservation and sustainable use of natural resources.

6.1 Does the person taking the action have a satisfactory record of responsible environmental management? Please explain in further detail.

The Western Sydney Parklands Trust (WSPT) has a record of responsible envirnmental management. As part of its ongoing strategic direction to protect the environment, since 2017 the parklands have expanded their bushland corridor by 300 ha to 1,356 ha. Details the environemntal management and environmental achievments of WSPT are outlined within the WSPT draft Plan of Management 2030 and include planting 352,580 indigenous seedlings within the park and investment of over $8.5 M for improved biodiversity and environmental conservation. Additionally, the WSPT draft Plan of Management 2030 outlines the following aims:

- WSPT aims to provide an additional 250 ha of bushland corridors to 1,606 ha (30%) by 2030.

- WSPT has been looking into more sustainable practices, with an aim to decrease potable water use and increase renewable energy for the ongoing parkland operations.

- WSPT has started capturing data on the parklands waterways and is looking to improve waterway health.

- WSPT are working with Blacktown City Council to improve stormwater inflows to Eastern Creek, inclding floodplain rehabilitation and recontouring (within Precint 1 of WSPT , north of Nurragingy reserve)

6.2 Provide details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against either (a) the person proposing to take the action or, (b) if a permit has been applied for in relation to the action – the person making the application.

N/A

6.3 If it is a corporation undertaking the action will the action be taken in accordance with

the corporation's environmental policy and framework?

Yes

6.3.1 If the person taking the action is a corporation, please provide details of the corporation's environmental policy and planning framework.

The WSPT is a self-funded Government agency which was formed by the NSW Parliament in 2006. The ten year vision for the Western Sydney Parklands was formalised by the *2010 Plan of Management* which was adopted by the Minister for Western Sydney on 25 January 2011. The *Parklands Plan of Management 2020 Supplement* was adopted by the Minister for Environment, Minister for Heritage on 2 March 2014. The updated Plan identifies the locations for the proposed land uses, including the business hubs, within the Parklands.

The Plans show that the proposed business hubs are generally located on the perimeter of the Parklands in areas of low conservation or recreation value and close to existing employment areas and the metropolitan road network. The hubs are proposed to be leased to provide ongoing income for the WSPT while the lands are retained in public ownership. The business hubs aim to deliver revenue from 2% of the WSPT land holdings to fund the management and enhancement of the remaining 98% of the Parklands.

The proposed Light Horse Interchange Business Hub forms an important component of the self-funded model for the WSPT. The proposed development of the site is consistent and compatible with the WSPT criteria for a business hub as outlined on page 17 of the *Parklands Plan of Management 2020 Supplement*.

The proposed Light Horse Interchange Business Hub will deliver an ongoing revenue stream for the WSPT and funding for future land acquisition and ongoing regeneration of bushland within the Western Parklands. It will also deliver economic benefits and employment generation for Western Sydney and the Greater Sydney Region.

6.4 Has the person taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?

Yes

6.4.1 EPBC Act No and/or Name of Proposal.

EPBC Act referral No: 2012/6617

Section 7 – Information sources

You are required to provide the references used in preparing the referral including the reliability of the source.

7.1 List references used in preparing the referral (please provide the reference source reliability and any uncertainties of source).

Reference Source	Reliability	Uncertainties
Bannerman SM and Hazelton PA (1990) Soil Landscapes of the Penrith 1:100,000 Sheet map and report, Soil Conservation Service of NSW, Sydney.	High	Nil
Department of the Environment (DotE) (2014). EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory), Commonwealth of Australia, 2014. Available at: http://www.environment.gov.au/system/files/resources/dc2ae592-ff25-4e2c-ada3-843e4dea1dae/files/koalareferral-guidelines.pdf. Accessed 18 January 2019.	High	Nil
Department of the Environment and Energy (DotEE) (2018). National Flying-fox monitoring viewer. Available at: http://www.environment.gov.au/webgis-framework/apps/ffcwide/ffc-wide.jsf. Accessed 17 January 2019	High	Nil
NSW Office of Environment and Heritage (OEH) (2019). NSW Wildlife Atlas - Database Search	High	Nil
Specht, R.L., Roe, E.M. and Boughton, V.H. (1974). Conservation of major plant communities in Australia and Papua New Guinea. Australian	High	Nil

