SMEC

Member of the Surbana Jurong Group



SMEC INTERNAL REF: 3002750

Environmental Impact Statement

William Hovell Drive Duplication - duplication of 4.5 kilometres of William Hovell Drive between John Gorton Drive and Drake-Brockman Drive, Belconnen, ACT

Proponent

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27 May 2022

Document Control

Document	William Hovell Drive Duplication
File Location	[X:\Projects\30027\3002750_WHDD\110 Detailed Design\116 Planning Approvals\116-6 EIS
Project Name	William Hovell Drive Duplication
Project Number	3002750
Revision Number	D

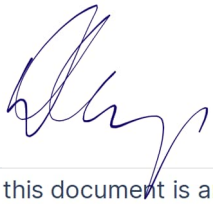
Revision History

Revision No.	Date	Prepared By	Reviewed By	Approved for Issue By
A	22/04/2021	J Miller; R Gray	G Tallentire	D Keep
B	6/05/2021	J Miller; R Gray	G Tallentire	D Keep
C	13/04/2022	J Miller	J Miller L Bochner	D Keep
D	27/05/2022	J Miller	J Miller L Bochner	D Keep

Issue Register

Distribution List	Date Issued	Number of Copies
Infrastructure Delivery Partners Group on behalf of Transport Canberra and City Services, Level 1, 480 Northbourne Avenue, Dickson 2602, Australia	27/05/2022	Issued Electronically
Environmental Planning and Sustainable Development Directorate	27/05/2022	Issued Electronically

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Glossary and Abbreviations

Term & Acronym	Description
ACTPLA	Australian Capital Territory Planning and Land Authority
AEC	Areas of Environmental Concern
Apia Convention	***Convention on Biological Diversity, the Convention on Conservation of Nature in the South Pacific 1990***
AADT	Annual Average Daily Traffic
AS	Australian Standard
BGW	Box-Gum Woodland
BPA	Bushfire prone area
CEMP	Construction Environmental Management Plan
CH	Chainage
CHA	Cultural Heritage Assessment
CITES	***Convention on International Trade in Endangered Species of Wild Fauna and Flora 1975***
Climate Change Strategy	***ACT Climate Change Strategy 2019-2025***
CoRTN	Calculation of Road Traffic Noise 1988
CSTM	Canberra Strategic Transport Model
CTMP	Construction Traffic Management Plan
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DA	Development Application
dB	Decibel – the measure of sound pressure level
Db(A)	Decibel – (A) weighted so that the scale approximates the response of the human ear
DBD	Drake-Brockman Drive
DBYD	Dial Before You Dig
EIS	Environmental Impact Statement
EP Act	***Environment Protection Act 1997***
EPA	Environmental Protection Authority
EPBC Act	Commonwealth ***Environmental Protection and Biodiversity Conservation Act 1999***
EPD	Environment and Planning Directorate
EPR	***Environment Protection Regulation 2005***
EPSDD	Environment, Planning and Sustainable Development Directorate
ESCP	Erosion and Sediment Control Plan

Term & Acronym	Description
ESD	Ecologically Sustainable Development
ESDD	Environmental and Social Due Diligence
FFDI	Forest Fire Danger Index
GDE	Groundwater Dependent Ecosystem
GHG	Greenhouse gas
GSM	Golden Sun Moth (***Synemon plana***)
GWP	Global Warming Potential
IBRA	Interim Biogeographic Regionalisation of Australia
IDPG	Infrastructure Delivery and Partners Group
JGD	John Gorton Drive
KTP	Key threatening process
$L_{aeq,T}$	The steady sound level that, over a specific period of time (T), would produce the same energy as the fluctuating sound level actually occurring
L_{den}	The average sound level over a 24-hour period
Lux	Maximum lighting levels
MNES	Matters of National Environmental Significance
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NARCliM	NSW and ACT Regional Climate Modelling
NATA	National Association of Testing Authorities
NBN	National Broadband Network
NC Act	***Nature Conservation Act 2014***
NDC	Nationally Determined Contribution
Noise Level (Target)	A noise level that should be adopted, acceptable for the area, land use and time of day
OGA	Open graded asphalt
P&D Act	***Planning and Development Act 2007***
PAD	Potential Archaeological Deposit
Project	The duplication of William Hovell Drive between John Gorton Drive (formally Coppins Crossing Road) and Drake-Brockman Drive. The duplication would include about 4.5km of new road, the signalising of the intersection at Drake-Brockman Drive, the upgrade of access to Weetangera Cemetery, the upgrade of underpass for the Bicentennial National Trail and the upgrade of vehicular access for Rangers to Kama Nature Reserve.
Project Site	The area to be directly affected by the Project, in this case, the portion of land within which construction and operation would occur
PTWL	Pink-tail Worm-lizard (***Aprasia parapulchella***)
RAO	Representative Aboriginal Organisation registered under the ***Heritage Act 2004***

Term & Acronym	Description
SBMP	***ACT Strategic Bushfire Management Plan*** (ACT Government, 2019b)
SDHDC	***Single Dwelling Housing Development Code*** (SDHDC, effective 28 October 2016)
SHE	Statement of Heritage Effects
Study Area	Project Site and surrounding area
SCAT	Sydney Coordinated Adaptive Traffic System
SLR	SLR Consulting Australia Pty Ltd
TCCS	Transport Canberra and City Services
TEC	Threatened Ecological Community
UXO	Unexploded ordinance
WHD	William Hovell Drive
WPM&C	The Whitlam Precinct Map and Code (WPM&C, effective 31 July 2021)
WSUD	Water Sensitive Urban Design
WWL	Waterway Works Licence

Executive Summary

SMEC has been engaged by Infrastructure Delivery Partners Group on behalf of Transport Canberra and City Services to undertake the detailed design of the duplication of a 4.5km portion of William Hovell Drive between John Gorton Drive and Drake-Brockman Drive in Molonglo Valley and Belconnen, ACT (the Project). The Infrastructure Delivery Partners Group are a part of Major Projects Canberra, the ACT Government directorate with the responsibility for directing and managing all aspects of major projects invested in by the ACT Government.

Key features of the Project include:

- Duplication of 4.5km of unduplicated road
- Provision of two on-road cycle paths and a dedicated off-road shared path
- A signalised intersection at Drake-Brockman Drive
- Tie in works to the existing road at both ends of the Project
- Upgrade of access road to Weetangera Cemetery from Drake-Brockman Drive
- Upgrade of underpass for the Bicentennial National Trail
- Upgrade of the vehicular access for Rangers to Kama Nature Reserve
- Retention and upgrade works at three existing underpasses
- Retaining wall structures
- Ancillary works such as batters, drainage and safety barriers
- Relocation of utilities such as water and sewer to accommodate new intersection at Drake-Brockman Drive
- Street lighting, median works and other road furniture
- Temporary construction set down areas, compounds and stockpiles
- Retention of 90km/h posted speed limit and 100km/h design speed.

Need for the Project

The portion of William Hovell Drive proposed to be upgraded is the only section of the road that remains unduplicated and operates at over 20,000 vehicles per day which significantly exceeds the capacity of a single carriageway road. Additional traffic generated by new residential development in the estate of Ginninderry (West Belconnen) and the new suburbs of Strathnairn and Macnamara will also be accommodated by the upgrade works. A SIDRA analysis found that the intersection of William Hovell Drive and Drake-Brockman Drive in its current form is expected to fail in 2031, with some movements operating at very high delay in the AM and PM peak periods and as such the overall average performance of the intersection falls below the required level of service. This resulting congestion also creates road safety concerns. The duplication of the road and provision for future delivery of a safe active travel route is expected to reduce congestion and resulting crashes. In addition, increased arterial capacity is expected to reduce the likelihood of east-west rat-running through Hawker, Weetangera, Cook, and Aranda.

This Environmental Impact Statement was prepared to inform consideration of the project by the Environment, Planning and Sustainable Development Directorate. The intention of this report is to provide sufficient background to define the scope of environmental assessment needed to support a development application made under the ***Planning and Development Act 2007***, as well as bilateral assessment of the Project as a Controlled Action under the ***Environment Protection and Biodiversity Conservation Act 1999***.

Alternatives considered

The ***William Hovell Drive Upgrade Feasibility Study Report*** (Calibre, 2018) identified four potential options for the upgrade of William Hovell Drive. These included various upgrade options to enable the existing three travel lanes to be converted to four with a central median.

A multi criteria analysis undertaken indicated that Option B (widening on left hand side of the carriageway (northeast side) was the preferred, or at least equally preferred option, for all of the criteria assessed. The key reasons for preferring Option B (i.e. the current Project subject to this Environmental Impact Statement) include the smallest resulting overall footprint, minimising required haulage, second lowest length of stormwater relocation and culvert extension, minimised impact on native vegetation, no impacts on the potential Molonglo 3 High Voltage alignment on the southern side of William Hovell Drive, being the easiest from a constructability perspective (including with respect to traffic management and safety), and fewer environmental impacts more generally.

The decision to update the existing roundabout with a signalised intersection was the subject of a separate design investigation which examined the benefits and disbenefits of each. The signalised intersection is preferred as it provides significant safety benefits for all users. Indeed, signalising intersections is generally considered the safest treatment to move cyclists and pedestrians over roads. Signals direct the movement of traffic across the intersection, minimising the risk of conflict. Investigations therefore demonstrated that traffic signals are required in order to address the increase in vehicles over the next 10 years as well as provide safe access for pedestrians and cyclists. In 2031, the traffic model shows that in the busiest time (the AM peak), the delays at the new William Hovell Drive/Drake-Brockman Drive signals compared to having the existing roundabout there in 2031 will be:

- Fifty-four additional seconds on Kingsford Smith Drive turning right onto Drake-Brockman Drive
- Twelve minutes less on Drake-Brockman Drive heading towards Belconnen.

Refer to Section 5.1 of this Environmental Impact Statement and the Transport Assessment Report provided in Appendix C for more details.

The preferred option therefore involves signalising the William Hovell Drive and Drake-Brockman Drive intersection when compared to the current intersection (i.e. a roundabout) in order to satisfy intersection performance requirements whilst also limiting future barriers to a range of active travel styles.

Further matters which were considered in finalising this option include:

- Public access directly off this arterial road to the Kama and Pinnacle Nature Reserves was not considered to be a safe option, as the William Hovell Drive road corridor will gradually hold increasing volumes of traffic under a 2031 design scenario. It is understood that Parks and Conservation will work with TCCS to ensure a new Whitlam access point into the Kama Nature Reserve is provided for the future.
- Protection of the two Nature Reserves during construction and minimising any ongoing impacts was identified early as a key priority of the Project.

Following community consultation undertaken in November and December 2021, a revised alignment of the shared user path was developed which relocates the path (between Drake-Brockman Drive and the underpass near the Weetangera Cemetery) to the western side of William Hovell Drive, rather than to the east. This updated alignment:

- Avoids unnecessary impacts to mature vegetation, with impacts being limited to only what is reasonably required to deliver the infrastructure
- Means the shared path can function alongside this Major Road without safety concerns
- Reduces the interface between cyclists and the off-leash dog area, which greatly improves safety for shared path users
- Provides for both experienced and inexperienced cyclists
- Includes the appropriate use of fencing and signage, albeit fencing will be removed at the interface with Bicentennial National Trail to avoid horses feeling “trapped” as riders traverse through this location.

Statutory and planning framework

The ***Planning and Development Act 2007*** as well as the ***Territory Plan 2008*** determine whether a development in the ACT is assessable in the Code, Merit or Impact track. The Project Site is entirely zoned Transport and Services TSZ1 - Transport under the ***Territory Plan 2008***, and Section 8.1 of the ***Territory Plan 2008*** provides that development for the purposes of Major Roads may be undertaken as Merit Track Development within this zone.

Part 4.2 and 4.3 of the ***Planning and Development Act 2007*** detail the activities, areas and processes when an Environmental Impact Statement is required. As per Section 123(b) of the ***Planning and Development Act 2007***, the Project is categorised as Impact Track due to the fact that it is described in Schedule 4 to the Act, and also due to Section 123(e) of the ***Planning and Development Act 2007***, as the Project is a controlled action under the ***Environment Protection and Biodiversity Conservation Act 1999*** which may be assessed under the bilateral process (i.e. by the ACT Government). Section 129 of the ***Planning and Development Act 2007*** sets out matters which must be considered in assessing Impact Track development.

The Project requires preparation of an Environmental Impact Statement under Section 127(2) of the ***Planning and Development Act 2007*** as it is likely to have a significant impact on listed threatened species and ecological communities under the ***Nature Conservation Act 2014*** and Sections 18 and 18A of the ***Environment Protection and Biodiversity Conservation Act 1999***. The relevant triggers are with respect to "Areas and Processes," due to the Project's predicted impacts on listed species (as confirmed via the ***Environment Protection and Biodiversity Conservation Act 1999*** referral), and the proposed clearing of more than 0.5 ha of native vegetation.

Community and stakeholder consultation

Consultation was undertaken with relevant stakeholders such as ACT Government, Federal Government, and various other regulatory entities during the preparation of the Draft Environmental Impact Statement. Matters raised by these stakeholders have been considered when assessing potential impacts and developing management measures.

A Draft version of this Environmental Impact Statement (the Draft Environmental Impact Statement) was submitted concurrently with a Development Application. The Development Application will be determined once this Environmental Impact Statement process is complete. The application number for the Environmental Impact Statement is EIS202000014 and for the Development Application is DA202138722. The public consultation period for the concurrent application was 35 working days, commencing on 5 July 2021. The public consultation period was extended and closed on 30 September 2021. Within these periods, the public could view the Draft Environmental Impact Statement and provide representations (i.e. written comments) on the Project.

Additional community consultation on this Project was undertaken from 8 November to 19 December 2021. Face to face stakeholder and community meetings occurred and feedback on the Project was encouraged via the ACT Government 'Your Say Conversation' online portal. The YourSay conversations feedback portal closed at 11.59 pm Sunday 19 December 2021. Consultation with the local community and stakeholders was therefore undertaken as part of the concurrent Development Application and Environmental Impact Statement processes. A Stakeholder Engagement Report was prepared to summarise the key outcomes of this engagement period and is provided as Appendix J.

Environmental impacts

Beneficial effects of the Project will include the provision of an increased capacity for vehicles to meet the forecast demand of the road, including increased traffic from nearby developments at West Belconnen, Strathnairn and Macnamara. The Project will also increase the safety of road travel within this part of the ACT. It therefore delivers on the aims of the ***ACT Transport Strategy 2020*** by providing safer and more efficient road transport in a growing residential area of the ACT, ensuring better traffic flow between Belconnen and key employment areas such as Civic, Parliamentary Zone and Wooden to a 2031 design scenario. The aims of the ***ACT Transport Strategy 2020*** are also met through the provision of additional shared path connectivity which rectifies a missing link in the current path network between Higgins and City. Moreover, the ***ACT Transport Strategy 2020*** (ACT Government, 2020) also shows that WHD will be used by Orbital (e.g. non-Rapid) bus routes. The increased capacity of the additional lane along WHD will provide improved travel speed and travel time reliability for these bus routes, without bus priority infrastructure, which would be more appropriate for Rapid corridors.

The Project would be delivered under an Environment Protection Agreement entered into between TCCS or its construction contractor under the ***Environment Protection Act 1997*** (refer to Section 3.1.5 below), as the Project involves a Class B activity as listed under Clause 1.3 of Schedule 1 to the Act, being for:

> ***major land development or construction activities, being—***

a) ***land development, or the construction of a commercial building, on a site of 0.3ha or more and including the construction of associated public infrastructure; or***
b) ***the construction of public infrastructure on a site of 0.3ha or more.***

During discussions with the Environment Protection Authority, consensus would be reached as to whether the Project requires a Waterway Works Licence under section 42 of the ***Water Resources Act 2007*** due to the proximity of works to Deep Creek.

The Project will also be delivered in conjunction with an Offset Management Plan to manage potentially significant impacts for threatened species and ecological communities; namely Box Gum Woodland, the Hoary Sunray, Superb Parrot, Pink-tailed Worm-lizard and Striped Legless Lizard.

The Project would directly clear portions of Box Gum Woodland ecological community, which is recognised as a Critically Endangered Ecological Community under the ***Nature Conservation Act 2014*** and the ***Environment Protection and Biodiversity Conservation Act 1999***. Various assemblages of Box Gum Woodland ecological communities can also provide habitat for the following:

- Pink-tailed Worm-lizards (Endangered under the ***Nature Conservation Act 2014 Act*** and Vulnerable under the ***Environment Protection and Biodiversity Conservation Act 1999***)
- Striped Legless Lizards (Vulnerable under the ***Nature Conservation Act 2014*** and the ***Environment Protection and Biodiversity Conservation Act 1999***)
- Hoary Sunray (Endangered under the EPBC Act).

As such, the Project also has the potential to impact on these species. Moreover, seven hollow bearing trees which have the potential to provide Superb Parrot breeding habitat would also be removed as part of the Project (Superb Parrot being Vulnerable under the ***Nature Conservation Act 2014 Act*** and the ***Environment Protection and Biodiversity Conservation Act 1999***).

As the Project will generally be within the existing road easement which is a highly modified environment, it largely avoids impacts on environmental values and land use. Despite best efforts to avoid impacts, there are some adverse environmental effects, most temporary in nature, which are likely to occur, and which therefore require mitigation measures.

This Environmental Impact Statement considers impacts on the following:

- Traffic and transport: A Safety in Design process identified 132 risks during the construction process, ranging from Medium to High, which were reduced to a rating of Very Low to Low with proposed mitigation options. Overall, there are not expected to be any negative impacts on the surrounding transport network from the duplication of William Hovell Drive. Refer to section 5.1 of this revised EIS for further details about traffic and transport impacts and proposed mitigation measures
- Flora and fauna: Identified potential impacts including clearing of vegetation and habitat, fauna injury of mortality resulting from vehicle collision, spread of weeds, exotic fauna and pathogens and noise, light and vibration. Mitigation measures reduced the range of identified risks from High to Significant, to a range of Very Low to Medium. TCCS and SMEC have met with the Conservator and agreed a pathway forward to achieving a Draft Offset Strategy and final Offset Management Plan for the Project. This is based on the first choice of offset being located to the west of Kama Nature Reserve. Offsets would cater to Box Gum Woodland, Hoary Sunray, Pink-tailed Worm-lizard, Superb Parrot and Striped Legless Lizard (recognised Matters of National Environmental Significance under the ***Environment Protection and Biodiversity Conservation Act 1999***). Refer to section 5.2 of this revised EIS for further details about flora and fauna impacts and proposed mitigation measures
- Utilities, infrastructure and lighting: Identified potential impacts including relocation of two existing overhead power poles, protection or relocation of four telecommunication lines and the potential for construction activities to temporarily disrupt communication and power. Proposed mitigation measures reduced the range of identified risks from High to Significant, to a rating of Low. Refer to section 5.3 of this revised EIS for further details about utilities, infrastructure and lighting impacts and proposed mitigation measures
- Heritage: Identified potential impacts including increased visibility of Weetangera Cemetery, and resulting increased risk of opportunistic vandalism, and impacts to the Kama Woodland/Grassland.

Potential for impacts to Aboriginal heritage sites if not identified and appropriately managed. Proposed mitigation measures reduced the identified risks from High, to a range of Very Low to Low. Refer to section 5.4 of this revised EIS for further details about heritage impacts and proposed mitigation measures

- Noise and vibration: Identified potential impacts including noise and vibration impacts from construction works. Increases in operational noise will be minor. Proposed mitigation measures reduced the identified risks from High to Low. Refer to section 5.5 of this revised EIS for further details about noise and vibration impacts and proposed mitigation measures
- Soils, geology and contamination: Identified potential impacts including sedimentation and erosion of soil, discovery of unexpected subsurface contamination, fly-tipped material within the Project's boundary and contamination of soil due to construction activities. Proposed mitigation measures reduced the range of identified risks from High, to a rating of Low. Refer to section 5.6 of this revised EIS for further details about soils, geology and contamination impacts and proposed mitigation measures
- Water quality and hydrology: Identified potential impacts including impacts to surrounding water quality, as well as to flooding and stormwater management systems. Proposed mitigation measures reduced the range of identified risks from High to Very Low. Refer to section 5.7 of this revised EIS for further details about water quality and hydrology impacts and proposed mitigation measures
- Landscape and visual: Identified potential impacts including visual impacts during and after construction, views available to sensitive receivers during construction and operation, impacts on recreational users of the area and consistency of development with values of retained heritage sites or areas of natural environmental values. Proposed mitigation measures reduced the range of identified risks from Very Low to High, to a range of Negligible to Low. Refer to section 5.8 of this revised EIS for further details about landscape and visual impacts and proposed mitigation measures
- Materials and waste: Identified potential impacts including production of waste materials during construction, excessive use of resources in construction and increase in waste to landfill during construction. Proposed mitigation measures reduced the range of identified risks from Very Low to High, to a range of Low to Very Low. Refer to section 5.9 of this revised EIS for further details about materials and waste impacts and proposed mitigation measures
- Climate change: Identified potential impacts including greenhouse gas emissions associated with construction and operation, lack of active transport options and urban heat island effect. Proposed mitigation measures reduced the range of identified risks from High to Very High, to a rating of Low. Refer to section 5.10 of this revised EIS for further details about climate change: impacts and proposed mitigation measures
- Socio-economic and health: Identified potential impacts including access to reserves and open space, as well as work health and safety risks to workers during construction. Proposed mitigation measures reduced the range of identified risks from Very Low to Moderate, to a range of Negligible to Medium (the Medium only being with respect to the timing of this finalised EIS). Refer to section 5.11 of this revised EIS for further details about socio-economic and health impacts and proposed mitigation measures
- Hazards and risks: Identified potential impacts including evacuation and emergency services access during bushfire situations, as well as onsite construction works creating an ignition source. Proposed mitigation measures reduced the range of identified risks from Medium to High, to a rating of Low. Refer to section 5.12 of this revised EIS for further details about hazards and risks impacts and proposed mitigation measures.

Adverse environmental impacts will be minimised by implementing mitigation measures outlined in this Environmental Impact Statement, and will include preparing and implementing a Construction Environmental Management Plan. TCCS will also enter into an Environment Protection Agreement with the ACT Environment Protection Authority.

Justification and conclusion

The Project will result in both beneficial and adverse impacts, however the mitigation measures summarised in this Environmental Impact Statement will manage and mitigate the identified adverse impacts. The Project is also directly aligned with various Statements of Strategic Directions as recognised within the ***Territory Plan 2008***, and furthermore meets the principles of Ecologically Sustainable Development as recognised under Section 9 of the ***Planning and Development Act 2007*** and Section 3A of the ***Environment Protection and Biodiversity Conservation Act 1999***.

Overall, it is recommended that the Project be approved, subject to suitable mitigation measures.

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1 Introduction

This Environmental Impact Statement (EIS) report has been prepared for the ACT Minister for Planning and Land Management regarding duplication of William Hovell Drive (WHD) between John Gorton Drive (JGD) and Drake-Brockman Drive (DBD) in Molonglo Valley and Belconnen (the Project).

The Project is a development of a type that meets Section 123 of the ***Planning and Development Act 2007*** (P&D Act) as it involves an activity mentioned in Schedule 4 of the P&D Act, therefore requiring an EIS to be prepared. A Draft version of this EIS (the Draft EIS) was submitted concurrently with a Development Application (DA) in July 2021. The DA will be determined once this EIS process is complete. The application number for the EIS is EIS202000014 and for the DA is DA202138722. The public consultation period for the concurrent application was 35 working days, commencing on 5 July 2021. The public consultation period was extended and closed on 30 September 2021. Within these periods, the public could view the Draft EIS and provide written comments (a representation) on the Project.

Additional community consultation on this project was undertaken from 8 November to 19 December 2021. Face to face stakeholder and community meetings occurred and feedback on the Project was encouraged via the ACT Government 'Your Say Conversation' online portal. The YourSay conversations feedback portal closed at 11.59pm Sunday 19 December 2021. Consultation with the local community and stakeholders was therefore undertaken as part of the concurrent DA and EIS processes.

The Project was also referred to the Australian Minister for the Commonwealth Department of Agriculture, Water and the Environment (DAWE), and was determined to be a controlled action under the ***Environmental Protection and Biodiversity Conservation Act 1999*** (EPBC Act) on 28 July 2020. This EIS therefore includes an assessment of the matters required by the Commonwealth to enable the Project to be assessed under the Australian Capital Territory Bilateral Agreement.

Overall, the Project as it has been revised in this version of the EIS is considered to best meet the objects of the P&D Act by delivering orderly and sustainable development consistent with the aspirations of Territorians, and in accordance with sound financial principles. It delivers on the aims of the ***ACT Transport Strategy 2020*** by providing safer and more efficient road transport in a growing residential area of the ACT, ensuring better traffic flow between Belconnen and key employment areas such as Civic, Parliamentary Zone and Wooden to a 2031 design scenario. The aims of the ***ACT Transport Strategy 2020*** are also met through the provision of additional shared path connectivity which rectifies a missing link in the current path network between Higgins and City. The ***ACT Transport Strategy 2020*** (ACT Government, 2020) also shows that WHD will be used by Orbital (e.g. non-Rapid) bus routes. The increased capacity of the additional lane along WHD will provide improved travel speed and travel time reliability for these bus routes, without bus priority infrastructure, which would be more appropriate for Rapid corridors.

The Project will also be delivered in conjunction with an Offset Management Plan to manage potential impacts for threatened species and ecological communities; namely Box Gum Woodland, the Hoary Sunray, Superb Parrot, Pink-tailed Worm-lizard and Striped Legless Lizard.