Reference Source	Reliability	Uncertainties
Journal of Botany 7, pp. 1–647.		
NSW Office of Environment and Heritage (2017). Biodiversity Assessment Method. Office of Environment and Heritage for the NSW Government, Sydney.	High	Nil
Pennay M (2010). Personal communication by email, 19 January 2010. New South Wales	High	Nil
Pennay, M. 2002. “Large Pied Bat Chalinolobus dwyeri”. Brigalow Belt South Stage 2 Vertebrate Fauna Survey, Analysis and Modelling Projects. Appendix 2 pages 38 -39. Resource and Conservation Division, Planning NSW, Sydney.	High	Nil
Department of Environment and Climate Change (DECC) 2007. Terrestrial vertebrate fauna of the Greater Southern Sydney region: Volume 2 Species of conservation concern and priority pest species. A joint project between the Sydney Catchment Authority and the Parks and Wildlife Division of the Department of Environment and Climate Change by the Information and Assessment Section, Metropolitan Branch, Climate Change and Environment Protection Group, Department of Environment and Climate Change (NSW).	High	Nil
Hoye G.A. and Dwyer P.D. 1995. Large-eared pied bat Chalinolobus dwyeri. Pp. 510-511 in R. Strahan (Ed.) The Mammals of Australia. Reed Books, Chatswood, NSW.	High	Nil
Kavanagh, R. P. (1984). Seasonal changes in habitat use by gliders and possums in southeastern New South Wales. In Possums and Gliders	High	Nil

Reference Source	Reliability	Uncertainties
(eds A. P. Smith & I. D. Hume), pp. 527-543. Surrey Beatty and Sons, Chipping Norton.		
Eyre, T. J. (2002). Habitat preferences and management of large gliding possums in southern Queensland. Ph.D. thesis, Southern Cross University, Lismore.	High	Nil
NSW Office of Environment and Heritage (OEH) (2018a). Regent Honeyeater – profile. Online at: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10841. Accessed 14 January 2019.	High	Nil
NSW Office of Environment and Heritage (OEH) (2018b). Swift Parrot – profile. Online at: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10455. Accessed 14 January 2019.	High	Nil
Department of Infrastructure, Planning and Natural Resources (2004). Nectar Food Trees – North East NSW. Northern Rivers CMA.	High	Nil
Tozer, M. (2003) The native vegetation of the Cumberland Plain, western Sydney: systematic classification and field identification of communities. Cunninghamia (2003) 8(1): 1–75.	High	Nil
NSW Office of Environment and Heritage (2015). Biodiversity Investment Opportunities Map: Mapping Priority Investment Areas for the Cumberland Subregion. Office of Environment and Heritage NSW, Sydney.	High	Nil

Section 8 – Proposed alternatives

You are required to complete this section if you have any feasible alternatives to taking the proposed action (including not taking the action) that were considered but not proposed.

8.0 Provide a description of the feasible alternative?

The proposed Business Hub has been the result of extensive consultation and planning as documented within the Western Sydney Parklands *2010 Plan of Management* and the *Parklands Plan of Management 2020 Supplement.* As part of this planning a full assessment of the parklands corridor was completed to determine the appropriate Business Hub location. No feasible alternatives were identified for the subject land.

8.1 Select the relevant alternatives related to your proposed action.

8.27 Do you have another alternative?

No

Section 9 – Contacts, signatures and declarations

Where applicable, you must provide the contact details of each of the following entities: Person Proposing the Action; Proposed Designated Proponent and; Person Preparing the Referral. You will also be required to provide signed declarations from each of the identified entities.