1.1 Project Description

Transport Canberra and City Services (TCCS) proposes to duplicate WHD between JGD (formally Coppins Crossing Road) and DBD (the Project). The duplication will include about 4.5km of new road, the signalising of the intersection at DBD, the upgrade of access to Weetangera Cemetery, the upgrade of underpass for the Bicentennial National Trail and the upgrade of vehicular access for Rangers to Kama Nature Reserve.

The Project includes the construction of new batters, retaining walls, drainage, safety barriers and street lighting. In addition, it includes the upgrade of existing structures including culverts and underpasses, median works, tie in works at both ends of WHD and landscaping works. A median barrier for improved safety along with the proposed duplication will also improve traffic flow during same direction accident situations.

The protection, adjustment and/or relocation of any affected services including electricity, water supply mains, stormwater and telecommunications will also occur if required.

These elements of the Project are summarised as follows:

- Duplication of 4.5km of unduplicated road
- Provision of two on-road cycle paths and a dedicated off-road shared path
- A signalised intersection at DBD
- Tie in works to the existing road at both ends of the Project
- Upgrade of access road to Weetangera Cemetery from DBD
- Upgrade of underpass for the Bicentennial National Trail
- Upgrade of the vehicular access for Rangers to Kama Nature Reserve
- Retention and upgrade works at three existing underpasses
- Retaining wall structures
- Ancillary works such as batters, drainage and safety barriers
- Relocation of utilities such as water and sewer to accommodate new intersection at DBD
- Street lighting, median works and other road furniture
- Temporary construction set down areas, compounds and stockpiles
- Retention of 90km/h posted speed limit and 100km/h design speed.

1.2 Project need and justification

The section of road between JGD and DBD is the only remaining unduplicated section of WHD. WHD is subject to traffic congestion, with around 20,000 vehicles per day travelling along the alignment, particularly during both the AM and PM peaks. Congestion is expected to continue increasing as the area also continues to be developed, including the adjoining regions of Molonglo Valley, the estate of Ginninderry (West Belconnen) and the new suburbs of Strathnairn and Macnamara.

Moreover, this section of WHD has a poor crash history record, with a relatively high number of serious crashes and safety issues identified along the alignment. The Project has the potential to reduce the frequency and severity of traffic incidents along this section of road. The Project will also retain the existing alignment of the Bicentennial National Trail, whilst finalising the missing shared path link between Higgins and City. This connection to the existing shared path adjacent to Bindubi Street offers users a safe, direct connection to Civic and the trunk cycle network around Lake Burley Griffin. Providing good access to this shared path will encourage broader use and less reliance on private cars. Given the rate of new residential development in the locality, there is likely to be a higher demand for various forms of active travel in the area. Whilst the suburb of Whitlam is still being developed, the path will also allow for connections with that area.

The Project is aligned with the objects of the P&D Act by delivering orderly and sustainable development consistent with the aspirations of Territorians, and in accordance with sound financial principles. Not proceeding with the Project would also mean that key aims under the ***ACT Transport Strategy 2020*** are not catered to in this part of the ACT, in terms of both road user safety and the improved provision of active travel options, and with decreased congestion for future Orbital public transport services along this route. Indeed, not proceeding with the Project alongside growing traffic demand in this locality would continue to exacerbate unnecessary safety risks for road users who travel along this stretch of road. The Project will generate significant safety benefits for such road users.

1.3 Purpose and structure of this report

An EIS is required to be prepared under Section 127(2) of the P&D Act. This report constitutes an EIS which has been prepared in support of the Project. The Project requires impact track assessment by virtue of Subsections 123(b) and (e) of the P&D Act, as it meets the triggers listed in Items 1 and 2 of Part 4.3 to Schedule 4 of the P&D

Act (refer to Section 3.1.1 below). These relevant impact track triggers relate to the Project's potential impact on listed species (as confirmed by its controlled action status) and will require the clearing of more than 0.5ha of native vegetation.

This EIS contains the following Chapters in order to respond to those matters:

- Introduction
- Project Details
- Legislative and Strategic Context
- Risk Assessment
- Assessment of Impacts
- Stakeholder Engagement and Consultation
- Recommendations
- Conclusion
- References
- Appendices.

1.4 Scoping Document

An initial Scoping Report was provided to the Australian Capital Territory Planning and Land Authority (ACTPLA) on 4 September 2020 (SMEC, 2020a). ACTPLA's Scoping Document for the Project was thereafter provided on 19 October 2020 in accordance with Section 212 of the P&D Act.

A Draft EIS and this subsequent revised EIS were prepared with reference to the Scoping Document dated 19 October 2020, and also with respect to the relevant matters for assessment set out within Section 129 of the P&D Act. Table 1-1 below identifies the Sections of this EIS where the requirements of the Scoping Document are addressed.

Table 1-1 Sections of the EIS where Scoping Document requirements are addressed

Scoping Document Reference	Description	Section of this EIS
1. Cover Page	• Project title • The date of the preparation of the document • Full name and postal address of the designated proponent • Name and contact details of the person/organisation who prepared the documents	Cover Page
2. Glossary	Provides a glossary of technical terms, acronyms and abbreviations used in the EIS	Page iii
3. Executive Summary	Non-technical description of the Project	Page v
4. Introduction	Summarise the background of the Project	Chapter 1
5.1 Proposal Details	Provide a description of the proposal, including: a) The objectives for the proposal	Section 2.1
	b) The location of the land to which the proposal relates, including detailed maps	Table 2-1 in Section 2.1 and

Scoping Document Reference	Description	Section of this EIS
		Figure 2-1 in Section 2.2.1
	c) The division and/or district names and block and/or section numbers of the land under the Districts Act 2002	Table 2-1 in Section 2.1
	d) If the land is leased – the lessee's name	Table 2-1 in Section 2.1
	e) If the land is unleased or public land – the custodian of the land	Table 2-1 in Section 2.1
	f) The purposes for which the land may be used	Table 2-1 in Section 2.1
	g) A clear identification of all lands subject to direct disturbance from the proposal and associated infrastructure and geomorphic features such as waterways and wetlands. This is to be supported by a map showing all affected lands	Figure 2-7
	h) An outline of any developments that have been, or are being, undertaken by the proponent, or other person(s) or entities on the land subject to this proposal	Table 2-1 in Section 2.1
	i) A description of all the components of the proposal, including the proposal specifications, the predicted timescale for implementation (design, approvals, construction and decommissioning) and project life	Sections 2.1 to 2.3
5.2. Alternatives to the Proposal	Provide details of any alternatives to the proposal considered in developing the proposal including a description of: a) Any alternatives to the proposal and provide reasons for selecting the preferred option (including any criteria used) with an analysis of site selection as an attachment to the EIS	Section 2.4
	b) Any matters considered to avoid or reduce potential impacts prior to the selection of the preferred option	Section 2.4
	c) Details of the consequences of not proceeding with the proposal.	Section 2.5
6. Legislative and Strategic Context	A description of the EIS process including any statutory approvals obtained or required for the proposal, and how the proposal is aligned with strategic priorities for the ACT.	Chapter 3
6.1. Statutory requirements	The description must include information on statutory requirements for the preparation of an EIS: • ***Planning and Development Act 2007*** • ***Planning and Development Regulation 2008*** • Related statutory approvals.	Section 3.1
6.2. Climate change	The EIS must include information on how the proposal will reduce the risks from climate change impacts and include proposed adaptation measures to reduce vulnerability and increase resilience of the community and the Territory, particularly the extreme events of heatwaves, droughts, storms with flash flooding and bushfires. The	Sections 3.2 and 5.10

Scoping Document Reference	Description	Section of this EIS
	information must address impacts on the local microclimate and how it will avoid contribution to urban heat and positively contribute to urban cooling measures. Additionally, the EIS must address the contribution the proposal will make to reducing greenhouse gas emissions and meeting the legislated target for a net zero emissions Territory (by 2045 at the latest). Preparation of the EIS must consider the relevant sections of the following ACT Government policies: • ACT Climate Change Strategy 2019-2025 • Canberra's Living Infrastructure Plan: Cooling the City.	
6.3. Other requirements	The description must also include information on how each of the following has been considered in the preparation of the EIS and the development of the proposal: • Territory Plan 2008 • ACT Planning Strategy • National Capital Plan • Relevant Environment Protection Policies and Environment Protection Guidelines (https://www.environment.act.gov.au/about/legislation_and_policies) • Transport for Canberra policy • Other relevant planning and environmental guidelines and management plans.	Section 3.3
6.3.1. Ecologically sustainable development	Provide a description of how the proposed development demonstrates ESD. This is to include long-term and short-term considerations related to economic development, social development and environmental protection at local, regional and national scales. The proponent should ensure that the EIS adequately addresses the ESD principles as defined by section 9 of the P&D Act.	Section 3.3.7
6.3.2. Territory Plan strategic directions	A statement must be provided regarding the proposal's consistency with the principles in the Statement of Strategic Directions in the ***Territory Plan 2008*** (Section 2.1 - Strategic Direction).	Section 3.3
7.1. Risk Assessment Methodology	Provide a risk assessment in accordance with the Australian and New Zealand Standard for risk management AS/NZS ISO 31000:2009 Risk Management – Principles and guidelines. The proposed criteria for determining which risks are potentially significant impacts must be described. ***Note: Various risks are identified by the Authority within the Scoping Document, which are required to be assessed within this Draft EIS.***	Chapter 4
8. Assessment of Impacts	Sufficient information is required to provide the Authority with an adequate understanding of the environmental impacts associated with the proposal.	Chapter 5

Scoping Document Reference	Description	Section of this EIS
	Each risk identified in Table 1 and in the proponent's PRA must be addressed, and structured, as set out in sections 8.1.1-8.1.5 below.	
8.1. Standard requirements	Methodology of Environmental conditions and values, investigations, impact, mitigation and residual risk.	Chapter 5
8.2. Detailed requirements	8.2.1. Traffic and transport • Provide a Traffic Impact Assessment prepared by a suitably qualified consultant that describes: o Traffic disruptions and other impacts during construction o The impacts to the current and future urban areas o Impacts on road safety and operation, particularly to vulnerable road users o The likely volume of traffic proposed to be accommodated during operation o How construction vehicle movement and parking will be managed.	Section 5.1 and Appendix C
	8.2.2. Flora and Fauna • Provide an Ecological Impact Assessment prepared by a suitably qualified consultant • Assess the direct impacts on flora and fauna in particular Golden Sun Moth, Pink-tailed Worm Lizard, Superb Parrot, Swift Parrot and any other threatened species and threatened ecological communities including Box Gum Woodland • Describe the impact of habitat fragmentation caused by the development, particularly the potential loss of wildlife movement corridors and habitat connections • Discuss the impact of night lighting and noise on nocturnal fauna and flora • Describe the impacts increased animal strikes and roadkill may have on threatened and non-threatened species, particularly kangaroos and threatened fauna and methods to mitigate these • Discuss the potential impacts to the adjacent nature reserves, including impacts from altered hydrology patterns and spread of invasive plants • Outline mitigation arrangement and whether an offset is likely to be required and, if so, how they comply with the EPBC Act environmental offsets policy and whether an offset management plan is likely to be required • Consider whether ongoing management, monitoring or reporting regimes are required.	Section 5.2 and Appendix D
	8.2.3. Utilities and infrastructure • Describe the existing utilities located on the land subject to this proposal • Describe any new utilities, removal or realignments required as a result of this development	Section 5.3

Scoping Document Reference	Description	Section of this EIS
	• Describe the impacts of planned and unplanned service disruptions, including to vital services such as health and emergency services.	
	8.2.4. Heritage • Provide a Cultural Heritage Assessment prepared by a suitably qualified consultant that includes details of all known heritage items and places, including but not limited to the Weetangera Cemetery, the Kama nature reserve and potential archaeological deposits • Describe the impact of construction and operation on known and unknown heritage items and places and measures to mitigate these.	Section 5.4 and Appendix E
	8.2.5. Noise, vibration and lighting • Provide an updated acoustic impact assessment prepared by a suitably qualified consultant • Identify any existing nearby sensitive receivers that could be affected by construction and operation of this proposal • Describe the impacts of noise and vibration on sensitive receivers during construction and operation, including current and future residents in Whitlam and Hawker • Consider noise source reduction measures attributed to both engine noise and road surface noise • Describe the impacts of light on sensitive receivers during construction and operation, including current and future residents in Whitlam and Hawker.	Refer to Sections 5.3, Section 5.5 and Appendix F
	8.2.6. Soils and Geology • Discuss any contamination impacts on site and how these will be managed during construction, particularly in areas where soil is proposed to be reused • Describe the impacts of soil erosion and sedimentation, and contaminated water run-off including from oils and other contaminants from vehicles during construction and operation and how these will be managed.	Section 5.6
	8.2.7. Water Quality and Hydrology • Describe the impacts of construction and operation on water quality in downstream waterways, including the Molonglo River and Deep Creek, including the proposed future Deep Creek Water Quality Control Pond • Describe the impact of sediment and road surface run-off entering nearby waterways • Describe the impacts of changes to water flow regimes, including consequences of increased water flow during large rainfall events.	Section 5.7
	8.2.8. Hazards and Risks • Describe the risk and impacts of a bushfire starting during construction • Describe the impact of a bushfire starting off site on assets and workers during construction	Section 5.7and Section 5.12

Scoping Document Reference	Description	Section of this EIS
	• Describe the impact of a large rainfall event on road infrastructure, the site and the downstream environment.	
	8.2.9. Landscape and Visual • Undertake a visual assessment and/or provide perspectives of the proposal from local vantage points • Describe the visual impact of the development on sensitive receivers during operation, including to current and future residents in Whitlam and Hawker.	Section 5.8
	8.2.10. Materials and Waste • Describe how construction waste will be managed, including disposal to landfill.	Section 5.9
	8.2.11. Climate Change • Describe the greenhouse gas emissions produced during construction and operation and the impact of these on climate change • Discuss how the proposal is consistent with ACT and national policies • Describe the urban heat impacts associated with the removal of a soft landscape and replacement with impervious surfaces.	Sections 5.10
	8.2.12. Socio-economic and health • Describe the impact on recreational users of the surrounding areas, including but not limited to the Bicentennial National Trail and adjacent open spaces and nature reserves • Provide details of any potential contaminants that may pose health risks to workers during construction.	Section 5.11
	8.2.13. Matters of National Environmental Significance (MNES) • Describe the impact on Box Gum Woodland, Superb Parrot, Swift Parrot, Golden Sun Moth and any other MNES potentially impacted by the project • For any matters identified as potentially impacted provide a description of the relevant impacts of the action including: o A detailed discussion of known threats o A detailed assessment of direct and indirect impacts on areas of habitat and populations of listed threatened species during pre-construction, construction and operation o Detailed information on the extent (in hectares) of known and potential habitat that occurs in the proposed site and surrounds which may potentially be impacted by the proposal o A detailed assessment of the nature and extent of the likely short term and long-term relevant impacts o A statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible	Sections 5.2 and Appendix D

Scoping Document Reference	Description	Section of this EIS
	• Outline how the proposal is consistent with: o Australia's obligations under the Convention on Biological Diversity, the Convention on Conservation of Nature in the South Pacific (Apia Convention), or the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) o Any relevant recovery plans or threat abatement plans o Any relevant strategic assessment reports o Any relevant Commonwealth recovery plans or threat abatement plans • If offsets are proposed to compensate for impacts on MNES, describe the proposed offsets and how they comply with the EPBC Act environmental offsets policy.	
8.3 Entity requirements	Addressing entity comments provided with the Scoping Document	Chapter 5 and Appendix B
9. Community and stakeholder consultation	Provides an overview of the community and stakeholder consultation processes that have been undertaken regarding the overall development of the proposal.	Chapter 6
	A1. Conservator of Flora and Fauna	Section 5.2, Chapter 6 and Appendix D
	A2. Environment Protection Authority (EPA)	Chapter 5 and Chapter 6
	A3. Emergency Services Agency (ESA)	Chapter 5 and Chapter 6
	A4. ACT Health	Chapter 5 and Chapter 6
	A5. ACT Heritage Council	Section 5.4
	A6. Development Coordination Branch, City Services, Transport Canberra and City Services (TCCS)	Section 5.1 and Chapter 6
	A7. Icon Water	Section 5.3
	A8. Jemena	Section 5.3
	A9. Suburban Land Agency (SLA)	Chapter 6
	A10. National Capital Authority (NCA)	Chapter 6
10. Recommendations	Provide a summary of any commitments to impact prevention, mitigation measures, offsetting measures and other actions within the EIS. Describe the monitoring parameters, monitoring points, frequency, data interpretation and reporting proposals.	Chapter 7

Scoping Document Reference	Description	Section of this EIS
11. Other relevant information		NA
12. References	A reference list using standard referencing systems must be included.	Chapter 9
13. Required Appendices	13.1. Scoping document for the EIS	Appendix B
	13.2. Scoping Document Reference	This Table 1-1
	13.3. Proponent's Environmental History	Table 2-1 in Section 2.1
	13.4. Information Sources	Chapter 9
	13.5. Study team	Appendix H
	13.6. Specialist studies	Appendix C to Appendix F
	13.7. Research	Chapter 5 and Chapter 9
Attachment A	Department of Agriculture, Water and the Environment (Commonwealth Government) Sets out parameters for assessment of impacts to listed species and ecological communities.	Chapter 6

2 Project Details

2.1 Project description

Table 2-1 Proponent and site identification

Item	Details
Location	The road duplication is proposed within the road reserve extending from JGD to DBD. This Site is unleased Territory land, with TCCS – Roads ACT as the custodian. The proposed locations for site compounds and stockpile areas are incorporated within the road reserve, and include: • Site Compound 1 located adjacent JGD intersection, approximate size 19,200m² • Site Compound 2 located at DBD intersection, approximate size 10,000m² • Stockpile Site 1 located at CH3500, approximate size 9,600m² • Stockpile Site 2 located at CH2100, approximate size 6,000m².
Existing land use	Road reserve.
Previous works	Construction and maintenance of the site as a road reserve. Potholing works have been recently undertaken to support the Detailed Design of the Project.
Total length	4.5km portion of WHD between JGD and DBD.
Proponent	Infrastructure Delivery Partners Group Callam Offices, Level 3, 50 Easy Street Phillip ACT 2606 | PO Box 158 Canberra ACT 2601 on behalf of Transport Canberra and City Services Level 1, 480 Northbourne Avenue, Dickson 2602 | GPO Box 158 Canberra ACT 2601.
Environmental performance history	SMEC has been engaged by the Infrastructure Delivery Partners Group on behalf of TCCS to undertake the detailed design and assessment of the duplication of WHD. The Infrastructure Delivery Partners Group are a part of Major Projects Canberra, the ACT Government directorate with the responsibility for directing and managing all aspects of major projects invested in by the ACT Government. The ACT Government takes a proactive and responsible approach to environmental management. As a custodian of transport services land within the ACT, TCCS has a quality history of environmental performance within the ACT more broadly. IDGP/TCCS/Major Projects Canberra has not been involved in 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. IDGP/TCCS/Major Projects Canberra will be undertaking the Proposal in accordance with their environmental policy and framework. The Project would be delivered in accordance with relevant ACT Government policies and guidelines. IDGP/TCCS/Major Projects Canberra has extensive experience with projects that have that have previously been referred under the EPBC Act.

Item	Details
	The following is a list of past proposals that were referred under the EPBC Act, indicating the experience of these ACT Government entities and their predecessors in successfully completing projects in accordance with environmental governance and compliance: • **2014/7327:** ACT Economic Development Directorate. o Symonston Residential Estate Stage 2, Symonston, ACT • **2015/7483:** ACT Shared Services Procurement/Transport. Construction of a link road on Majura Parkway, Pialligo, ACT • **2016/7742:** ACT Procurement/Transport. Construction of the IKEA Canberra Northern Access Road, ACT • **2016/7781:** Land Development Agency. Urban Development of part Block 5 Section 10 Greenway • **2017/8013:** Environment, Planning and Sustainable Development Directorate. Construction of public housing units within Block 29, Section 36, Mawson, ACT • **2017/8061:** Chief Minister, Treasury and Economic Development Directorate. Molonglo 3 Water Supply Pipeline, ACT • **2017/8074:** Chief Minister, Treasury and Economic Development Directorate - ACT Procurement. Canberra Brickworks Development, Blocks 1, 7 and 20, Section 102, Yarralumla, ACT • **2017/8093:** Environment Planning and Sustainable Development Directorate. Mulligans Flat Woodland Sanctuary –Goorooyarroo extension of predator proof fence, ACT • **2019/8449:** City Renewal Authority. City Hill Section 63 Redevelopment Project, ACT • **2019/8582:** Major Projects Canberra. City to Commonwealth Park Light Rail Project, ACT • **2019/8491:** Major Projects Canberra. City to Commonwealth Park Light Rail Project, ACT • **2019/8490:** Chief Minister, Treasury and Economic Development Directorate - ACT Procurement. City to Commonwealth Park Light Rail Project, ACT.
Land zoning	Transport and Services – TSZ1 - Transport under the ***Territory Plan 2008***.
Purposes for which the land may be used	As specified in Section 8.1 of the Territory Plan 2008, the following land uses may be undertaken as Merit Track Development within the Transport and Services TSZ1 zone: • Ancillary use minor road • Car park minor use • Communications facility pedestrian plaza • Consolidation public transport facility • Demolition sign • Development in a location and of a type identified • In a precinct map as additional merit track • Development • Subdivision • Major road temporary use • Major service conduits varying a lease (where not prohibited, code track or impact track assessable.).
Existing approval applying to the Project	None.

2.2 Project Objectives

The objectives of the Project are to:

- Increase the capacity of WHD so as to relieve the AM and PM traffic congestion from West Belconnen whilst also improving road safety and efficiency of car emissions
- Serve growing residential suburbs within the broader locality
- Increase the provision of active transport options within the region
- Meet the needs of a range of active transport and recreational land users in the locality, including pedestrians, dog owners, horse riders, and both on-road and off-road cyclists
- Rectify a missing link in the current shared path network between Higgins and City
- Retain as many hollow bearing trees as possible
- Design the overall road width to be as narrow as possible between the two Nature Reserves
- Have no more environmental impact than is necessary to deliver an optimum road design for this section of the WHD corridor
- Protection of the two Nature Reserves during construction and minimise ongoing impacts to them
- Avoid impacts to heritage items where reasonable and feasible to do so
- Deliver an Offset Management Plan which meets the requirements of threatened species under the ***Nature Conservation Act 2014*** (NC Act) and the EPBC Act
- Provide for the orderly development of the ACT
- Meet the principles of ecologically sustainable development.

2.2.1 Project location

The proposed road duplication is to be completely contained to the road reserve extending from JGD to DBD. This Site is unleased Territory land, with TCCS – Roads ACT as the custodian. The land is zoned TSZ1 – Transport under the Territory Plan, and runs adjacent to parcels of leased rural land, nature reserves and existing and future urban areas (Blocks 1385 and 1565).

Proposed locations for site compounds and stockpile areas include:

- Site Compound 1 located adjacent JGD intersection, approximate size 19,000m²
- Site Compound 2 located at DBD intersection, approximate size 10,000m²
- Stockpile Site 1 located at CH3500, approximate size 10,000m²
- Stockpile Site 2 located at CH2100, approximate size 6,000m².

Figure 2-1 provides a map of the Project Site and surrounding Study Area more broadly.

The Project Site crosses a hillside that sweeps to the south of The Pinnacle Extension Nature Reserve and to the north of the Kama Nature Reserve. From the intersection with JGD, WHD declines slightly and then steadily increases in gradient toward the Kama and The Pinnacle Extension Nature Reserves. The road turns slightly to the north and continues to increase in gradient with the highest point located near the Weetangera Cemetery.

Centrally through the alignment, the embankment on the south-western side of WHD becomes relatively steep, with views from the road reserve over rural rolling hills toward development in the Molonglo Valley. Mounds of fill from the previous construction of WHD are located along the north-eastern side of the alignment and generally obscure views from the road.

The Project is located entirely within the Murrumbateman Interim Biogeographic Regionalisation of Australia (IBRA) Subregion of the South Eastern Highlands IBRA Bioregion (IBRA v.7). The Murrumbateman IBRA Subregion covers an area of approximately 630,454ha. Figure 2-2, Figure 2-3 and Figure 2-4 contain photographs of the Project Site and surrounding landscape.



Figure 2-1 Project Site



Figure 2-2 Photograph taken south-east, adjacent to Whitlam and looking toward the intersection with JGD (SMEC, 2021)



Figure 2-3 Photograph taken looking north-west along WHD to the north of Whitlam (SMEC, 2021)



Figure 2-4 Photograph taken from top of fill mound looking south-west over rural hills toward development in Molonglo Valley (SMEC, 2021)

2.2.2 Key Features

The duplication of WHD will occur along the 4.5km stretch of road between JGD and DBD in the districts of Molonglo Valley and Belconnen, ACT. The Project comprises the following:

- Duplication of 4.5km of unduplicated road
- Two on-road cycle paths and a dedicated off-road shared path
- A signalised intersection at DBD
- Tie in works to the existing road at both ends of the Project
- Upgrade of access road to Weetangera Cemetery from DBD
- Upgrade of underpass for the Bicentennial National Trail
- Upgrade of the vehicular access for Rangers to Kama Nature Reserve
- Retention and upgrade work of three existing underpasses
- Retaining wall structures
- Ancillary works such as batters, drainage and safety barriers
- Relocation of utilities such as water and sewer to accommodate new intersection at DBD
- Street lighting, median work and other road furniture
- Temporary construction set down areas, compounds and stockpiles
- Retention of 90km/h posted speed limit and 100km/h design speed.

The preliminary footprint of the project is approximately 31.9ha (including 8ha of existing road). This has been derived by adopting a 10m construction buffer for the majority of the Project (note that in some areas, this buffer

is reduced to around 5m). Preliminary engineering design for the Project has considered a 40-year design life for pavement, with a 100-year design life for underpasses and bridge structures.

A general arrangement plan of the proposed road duplication is provided in Appendix A and is reproduced in Figure 2-5 below.

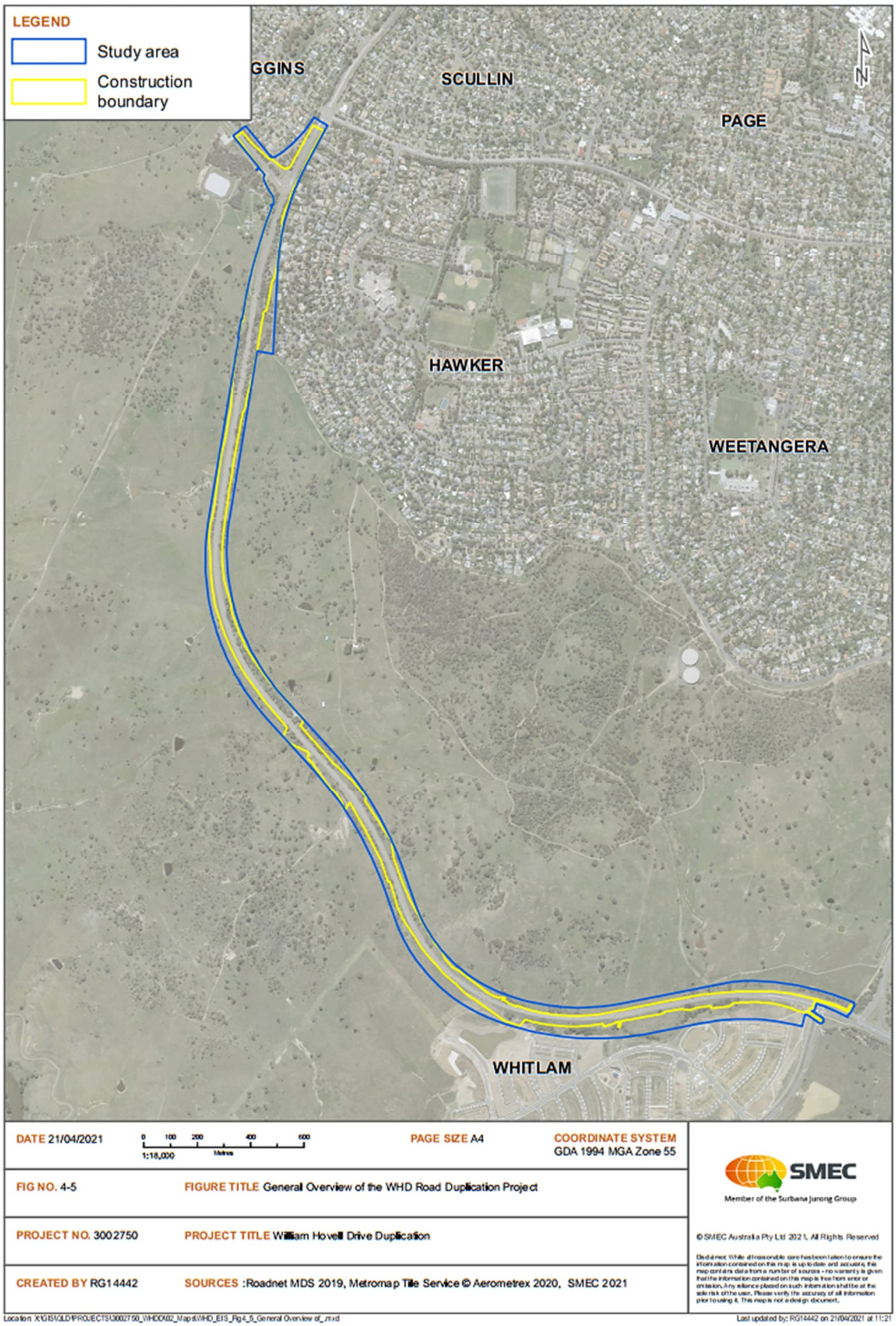


Figure 2-5 General overview of the WHD Road Duplication Project

2.2.3 Project Setting

Surrounding Land Uses

The Project is contained within the road reserve extending from JGD in the south to DBD in the north. The Project will tie into the existing road network to the east of JGD and includes a signalised intersection at DBD. The Project Site currently contains a two-way road, with a 90kmph speed limit and one lane in each direction.

Surrounding land uses include rural leases, suburban areas and nature reserves. The new suburb of Whitlam is currently under construction by the Suburban Land Agency on the parcel of land extending west of JGD and south of the Project, to the eastern edge of the Kama Nature Reserve (refer to Figure 2-6 below).

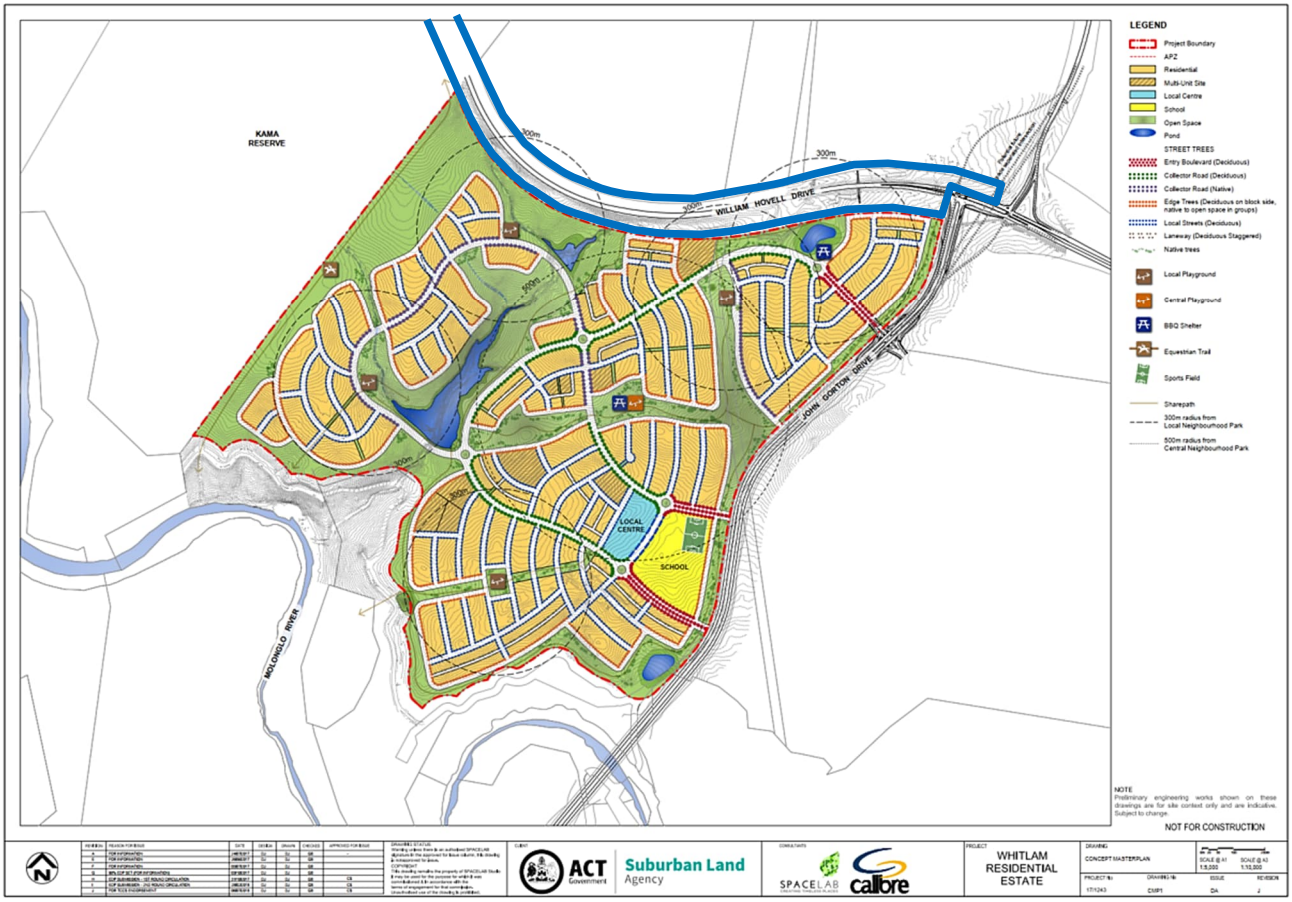


Figure 2-6 Masterplan of new suburb of Whitlam. Project Site outlined in blue

Land to the north of WHD comprises rural leases and The Pinnacle Extension Nature Reserve. Towards the intersection with DBD, the rear of residential properties in Hawker are visible from the road reserve.

Together, The Pinnacle Nature Reserve and Kama Nature Reserve form a regional ecological link or biodiversity corridor. These nature reserves facilitate movement of species through habitat patches existing in the landscape. Retaining connectivity is important to facilitate the movement of genes, individuals, species and populations, and to mitigate the isolation of species and the loss of biodiversity, as per the objectives of the NC Act.

The Kama Nature Reserve comprises 155ha, and is bound by WHD to the north of the reserve and to the east by the new suburb of Whitlam. The Kama Nature Reserve was established as a nature reserve in 2008 and was listed on the ACT Heritage Register in 2012 for its natural heritage values. According to the ***Molonglo River Reserve: Kama Operational Plan 2014*** (Territory Municipal Services, 2014) "Kama is part of a key corridor between the Molonglo River and the Belconnen Woodlands." Kama Nature Reserve is identified as an offset site under the ***Molonglo Valley Plan for the Protection of Matters of National Environmental Significance*** (ACTPLA, 2011).

The Pinnacle Nature Reserve, comprising 154ha, adjoins the rear of parcels of residential development in Hawker and Weetangera. The 2016 Pinnacle Extension (an offset area under the ***Molonglo Valley Plan for the Protection of Matters of National Environmental Significance*** (ACTPLA, 2011)) runs between the western boundary of The Pinnacle Nature Reserve and the north-eastern side of WHD, and is approximately 19.5ha. The Pinnacle Extension Nature Reserve is directly north of the Kama Nature Reserve, and together these areas provide an important ecological corridor.

The western side of the Kama Nature Reserve adjoins rural properties (Belconnen Block 1596 and Block 1593) which are provided with a heritage overlay. These properties contain the Weetangera Cemetery and former location of the Weetangera Methodist Church.

Land along the north-eastern side of WHD comprises leased rural land and The Pinnacle Extension Nature Reserve (partial Belconnen Block 1616). Land east of The Pinnacle Extension Nature Reserve is designated land under the National Capital Plan and the Territory Plan.

Geomorphic Features

The southern extent of the Project Site supports a semi-permanent second order stream, Deep Creek that drains into the Molonglo River. A sedgeland, occurring within the western portion of the Project Site near Kama Nature Reserve, also drains to Molonglo River.

The construction and operation of the Project have the potential to change the hydrology within and adjacent to the Project Site. Changes to hydrology have the potential to alter the vegetation dependent on the existing hydrological regimes. Within the Project Site, changes to hydrology may impact the Threatened Ecological Community (TEC) Box Gum Woodland (BGW) and habitat of threatened species. The hydrology will most likely be changed by infilling existing drainage channels and/or impacting groundwater during the construction process. The extent of the expected impact will be confirmed once drainage design has progressed.

Existing Infrastructure

As WHD is within an existing urbanised area, there are existing infrastructure and services located along the Project alignment. These include assets owned by the following utility providers:

- Icon Water:
    - Two Bulk Supply Water Mains (900mm and 500mm)
    - 900mm watermain crossing perpendicular from the Higgins Reservoir underneath DBD
    - 600mm watermain running parallel with the DBD along the westbound carriageway
    - 675mm watermain from the Higgins Reservoir crossing DBD and running under the existing road median of WHD
    - 150mm watermain on WHD on the south bound carriageway side
    - 100mm crossing from Florina Place to Higgins Reservoir
    - 100mm crossing 100m west of WHD and JGD intersection
- NBN:
    - An existing NBN line runs underneath DBD, approximately 100m west of the intersection with WHD
- Optus:
    - An existing Optus line crossing WHD between Florina Place and Higgins Reservoir
- Telstra:
    - There are existing Telstra assets underneath DBD
- TransACT:
    - Located on the existing power poles crossing WHD near the DBD intersection
    - Existing TransACT line underneath DBD, approximately 100m west of the intersection with WHD
- EvoEnergy:
    - Existing overhead power lines at the intersection of DBD and WHD.

2.2.4 Construction method

Detailed construction staging will be determined through the later stages of the design with the following factors influencing final construction staging:

- The duplication of WHD is proposed to be delivered in 2 packages. Phase 1 commencing at Chainage 2370 through to Chainage 4900 and Phase 2 commencing at Chainage 0 through to Chainage 2370. Phase 2 includes the signalisation of DBD intersection
- Phase 1 is proposed to commence first to minimise potential impacts to Whitlam development. Depending on traffic impacts it may be possible for packages to take place concurrently
- Timing of works in various areas of the project will be influenced by environmental matters (e.g. timing of tree removal with consideration for minimising impacts to threatened species)
- Timing of DBD intersection works and relocation of watermain infrastructure is to take place in winter to avoid impacting water supply
- Construction staging of DBD intersection will need to allow for all existing traffic movements
- Construction staging along WHD will need to allow for continuous flow of traffic
- Timing of underpass extensions will need to be considered. Works are expected to take place early within each phase
- Relocation of Utilities including water, electrical and telecommunications infrastructure could potentially be included as early works.

2.2.5 Timeframe

2.2.5.1 Construction

Constructability of the proposed alignment, traffic management and the adjacent land development project were the key considerations for determining the proposed construction staging of the project. It is proposed to divide the project into two phases of similar size, providing flexibility with regards to procurement and traffic delays. This strategy was analysed and discussed during design workshops. It should be noted that the split between projects remain flexible and can be adjusted to balance out cost between phases if required.

Phase one: CH2370 to CH4900

The proposed road cross section allows for initial offline construction of the northbound carriageway from CH3630 to CH4900. This is followed by a traffic switch and construction of the southbound carriageway from Chainage CH2370 to CH4220 end. A final traffic switch is then required to complete the northbound carriageway from CH2370 to 3630.

Phase two: CH00 to CH2370

Phase 2 works commence from CH380 to CH1850 focussing on the northbound carriageway and median. Following a traffic switch the southbound carriageway can be constructed in full from CH380 to CH2370. Once works of WHD are substantially complete focus moves to the DBD Intersection where temporary traffic diversions and traffic switches will be required to construct (stages 4 and 5).

The current program utilises a sequential works sequence to minimise concurrent staging. There is potential to reduce the duration of Phase 2 by undertaking Stage 2 and 4 concurrently, noting that this will result in an increased impact to traffic.

Construction staging drawings have been produced as part of this submission (refer to summary provided in Table 2-2 below). The proposed construction of the Project is estimated to be around 28 months, and will be divided into two phases, with Phase 1 comprising three stages and Phase 2 comprising five stages, as per Table 2-2 below. The stages will take place across the length of the Project. TCCS is expecting to commence early works for the Project from around August 2022 to April 2023, with the main Project works to be completed from around September 2025.

Table 2-2 Preliminary construction staging

Package	Construction Stage	Construction description	Start Chainage	End Chainage	Duration
Phase 1			2370	4900	53 weeks
	Stage 1	Construct northbound carriageway	4650	4660	16 weeks
	Stage 2	Construct southbound carriageway	2370	4220	22 weeks
	Stage 3	Construct remainder of northbound carriageway	2370	4650	15 weeks
Phase 2			0	2370	68 weeks
	Stage 1	Construct northbound carriageway	450	1850	11 weeks
	Stage 2	Construct southbound carriageway	660	2370	23 weeks
	Stage 3	Construct northbound carriageway	1850	2370	7 weeks
	Stage 4	Construct northbound and southbound carriageways including shared user path	120	660	13 weeks
	Stage 5	Construction DBD	0	450	14 weeks

2.3 Operation of the Project

Once operational, the Project will function as a Major Road as defined in the ***Territory Plan 2008***, and under the custodianship of TCCS - Roads ACT. It will be open for public use and has been designed to have a 40-year life for pavements, and a 100-year design life for underpasses and bridge structures.

2.4 Alternatives to the Project

The ***William Hovell Drive Upgrade Feasibility Study Report*** (Calibre, 2018) identified four potential options for the upgrade of WHD. These included different upgrade options to enable the existing three travel lanes to be converted to four with a central median as follows:

- Option A – widening on right hand side of the carriageway (southwest side)
- Option B – widening on left hand side of the carriageway (northeast side)
- Option C - widening on the left-hand side (northeast side) except in the central section where the widening is on the right-hand side (southwest)
- Option D – widening on both sides of the carriageway.

A multi criteria analysis was undertaken using the following criteria:

- Layout and footprint
- Earthworks volumes and geotechnical conditions
- Stormwater
- Environmental impacts
- Utilities

- Constructability, traffic management and safety.

The analysis attempted to ascertain a preferred option for the purposes of further progressing the design and any associated budget considerations. The following criteria were omitted because they were found to be fundamentally the same for all options:

- Function and performance
- Safety
- Construction, operational and maintenance costs.

The results of the multi-criteria analysis showed that Option B was the preferred or at least equally preferred option for all six criteria assessed. The key reasons for preferring Option B (i.e. the current Project) were as follows:

- Smallest overall footprint
- Smallest volume of fill required, thereby minimising hauling within the Project Site
- Earthworks only required on one side of the carriageway overcoming the need to haul across WHD
- Second lowest length of stormwater relocation and culvert extension
- Minimising impacts on native vegetation and BGW
- No impacts on the potential Molonglo 3 High Voltage alignment on the southern side of WHD
- Easiest from a constructability perspective, including with respect to traffic management and safety
- Environmental impacts more generally (as outlined within Sections 2.4.1 and 2.4.2 below).

Three upgraded intersection layouts were tested (refer to Appendix C), which were:

- Upgraded roundabout: This layout uses a much larger roundabout with two circulating lanes. The southbound through movement, northbound left turn and eastbound left turn all use continuous lanes that effectively bypass the intersection before merging downstream
- Signalised intersection: The signalised intersection has a relatively compact footprint, with two lanes for each through and right turn movement. The left turns from the south and west have a high-angle slip lane with priority control
- Signals retrofitted to existing roundabout: This layout entailed the retention of existing roundabout layout and alignment with the addition of signals to control vehicles entry to the roundabout.

The signalised roundabout was eliminated as a viable option following advice from the Project's civil design team. This is due to the existing roundabout being significantly smaller than design guidelines require. The existing roundabout does not cater for the B-double design vehicle. The upgraded roundabout was also removed as a viable option due to the required size of the intersection and the absence of appropriate active travel facilities.

Whilst an upgraded roundabout option would have provided acceptable wait times for vehicles, it would have a significantly larger construction footprint and therefore potential environmental impact. Additionally, the continuous flow of a roundabout provides a deterrence for active travel as it is difficult for pedestrians and cyclists to find a gap in traffic. The signals were chosen as they meet the design criteria, minimise the environmental impact and promote safe, active travel.

The decision to update the existing roundabout with a signalised intersection was the subject of a separate design investigation which examined the benefits and disbenefits of each. The signalised intersection is preferred as it provides significant safety benefits for all users. Signalising of intersections is considered the safest treatment to move cyclists and pedestrians over roads. Signals direct the movement of traffic across the intersection, minimising the risk of conflict. Indeed, investigations demonstrated that traffic signals are required in order to address the increase in vehicles over the next 10 years as well as provide safe access for pedestrians and cyclists. In 2031, the traffic model shows that in the busiest time (the AM peak), the delays at the new WHD/DBD signals compared to having the existing roundabout there in 2031 will be:

- Fifty-four (44) additional seconds on Kingsford Smith Dr turning right onto Drake-Brockman Drive
- Twelve minutes (12) less on Drake-Brockman Dr heading towards Belconnen (refer to Appendix C).

The preferred option therefore involves signalising the WHD and DBD intersection when compared to the current intersection (i.e. a roundabout) in order to satisfy intersection performance requirements whilst also limiting future barriers to active travel.

Further matters which were considered in finalising this option include:

- Public access directly off this arterial road to the Kama and Pinnacle Nature Reserves was not considered to be a safe option, as the William Hovell Drive road corridor will gradually hold increasing volumes of traffic under a 2031 design scenario. It is understood that Parks and Conservation will work with TCCS to ensure a new Whitlam access point into the Kama Nature Reserve is provided for the future
- Protection of the two Nature Reserves during construction and minimising any ongoing impacts was identified early as a key priority of the project.

Following community consultation, a revised alignment of the shared user path has been developed to relocate the path (between DBD and the underpass near the Weetangera Cemetery) to the western side of WHD rather than to the east. This updated alignment:

- Avoids unnecessary impacts to mature vegetation, with impacts being limited to only what is reasonably required to deliver this infrastructure
- Means the shared path can function alongside this Major Road without safety concerns
- Reduces interface between cyclists and the off-leash dog area, which greatly improves safety for shared path users
- Provides for experienced and inexperienced cyclists
- Includes the appropriate use of fencing and signage, albeit fencing will be removed at the interface with Bicentennial National Trail to avoid horses feeling "trapped" as riders traverse through this location.

2.4.1 Ecology

Refinement and micro-siting of the design has enabled impacts on some areas of identified habitat to be avoided. A comparison of impact areas against initial project design and later design iterations is provided in Table 2-3. Table 2-3 provides a comparison of the initial Project design, and the refined design and details where impacts on Pink-tailed Worm-lizard (PTWL) and Box Gum Woodland habitat have been avoided. BGW also provides habitat features for Striped Legless Lizard, Superb Parrot, and Hoary Sunray.

Table 2-3 Impact and avoidance areas

Impacted matter	Impact area initial design	Impact area micro-sited design (current)	Total avoidance area
PTWL habitat	0.28ha	0.23ha	0.05ha
BGW	13.75ha	8.57ha	5.18ha

To inform the preliminary road design, SMEC undertook a constraints mapping exercise in GIS, combining relevant public (ACTmapi) and Project specific data. The constraints map prepared for the Project is provided in Figure 2-7 below. Table 2-4 further below also sets out how the Project has gone through additional micro-siting in order to avoid direct impacts to potential.

The TCCS and SMEC project teams have held several meetings with the ACT Government Ecologist, the Office of the Conservator for Flora and Fauna and EPSDD environmental officers to incorporate design measures to reduce impacts to the wildlife corridor and maintain connectivity between the two Nature Reserves.

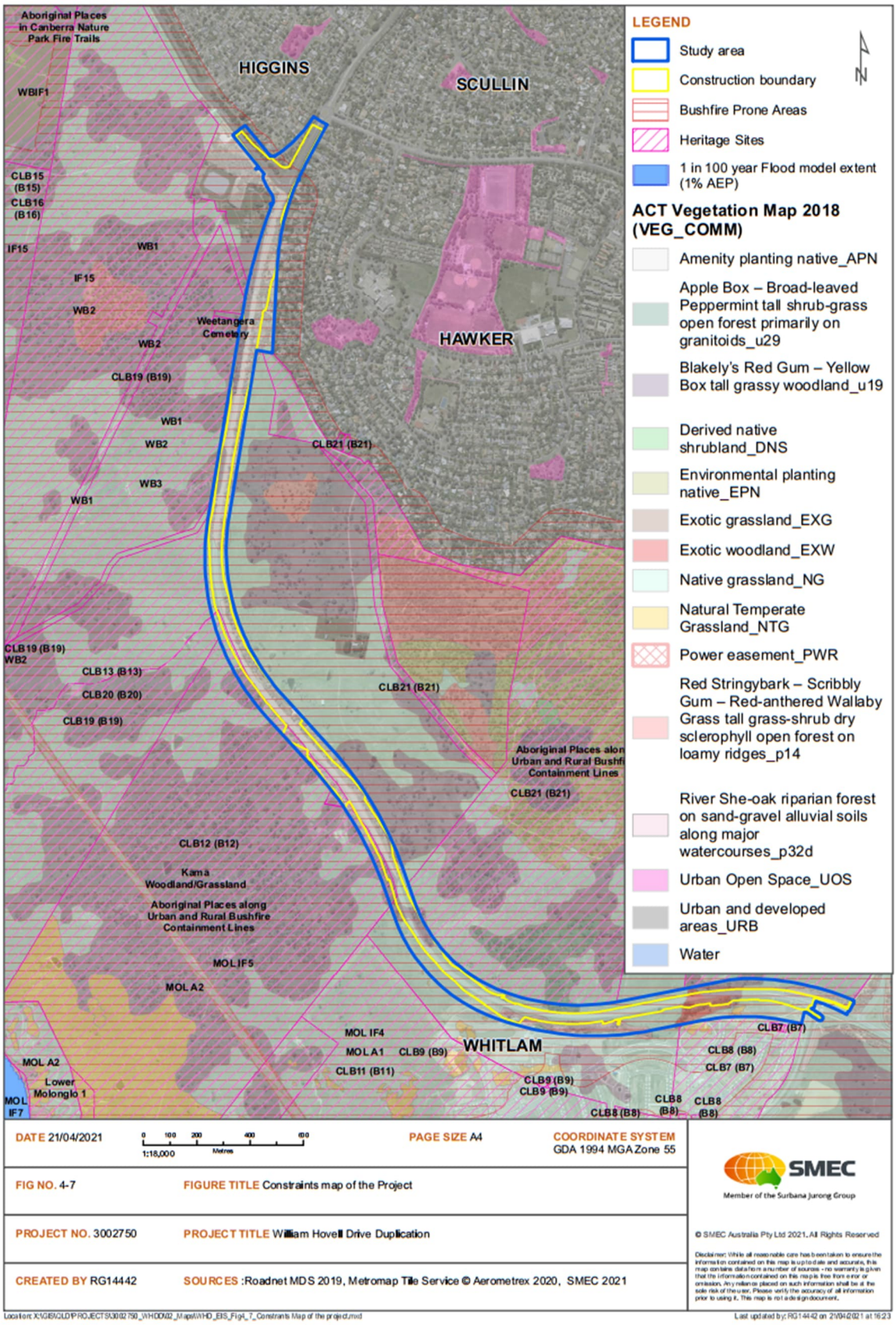


Figure 2-7 Constraints map of the Project

Table 2-4 Measures to avoid impacts on PTWL

Initial Design	Refined Design - Micro-siting and Avoiding Impact
Pink areas indicate PTWL habitat. The larger patch (0.04ha) was directly impacted in the initial design.	 The design has been refined to minimise direct impacts on this PTWL habitat patch.