9.0 Is the person proposing to take the action an Organisation or an Individual?

Organisation

9.2 Organisation

9.2.1 Job Title

Executive Director

9.2.2 First Name

Suellen

9.2.3 Last Name

Fitzgerald

9.2.4 E-mail

Suellen.Fitzgerald@wspt.nsw.gov.au

9.2.5 Postal Address

Level 7

10 Valentine Avenue
Parramatta NSW 2150
Australia

9.2.6 ABN/ACN

ABN

85202544800 - Western Sydney Parklands Trust

9.2.7 Organisation Telephone

02 9895 7500

9.2.8 Organisation E-mail

info@wspt.nsw.gov.au

9.2.9 I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:

Not applicable

Small Business Declaration

I have read the Department of the Environment and Energy's guidance in the online form concerning the definition of a small a business entity and confirm that I qualify for a small business exemption.

Signature:..... Date: .....

9.2.9.2 I would like to apply for a waiver of full or partial fees under Schedule 1, 5.21A of the EPBC Regulations

No

9.2.9.3 Under sub regulation 5.21A(5), you must include information about the applicant (if not you) the grounds on which the waiver is sought and the reasons why it should be made

Person proposing the action - Declaration

I, SUELLEN FITZGERALD, declare that to the best of my knowledge the information I have given on, or attached to the EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence. I declare that I am not taking the action on behalf of or for the benefit of any other person or entity.

Signature: Suellen Fitzgerald Date: 6/02/19

I, SUELLEN FITZGERALD, the person proposing the action, consent to the designation of _____ as the proponent of the purposes of the action describe in this EPBC Act Referral.

Signature: S. Fitzgerald Date: 6/02/19

9.3 Is the Proposed Designated Proponent an Organisation or Individual?

Organisation

9.5 Organisation

9.5.1 Job Title

Executive Director

9.5.2 First Name

Suellen

9.5.3 Last Name

Fitzgerald

9.5.4 E-mail

Suellen.Fitzgerald@wspt.nsw.gov.au

9.5.5 Postal Address

Level 7

10 Valentine Avenue
Parramatta NSW 2150
Australia

9.5.6 ABN/ACN

ABN

85202544800 - Western Sydney Parklands Trust

9.5.7 Organisation Telephone

02 9895 7500

9.5.8 Organisation E-mail

info@wspt.nsw.gov.au

Proposed designated proponent - Declaration

I, SUELLEN FITZGERALD, the proposed designated proponent, consent to the designation of myself as the proponent for the purposes of the action described in this EPBC Act Referral.

Signature: S. Fitzgerald Date: 6/02/19

9.6 Is the Referring Party an Organisation or Individual?

Organisation

9.8 Organisation

9.8.1 Job Title

Ecologist

9.8.2 First Name

Brian

9.8.3 Last Name

Towle

9.8.4 E-mail

brian.towle@ecoplanning.com.au

9.8.5 Postal Address

74 Hutton Avenue
Bulli NSW 2516
Australia

9.8.6 ABN/ACN

ABN

48602713691 - ECOPLANNING PTY. LTD.

9.8.7 Organisation Telephone

(02) 4244 2736

9.8.8 Organisation E-mail

info@ecoplanning.com.au

Referring Party - Declaration

I, ___Brian Towle_____, I declare that to the best of my knowledge the information I have given on, or attached to this EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence.

Signature:……Date: …13/02/2019……

Appendix A - Attachments

The following attachments have been supplied with this EPBC Act Referral:

1. Fauna_species_list.docx
2. Flora_species_list.docx
3. Lighthorse Interchange Business Hub proposal.jpg
4. Lighthorse Interchange Business Hub site location.jpg
5. Lighthorse Interchange Business Hub vegetation communities.jpg
6. Lighthorse Interchange Business Hub vegetation plots_low_res.jpg
7. WSP - Plan of Management Supplement 2020.pdf