Following consultation with ACT Government stakeholders including the Conservator of Flora and Fauna, the Project footprint has been minimised between the Kama and The Pinnacle Extension Nature Reserves to retain connectivity of BGW, and the design has been micro-sited in this area to retain as many hollow bearing trees as possible. Moreover, the overall road width has been designed to be as narrow as possible between the two nature reserves. Some batters will be laid back to allow Kangaroos and Wallabies to escape the roadway and back into the Nature Reserves. However, fencing will be used to direct wildlife to the dedicated culvert underpasses, which will be designed to be used by various wildlife.

A further option to provide a fauna bridge as an offset measure was also requested for consideration as part of the scope by the Conservator of Flora and Fauna. TCCS has committed to pursuing a Future Feasibility Study to consider whether such a structure provides a demonstrable benefit in this location. Reasons for not including a fauna bridge as part of the current EIS scope include:

- Construction of a fauna bridge to improve connectivity between The Pinnacle and Kama Nature Reserves could expand the Project's clearing footprint, creating additional direct impacts, most likely for Box Gum Woodland TEC and therefore additional direction from DAWE as a potentially Controlled Action under the EPBC Act
- Lack of clear direction from the Conservator on the form and function which such a bridge should take. For instance, a bridge heavily vegetated with canopy cover could provide habitat and connectivity for certain species (avifauna/arboreal fauna and some ground-dwelling fauna), at the expense of species which are considered to have a greater potential to be impacted by this Project (such as PTWL and Striped Legless Lizard which prefer more open habitats with grassy/rocky features). Whereas a bridge vegetated with grassy native species and which potentially provides habitat and connectivity for PTWL and Striped Legless Lizard will not necessarily provide adequate compensatory offset for the directly impacted BGW TEC which TCCS has committed to offset as part of this EIS
- The Project has already committed to two types of fauna crossing structures across the WHD road reserve: box culverts and a rope bridge, in addition to committing to BGW offsets (refer to Appendix L). The question of whether a fauna bridge provides a demonstrable benefit above and beyond the current approach for the relevant species of concern will have to be considered.

The above matters will need to be considered in further detail as part of a Future Feasibility Study with adequate budget to undertake this assessment and reach a sound recommendation. Such a Feasibility Study is considered

to be outside the scope of the current Project, and therefore this EIS. In the meantime, TCCS remains committed to continuing its engagement with the Conservator regarding establishment of a direct offset for the Project as its first choice of offset (most likely west of the Kama Nature Reserve). TCCS also remains committed to the establishment of two box culvert and one rope bridge fauna crossings (refer to Appendix L).

2.4.2 Heritage

Initial options assessment has also confirmed that the Project can proceed without significant impacts to previously identified heritage sites. Construction site fencing will be established to form a barrier around sensitive heritage areas in the identified Potential Archaeological Deposit (PAD) sites, the Weetangera Cemetery, and the Kama and The Pinnacle Extension Nature Reserves. This will help to prevent accidental impacts to known areas of heritage and ecological importance. An Unexpected Finds Protocol will also be established and implemented during site works to ensure any previously unidentified heritage finds are appropriately managed. Further details are set out within Section 5.4 below.

2.5 Consequences of not proceeding

Should the Project not proceed, this section of WHD will remain the only unduplicated section of this road. This will result in:

- Increasing road congestion, particularly during peak AM and PM periods at the WHD and DBD intersection
- Increasing risks to motorists, as a historically crash-affected alignment of road reserve continues to see significant road-user growth with no road works to ameliorate the risks associated with this road's existing configuration
- Increased likelihood of east-west rat-running through Hawker, Weetangera, Cook, and Aranda
- No provision for safe, future shared path extension connecting to Bindubi Street, Civic and the trunk cycle network around Lake Burley Griffith, including no future provision for surrounding residents to use active transport methods for personal journeys
- Overall, failing to meet the traffic and transport needs of the residents of the adjoining regions of Molonglo Valley, the estate of Ginninderry (West Belconnen) and the new suburbs of Strathnairn, Macnamara and Whitlam.

3 Legislative and Strategic Context

This Chapter provides an overview of the relevant legislative context for the Project, including the EIS triggers, statutory requirements and assessment against relevant strategic priorities for the ACT, including those of the:

- ***Territory Plan 2008***
- ***ACT Planning Strategy 2018*** (ACT Government, 2018a)
- ***ACT Transport Strategy 2020***
- ***Healthy Canberra: ACT Preventative Health Plan 2020-2025***
- ***National Capital Plan***
- ***ACT Climate Change Strategy 2019-2025***
- ***Canberra's Living Infrastructure Plan: Cooling the City*** (ACT Government, 2019c)
- Principles of ecologically sustainable development (ESD).

3.1 Statutory requirements

The following statutory requirements are relevant to the Project.

3.1.1 Planning and Development Act 2007

The ***Planning and Development Act 2007*** (P&D Act) is the chief determining piece of legislation for impact assessment procedures in the ACT. The P&D Act also provides the basis for land use zoning under the ACT Territory Plan 2008.

Part 4.2 and 4.3 of the P&D Act detail the activities, areas and processes when an EIS is required (refer to Table 3-1 and Table 3-2 below). As per Section 123(b) of the P&D Act, the Project is categorised as Impact Track due to the fact that it is described in Schedule 4 to the Act, and also due to Section 123(e) of the P&D Act, as the Project is a controlled action under the EPBC Act which may be assessed under the bilateral process (refer to Sections 3.1.3 and 3.1.4 below).

The Project requires preparation of an EIS under Section 127(2) of the P&D Act as it is likely to have a significant impact on species listed under the NT Act and the EPBC Act. The relevant triggers are with respect to "Areas and Processes," due to the Project's predicted impacts to listed species (as confirmed via the EPBC Act referral – refer to Section 3.1.3 below), and the proposed clearing of more than 0.5ha of native vegetation (refer to Table 3-1 below).

Section 129 of the P&D Act sets out matters which must be considered in assessing Impact Track development.

Table 3-1 Schedule 4 Planning and Development Act EIS triggers – activities

Item	Development Proposal	Comment
1	Proposal for construction of a transport corridor including a major road, a dedicated bus way, a railway, or a light rail corridor, on any land, other than on land designated under the territory plan as a future urban area or in a transport and services zone, if the proposal is likely to have a significant adverse environmental impact on— ***(a) air quality so as to be detrimental to the health of persons in an adjoining residential, commercial or community facility zone; or***	N/A – the Project will not have detrimental impact on adjoining zones.

Item	Development Proposal	Comment
	(b) ***ambient noise or vibration so as to be detrimental to the health of persons in an adjoining residential, commercial or community facility zone***	
2	Proposal that involves — ***(a) electricity transmission line construction, including additions or realignment works, outside an existing easement or exceeding 500m in length, that are intended to carry underground or above ground transmission lines with a voltage of 132kV or more; or*** ***(b) a coal electricity generating station; or*** ***(c) an electricity generating station (other than a coal electricity generating station) including gas, wind, hydroelectric, geothermal, biomaterial, solar power or co-generation—*** ***(i) that is capable of supplying—*** A. the amount of electrical power prescribed by regulation; or B. if no amount is prescribed— 4MW or more of electrical power; or ***(ii) in a location or of a kind or nature prescribed by regulation; or*** (d) ***an electricity generating station if the temperature of water released from the station into a body of water (other than an artificial body of water) is likely to vary by more than 2oC from the ambient temperature of the body of water***	N/A
3	Proposal for construction of a water storage dam — ***(a) that will be at least 15m high when measured from the lowest point of the general foundations to the crest of the dam; or*** ***(b) that will be at least 10m high when measured from the lowest point of the general foundations to the crest of the dam if—*** ***(i) the crest is not less than 500m in length; or*** ***(ii) the water storage capacity of the reservoir formed by the dam at normal operating level is at least 1 000 000 m3; or*** ***(iii) the recommended design flood discharge dealt with by the dam is at least 2000m3 per second; or*** ***(c) in the river corridor zone under the territory plan unless the conservator of flora and fauna produces an environmental significance opinion that the proposal is not likely to have a significant adverse environmental impact; or*** (d) ***on a continuously flowing river in a non-urban zone under the territory plan unless the conservator of flora and fauna produces an environmental significance opinion that the proposal is not likely to have a significant adverse environmental impact***	N/A
4	Proposal for construction of an airport or airfield (other than a helicopter landing facility used exclusively for emergency services purposes, including medical evacuation, firefighting, retrieval or rescue)	N/A

Item	Development Proposal	Comment
5	Proposal for construction of a wastewater treatment plant (including a plant for the treatment of sewage or other effluents) that— ***(a) will be less than 1km from the boundary of a residential block or unit in a residential or commercial zone; or*** ***(b) will be able to treat each day more than —*** ***(i) 2 500 people equivalent capacity; or*** ***(ii) 750kL; or*** ***(c) will have capacity to store more than 1kt of sewage, sludge or effluent; or*** ***(d) will incinerate sewage or sewage products; or*** ***(e) will have a capacity to treat more than 100ML of wastewater (excluding stormwater) each year; but*** ***(f) is not —*** ***(iii) a plant for the treatment of stormwater; or*** ***(iv) a small-scale wastewater treatment plant (including a plant for the treatment of sewage or other effluent but not including a small-scale plant prescribed by regulation); or*** ***(v) a residential on-site wastewater treatment system (including a septic tank)***	N/A
6	Proposal for construction of a petroleum storage facility with a storage capacity greater than 500 kL of petroleum products at 1 time	N/A
7	Proposal for construction of a permanent venue for the conduct of motor racing events	N/A
8	Proposal for use of land for a commercial landfill facility, other than for the disposal of virgin excavated natural material (or other earth and rock fill that is inert waste) if— ***(a) the intended capacity of the facility is more than 5kt each year, or 20kt in total; or*** ***(b) the facility will be—*** ***(i) in an area with a high-water table, highly permeable soils, sodic soils or saline soils; or*** ***(ii) less than 2km from the boundary of a residential block or unit in a residential or commercial zone***	N/A
9	Proposal for the construction of a waste management facility that is— ***(a) an incineration facility for the destruction by thermal oxidation of waste including biological, veterinary, medical, clinical, dental, quarantine and municipal waste; or*** ***(b) for the sterilisation of clinical waste; or*** (c) ***for the storage, treatment, disposal, processing, recycling, recovery, use or reuse of regulated waste***	N/A
10	Proposal for a waste transfer station or recycling facility that sorts, consolidates or temporarily stores solid waste (including municipal waste) for transfer to another site for disposal, storage, reprocessing, recycling, use or reuse, if the transfer station —	N/A

Item	Development Proposal	Comment
	(a) is intended to handle more than 30kt of waste each year; or will be less than 1km from the boundary of a residential block or unit in a residential or commercial zone; but ***(b) is not a small-scale waste management facility, on or near a residential block or near a residential unit, consisting of wheelie bins, small hoppers, or other small waste management bins or enclosures for the use of people living on the residential block or in the residential unit***	
11	Proposal that involves storage of the placard quantity of a Schedule 11 hazardous chemical on land, or in a building or structure on the land, that, immediately before the commencement day, was not registered as premises in the placard quantity register, unless the authority produces an environmental significance opinion indicating that the proposal is not likely to have a significant adverse environmental impact.	N/A

Table 3-2 Schedule 4 Planning and Development Act EIS triggers – areas and processes

Item	Development Proposal	Comment
1	Proposal that is likely to have a significant adverse environmental impact on 1 or more of the following, unless the conservator of flora and fauna provides an environmental significance opinion indicating that the proposal is not likely to have a significant adverse environmental impact: ***(a) a critically endangered species;*** ***(b) an endangered species;*** ***(c) a vulnerable species;*** ***(d) a conservation dependent species;*** ***(e) a regionally threatened species;*** ***(f) a regionally conservation dependent species;*** ***(g) a provisionally listed threatened species;*** ***(h) a listed migratory species;*** ***(i) a threatened ecological community;*** ***(j) a protected native species;*** ***(k) a Ramsar wetland;*** (l) ***any other protected matter***	Yes – the Project has the potential to impact on listed species. This has been confirmed through the referral of the project under the EPBC Act (refer to Appendix D and Appendix G).
2	Proposal involving — ***(a) the clearing of more than 0.5ha of native vegetation in a native vegetation area, other than on land that is designated as a future urban area under the territory plan, unless the conservator of flora and fauna produces an environmental significance opinion that the clearing is not likely to have a significant adverse environmental impact; or*** (b) ***the clearing of more than 5.0ha of native vegetation in a native vegetation area, on land that is designated as a future urban area under the territory plan, unless the conservator of flora and fauna produces an environmental significance opinion that the clearing is not likely to have a significant adverse environmental impact***	Yes – the Project will require clearing of more than 0.5ha of native vegetation.

Item	Development Proposal	Comment
3	Proposal for development in a reserve, unless— (a) ***the conservator of flora and fauna produces an environmental significance opinion that the proposal is not likely to have a significant adverse environmental impact; or*** (b) ***the proposal is for minor public works to be carried out by or for the Territory in accordance with a minor public works code approved by the conservator of flora and fauna under the Nature Conservation Act 2014, section 318A***	N/A – the Project does not involve works in a reserve.
4	Proposal that is likely to have a significant adverse environmental impact on — ***(a) a domestic water supply catchment; or*** ***(b) a water use purpose mentioned in the territory plan (water use and catchment general code); or*** (c) ***a prescribed environmental value mentioned in the territory plan (water use catchment general code) of a natural waterway or aquifer***	N/A - the current design will not have a significant adverse environmental on a domestic water supply, water use purpose or a prescribed environmental value mentioned in the territory plan
5	Proposal that is likely to result in environmentally significant water extraction or consumption, other than a proposal for an urban lake, pond or retardation basin or a wastewater reuse scheme— ***(a) in an existing urban area or on land that has been designated as a future urban area; and*** (b) ***that is designed in accordance with the water sensitive urban design general code under the territory plan***	N/A - the Project is not likely to result in environmentally significant water extraction or consumption
6	Proposal that is likely to have a significant adverse impact on the heritage significance of a place or object registered under the Heritage Act 2004, unless— ***(a) the heritage council produces an environmental significance opinion that the proposal is not likely to have a significant adverse impact; or*** ***(b) the proposal is the demolition of a building that is affected residential premises, and the heritage council has approved a statement of heritage effect in relation to the proposal*** Note 1 Affected residential premises—see the dictionary. Note 2 Statement of heritage effect—see the Heritage Act 2004, s 61G.	No, the current design will avoid impact and provide a buffer to identified places of heritage significance.
7	Proposal involving land included on the register of contaminated sites under the ***Environment Protection Act 1997*** unless the authority produces an environmental significance opinion indicating that the proposal is not likely to have a significant adverse environmental impact	N/A – the Project does not involve works on land included on the register of contaminated sites.
8	Proposal, other than on land in an existing urban area or land that is designated under the territory plan as a future urban area, with the potential to adversely affect the integrity of a site where significant environmental or ecological scientific research is being conducted by a government entity, a university or another entity prescribed by regulation	N/A – the Project does not involve works on land identified as an existing urban area or land that is designated under the territory plan as a future urban area.

Table 3-3 below sets out how the objects of the P&D Act have been met in the preparation of this revised EIS.

Table 3-3 Section 6 objects of the Planning and Development Act

Subsection	Matter	Comment
6	The object of this Act is to provide a planning and land system that contributes to the orderly and sustainable development of the ACT	The Project has followed the statutory provisions which it is required in order to meet the requirements of the P&D Act, the EPBC Act, the NC Act and other relevant pieces of legislation. It delivers on the aims of the ***ACT Transport Strategy 2020*** by providing safer and more efficient road transport in a growing residential area of the ACT, ensuring better traffic flow between Belconnen and key employment areas such as Civic, Parliamentary Zone and Wooden to a 2031 design scenario. The aims of the ***ACT Transport Strategy 2020*** are also met through the provision of additional shared path connectivity which rectifies a missing link in the current path network between Higgins and City. The ***ACT Transport Strategy 2020*** (ACT Government, 2020) also shows that WHD will be used by Orbital (e.g. non-Rapid) bus routes. The increased capacity of the additional lane along WHD will provide improved travel speed and travel time reliability for these bus routes, without bus priority infrastructure, which would be more appropriate for Rapid corridors. The Project will also be delivered in conjunction with an Offset Management Plan to manage potential impacts for threatened species and ecological communities. Refer to Section 3.3.7 below for a consideration of how the Project meets the requirements of ecologically sustainable development. Refer to Section 5.10 regarding potential climate change impacts. TCCS and SMEC have met with the Conservator and agreed a pathway forward to achieving a Draft Offset Strategy and final Offset Management Plan to manage potentially significant biodiversity impacts from the Project. This is based on the first choice of offset being located to the west of Kama Nature Reserve. An indicative timeframe for achieving this goal of a final Offset Management Plan is set out within Section 5.2.4 below. The relevant consultation processes will be followed during the process of finalising the Offset Management Plan for the Project.
6(a)	Consistent with the social, environmental and economic aspirations of the people of the ACT	The Project objectives (refer to Section 2.2) and Project alternatives (refer to Section 2.4) establish how decision-making for the Project has taken into account a range of social, environmental and economic considerations. Section 6 and Appendix J set out how the community and various

Subsection	Matter	Comment
		stakeholders have been consulted with in revising the design of the Project.
6(b)	In accordance with sound financial principles.	The Project has been forward planned and budgeted for, and complements surrounding growth in the new residential suburbs/estates of Ginninderry (West Belconnen), Strathnairn, Macnamara and Whitlam.

3.1.2 Planning and Development Regulation 2008

The Scoping Document stipulates that the EIS must be prepared according to the ***Planning and Development Regulation 2008***. Clause 50 of the ***Planning and Development Regulation 2008*** outlines the requirements for preparing an EIS within the ACT. These matters are set out within Table 3-4 below.

These requirements as set out within the ***Planning and Development Regulation 2008*** have been adhered to in the preparation of this EIS.

Table 3-4 Clause 50 of the Planning and Development Regulation

Subclause No	Requirement	Section of this EIS
(1)	An EIS in relation to a development proposal that is to be assessed by the Territory in accordance with a bilateral agreement under the ***Environment Protection and Biodiversity Conservation Act 1999*** (Cwlth) must address the matters mentioned in the ***Environment Protection and Biodiversity Conservation Regulations 2000*** (Cwlth), schedule 4.	Section 3.1.3
(2)	An EIS in relation to a development proposal (including a proposal to which subsection (1) applies) must include the following:	
(a)	a non-technical summary of the EIS, including a summary of its recommendations	Page v
(b)	a glossary of technical terms and any abbreviations and acronyms used in the EIS;	Page iii
(c)	a description of the proposal, including—	
(i)	the location of the land to which the proposal relates	Table 2-1 in Section 2.1 and Figure 2-1 in Section 2.2.1
(ii)	if the land is leased—the lessee's name	Table 2-1 in Section 2.1
(iii)	if the land is unleased land or public land—the custodian of the land	Table 2-1 in Section 2.1
(iv)	the purposes for which the land may be used	Table 2-1 in Section 2.1
(v)	if the land is leased— (A)the block and section number and division of the land and the volume and folio of the Crown lease; or (B) if the land is under a land sublease—the sublease plan number and the volume and folio of the Crown lease	Table 2-1 in Section 2.1
(vi)	a statement of the proposal's objectives	Section 2.1
(vii)	the time for implementation of the proposal, including for any stage	Sections 2.1 to 2.3

Subclause No	Requirement	Section of this EIS
(viii)	details of any action that has been, or is being, taken by the proponent, or any other entity, in relation to the land to which the proposal relates	Table 2-1 in Section 2.1
(ix)	details of any alternatives to the proposal considered in developing the proposal	Section 2.4
(d)	a description of the EIS process, including—	
(i)	any statutory approval obtained or required for the proposal	Chapter 3
(ii)	the base information used for predicting each potentially significant environmental impact identified in the scoping document for the EIS	Sections 5.1.1, 5.2.1, 5.3.1, 5.4.1, 5.5.1, 5.6.1, 5.7.1, 5.8.1, 5.9.1, 5.10.1, and 5.11.1
(iii)	the criteria used for assessing the significance of each environmental impact and the performance of any alternative to the proposal considered under paragraph (c)(ix).	Sections 2.4, 4 and 5
(e)	a statement about the proposal's compatibility with the principles for environmental sustainability in the territory plan (2 Strategic Direction)	Section 3.3.7
(f)	for each potentially significant environmental impact identified in the scoping document for the development proposal—	
(i)	an identification of the relevant environmental values	Sections 5.1.1, 5.2.1, 5.3.1, 5.4.1, 5.5.1, 5.6.1, 5.7.1, 5.8.1, 5.9.1, 5.10.1, and 5.11.1
(ii)	an identification of the findings and results of any environmental investigation in relation to the land to which the proposal relates	Sections 5.1.4, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.3, 5.7.3, 5.8.3, 5.9.3, 5.10.3, 5.11.3 and 5.12.2
(iii)	a description of the effects of the environmental impact (including cumulative and indirect effects) on physical and ecological systems and human communities	Sections 5.1.4, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.3, 5.7.3, 5.8.3, 5.9.3, 5.10.3, 5.11.3 and 5.12.2
(iv)	an analysis of the significance of the potential environmental impact of the development	Sections 5.1.4, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.3, 5.7.3, 5.8.3, 5.9.3, 5.10.3, 5.11.3 and 5.12.2
(v)	a statement of the approach proposed to be taken to the environmental management of the land to which the proposal relates, including any proposed impact prevention, mitigation or offsetting measures to deal with the environmental impact of the proposal	Sections 5.2.4 and 7
(g)	a description of consultation undertaken for the EIS	Section 6
(h)	for a revised EIS—a summary of the representations made within the public consultation period	Section 6
(i)	the EIS's recommendations.	Section 7
(3)	For subsection (2)(f), each potentially significant environmental impact identified in the scoping document for the EIS must be addressed in its own part of the EIS.	Sections 5.1.4, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.3, 5.7.3,

Subclause No	Requirement	Section of this EIS
		5.8.3, 5.9.3, 5.10.3, 5.11.3 and 5.12.2
(4)	For subsection (2)(f)(v), the approach proposed to be taken to the environmental management of the land may be set out in a management plan for the land.	Noted
(5)	An EIS must be prepared in accordance with any requirement set out in the scoping document for the EIS.	Section 1.4

3.1.3 Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)

The Commonwealth's ***Environment Protection and Biodiversity Conservation Act 1999*** (EPBC Act) is the Australian Government's key piece of environmental legislation. In accordance with the EPBC Act, approval is required for any proposed action likely to have a significant impact on Matters of National Environmental Significance (MNES) protected by the EPBC Act. Potentially significant impacts on any MNES trigger a referral process under the EPBC Act.

The Project has been referred to the DAWE for confirmation of whether impact on MNES is deemed significant and whether the Project constitutes a Controlled Action. A Referral Decision was received on 29 July 2020 (EPBC 2020/8703) confirming that the Project is a controlled action and requires assessment and approval under the EPBC Act. The Project will be assessed under the bilateral agreement with the ACT.

As set out within Section 5.2.2.4 below and in Appendix B of Appendix D to this EIS, the ***Preliminary Environmental Assessment: William Hovell Drive Duplication*** (SMEC, 2020b) identified one TEC, Yellow Box–Blakely's Red Gum Grassy Woodland (critically endangered under the NC Act), which is considered equivalent to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (critically endangered) under the EPBC Act.

As set out within Section 5.2.2.5 below and in Appendix B of Appendix D to this EIS, a desktop biodiversity search identified six flora species or ecological communities with a moderate or higher likelihood of occurring within the Study Area.

As set out within Section 5.2.2.6 below and in Appendix B of Appendix D to this EIS, a desktop biodiversity search identified 34 fauna species likely to occur within the Study Area listed as threatened or migratory under the NC Act and/or the EPBC Act.

A likelihood of occurrence assessment was undertaken for these species after the site visit was performed in order to determine whether suitable habitat for each species occurs within the Study Area (refer to Appendix B of Appendix D). Of the 34 species assessed for likelihood of occurrence, only 13 were identified as having a moderate or higher likelihood of occurrence in the Study Area based on the availability of suitable habitat and recent nearby sightings (refer to Section 5.2.2.6 below). Seven of these species are listed as either Vulnerable or Critically Endangered under the EPBC Act. These seven species are therefore MNES under the EPBC Act, and include:

- Pink-tailed Worm-lizard (***Aprasia parapulchella***) (Endangered under the NC Act and Vulnerable under the EPBC Act)
- Striped Legless Lizard (***Delma impar***) (Vulnerable under the NC Act and the EPBC Act)
- Regent Honeyeater (***Anthochaera phrygia***) (Endangered under the NC Act and Critically Endangered under the EPBC Act)
- Superb Parrot (***Polytelis swainsonii***) (Vulnerable under the NC Act and EPBC Act)
- Grey headed Flying Fox (***Pteropus poliocephalus***) (Vulnerable under the NC Act and the EPBC Act)
- Swift Parrot (***Lathamus discolor***) (Vulnerable under the NC Act and Critically Endangered under the EPBC Act)

- White-throated Needletail (***Hirundapus caudacutus***) (Vulnerable under the NC Act and the EPBC Act).

One species listed as vulnerable under the NC Act and EPBC Act was recorded during the survey period, being the Superb Parrot. Assessments of Significance were prepared for these species. In addition, and Assessment of Significance was also undertaken for the Golden Sun Moth, despite habitat not considered to be present at the site. Assessments of Significance were also carried out for the Hoary Sunray and BGW. These Assessments of Significance can be found in Appendix C of Appendix D to this EIS, and are also summarised in Section 5.2.3.10 of this EIS. All of these species and the BGW TEC constitute MNES under the EPBC Act.

In addition, two species listed only as Migratory under the EPBC Act were listed as having a moderate likelihood of occurrence within the Study Area (i.e. the Fork-tailed Swift and the Satin Flycatcher). The White-throated Needletail is listed as both Vulnerable and Migratory under the EPBC Act.

Section 5.2.2.7 of this EIS explains how Migratory species, including the Fork-tailed Swift and the Satin Flycatcher are unlikely to be impacted by the Project. An Assessment of Significance has been prepared for the White-throated Needletail, and is provided in Appendix C of Appendix D to the EIS, and summarised in Section 5.2.3.10.

Overall, the Project would directly clear portions of Box Gum Woodland TEC which is recognised as a Critically Endangered Ecological Community under the EPBC Act. Various assemblages of BGW communities can also provide habitat for the following:

- Pink-tailed Worm-lizards (Vulnerable under the EPBC Act)
- Striped Legless Lizards (Vulnerable under the EPBC Act)
- Hoary Sunray (Endangered under the EPBC Act).

The Project will therefore be delivered in conjunction with an Offset Management Plan to manage potentially significant impacts for threatened species and ecological communities; namely Box Gum Woodland, the Hoary Sunray, Superb Parrot, Pink-tailed Worm-lizard and Striped Legless Lizard (refer to Section 5.2.4 below).

Table 3-5 below sets out the matters which are required to be provided within an EIS that is prepared under the EPBC Act, as per Schedule 4 of the ***Environment Protection and Biodiversity Conservation Regulations 2000*** (EPBC Regulation).

Table 3-5 Schedule 4 of the EPBC Regulation

Clause	Requirement	Section of this EIS
1 General Information		
1.01	The background of the action, including:	
(a)	The title of the action	Section 2.1
(b)	The full name and postal address of the designated proponent	Section 2.1
(c)	A clear outline of the objective of the action	Section 2.2
(d)	The location of the action	Section 2.2.1
(e)	The background to the development of the action	Section 1
(f)	How the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action	Section 5.2.3.9
(g)	The current status of the action	Section 2.4
(h)	The consequences of not proceeding with the action	Section 2.5
2 Description		
2.01	A description of the action, including:	

Clause	Requirement	Section of this EIS
(a)	All the components of the action	Section 2
(b)	The precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts	Refer to Appendix A
(c)	How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts	Sections 2.2.4 and 2.2.5
(d)	Relevant impacts of the action	Sections 5.1.4, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.3, 5.7.3, 5.8.3, 5.9.3, 5.10.3, 5.11.3 and 5.12.2
(e)	Proposed safeguards and mitigation measures to deal with relevant impacts of the action	Sections 5.1.5, 5.2.4, 5.3.4, 5.4.4, 5.5.4, 5.6.4, 5.7.7, 5.8.4, 5.9.4, 5.10.4, 5.11.4, 5.12.3 and 7
(f)	Any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action	Sections 5.1.5, 5.2.4, 5.3.4, 5.4.4, 5.5.4, 5.6.4, 5.7.7, 5.8.4, 5.9.4, 5.10.4, 5.11.4, 5.12.3 and 7
(g)	to the extent reasonably practicable, any feasible alternatives to the action, including: (i) if relevant, the alternative of taking no action; (ii) a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action (iii) sufficient detail to make clear why any alternative is preferred to another	Sections 2.4 and 2.5
(h)	Any consultation about the action, including: (i) any consultation that has already taken place (ii) proposed consultation about relevant impacts of the action (iii) if there has been consultation about the proposed action--any documented response to, or result of, the consultation	Section 6 and Appendix J
(i)	Identification of affected parties, including a statement mentioning any communities that may be affected and describing their views	Section 6 and Appendix J
3 Relevant impacts		
3.01	Information given under paragraph 2.01(d) must include:	
(a)	A description of the relevant impacts of the action	Sections 5.1.4, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.3, 5.7.3, 5.8.3, 5.9.3, 5.10.3, 5.11.3 and 5.12.2
(b)	A detailed assessment of the nature and extent of the likely short term and long-term relevant impacts	Section 5.2

Clause	Requirement	Section of this EIS
(c)	A statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible	Section 5.2
(d)	Analysis of the significance of the relevant impacts	Sections 5.1.4, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.3, 5.7.3, 5.8.3, 5.9.3, 5.10.3, 5.11.3 and 5.12.2
(e)	Any technical data and other information used or needed to make a detailed assessment of the relevant impacts	Section 9 and Appendix D
4	Proposed safeguards and mitigation measures	Sections 5.1.5, 5.2.4, 5.3.4, 5.4.4, 5.5.4, 5.6.4, 5.7.7, 5.8.4, 5.9.4, 5.10.4, 5.11.4, 5.12.3 and 7
4.01	Information given under paragraph 2.01(e) must include:	
(a)	A description, and an assessment of the expected or predicted effectiveness of, the mitigation measures	Sections 5.1.6, 5.2.5, 5.3.5, 5.4.5, 5.5.5, 5.6.5, 5.7.8, 5.8.5, 5.9.5, 5.10.5, 5.11.5, 5.12.4
(b)	Any statutory or policy basis for the mitigation measures	Section 3
(c)	The cost of the mitigation measures	TCCS, as a public authority, has budgeted for the cost of undertaking suitable mitigation measures with respect to this Project (refer to Section 3.3.7.5)
(d)	An outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing	Sections 3.3.7.2 and 7 It is not proposed that the Project be subject to additional environmental auditing provisions
(e)	The name of the agency responsible for endorsing or approving each mitigation measure or monitoring program	Sections 3.3.7.2 and 7
(f)	A consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the action, including mitigation measures proposed to be taken by State governments, local governments or the proponent	Section 7
5	Other approvals and conditions	
5.01	Information given under paragraph 2.01(f) must include:	
(a)	details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including: (i) what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy;	Section 3

Clause	Requirement	Section of this EIS
	(ii) how the scheme provides for the prevention, minimisation and management of any relevant impacts.	
(b)	A description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the action	Table 2-1 in Section 2.1
(c)	A statement identifying any additional approval that is required	Executive Summary, Sections 3.1.5, 5.2.4 and 8
(d)	A description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action	Sections 3.3.7.2, 5.1.5, 5.2.4, 5.3.4, 5.4.4, 5.5.4, 5.6.4, 5.7.7, 5.8.4, 5.9.4, 5.10.4, 5.11.4, 5.12.3 and 7
6	Environmental record of person proposing to take the action	
6.01	Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:	NA.
(a)	The person proposing to take the action	Section 2.1
(b)	For an action for which a person has applied for a permit, the person making the application	Section 2.1
6.02	If the person proposing to take the action is a corporation--details of the corporation's environmental policy and planning framework	NA – the proponent is a public authority
7	Information sources	
7.01	For information given in a draft public environment report or environmental impact statement, the draft must state:	
(a)	The source of the information	Section 9
(b)	How recent the information is	Section 9
(c)	How the reliability of the information was tested	Sections 5.1.4, 5.2.3, 5.3.3, 5.4.3, 5.5.3, 5.6.3, 5.7.3, 5.8.3, 5.9.3, 5.10.3, 5.11.3 and 5.12.2
(d)	What uncertainties (if any) are in the information).	Sections 5.1.6, 5.2.5, 5.3.5, 5.4.5, 5.5.5, 5.6.5, 5.7.8, 5.8.5, 5.9.5, 5.10.5, 5.11.5, 5.12.4

3.1.4 ACT Government Approval Process

It is requested that the Project be considered under the bilateral agreement for environmental assessment between the Commonwealth and the ACT Government. This will require the Environment, Planning and Sustainable Development Directorate (EPSDD) to consult with DAWE to provide input to scoping document requirements, as well as the EIS and future DA. A flowchart of this process is provided in Figure 3-1 below.

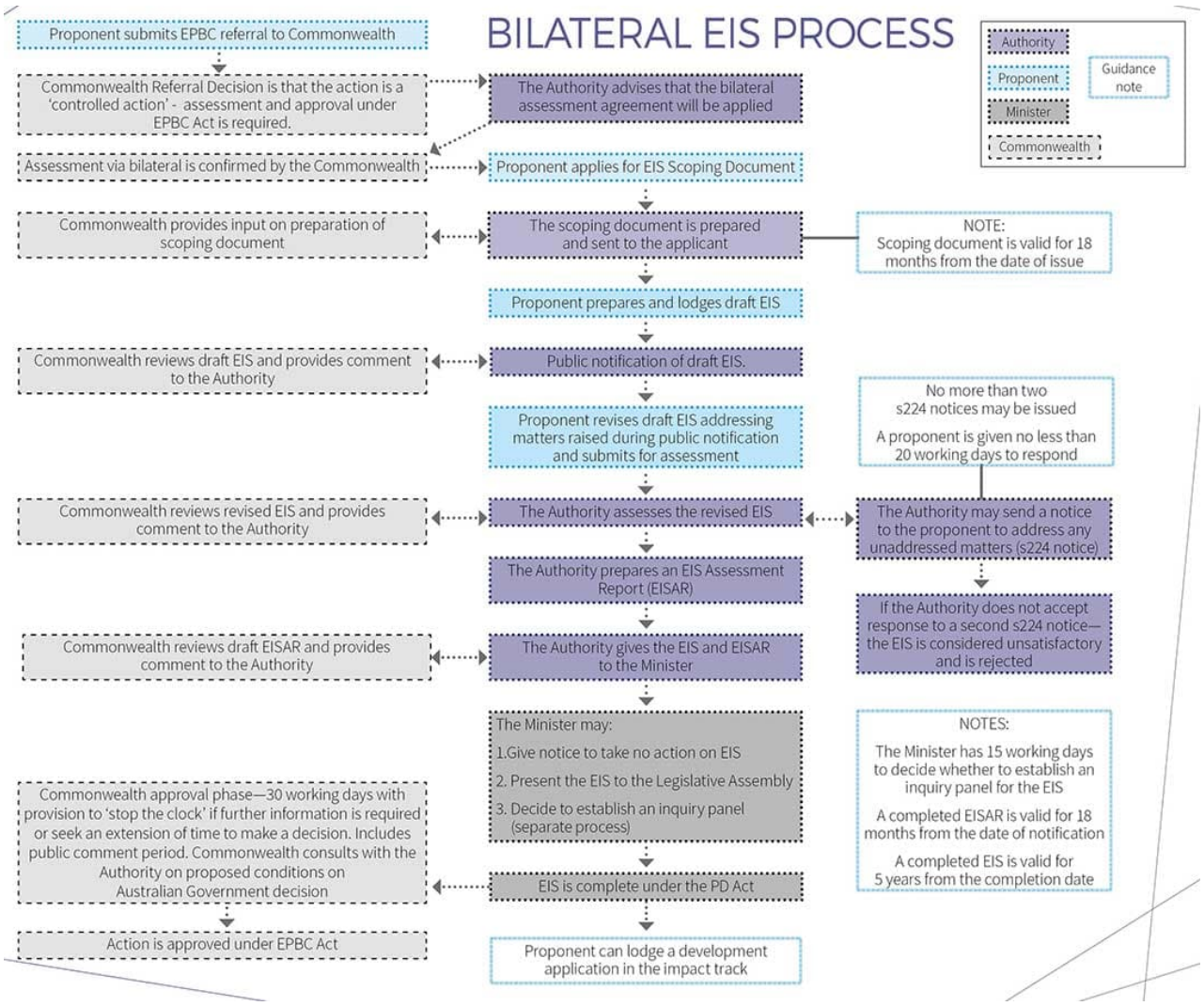


Figure 3-1 Bilateral EIS process

3.1.5 Environment Protection Act 1997

The ***Environment Protection Act 1997*** (EP Act) protects the environment from pollution and its effects. The EP Act provides the regulatory framework to help reduce and eliminate the discharge of pollutants into the air, land and water. Appropriate measures will be established during construction site rehabilitation to minimise erosion of batters adjacent to the road and minimise sediment transfer to nearby waterways.

The EP Act establishes the Environment Protection Authority (EPA) as the statutory decision maker for environmental regulation and policy. The EPA administers legislation covering air and water quality, waste, contaminated land, noise, pesticides and hazardous waste. It is an offence under Sections 137, 138 and 139 of the EP Act to cause environmental harm, material environmental harm, serious environmental harm, or likely environmental likely material environmental harm or likely serious environmental harm.

The Project involves a Class B activity as listed under Clause 1.3 of Schedule 1 to the EP Act, being for:

> ***major land development or construction activities, being—***
>
> ***c) land development, or the construction of a commercial building, on a site of 0.3ha or more and including the construction of associated public infrastructure; or***
> ***d) the construction of public infrastructure on a site of 0.3ha or more;***
>
> ***but not including the installation of pipes or lines for linear utilities such as gas, water, electricity and telephone.***

As well as for:

management of municipal services maintenance on unleased land, being the maintenance of—

(a) urban parkland or other municipal landscapes; or

(b) public places, public roads or public footpaths; or

(c) the stormwater system.

TCCS or its construction contractor will therefore enter into an Environment Protection Agreement with the EPA (refer to Section 5.6.4 below).

3.1.5.1 Environmental Authorisations

Environmental authorisations are a form of licence to conduct an activity which has a significant potential to cause environmental harm. An authorisation sets out the conditions under which the activity may be conducted.

3.1.5.2 Environment Protection Policies

Environment Protection Policies help to explain and apply the EP Act and the ***Environment Protection Regulation 2005*** (EPR). There are eight policies, with the following relating to particular areas of environment protection applicable to the Project:

- General
- Air
- Contaminate sites
- Hazardous materials
- Noise
- Water.

Management plans which are required to be prepared to guide the potential environmental impacts of the Project's construction (refer to Sections 3.3.7.2 and 7) would be guided by these polices.

3.1.6 Nature Conservation Act 2014

The ***Nature Conservation Act 2014*** (NC Act) establishes a formal process for the identification and protection of threatened species and ecological communities in the ACT region. The NC Act requires the Conservator of Flora and Fauna to prepare an action plan in response to each declaration of a threatened species, ecological community or threatening process.

Proponents must assess the likely impact of the proposed development on threatened species and ecological communities listed under the NC Act. As such, the NC Act applies to the Project and this EIS has assessed the Project against the relevant NC Act requirements within the biodiversity assessment (refer to Section 5.2 below and Appendix D)

Part 2.1 of the NC Act establishes the role and function of the Conservator of Flora and Fauna in the administration of licensing for taking, owning, selling, importing and exporting native plants and animals, for establishing the Biodiversity Research and Monitoring Program, for managing Nature Reserves in the ACT and for protecting and conserving threatened species and ecological communities for example, through the preparation of species conservation and management plans and involvement in the development approvals process (Section 318).

In preparing advice regarding development applications, the Conservator must consider MNES Significant Impact Guidelines, the ACT Offsets Policy and any other published guideline, policy or plan regarding protected matters or MNES.

3.1.7 Tree Protection Act 2005

The ***Tree Protection Act 2005*** protects registered or regulated trees from removal. The Project does not require the removal of any tree registered under the ACT Provisional Tree Register or the ACT Tree Register. Additionally, the Project Site comprises area designated as road reserve, that is not within a tree management

precinct, and does comprise any regulated trees that may need to be protected. Section 5.2.2.3 below provides the details of a registered tree within the Study Area.

As set out within Section 5.4.3.1 below, one mature Cypress Tree within the heritage-listed Weetangera Cemetery would have around 5-6% of its Tree Protection Zone impacted by the Project. This EIS therefore seeks approval to undertake these minor impacts to this tree.

3.1.8 Pest Plants and Animals Act 2005

The ***Pest Plants and Animals Act 2005*** identifies pest plants and animals within the Territory and promotes a strategic and sustainable approach to protecting the ACT's land and aquatic resources from threats from pest plants and animals. The ***Pest Plants and Animals Act 2005*** is relevant to the Project, as the basis for identifying and managing clearing of pest species within and adjacent to the road duplication. Additional matters with respect to invasive flora and fauna species related to the Project are considered within Section 5.2 and Appendix D.

3.1.9 Water Resources Act 2007

Under section 42 of the ***Water Resources Act 2007,*** administered by the EPA, construction or altering a water structure, or doing any other work in or on a waterway, is not permitted before obtaining a Waterway Works Licence (WWL). When considering an application for a WWL, the EPA must be satisfied that the work will not adversely affect the flow or quality of the water, the aquatic habitat in the waterway or the interests of other water users. Consultation will be undertaken with the EPA as to whether a WWL will be required due to proximity to Deep Creek.

3.1.10 Heritage Act 2004

The ***Heritage Act 2004*** sets out a regime for the recognition, registration and conservation of:

- Places and objects that have natural heritage significance
- Places and objects that have cultural heritage significance
- Aboriginal places and objects.

It also provides a system integrated with ACT land planning and development to consider DAs having regards to the heritage significance of places, as well as the prevailing heritage guidelines. The ***Heritage Act 2004*** also establishes the ACT Heritage Council. Part 15 of the ***Heritage Act 2004*** sets out the process for entering into heritage agreements. Various criminal offences are furthermore set out with regards to damaging heritage items or places.

Both a Cultural Heritage Assessment and a Statement of Heritage Effects has been prepared in support of the Project. These are summarised in Section 5.4, and provided in full within Appendix E.

3.2 Climate Change

3.2.1 ACT Climate Change Strategy 2019 – 2025

The ***ACT Climate Change Strategy 2019-2025*** (Climate Change Strategy) outlines the next stage of the ACT Government's climate change response and identifies actions to meet the targets and prepare for climate change. As the ACT maintains 100% renewable energy into the existing network, the strategy places a strong focus on reducing emissions from transport and gas. The Project is directly aligned with these key drivers, as it will have a slightly beneficial impact on traditionally-fuelled car emissions by improving the efficiency of car travel along this section of road. By enhancing the options for private journeys to be taken as active transport into Civic through the provision of potential, future additional shared pathways, the Project could also lead the way for a small, beneficial impact on the ACT's overall emissions as the residential population in this part of the Territory increases.

Whilst there will be some minor greenhouse gas (GHG) emissions generated during the construction of the Project, via the use of road-building plant and equipment, these will be mitigated through appropriate management measures as part of a Construction Environmental Management Plan (CEMP).

Further details of the Project's alignment with the Climate Change Strategy are set out within this Section 3.2.1. Further technical assessment of the Project's potential climate change impacts is detailed within Section 5.10.

3.2.1.1 Project need

The Project has been designed and planned, taking into consideration the ACT's ***Climate Change and Greenhouse Gas Reduction Act 2010***, which sets the ultimate target of net zero emissions by 2045 and interim emissions reduction targets for 2025, 2030 and 2040. TCCS acknowledges that transport emissions are the single largest source of ACT emissions. The Project has attempted to balance the need for road safety and the strategic need for the duplication, along with supporting the ACT's emissions reduction targets.

A SIDRA analysis found that the intersection of WHD and DBD in its current form is expected to fail in 2031, with some movements operating at very high delay in the AM and PM peak periods and as such the overall average performance of the intersection falls below the required level of service. This resulting congestion also creates road safety concerns. The duplication of the road and provision for future delivery of a safe active travel route is expected to reduce congestion and resulting crashes. One of the key objectives of the Project, as noted in section 2.2 of the revised EIS, is to 'increase the capacity of WHD so as to relieve the AM and PM traffic congestion from West Belconnen whilst also improving road safety and efficiency of car emissions'. This objective is consistent with the ***ACT Climate Change Strategy 2019-2025*** (Climate Change Strategy).

Regarding transport, the ACT Climate Change Strategy 2019-2025 specifies the key elements of Government's response to transport-related climate change issues. These are set out within Table 3-6 below.

Table 3-6 Climate change strategy – Government response, goals and actions for transport

Government Response and Goals	Context of the Project
Improve public transport to provide an extensive, user-friendly light rail and bus network that is well integrated with active travel options and supported by an expanded network of Park and Ride facilities.	The Project is consistent with the Climate Change Strategy and its goals. The road duplication will have on-road cycle lanes in each direction and an off-road shared path for the length of the upgrade. The shared path will continue through to Bindubi Street to provide for a missing link in the current path network. Furthermore, the new road duplication will be able to accommodate public transport in the form of buses if required in the future. This in turn will assist community members to make low-emission transport choices.
Plan for a compact and efficient city to improve access to public transport and active travel options and to reduce travel distances and reliance on private car use.	The shared path will continue through to Bindubi Street to rectify a missing link in the current path network between Higgins and City
Make the best use of roads, with a greater focus on moving people and goods.	The duplication of the road and provision for future delivery of a safe active travel route is expected to reduce congestion and resulting crashes. One of the key objectives of the Project, as noted in section 2.2 of the revised EIS, is to 'increase the capacity of WHD so as to relieve the AM and PM traffic congestion from West Belconnen whilst also improving road safety and efficiency of car emissions'
Support active travel, including the use of electric bikes, by improving the quality and safety of cycling and walking infrastructure.	The Project provides for various forms of active travel users, including both on and off-road cyclists, as well as for shared path walkers, runners and horse riders.

Government Response and Goals	Context of the Project
Encourage zero emissions vehicles by providing incentives, facilitating installation of charging infrastructure, running commercial and freight vehicle trials and working toward a zero emissions Government passenger vehicle and bus fleet.	The Project does not inhibit the future provision of these facilities to encourage electric vehicle uptake. It would improve congestion along an existing, arterial road network which can be used in future to service electric public transport bus fleets (such as Orbital services).
Goal 3.3 Plan for a compact and efficient city with improved access to sustainable transport options by delivering up to 70% of new housing within our existing town and group centres and along key transit corridors.	The Project involves the use of an existing arterial road corridor which is surrounded by upcoming future residential estates. The Project does not seek to provide a new, greenfield road development.
Goal 3.4 Prioritise improving public transport services and supporting infrastructure, including buses, light rail stage two and connecting services.	The Project would improve congestion along an existing, arterial road network which can be used in future to service electric public transport bus fleets (such as Orbital services).
Goal 3.5 Maximise accessibility to the rapid bus and light rail networks through feeder services and expanding the Park and Ride network.	
Goal 3.9 Prioritise walking and cycling and enhance active travel infrastructure to improve safety and connectivity of the active travel network.	The road duplication will have on-road cycle lanes in each direction and an off-road shared path for the length of the upgrade. The shared path will continue through to Bindubi Street to provide for a missing link in the current path network. The Project provides for various forms of active travel users, including both on and off-road cyclists, as well as for shared path walkers, runners and horse riders.
Action 5.6 of the Climate Change Strategy 2019-25 requires that EPSDD and CMTEDD: Ensure all new Government capital works with a budget of more than $10 million either seek or are consistent with an independent sustainability rating such as an Infrastructure Sustainability rating from the Infrastructure Sustainability Council of Australia (ISCA), or a Greenstar rating from the Green Building Council of Australia or equivalent, and review ratings at least every five years.	Suitable sustainability targets for the Project would be worked into the construction documents package, in consultation with EPSDD.

These matters are discussed in further detail within Sections 3.2.1.2 to 3.2.1.5 below.

3.2.1.2 Traffic

In general, road projects are undertaken to improve traffic flows which have direct benefits in terms of reductions in traffic congestion, idle time or stop/start traffic. These improvements in traffic flow will result in reduced fuel use, relative to a base case of no duplication project. The Transport Assessment Report in Appendix C evidences that the Project will have a slightly beneficial impact on traditionally-fuelled car emissions by improving the efficiency of car travel along this section of road.

As the ACT maintains 100% renewable energy into the existing network, the strategy places a strong focus on reducing emissions from transport and gas. The Project is directly aligned with these key drivers. By enhancing the options for private journeys to be taken as active transport into Civic through the provision of potential, future additional shared pathways, the Project could also lead the way for a small, beneficial impact on the ACT's overall emissions as the residential population in this part of the Territory increases.

Whilst there will be some minor GHG emissions generated during the construction of the Project, via the use of road-building plant and equipment, these will be mitigated through appropriate management measures as part of a CEMP.

3.2.1.3 Public transport/active travel

Action point 3.16 in the Climate Change Strategy establishes the goal to 'explore and implement new approaches to improving the productivity of key transport corridors through prioritisation of public transport and/or active travel'. The Project is consistent with the Climate Change Strategy and its goals. The road duplication will have on-road cycle lanes in each direction and an off-road shared path for the length of the upgrade. The shared path will continue through to Bindubi Street to provide for a missing link in the current path network. Furthermore, the new road duplication will be able to accommodate public transport in the form of buses if required in the future.

As explained in Section 5.1.4 below, that while there is currently a low usage of the road by active transport (bicyclists), this outcome may be due to the location, design of intersections as well as the speed of traffic. It also notes that demand for active travel may be higher in future with continued urban development. The duplication may also address other barriers to bicycle use on the road, including safety, accessibility, lighting and connectivity. This position, in particular, is supported by Sections 4.2 and 5.4 of Appendix C Transport Assessment Report.

One of the key priorities post 2025 in the Climate Change Strategy is to 'continue to electrify public and private transport and support active travel.' The Project is consistent with this vision, providing safe and updated infrastructure that will encourage more active travel and can facilitate public transport usage.

The ***ACT Transport Strategy 2020*** includes a section on the current and future active transport directions for the City. The Planning for Active Travel in the ACT – Active Travel Infrastructure Interim Planning Guideline (January 2019), and Municipal Infrastructure Standards 05 (MIS5) Active Travel Facilities Design, sets out guidance for establishing active travel infrastructure, and using the Active Travel Route System. Shared paths are categorised as 'Community Routes'. The shared path design has been designed with extensive community consultation and it's design is consistent with 'community routes' encouraging more active travel and less reliance on fossil fuelled vehicles.

3.2.1.4 Electric vehicles

The speed of electric vehicle uptake and is not within the scope of this Project. Section 5.10.3.1 discusses the forecasted rates of electric vehicle usage. The pace of such uptake will be aided by the implementation of the ***Zero Emissions Vehicles Action Plan 2018–21***, as outlined in the action point 3.21 of the Climate Change Strategy. Regardless of the pace of such uptake, the need for safe road services will not decrease and electric vehicles will require the same road infrastructure as traditional petrol vehicles. Furthermore, the expansion of the greenfield housing estates at Whitlam is indicative of the growing population of Canberra and its surrounding suburbs, and that demand for roads will continue to grow proportionate to population. The Project and its active travel infrastructure is consistent with the Climate Change Strategy goal to 'encourage the uptake of zero emissions vehicles and electric bikes.'

3.2.1.5 Urban heat island impact

Expansion of the WHD road corridor will also contribute to localised urban heat island effect, as is already recognised for the broader locality under Mapping surface urban heat in Canberra (CSIRO, 2017) (due to existing grasslands and the existing WHD road corridor). The Project has committed to tree and shrub replacement ratios of 1:10 and 1:4 respectively. In addition, landscaping plans for the Project will consider the use of lighter colours in delivering hard infrastructure components of the Project where reasonable and feasible to do so, and where road safety/legibility will not be compromised. These Project commitments are consistent with the Climate Change Strategy, in particular the key priority post 2025 to 'continue to increase tree canopy cover and maintain a healthy urban forest'. Furthermore, the Project is consistent with the Climate Change Strategy key priority to 2025 to 'implement Canberra's Living Infrastructure Plan to reduce urban heat and improve liveability.'

Regarding urban heat, the ***ACT Climate Change Strategy 2019-2025*** specifies the following Goal as is relevant to the Project, and outlined within Table 3-7 below.

Table 3-7 Climate change strategy – goals for urban heat

Goals	Context of the Project
Goal 4.22 Implement Canberra's Living Infrastructure Plan to work towards 30% urban canopy cover and 30% surface permeability, account for the value of living infrastructure and assess local needs for managing heat.	Landscaping plans for the Project will consider the use of lighter colours in delivering hard infrastructure components of the Project where reasonable and feasible to do so, and where road safety/legibility will not be compromised. These landscaping plans, along with the 1:10 and 1:4 tree and shrub replacement commitments are consistent with goal 4.22 of the Climate Change Strategy to 'implement Canberra's Living Infrastructure Plan to work towards 30% urban canopy cover and 30% surface permeability, account for the value of living infrastructure and assess local needs for managing heat.'

Further details regarding the potential climate change impacts of the Project are outlined within Section 5.10 below.

3.2.2 Canberra's Living Infrastructure Plan: Cooling the City

Canberra's Living Infrastructure Plan: Cooling the City (ACT Government, 2019c) sets out the ACT Government's commitment to maintain and improve living infrastructure within Canberra. The Plan recognises the role that 'living infrastructure' plays in keeping the City's temperature cool as the climate warms, becomes more variable, and also more extreme.

The Project proposes to provide an offset against the loss of BGW TEC habitat by protection of land to the west of Kama Nature Reserve which will preserve nesting habitat for Superb Parrot and retain old growth trees and native grassland understorey. Revegetation and rehabilitation will be undertaken during the Project and include:

- Prior to revegetation works excavated or disturbed areas to be rehabilitated so that material is reinstated in original sequence i.e., topsoil at surface and subsoil below
- All areas of disturbance must be revegetated immediately following construction
- Revegetation to be undertaken using a cover crop of sterile Rye Grass to ensure that rapid stabilisation occurs
- A suite of suitable local native species will be used in conjunction with the Rye Grass cover crop. The seed mix will be a locally collected species mix including four species.

Moreover, native, mature trees removed as a result of the Project will be replaced at a ratio of 1:10. Native shrubs removed as a result of the Project will be replaced at a ratio of 1:4. The locations of these plantings must be considered as part of the landscaping and offset plans prepared for the Project. Proposed landscaping trees will either be ***Casuarina Cunninghamiana***, or one of six different species of Eucalyptus.

Landscaping plans for the Project will also consider the use of lighter colours in delivering hard infrastructure components of the Project where reasonable and feasible to do so, and where road safety/legibility will not be compromised.

3.3 Other requirements

3.3.1 Territory Plan 2008

The ***Territory Plan 2008*** is the statutory document guiding planning and development within the ACT. Whilst this EIS is subject to a DA which will include a statement against the ***Territory Plan 208*** Criteria, the Project has considered the key aspects of the ***Territory Plan 2008*** as follows.

3.3.1.1 Strategic Directions

The Project is directly aligned with various Statements of Strategic Directions as recognised within the ***Territory Plan 2008***:

- 1.0 Integrated land use and transport planning will seek to maximise accessibility and transport efficiency, prioritise active travel, reduce energy consumption, increase physical activity, support the preferred pattern of development, promote safety, safeguard environmental quality, and minimise GHG emissions
- 1.11 Policies for environmental planning and management will ensure amenity, minimise pollution, and protect public health and safety
- 1.13 The characteristics of the city that contribute to economic growth: Canberra's role as the national capital and the seat of Federal Parliament; the ease of getting around the city; the safe and clean environment; and the vibrancy of centres as places of social, cultural and business exchange, will be enhanced
- 1.15 Tourism will be fostered by permitting a variety of entertainment, leisure and accommodation facilities, including opportunities for ecotourism, in appropriate locations throughout the Territory
- 1.18A Development is planned to promote active living through the following six principles:
    - a) providing connectivity between uses and activity nodes
    - b) preserving open space
    - c) encouraging mixed land use and density
    - d) ensuring public places are safe and attractive for all
    - e) providing supportive infrastructure that encourages regular physical activity
    - f) ensuring environments promote social inclusion, and are equitable and where practicable are accessible by all
- 1.19 A variety of open space types will be provided in each district or local area to meet the diverse recreational needs of residents and visitors, and to contribute to community health.
- 1.20 Planning policies for community facilities and open space will encourage multiple use and flexible design to allow for changing needs
- 1.24 All new developments and re-developments will be planned with appropriate and segregated network facilities for pedestrians and cyclists; provision for accessible public transport; a legible and permeable hierarchy of roads; conveniently located commercial and community facilities; and a network of open spaces
- 1.25 Heritage and cultural values will be safeguarded, including in particular those of the Territory's Aboriginal peoples and those derived from both its rural history and urban development as the National Capital. The distinctive qualities of residential areas and other places, as well as elements of community heritage, will also be recognised and their conservation promoted
- 1.26 Identified places of heritage significance will be protected in accordance with requirements for their conservation contained in the Heritage Register and any relevant heritage guidelines under the Heritage Act 2004. Special provisions are included in the Heritage Act for the recognition, registration and conservation of Aboriginal heritage
- 2.1 Canberra will continue to develop as a series of discrete urban areas within a landscape setting of hills, ridges and other open spaces. Each town will offer a diversity of housing types; the broadest possible range of employment opportunities; and convenient, linked access prioritising active travel to centres, community facilities and open space
- 2.6A Development will provide suitable and well-designed supportive infrastructure that enhances the experience of the urban environment for people of all abilities and encourages and supports regular physical activity
- 2.7 Development will be planned to encourage use of public transport, walking and cycling, including commuter cycling. Routes will be reserved for an enhanced inter-town public transport system. Requirements for vehicle parking will be related to commercial needs and transport policy objectives
- 2.9 A planned hierarchy of roads will be maintained in order to promote road safety, protect the amenity of residential and commercial areas, and facilitate the efficient movement of major traffic flows and heavy vehicles
- 2.10 Adequate provision of open space throughout the Territory will remain a high priority. Open space will be planned and carefully maintained as an integrated, hierarchical system that provides for a diversity

of sport and recreation activities, contributes to the legibility and character of urban development, is cost-effective to maintain, and assists in the effective management of stormwater

- 2.16 Retention of Canberra's unique landscape setting, including the integration of natural and cultural elements that create its 'garden city' and 'bush capital' qualities, will be accorded the highest priority. Special attention will be given to safeguarding visual amenity, protecting vegetation and other important features within the established urban landscape, and ensuring the high quality of environmental design in new developments or redevelopment.

The Project will increase the safety and efficiency of a key road which has enabled the well-planned expansion of residential development within the ACT. In doing so, it also provides the opportunity to develop new shared pathways at the site in future which will improve the opportunities for residents and visitors of the ACT to pursue active transport journeys or engage in other active leisure pursuits.

The Project proposes to provide an offset against the loss of BGW TEC habitat by protection of land to the west of Kama Nature Reserve which will preserve nesting habitat for Superb Parrot and retain old growth trees and native grassland understorey. Revegetation and rehabilitation will be undertaken during the Project and include:

- Prior to revegetation works excavated or disturbed areas to be rehabilitated so that material is reinstated in original sequence i.e., topsoil at surface and subsoil below
- All areas of disturbance must be revegetated immediately following construction
- Revegetation to be undertaken using a cover crop of sterile Rye Grass to ensure that rapid stabilisation occurs
- A suite of suitable local native species will be used in conjunction with the Rye Grass cover crop. The seed mix will be a locally collected species mix including four species.

3.3.1.2 Zoning

The Project is proposed on unleased Territory land under the ACT Government jurisdiction. As shown in Figure 3-2, the Project is on land zoned Transport and Services TSZ1 - Transport.

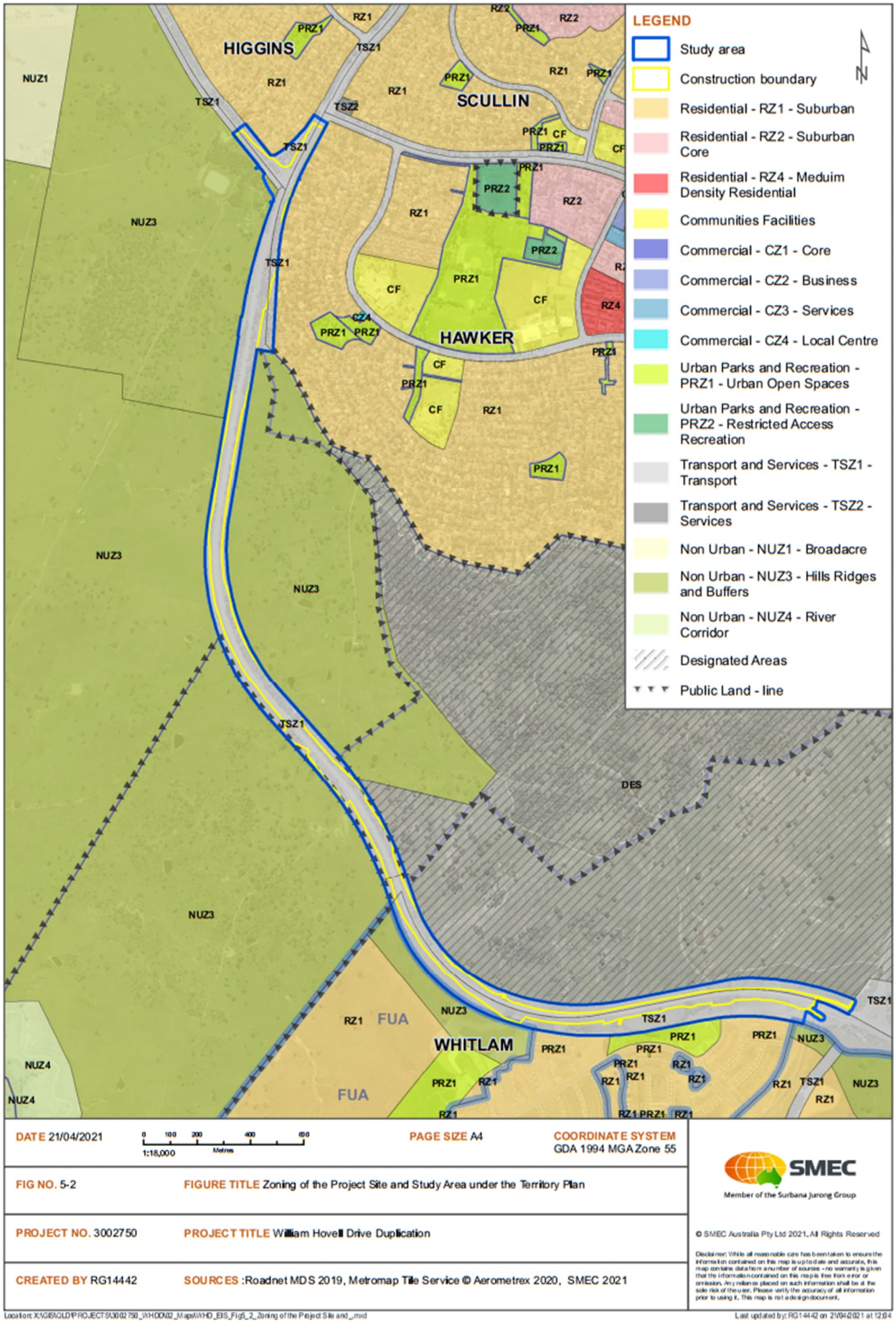


Figure 3-2 Zoning of the Project Site and Study Area under the Territory Plan (SMEC, 2020)

3.3.2 ACT Planning Strategy 2018

The ***ACT Planning Strategy 2018*** (ACT Government, 2018a) recognises the social, economic and environmental changes occurring in our growing and thriving city. The Strategy reflects and integrates the vision and directions of the community and other ACT Government strategies, particularly housing transport and climate change. The vision of this strategy is to be a sustainable, competitive and equitable city that respects Canberra as a city in the landscape and the National Capital, while being responsive to the future and responsive to the future and resilient to change.

The ***ACT Planning Strategy 2018*** (ACT Government, 2018a) identifies the Molonglo Valley as being a Group Centre, within a broader Urban Intensification Locality. WHD is one of the primary road reserves servicing the Molonglo Valley and connecting it to the wider ACT roads network.

Direction 1.1 of the ***ACT Planning Strategy 2018*** (ACT Government, 2018a) is as follows:

> ***Support sustainable urban growth by working towards delivering up to 70% of new housing within our existing urban footprint, and by concentrating development in areas located close to the city centre, town and group centres and along key transit corridors.***

The need for the Project itself arises out of this Strategic Direction, as growing residential demand within regions of Molonglo Valley, the estate of Ginninderry (West Belconnen) and the new suburbs of Strathnairn and Macnamara have increased the need to complete the duplicate WHD and provide enhanced safety, travel efficiency and active travel outcomes for these residents.

The Project is also considered to directly align with Strategic Direction 1.3, which states:

> ***Use infrastructure efficiently to support our growing community.***

The Project represents efficient use of an existing road transport corridor in order to significantly improve transport outcomes for the ACT's residents and visitors.

The Project is also aligned with Strategic Direction 2.3 and its associated Action 2.3.1 which are, respectively:

> ***Improve the character of our city centre to improve liveability and activity.***

> ***Establish an approach to the urban design of the city centre that focusses on interconnected precincts, and considers matters relevant to the city centre location including:***

Indeed, the Project will make provision for a future potential shared pathway connecting to the existing shared path adjacent to Bindubi Street, will offer users a safe, direct connection to Civic and the trunk cycle network around Lake Burley Griffin. Allowing the site to be connected to this active transport infrastructure will encourage broader use of these active transport links and less reliance on private cars.

In this sense, the Project also meets Strategic Directions 4.1 and 4.2, which are:

> ***Deliver social infrastructure that meets community needs and supports strong communities***.

> ***Deliver recreation, open (green) space and public spaces that support social interaction, physical and mental health and engagement in public life.***

In particular, the provision for a potential future shared path delivers directly on Action 4.2.2 of the ***ACT Planning Strategy 2018*** (ACT Government, 2018a) which is as follows:

> ***Investigate opportunities to enhance the network of accessible, high quality local urban open space to meet changing community need through a district planning approach that considers:***
>
> - ***distribution, role and quality of open space network***
> - ***neighbourhood connectivity, including access to nature reserves within the urban environment***
> - ***strategic alignment of urban growth and further investment with the open space network.***

The Project can also be considered to support Strategic Direction 5.1, which is:

> ***Enhance accessibility by better integrating transport and land use.***

Specifically, the Project directly delivers on the following related Actions:

> ***Action 5.1.1 Support the integrated transport network by focussing urban intensification in town centres and around group centres and along the major public transport routes and balancing where greenfield expansion occurs.***
>
> ***Action 5.1.2 Support the delivery of the government's transport strategy to expand movement options (particularly active travel) and the delivery of the government's Climate change strategy to reduce greenhouse gas emissions from transport.***
>
> ***Action 5.1.4 Plan and strategically locate community infrastructure, services and open space in order to optimise accessibility and meet the needs of a growing and changing population.***

It will also meet Strategic Direction 5.2 which aims to:

> ***Deliver well designed, safe and sustainable streets and public spaces to create walkable neighbourhoods that are inclusive and fair.***

Specifically, the Project directly delivers on the following related Actions:

> ***Action 5.2.1 Apply the Movement and Place Framework in future precinct planning to recognise people and place in the design and function of precincts. Include the following principles:***
>
> - ***permeable street layouts***
> - ***safe and efficient active travel routes connected to centres, schools, public transport and local activities***
> - ***support emerging transport trends such as bike share and car share.***
>
> ***Action 5.2.2 Support the Active Travel Office to improve walking and cycling network connectivity and urban amenity, particularly close to key transport corridors, local and town centres and education institutions.***
>
> ***Action 5.2.3 Through place making and improved urban design, deliver high quality streets and places to facilitate social inclusion, activity and improve accessibility.***

The Project furthermore directly delivers on Strategic Direction 5.3, which is:

> ***Create a better experience for walking and cycling into and within the city centre and our town centres.***

Specifically, the Project directly delivers on the following related Actions:

> ***Action 5.3.1 Work with the City Renewal Authority and other partners to create high quality, lively and safe streets and public spaces in the city centre that encourage walking, cycling and public transport use.***
>
> ***Action 5.3.2 Support the development of high quality, lively and safe streets and public spaces in our town centres that encourage walking, cycling and public transport use.***

3.3.3 Transport for Canberra Transport for a sustainable city 2012-2031

Figure 3-3 below sets out the Transport for Canberra Strategic Goals which are embodied within ***Transport for Canberra Transport for a sustainable city 2012-2031*** (Environment and Sustainable Development Directorate, 2012). The Project is directly aligned with many of these Strategic Goals as follows:

- Efficiency - the Project represents efficiency in the use of existing transport infrastructure by widening and improving an existing road corridor rather than constructing a new road corridor. The Project therefore also represents value for money
- Active travel - the Project will provide a future potential active transport corridor alongside WHD. This potential future shared path could connect to the existing shared path adjacent to Bindubi Street, potentially offering users a safe, direct connection to Civic and the trunk cycle network around Lake Burley Griffin. Providing a good access to this shared path will encourage broader use of active transport links and less reliance on private cars

- Integrated transport system – the Project will integrate both car travel and active travel modes with key arterial transport networks within the ACT, allowing transport users to also access public transport and other modes of transport
- Safe - the Project will improve the safety of both car and active transport journeys within this region of the ACT.



Figure 3-3 Transport for Canberra Strategic Goals (Environment and Sustainable Development Directorate, 2012)

3.3.4 ACT Transport Strategy 2020

The ***ACT Transport Strategy 2020*** (ACT Government, 2020) identifies how the COVID-19 pandemic has provided the ACT with a once in a lifetime opportunity to reconsider individual transport behaviours to maintain the economic, health and environmental potential of reduced congestion. At the time of preparing the ***ACT Transport Strategy 2020*** (ACT Government, 2020), the ACT had around 1,000km of shared pathways, 2,500km of footpaths, and around 3,100km of roads, evidencing how most roadways in the ACT are supported by either a footpath or shared pathway. Cars remain the dominant mode of transport for ACT residents, with walking, public transport, and cycling following respectively. As stated in the Strategy: 'Continuing to increase flexibility, by building on the modern public transport network introduced in 2019 and harnessing the opportunities of on-demand travel, especially in our outer suburbs, will offer people more choice over how they travel.'

The Project will deliver on this vision as identified within the ***ACT Transport Strategy 2020*** (ACT Government, 2020), by improving the quality of road infrastructure which ACT residents and visitors may use for driving and cycling.

The ***ACT Transport Strategy 2020*** (ACT Government, 2020) also shows that WHD will be used by Orbital (e.g. non-Rapid) bus routes. The increased capacity of the additional lane along WHD will provide improved travel speed and travel time reliability for these bus routes, without bus priority infrastructure, which would be more appropriate for Rapid corridors.

3.3.5 Healthy Canberra: ACT Preventative Health Plan 2020-2025

Healthy Canberra: ACT Preventative Health Plan 2020-2025 (ACT Health, 2019) seeks to improve health and wellbeing by supporting and promoting healthy and active lifestyles. This includes promoting and enabling active living, for instance by developing Canberra as a walkable and cycle-friendly city and prioritising walking and cycling as a mode of transport for people of all ages and abilities. ***Healthy Canberra: ACT Preventative Health Plan 2020-2025*** (ACT Health, 2019) aims to see more adults and children using active modes of transport as we know that physical activity and movement have many physical and mental health benefits and can reduce the risk of developing chronic diseases.

The Project is directly aligned with the aims of ***Healthy Canberra: ACT Preventative Health Plan 2020-2025*** (ACT Health, 2019), as it will improve the quality of road infrastructure which ACT residents and visitors may use for driving and cycling.

3.3.6 National Capital Plan

The Project does not involve the use of any land which is currently considered to be National Land. However, the Project is generally aligned with the Statement of Planning Principles within the National Capital Plan with regards to environmental sustainability, liveability and open space, urban design and heritage and accessibility. In particular, the Project will enhance the provision of:

> ***Accessible movement systems for a diversity of pedestrian, cycle, public transport and private transport modes will be provided, with good connections between different modes of transport.***

3.3.7 Ecologically Sustainable Development

Section 9 of the P&D Act outlines the key considerations for ESD principles applicable to development within the ACT. Similar considerations apply under Section 3A of the EPBC Act. The Project has been assessed against these within 3.3.7.1 to 3.3.7.5.

3.3.7.1 Long and short-term decision making

Section 3A of the EPBC Act requires that decision-making processes should integrate long and short-term economic, environmental, social and equitable considerations in order to demonstrate the provision of ESD. The Project will allow this existing arterial road corridor to continue to provide its functions whilst meeting the requirements of future traffic demands which are being driven by nearby residential estate development. This will also ensure that the road can safely meet the needs of road users in this area of the ACT, including future users of the Orbital public transport system. Budget funding has been set aside to deliver the Project and so meet the road safety needs of local constituents and visitors to the ACT. It allows for the provision of improved shared path access along the road corridor, which in turn will promote social and equitable outcomes by improving active travel and recreational access in the locality.

Proposed biodiversity offsets and dedicated road crossings for fauna species will ensure that the Project provides for long-term needs of threatened species in the locality.

3.3.7.2 The precautionary principle

In assessing potential alternative Project options and in micro-siting the preferred Project, the precautionary approach has been applied as follows:

- A broad interpretation of ecological thresholds and conditions for classifying threatened species habitat and TECs was utilised
- The precautionary approach was utilised in undertaking an initial Likelihood of Occurrence assessment
- In the first instance, it was indicated precautionarily that potential impacts on the marginal areas of GSM habitat may be significant.

A number of management measures have been proposed to minimise the potential impacts of constructing and operating the Project, including residual impacts. These safeguards will be implemented during construction and operation, and no mitigation measures will be disregarded due to lack of scientific certainty.

A CEMP will be prepared and approved prior to works commencing. All works, including excavation, vehicle movement, stockpiling, topsoil management and spoil disposal will be undertaken in accordance with the approved CEMP and relevant sub-plan protocols to prevent further spread of weed species during and after construction, or unidentified impacts to native vegetation, particularly along buffers with the two nature reserves.

Prior to construction, the CEMP will be required and be approved by the EPA and other Government environmental agencies. The following additional plans and strategies will also be prepared to support the Project (some of which will be in the form of sub-plans to the CEMP):

- Draft Offset Strategy and final Offset Management Plan. This is based on the first choice of offset being located to the west of Kama Nature Reserve (refer to Section 5.2.4 below for more details)
- Flora and Fauna Management Plan
- Tree Management Plan
- Unexpected Discovery Plan for heritage items
- Erosion and Sediment Control Plan
- Landscape Plan
- Waste Management Plan
- Asset Management Plan applying to Vegetation Management (bushfire and environmental) Works Plan
- Construction Traffic Management Plan

Management plans which are required to be prepared to guide the potential environmental impacts of the Project's construction would be guided by the Environment Protection Policies applicable to works within the ACT as per the EP Act and the EPR (refer to Section 3.1.5.2 above).

In addition, The following monitoring measures are committed to in sections 5.2.4 and 7 of this EIS:

- Weed extent in the adjoining nature reserves should be documented before construction and monitored monthly during construction. If weed presence and/or extent has increased the construction contractor is to engage a suitably qualified regeneration specialist to undertake weed removal of these areas in line with the management plan for the reserve
- Roadkill should be monitored monthly during construction by a suitably qualified person and for two years during operation to determine if mitigation measures have been effective. Adaptive management (e.g. moving barriers and wildlife fencing) should be adopted based on the results of the monitoring. A report on roadkill should be written to determine if there are hotspots on the new road and include recommendations for reducing roadkill in these hotspots. Adaptive management should be used to undertake recommendations of the report
- Any connectivity structures will be monitored by remote sensor cameras for a period of three years after construction
- Newly created road verges will be monitored, and adaptive management is undertaken to limit mowing/encourage recruiting Hoary Sunray specimens within the site
- Exclusion fencing (1.8 m tall chainmesh fence) to be included on each side of WHD in the vicinity of the Nature Reserves, extending at least 200m past the fauna crossings. The effectiveness of this exclusion fencing will be monitored during the operational stage of the Project.

These measures would ensure the Project's compliance with relevant statutory requirements under key statutory provisions applicable to the Project, including the P&D Act, EP Act, Heritage Act, NC Act, and the EPBC Act. TCCS would review and approve all management plans prepared by the Construction Contractor or similar. EPSDD, the Conservator and other key ACT agencies would approve the Project's overall mitigation measures which have been committed to within Section 7 of this EIS.

The Project would also be delivered under an Environment Protection Agreement entered into between TCCS or its construction contractor under the EP Act, to drive compliance with the EP Act. (refer to Section 3.1.5 above). The EPA would therefore approve the terms of this Environment Protection Agreement.

3.3.7.3 Inter-generational equity

Given the location of the Project Site, it is considered that the Project will not generate any impacts which will adversely impact the health, diversity or productivity of the environment for future generations. Rather, the Project will benefit future generations by improving the efficiency, safety and carrying capacity of the current arterial road network whilst also enhancing opportunities for ACT residents and visitors to undertake active transport journeys and active leisure pursuits. The proposed Offset Management Plan will ensure the Project's biodiversity impacts can be appropriately compensated.

3.3.7.4 Conservation of biological diversity and ecological integrity

The ***Biodiversity Impact Assessment: William Hovell Drive Duplication*** (SMEC, 2021) (refer to Section 5.2 and Appendix D) sets out how revegetation and rehabilitation will be undertaken during the Project, including:

- Prior to revegetation works excavated or disturbed areas to be rehabilitated so that material is reinstated in original sequence i.e., topsoil at surface and subsoil below
- All areas of disturbance must be revegetated immediately following construction
- Revegetation to be undertaken using a cover crop of sterile Rye Grass to ensure that rapid stabilisation occurs
- A suite of suitable local native species will be used in conjunction with the Rye Grass cover crop. The seed mix will be a locally collected species mix including four species.

It is moreover proposed to replace native, mature trees at a ratio of 1:10. Native shrubs removed as a result of the Project will be replaced at a ratio of 1:4. The locations of these plantings must be considered as part of the landscaping and offset plans prepared for the Project. Proposed landscaping trees will either be ***Casuarina Cunninghamiana***, or one of six different species of Eucalyptus.

The Project also proposes a formal offset against the loss of BGW TEC habitat, demonstrating the value of this ecological resource. TCCS and SMEC have met with the Conservator and agreed a pathway forward to achieving a Draft Offset Strategy and final Offset Management Plan for the Project. This is based on the first choice of offset being located to the west of Kama Nature Reserve (refer to Section 5.2.4 below).

The approach to minimising fragmentation, improving connectivity and reducing the incidence of roadkill events that are being incorporated into the Project's design is:

- One fauna crossing (rope bridge) to assist arboreal and avifauna to safely cross the road reserve
- Two fauna crossings (box culverts) to assist ground-dwelling fauna to safely cross the road reserve. These will be designed to be used by various wildlife
- Some batters will be laid back to allow Kangaroos and Wallabies to escape the roadway and back into the Nature Reserves. However, exclusion fencing (1.8 m tall chainmesh fence) will be included on each side of WHD in the vicinity of the Nature Reserves, extending at least 200m past the fauna crossings. This will assist in reducing the risks to native and non-native fauna from being injured or killed by road traffic. It will also improve the safety of road users by decreasing the risks of vehicle collision with large fauna species. The effectiveness of this exclusion fencing will be monitored during the operational stage of the Project.

It is considered that these measures, when taken as a whole, will successfully meet the criteria of biological diversity and ecological integrity.

3.3.7.5 Improved valuation, pricing and incentive mechanisms

This EIS has examined the environmental impacts of the Project and nominated specific management measures to mitigate the potential for adverse impacts. The requirement to implement these management measures will result in an economic cost to the Proponent. Implementing these management measures will increase both the Project's capital and operating costs. This indicates how environmental resources have been given appropriate valuation.

The design of the Project was developed with the intent of minimising the potential impacts on the Study Area and beyond (refer to Section 2.4 above). This process demonstrates how the Project is being developed with regard to minimising harm to environmental values where reasonable and feasible to do so.

The Project also proposes a formal offset against the loss of BGW TEC habitat, demonstrating the value of this ecological resource, as well as local species which rely on this area. TCCS and SMEC have met with the Conservator and agreed on a pathway forward to achieving a Draft Offset Strategy and final Offset Management Plan for the Project. This is based on the first choice of offset being located to the west of Kama Nature Reserve. An indicative timeframe for achieving this goal of a final Offset Management Plan is set out within Section 5.2.4 below. The relevant consultation processes will be followed during the process of finalising the Offset Management Plan for the Project.

TCCS, as a public authority, has budgeted for the cost of undertaking suitable mitigation measures with respect to this Project.

4 Risk Assessment

To understand the potential risks that need to be mitigated and managed during the construction and operation phases, a risk assessment has been undertaken for the Project. This risk assessment provides a consistent framework to identify, assess and mitigate environmental and social impacts associated with the Project. The objective of the risk assessment is to:

- Establish how TCCS has fully considered the environmental and social risks associated with the Project
- Ensure that risk controls and mitigations have been considered during the options assessment of the Project and during the subsequent design stages
- Ensure that risks and their potential impacts are managed during the planning, construction and operation of the Project.

4.1 Risk assessment methodology

A risk is defined as "the chance of something happening that will have an impact upon objectives." It is measured in terms of consequence and likelihood (***AS/NZS 31000: 2018 Risk Management*** (International Standards Organisation, 2009)). Regarding the Project itself, risk is the probability that the Project has an impact on environmental and social objectives, including compliance with regulatory requirements and the Scoping Document.

A risk management process involves identifying and assessing actual and potential risks to the environment as follows:

- Identify risks
- Evaluate the likelihood that the impact will take place
- Evaluate the severity of the anticipated consequences
- Cross-reference risk consequences and likelihood to determine risk level and impact significance
- Risk elimination and control
- Update risk assessment (residual risk after risk controls are accounted for).

This process allows for the prioritisation of impacts according to their associated risk levels. Subsequently, identified risks may be avoided, or when this is not possible, control measures may be implemented to reduce these risks.

An assessment of the residual risks following the implementation of control measures is also undertaken to obtain a Residual Risk Level. The following risk assessment methodology is consistent with ***AS/NZS 31000: 2018 Risk Management*** (International Standards Organisation, 2009).

4.1.1 Identify risks

A Preliminary Risk Assessment was submitted as part of the initial Scoping Report provided to ACTPLA on 4 September 2020 (SMEC, 2020a). The Scoping Document requires that the Preliminary Risk Assessment be updated to show any further risks identified as a result of the impact assessment within Chapter 5 below, as well as to capture post mitigation or 'residual' risks.

4.1.2 Evaluating likelihood

The likelihood of an impact occurring is best described in terms of probability. Overlaying this is the need to recognise the uncertainty that may be associated with potential impacts, particularly during the preliminary risk assessment process. Best practice dictates that where there is scientific uncertainty, a cautious approach is warranted which will identify a higher level of risk.

Each identifiable potential impact can be assigned a likelihood between 'remote' and 'almost certain'. In simplifying the possible impacts for the purposes of a risk assessment an element of subjectivity is introduced. Refer to Table 4-1 below for the likelihood assessment key used in this risk assessment.

Table 4-1 Risk likelihood assessment key

Likelihood	
Remote (R)	Extremely rare or previously unknown to occur
Unlikely (U)	Unlikely to occur during the Project
Possible (P)	Possible under exceptional circumstances
Likely (L)	May occur during the Project or beyond the Project
Almost Certain (C)	Expected to occur during the Project or beyond the Project

4.1.3 Evaluating consequence

The consequences of an impact require a degree of subjective assessment as the likely consequences of an impact may consist of several elements. For the purpose of this risk assessment, the elements that were considered are illustrated in Table 4-2 below. Several of the elements are interrelated and a consequence is major if any one of the elements has a predicted major impact. A subjective decision is needed for each possible impact as to the level of consequence taking a balanced view of the impact against each of the elements.

The consequence of an impact used in the risk assessment needs to be the reasonably foreseeable consequence. If there is a large amount of uncertainty, then the consequence may be worse.

Table 4-2 Consequence assessment key

Consequence					
	Insignificant (F)	**Minor (I)**	**Moderate (D)**	**Major (J)**	**Catastrophic / Significant (S)**
Community Consequence Descriptions	Negligible complaints or concerns	Public concern limited to local complaints	Local public or media attention and complaints	Attention from media or heightened concern from community	Adverse national media or public attention
	People largely unaffected	Temporary and localised effects on people's livelihoods	Widespread and temporary, or localised and permanent effects on people's livelihoods	Widespread and temporary, or, localised and permanent effects on livelihood and/or displacement of people	Entire villages, communities or groups are displaced, and livelihoods are affected
Environmental Consequence Descriptions	Impacts such as localised or short-term effects on habitat, species or environmental attributes.	Onsite release with minor environmental impacts.	Onsite release and some detrimental effects	Resulting in offsite release and some detrimental effects.	Resulting in permanent offsite detrimental effect.
	Negligible environmental impacts	Localised, long term degradation of sensitive habitat, species or environmental attributes.	Localised and irreversible habitat damage or loss of habitat, species or environmental attributes.	Widespread and persistent changes to habitat, individual species or environmental attributes.	Loss of a significant portion of a valued species or loss of effective ecosystem function on a widespread scale.
Health /Safety Consequence Descriptions	No detectable change	Some minor detectable change	Change requiring basic treatment or medical attention	Change resulting in medical treatment and hospitalisation	Significant / life threatening change
	No Injuries	First Aid treatment	Medical treatment, lost time injuries, plant damage	Extensive injuries, plant damage	Multiple deaths or deaths, permanent significant injury
Economic	Minimal losses	Several thousand dollars lost revenue or remediation costs	Half million dollars in lost revenue or remediation costs	One million dollars in lost revenue or remediation costs	Several million dollars in lost revenue or remediation costs

4.1.4 Risk rating level

The risk significance level is determined by cross-referencing the pre-control likelihood and consequence. The risk rating level is determined from Table 4-3 below.

Table 4-3 Risk rating matrix

Likelihood	Consequence					
-	**Positive**	Minimal	Minor	Moderate	Major	Catastrophic
Remote	Beneficial	Negligible	Negligible	Very Low	Low	Medium
Unlikely	Beneficial	Negligible	Very Low	Low	Medium	High
Possible	Beneficial	Very Low	Low	Medium	High	Very High
Likely	Beneficial	Low	Medium	High	Very High	Significant
Almost certain	Beneficial	Medium	High	Very High	Significant	Significant

4.1.5 Risk Control

Risk control is defined as 'an existing process, policy, device, practice or other action that acts to minimise negative risk or enhance positive opportunities' (***AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines*** (International Standards Organisation, 2009)).

Chapter 5 of this EIS further assesses the risks identified in the Preliminary Risk Assessment and provides an updated assessment based on control measures to determine the residual risk.

4.2 Preliminary risk assessment

To understand the initial risks that were needing to be mitigated and managed during the construction and operation phases of the Project, a preliminary risk assessment was undertaken. The preliminary risk assessment was submitted as part of the initial Scoping Report (SMEC, 2020a) in accordance with the '***Proponents Guide to Environmental Impact Statement***' (ACTPLA, 2017) on 4 September 2020 (SMEC, 2020a).

The preliminary risks have been reviewed and updated to include risks identified in the Scoping Document (refer to Table 1 of Scoping Document Application Number: 202000014) in line with comments received from entities in relation to the Project. Table 4-4 below compiles the identified risks from the Preliminary Risk Assessment and the Scoping Document required to be assessed in this EIS. The preliminary risks identified in the Scoping Report are also provided.

4.3 Updated risk assessment

Risks were assessed further as part of this EIS. The updated risks showing likelihood, consequence and significance for the Project (risk rating – both pre and post mitigation) are set out within Chapter 5 together with the detailed assessment of the risks and their anticipated impact.

Table 4-4 Update risk assessment

Environmental theme and EIS Section	Scoping Document risk identified	Pre-Mitigation Risk Assessment			
		Scoping Report preliminary risk identified	Likelihood	Consequence	Risk Rating
Traffic and transport **Section 5.1**	• Traffic disruption during construction • Increased traffic volume during operation, causing further delays and impacting on road safety • Impact of duplicated road on road safety and operation • The proposed signalised intersection impacts on road safety and operation.	Traffic volume increases in the Project area during construction and operation	Possible	Moderate	Medium
		Temporary loss of access and traffic disruptions (e.g. temporary diversions) during construction	Likely	Minor	Medium
		Temporary traffic management measures during construction are not suitable and result in near miss incidents, crashes, injuries or death	Possible	Major	High
Biodiversity (flora and fauna) **Section 5.2**	• Direct impacts on threatened flora and fauna, threatened ecological communities and non-threatened flora and fauna from clearing and other construction works • Increased habitat fragmentation impacting species movement • Loss of fauna from vehicle strikes and roadkill • Impacts to adjoining nature reserves during construction and operation.	Presence or extent of threatened species and ecological communities not identified prior to development design, resulting in unanticipated impacts.	Possible	Major	High
		Incursion of vehicles, light, noise, invasive species and increased recreational use caused by greater human access into areas of environmental significance	Almost certain	Minor	High
		Clearing of trees and other vegetation causing impacts including loss of amenity, loss of habitat, increased erosion and water runoff	Likely	Moderate	High
		Vegetation clearing activities during construction disturb native animals and increase the potential for vehicle strike	Possible	Major	High
		Project activities facilitate spread of exotic flora into adjacent areas, leading to weed establishment	Possible	Major	High

Environmental theme and EIS Section	Scoping Document risk identified	Pre-Mitigation Risk Assessment			
		Scoping Report preliminary risk identified	Likelihood	Consequence	Risk Rating
		Project attracts additional vermin and pest species, which result in greater competition for resources with native species	Possible	Major	High
		Clearing of vegetation results in a loss of connectivity through fragmentation in the landscape, or obstructing local movement corridors	Possible	Major	High
		Clearing of protected trees that have not been approved to be cleared	Possible	Major	High
		Intrusive site investigations (e.g. geotechnical, contamination test pitting) are undertaken prior to PD Act and EPBC Act Approval resulting in impacts to MNES prior to approval being gained, and potential non-compliance with either Act.	Possible	Major	High
		Clearing of vegetation results in a loss of connectivity through fragmentation in the landscape, or obstructing local movement corridors.	Almost certain	Major	Significant
		Addition of construction of barriers to movement, including safety railings, wider paved roads, more lighting, noise and disrupted water courses.	Almost certain	Major	Significant
Utilities and infrastructure **Section 5.3**	• Impacts on existing infrastructure during construction and operation • Disruption to vital services due to service outages during construction.	Requirement to install new infrastructure to service the project impacting on existing infrastructure	Almost certain	Major	Significant
		Temporary services disruption during utility works as part of the Project	Likely	Moderate	High

Environmental theme and EIS Section	Scoping Document risk identified	Pre-Mitigation Risk Assessment			
		Scoping Report preliminary risk identified	Likelihood	Consequence	Risk Rating
		Accidental damage to utilities and other essential infrastructure	Possible	Major	High
Heritage items and places **Section 5.4**	• Impacts to known heritage items and places • Impacts to unknown or undiscovered heritage items and places.	The Project results in impacts to the heritage values of the Weetangera Cemetery or Kama Nature Reserve due to the recommendations of the Conservation Management Plan not being appropriately implemented during the design phase.	Possible	Major	High
		Potential damage or destruction of unknown Aboriginal heritage items	Possible	Major	High
		Uncontrolled access by vehicles leads to damage to heritage elements (identified PADs) or trees to be retained.	Possible	Major	High
		Potential damage or destruction of unknown non-Aboriginal heritage items	Possible	Major	High
Noise, vibration and lighting **Sections 5.5 and 5.3**	• Noise and vibration impacts to sensitive receivers during operation • Light impact to sensitive receivers during construction and operation.	Intermittent noise and vibration emitted from the equipment required to carry out the proposed construction of the Project impacting residential and non-residential receivers.	Likely	Moderate	High
		Local residents in surrounding suburbs exposed to increased levels of noise and vibration	Likely	Moderate	High
		Increased luminance for residents impacting amenity of sensitive receivers during construction and operation	Likely	Moderate	High
Soils and geology **Section 5.6**	• Disturbance to or movement of contaminated soil during construction	Inadequate investigation of site geotechnical issues resulting in additional works, delays to works and contractor claims	Possible	Major	High

Environmental theme and EIS Section	Scoping Document risk identified	Pre-Mitigation Risk Assessment			
		Scoping Report preliminary risk identified	Likelihood	Consequence	Risk Rating
	• Contamination of soil during construction and operation.	Disturbance of currently unidentified contaminated soils during construction	Possible	Major	High
		Disturbance of soil associated with construction leading to increased soil and sediment erosion	Likely	Moderate	High
		Surface water runoff containing sediment and soil leaving the construction site due to inadequate surface water and sediment and erosion control measures being implemented	Likely	Moderate	High
Water and hydrology **Section 5.7**	• Reduction in water quality in waterways due to runoff and sedimentation during construction and operation • Change to water flow regimes in waterways due to construction and operation.	Local and regional drainage conditions altered	Possible	Major	High
		Changes to existing flow paths and overland flow due to proposed Project	Possible	Major	High
		Potential changes to groundwater availability due to vegetation removal or excavation including impacts on groundwater dependent ecosystems and water users within the catchment. Such impacts could be further exacerbated by climate change.	Possible	Major	High
		Additional run off from new impervious surfaces increases flow downstream and impacts areas beyond the project boundaries.	Likely	Moderate	High
Landscape and visual **Section 5.8**	• Visual impacts to sensitive receivers during operation.	Visual impacts during and following construction not anticipated	Unlikely	Minor	Very Low
		Views available to occupants of nearby sensitive receivers are altered	Unlikely	Minor	Very Low

Environmental theme and EIS Section	Scoping Document risk identified	Pre-Mitigation Risk Assessment			
		Scoping Report preliminary risk identified	Likelihood	Consequence	Risk Rating
		Species planted as part of the Project are inappropriate for landscape and impact on amenity of open spaces	Possible	Moderate	Medium
		Development is not consistent with values of retained heritage sites, or areas of natural environmental value	Possible	Major	High
		Development impacts on recreational use/users of the area – Bicentennial Nature Trail	Possible	Major	High
Materials and waste **Section 5.9**	• Increase in waste to landfill during construction.	Waste materials produced during construction of the Project not stored or managed effectively	Possible	Major	High
		Excessive resources used in the construction of the Project	Unlikely	Minor	Very Low
Climate change **Section 5.10**	• Greenhouse gas emissions from construction and operation contributing to climate change • Increased impervious surfaces, adding to the urban heat island effect.	Greenhouse gas emissions from vehicles and machinery working	Almost certain	Moderate	Very High
		More regular Inspection of road surface and associated infrastructure required	Possible	Major	High
Socio-economic and health **Section 5.11**	• Impact on recreational users of reserves and open space adjacent to the current road alignment • Work, health and safety risk to workers during construction.	Identified impact not assessed in Scoping Report preliminary risk assessment			
		Increased risk of bushfire associated with sparks from construction equipment and vehicles	Possible	Major	High

Environmental theme and EIS Section	Scoping Document risk identified	Pre-Mitigation Risk Assessment			
		Scoping Report preliminary risk identified	Likelihood	Consequence	Risk Rating
Hazards and risks (bushfire and rain event) **Sections 5.12 and 5.7**	• Bushfire started during construction and operation impacting assets and people off site • Bushfire started offsite impacting the Project and people on site • Rain event causing flooding, erosion or damage to road infrastructure.	Increased risk of bushfire through vehicle accidents	Possible	Major	High
		Potential loss of life and property as a result of bushfire during construction	Unlikely	Major	Medium
		Identified impact not assessed in Scoping Report preliminary risk assessment			
Air quality	• NA	Heavy vehicle exhaust emissions cause increase reduction in local air quality	Possible	Moderate	Medium
		Use of construction equipment (e.g. excavators) causing dust and particulate matter reducing local air quality (e.g. though stockpiling, earthworks etc)	Likely	Moderate	High
		Odour issues through improper waste management and storage	Unlikely	Moderate	Low
Approvals, delivery and compliance	• NA	Preparation and approval of the DA documents for the site may result in delays for the entire development.	Possible	Major	High
		Delays in approval decisions result in delayed delivery and financial implications for the project.	Possible	Major	High
		Construction activities result in environmental impacts that are not reported or otherwise acted upon adequately.	Possible	Major	High
		Public comment period of EIS raises significant issues that delay release of final EIS report	Possible	Moderate	Medium

Environmental theme and EIS Section	Scoping Document risk identified	Pre-Mitigation Risk Assessment			
		Scoping Report preliminary risk identified	Likelihood	Consequence	Risk Rating
		Increased media attention and political interest affect the community interest or perceptions of the Project in general	Possible	Moderate	Medium
		Required biodiversity offsets are not available in the ACT	Possible	Moderate	Medium
Matters of National Environmental Significance **Section 5.2**	• Construction and operation impacts on EPBC Act listed threatened species and communities and any other matters of national environmental significance • Project fails to comply with Commonwealth recovery plans or threat abatement plans.	Identified impact not assessed in Scoping Report preliminary risk assessment			

5 Assessment of Impacts

This Chapter sets out a detailed explanation of the potential construction and operational environmental impacts of the Project. It summarises the key technical information which is contained within Appendix C to Appendix F.

5.1 Traffic and transport

Appendix C contains the ***Transport Assessment Report: William Hovell Drive Duplication*** (SMEC, 2021) (Transport Assessment). This Section summarises the findings of that Transport Assessment, setting out the potential traffic and transport impacts of the Project. It also meets the following assessment requirements as identified in the Scoping Document (refer to Section 1.4 above):

- Describe traffic disruptions and other impacts during construction
- Describe the impacts to the current and future urban areas
- Describe impacts on road safety and operation, particularly to vulnerable road users
- Describe the likely volume of traffic proposed to be accommodated during operation
- Describe how construction vehicle movement and parking will be managed.

This Section 5.1 and Appendix C also meet the relevant Entity Requirements (refer to Section 1.4 above and Appendix B).

5.1.1 Environmental conditions and values

The 4.5km section of WHD between JGD and DBD is the only remaining unduplicated portion of the road. It is subject to traffic congestion, particularly during the morning and evening peaks. Upgrades have therefore been identified as a requirement in order to support new residential development in the Molonglo Valley and West Belconnen.

Traffic counts and subsequent modelling identified that the key traffic movements in the AM are the southbound through on Kingsford Smith Drive and the right turn from DBD (refer to Table 5-1 below). Together, these two movements account for approximately 70% of the traffic through the intersection. In the PM peak, the key movements are the northbound through movement and left turn from WHD, which are the reverse movements from the AM peak. These two movements account for approximately 65% of the traffic at the intersection. These proportions are typical of an outer arterial road, connecting largely residential areas in Belconnen to the employment areas of Civic, Parliamentary Zone and Woden.

Table 5-1 Intersection turn volumes (2020)

Approach	Movement	2020 AM	2020 PM
William Hovell Drive	Left	142	568
	Through	291	1,142
	Total	**433**	**1,710**
Kingsford Smith Drive	Through	1,063	321
	Right	86	259
	Total	**1,149**	**580**
Drake-Brockman Drive	Left	356	184
	Right	745	210

Approach	Movement	2020 AM	2020 PM
	Total	1,101	394
Total		**2,683**	**2,684**

Based on the traffic counts undertaken for the Project, from 13 to 19 February 2020, the road currently accommodates more than 20,000 vehicles per day which significantly exceeds the capacity of a single carriageway road. The road is also recording higher than average crash rates. Based on congestion and road safety issues, there is a clearly demonstrated need for the Project.

Analysis using SIDRA software was undertaken for the intersection of WHD – Kingsford Smith Drive – DBD and found the current intersection operates well for existing (2020) traffic volumes.

Future traffic volumes were calculated based on growth rates obtained from the CSTM. The CSTM is a four-step transport model that performs trip generation, trip distribution, mode choice and traffic assignment using the Canberra and surrounding regions road network and land use. In each model year (2016, 2021 and 2031) the CSTM incorporates all known land use and transport network developments. These factors are considered during each step of the four-step model to forecast transport demand, determine where that additional demand will be generated, which mode it will use and the routes on which those trips will travel through the network. CSTM modelling for this project was conducted by TCCS and model outputs were supplied to SMEC.

Table 5-2 shows the 2020 surveyed volumes, growth rates calculated from the CSTM outputs and 2031 forecast volumes based on those growth rates. The table shows that, while there is a substantial increase in overall traffic at the intersection, there is a decrease in some movements and an increase in others. In particular, the peak directional proportion along Kingsford Smith Drive and WHD appears to reverse between 2020 and 2031. In 2020, approximately 70% of the traffic at the intersection travels south (to the city) in the AM and north (to Belconnen) in the PM. In 2031, approximately 60% of the traffic travels in the opposite direction. It appears that this change is due to the development in Molonglo, near the southern end of WHD. The extra traffic generated by Molonglo through Glenloch Interchange and along Parkes Way is likely to force traffic from Belconnen to use an alternative route (possibly Belconnen Way/Barry Drive). In addition, some of the residents of Molonglo will travel north to Belconnen, along Bindubi Street, Coulter Drive and WHD.

Table 5-2 Intersection turn volumes and growth rates

Approach	Movement	2020 Volumes		2020-2021 Annual Growth		2031 Volumes	
		AM	PM	AM	PM	AM	PM
William Hovell Drive	Left	142	568	5%	4%	242	860
	Through	291	1,142	14%	-13%	1,311	216
	Total	**433**	**1,710**	**12%**	**-4%**	**1,553**	**1,077**
Kingsford Smith Drive	Through	1,063	321	-12%	14%	251	1,355
	Right	86	259	4%	9%	142	717
	Total	**1,149**	**580**	**-9%**	**12%**	**394**	**2,072**
Drake-Brockman Drive	Left	356	184	8%	5%	887	347
	Right	745	210	3%	4%	1,072	326
	Total	**1,101**	**394**	**5%**	**5%**	**1,959**	**673**
Total		**2,683**	**2,684**	**3%**	**3%**	**3,906**	**3,822**

Similar to the growth calculations for the intersection turn volumes, the midblock volumes on WHD were calculated from existing volumes and growth rates from the CSTM. Table 5-3 shows the 2020 surveyed volumes, 2020-2031 growth rates and calculated 2031 annual and Annual Average Daily Traffic (AADT) volumes. WHD shows a relatively low growth rate for the AADT at 1% per annum. It is likely that this volume growth does not accurately reflect the increase in travel demand, and some trips are using other parts of the network.

Table 5-3 Annual and AADT traffic volumes

Period	2020 WHD Volume		2020-2031 Growth Rate		2031 WHD Volume	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
Annual Volume	3,519,493	3,286,562	1%	1%	3,735,765	3,556,872
AADT	**9,616**	**8,980**			**10,207**	**9,718**

The intersection turning volumes for the 2031 SIDRA Intersection analysis were generated from observed AM and PM peak turning movement counts collected in 2020. These observed volumes were extrapolated to 2031 volumes using growth factors calculated from the CSTM outputs for 2016, 2021 and 2031.

The 2031 Existing scenario represents the current intersection layout. This configuration was analysed first to determine if there are likely to be significant performance issues. The assessment found significant issues for some movements at the intersection.

The SIDRA analysis results (Average Delay, Level of Service and 95th Percentile Back of Queue) for the Existing AM and PM scenarios in 2031 are shown in Table 5-4.

Table 5-4 shows that the existing intersection is expected to fail in 2031, with some movements operating at very high delay in the AM and PM peak periods and as such the overall average performance of the intersection falls below the required level of service. The movements that fall below the required Level of Service (LoS) are highlighted in Table 5-4.

Table 5-4 Existing Intersection turn volumes and growth rates

Approach	Movement	2031 AM			2031 PM		
		Delay (s)	LoS	Queue (m)	Delay (s)	LoS	Queue (m)
William Hovell Drive	Left	7.3	A	49.9	129.5	F	574.4
	Through	7.8	A	49.9	14.1	A	22.6
	Average/max	**7.7**	**A**	**49.9**	**106.3**	**F**	**574.4**
Kingsford Smith Drive	Through	6.3	A	0.0	6.4	A	0.0
	Right	13.8	A	9.9	14.2	A	48.9
	Average/max	**9.0**	**A**	**9.9**	**9.1**	**A**	**48.9**
Drake-Brockman Drive	Left	852.2	F	2,104.3	7.0	A	14.5
	Right	790.3	F	2,428.0	11.7	A	13.3
	Average/max	**818.3**	**F**	**2,428.0**	**9.3**	**A**	**14.5**
Average/max		**414.5**	**F**	**2,428.0**	**36.5**	**C**	**574.4**

Previous work undertaken by Calibre (***William Hovell Drive Upgrade Feasibility Study – Environmental, Heritage and Traffic and Transport Inputs to the Feasibility Study***, (WSP, 2018)) found that WHD experienced injuries at approximately four times the national average for urban and rural roads. Specific issues noted in that study included:

- WHD performs a through arterial function, with limited alternative routes
- Current active transport network provision along the corridor is limited
- Traffic demands indicate that AM current peak hour volumes southbound are at or near capacity (>1,800 vehicles per hour)
- High crash rates are indicative of:
    - Stop start conditions at intersections and midblock
    - High levels of sideswipes midblock suggest southbound and northbound lane merge is not operating effectively.

5.1.2 Investigations

The Transport Assessment (refer to Appendix C) reviewed the following information for the Project:

- Crash statistics
- Transport network plans, as outlined in the ***ACT Transport Strategy 2020***
- Traffic survey data.

A traffic study was undertaken to understand the capacity and performance of the intersection of WHD and DBD, particularly given future anticipated traffic demands. The assessment of the intersection included traffic count surveys, strategic transport modelling and SIDRA analysis.

Future traffic modelling based on the CSTM was undertaken and considered the future design year 2031. The model found that while there will be a substantial increase in overall traffic at the intersection, there will also be a decrease in some movements and an increase in others. It appears that this change will be due to the development in Molonglo, near the southern end of WHD. The extra traffic generated by Molonglo through the Glenloch Interchange and along Parkes Way is likely to force traffic from Belconnen to use an alternative route (possibly Belconnen Way/Barry Drive). In addition, some of the residents of Molonglo will travel north to Belconnen, along Bindubi Street, Coulter Drive and WHD.

The SIDRA analysis found that the intersection in its current form is expected to fail in 2031, with some movements operating at very high delay in the AM and PM peak periods and as such the overall average performance of the intersection falls below the required level of service.

5.1.3 Intersection design options

The CSTM was used to determine the projected growth of traffic along the WHD corridor. The CSTM is a four-step model that performs trip generation, trip distribution, mode choice and traffic assignment using the Canberra road network and land use. The CSTM is used to forecast traffic growth, determine where that additional traffic will be generated and how that traffic will travel through the road network. CSTM modelling for the Project was conducted by TCCS and model outputs were supplied to SMEC to inform the Transport Assessment (refer to Appendix C).

According to the Transport Assessment (refer to Appendix C) the Project will not generate any traffic, according to traditional traffic generation methodologies. However, the upgrade will result in a redistribution of traffic across the Canberra road network and may also lead to a small increase in traffic volumes due to the relatively lower congestion and easier road travel. This increase in traffic should be accompanied by a reduction in traffic volumes across other arterial and lower order roads in Belconnen.

The performance of the intersection of WHD and DBD was also investigated using SIDRA analysis. Firstly, a 'do nothing' approach was tested, based on the existing round-a-bout. This found significant reduction in the level of service (i.e. traffic delays).

To address the issues identified in the 2031 Existing scenario analysis, three upgraded intersection layouts were tested, which were:

- Upgraded round-a-bout: This layout uses a much larger round-a-bout with two circulating lanes. The southbound through movement, northbound left turn and eastbound left turn all use continuous lanes that effectively bypass the intersection before merging downstream
- Signalised intersection: The signalised intersection has a relatively compact footprint, with two lanes for each through and right turn movement. The left turns from the south and west have a high-angle slip lane with priority control
- Signals retrofitted to existing round-a-bout: This layout entailed the retention of existing round-a-bout layout and alignment with the addition of signals to control vehicles entry to the roundabout.

The signalised round-a-bout was eliminated as a viable option following advice from the civil design team. This is due to the existing round-a-bout being significantly smaller than design guidelines require. The existing round-a-bout does not cater for the B-double design vehicle. The upgraded round-a-bout was also removed as a viable option due to the required size of the intersection and the absence of appropriate active travel facilities.

In consultation with TCCS, it has therefore been confirmed that the preferred option is to signalise the intersection with DBD. This will satisfy the intersection performance requirements, whilst also limiting future barriers to active travel. The potential layout of the signalised intersection of WHD and DBD is provided in Figure 5-1 below.

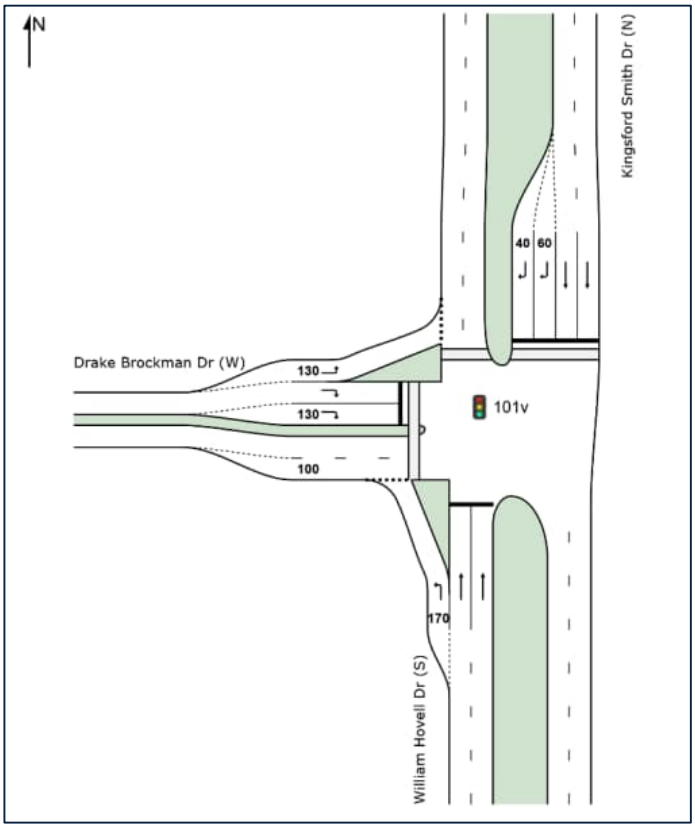


Figure 5-1 Potential signalised intersection layout

Table 5-5 shows that the signalised intersection is expected to generally operate well in 2031, with one movement operating at LoS "E" in the 2031 AM peak and all movements operating well in the 2031 PM peak.

Table 5-5 Intersection analysis results – signalised layout (2031 project operational scenario)

Approach	Movement	2031 AM			2031 PM		
		Delay (s)	LoS	Queue (m)	Delay (s)	LoS	Queue (m)
William Hovell Drive	Left	8.7	A	15.4	25.3	B	162.6
	Through	55.1	D	356.2	24.3	B	22.9
	Average/max	**47.8**	**D**	**356.2**	**25.1**	**B**	**162.6**
Kingsford Smith Drive	Through	14.7	B	26.6	6.3	A	88.2
	Right	67.6	E	43.9	31.5	C	108.3
	Average/max	**33.8**	**C**	**43.9**	**15.0**	**B**	**108.3**
Drake-Brockman Drive	Left	54.0	D	415.0	8.9	A	17.8
	Right	53.0	D	242.5	41.7	C	42.8
	Average/max	**53.5**	**D**	**415.0**	**24.8**	**B**	**42.8**
Average/max		**49.3**	**D**	**415.0**	**19.6**	**B**	**162.6**

5.1.4 Impacts

The assessment of construction traffic impacts has involved a review of the types of construction activities proposed, staging of work, construction traffic generation and working hours. The assessment of construction traffic impacts has involved a review of the types of construction activities proposed, staging of work, construction traffic generation and working hours. Most of the construction process will be undertaken offline, with minor impacts to traffic operations during final tie-in and diversion of traffic onto the new carriageway. The conversion of the intersection of DBD and WHD to signals will represent a possible disruption. Construction staging and temporary pavement will be investigated prior to construction to mitigate potential impact at the intersection.

Once operational, the proposed duplication of WHD between DBD and Coulter Drive provides better traffic flow between Belconnen and key areas including Civic, Parliamentary Zone and Woden, considering the proposed design year of 2031 has been adopted.

Currently, sections of WHD operate close to capacity and the resultant congestion leads to an increase in crashes. The duplication of the road and provision for future delivery of a safe active travel route is expected to reduce congestion and ensuing crashes. In addition, increased arterial capacity is expected to reduce the likelihood of east-west rat-running through Hawker, Weetangera, Cook, and Aranda.

WHD forms the only internal road link in the project. After the duplication, WHD is expected to operate at an acceptable LoS (refer to Table 5-5 in Section 5.1.3 above).

WHD is not currently used for public transport services, and there are no plans to provide rapid public transport on this corridor in the future. The road design allows for passage of buses, and it is not expected that there will be any public transport stops on WHD, due to its relatively rural nature and separation from nearby urban areas Belconnen and Molonglo. Whilst the Project's design allows for the passage of buses, the Project does not include any dedicated public transport facilities.

The ACT Transport Strategy shows that WHD will be used by Orbital (e.g. non-Rapid) bus routes. The increased capacity of the additional lane will provide improved travel speed and travel time reliability for these bus routes, without bus priority infrastructure, which would be more appropriate for Rapid corridors.

The project does not include any parking for the main alignment and will not generate additional service vehicles.

WHD forms a key arterial route between Belconnen and Civic. It also provides access from Belconnen to the Tuggeranong Parkway and Parkes Way at Glenloch Interchange, which in turn provide access to the Parliamentary Triangle, Woden and Tuggeranong. Currently, traffic moves primarily in the peak direction, e.g. from residential areas in Belconnen to employment areas in the AM peak and back again in the PM peak. In the future, with the development of Molonglo, the peak direction will be less defined, with traffic travelling from Molonglo to Belconnen in the AM peak period. This increase will tend to increase the AADT, without increasing the peak direction flow.

CSTM modelling was undertaken by TCCS and the outputs were supplied to SMEC. Figure 5-2 and Figure 5-3 below show the model outputs for the 2031 AM and PM peak periods respectively. These outputs show that, after the Project is operational, there will be no capacity issues on WHD. The traffic volumes on WHD between DBD and JGD are likely constrained by a lack of capacity further east on WHD between JGD and Bindubi Street.

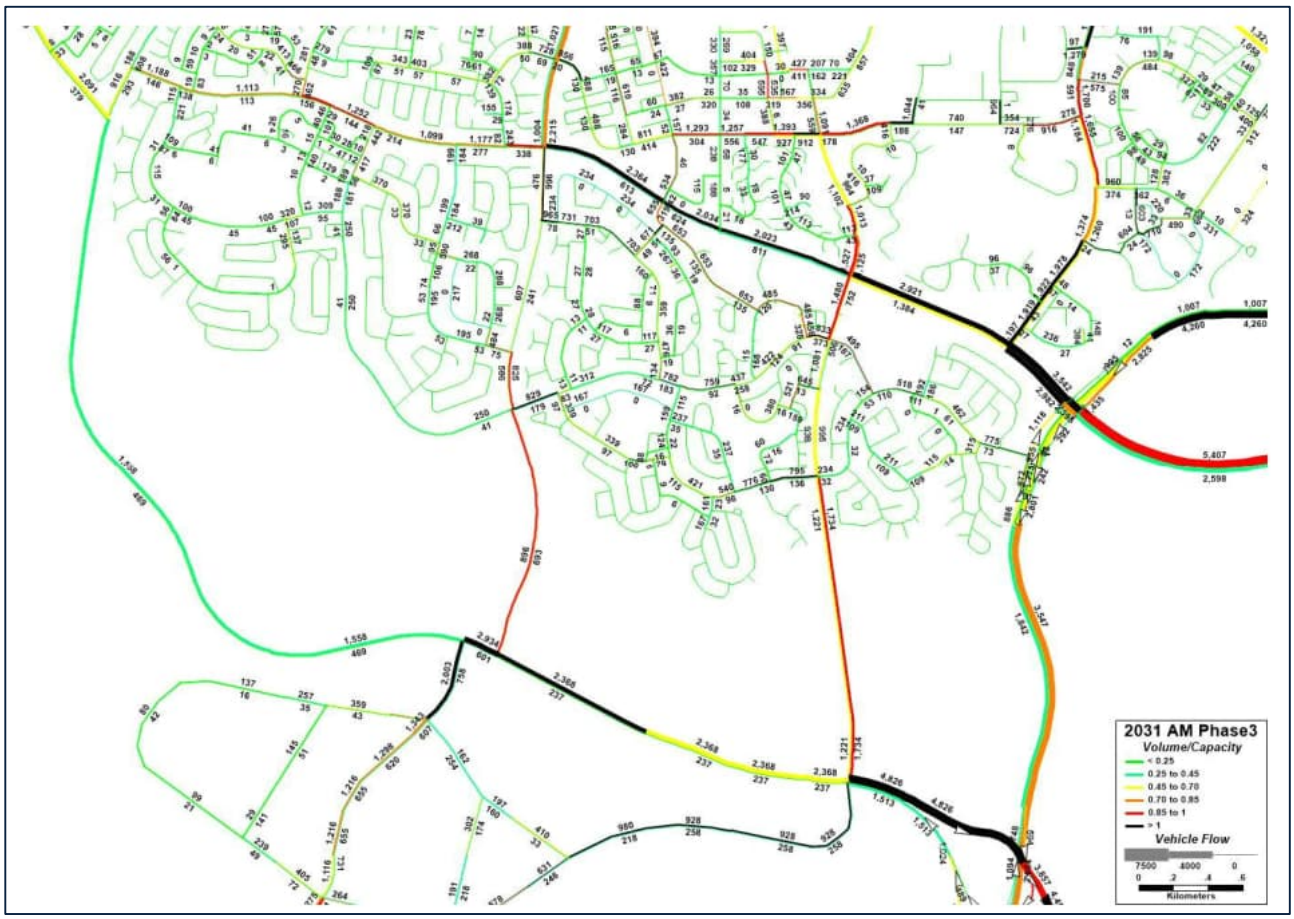


Figure 5-2 Traffic volumes for 2031 AM peak hour (TCCS)

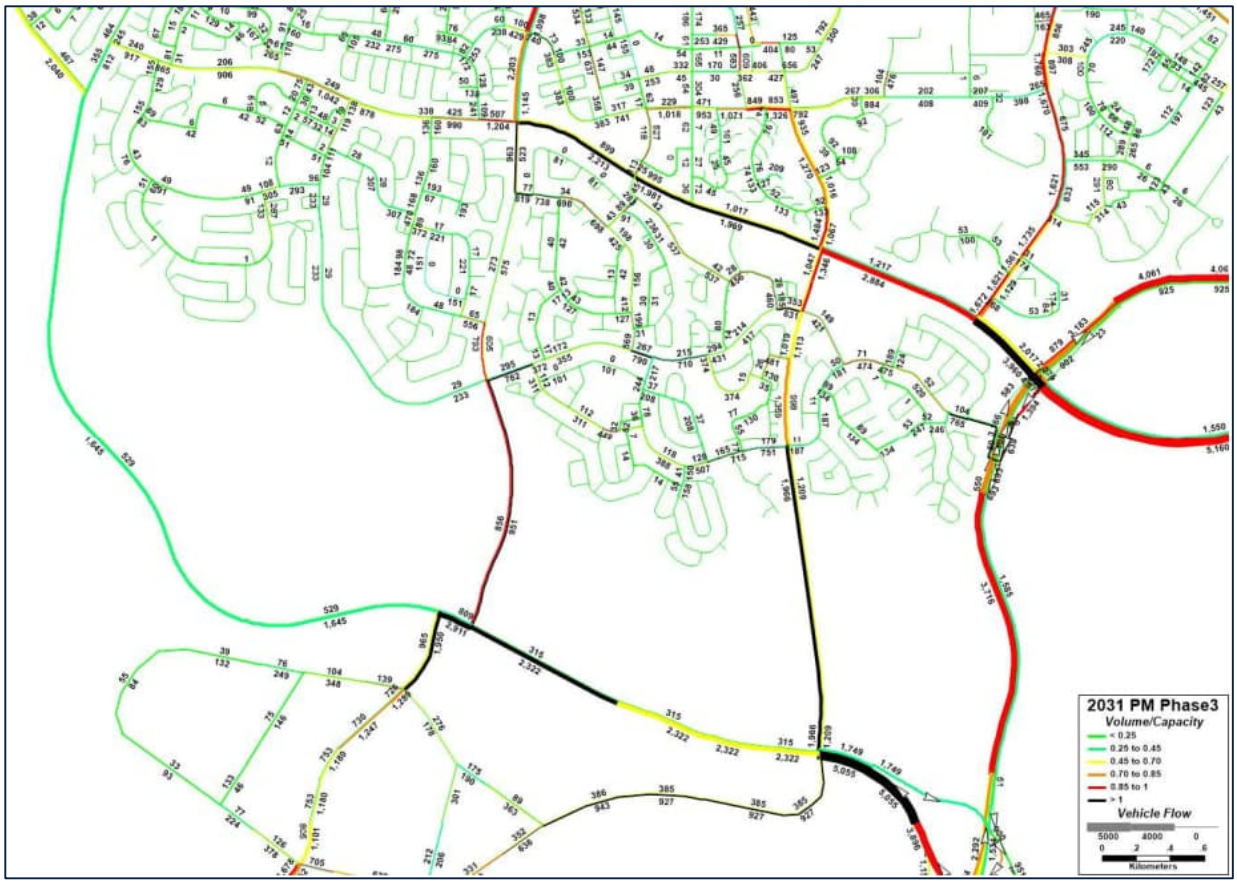


Figure 5-3 Traffic volumes for 2031 PM peak hour (TCCS)

The relatively rural location of WHD means that the duplication will not have any significant impact on current and future urban areas. Indeed, the WHD road reserve is located adjacent to 17 residential properties in Hawker, and close to a further 31 future properties in Whitlam (separated by roads and water courses). As set out within Appendix C, the corridor is near a small number of properties in those areas, however the duplication will not have any significant negative impact on access to, or movement within, those urban areas.

The proposed road upgrade has been through a Safety in Design process, which identified 132 risks during the construction process, ranging from Low to Very High. Mitigation options were developed for all risks, which reduced the risk ratings to a range from Low to Moderate.

The proposed road duplication will address most of the key issues noted by Calibre (Calibre, 2018), including:

- Limited safe active travel opportunities
- Limited capacity
- Congested merge and intersection point.

The existing intersection layout of WHD, DBD and Kingsford Smith Drive will operate at an unsatisfactory Level of Service under the forecast traffic volumes in 2031. Upgrading this intersection to a signalised T-intersection will allow it to operate well in the 2031 AM and PM peak periods, with LOS D in the AM and LOS B in the PM peak. One movement is expected to operate at LOS E in the AM. No movements operate at LOS F in either peak period.

The traffic surveys showed that there is currently very low demand through the Study Area for active travel. Across the six-hour survey periods, only two cyclists were counted, turning left from DBD onto Kingsford Smith Drive. Part of this low demand is likely to be the somewhat remote location but also the design of the intersection and nearby facilities. Round-a-bouts offer poor accessibility for pedestrians and cyclists as they must find gaps in the traffic stream. The existing southbound bypass lane operates at 80km/hr and represents a substantial risk for pedestrians and cyclists.

The duplication of WHD is expected to have a very minor impact on public transport mode choice. The easing of congestion on an arterial route may very slightly increase the attractiveness of private vehicle travel, primarily

between Belconnen and Civic. However, the improvement of cycle facilities with the 2.0m wide shoulder is expected to lead to a positive change in the number of cyclists in the area, primarily commuting, but also recreational.

Whilst the Project will generally retain the existing alignment of the Bicentennial National Trail, TCCS will commence the process of adjusting the trail alignment near DBD to de-conflict the interface with the new shared path alignment (noting that the Project provides for the future provision of a potential off-road shared path for the length of the upgrade). Given the rate of new residential development in the locality, there is likely to be a higher demand for active travel in the area. If the future provision for a shared pathway is taken up, it will connect to the existing shared path adjacent to Bindubi Street and offer users a safe, direct connection to Civic and the trunk cycle network around Lake Burley Griffin. Providing good access to this shared path will encourage broader use and less reliance on private cars. The proposed on-road cycle lanes represent a significant improvement in cycling amenity in the Study Area.

In the future, as development in Molonglo and West Belconnen increase, there is likely to be a higher demand for active travel in the area. The Project allows for the future provision of a shared path running beside WHD, which may connect to the existing shared path adjacent to Bindubi Street. This could offer users a safe, direct connection to Civic and the trunk cycle network around Lake Burley Griffin. Providing good access to this potential future shared path will encourage broader use and less reliance on private cars.

Overall, there are not expected to be any negative impacts on the surrounding transport network from the duplication of WHD.

Traffic modelling undertaken by TCCS and supplied to SMEC as an input to the project showed that WHD is expected to carry up to 1,645 vehicles per hour in the peak direction in 2031 once the Project is operational. These volumes are likely lower than the true demand due to capacity constraints elsewhere in the network

In terms of traffic impacts during construction, it is recommended that a Construction Traffic Management Plan (CTMP) be prepared which incorporates proposed mitigation measures to ensure disruptions to existing traffic flows are minimised as much as possible.

The access to nature reserves and the cemetery along the southern side of the road reserve are to be upgraded as part of this Project. There are three cast in-situ underpasses within the Project Site which will also need to be extended to accommodate the widened road. The locations are as follows:

- Underpass 1 - Chainage 735.465 (TCCS Bridge Number 1156)
- Underpass 2 - Chainage 2440 (TCCS Bridge Number 1155)
- Underpass 3 - Chainage 4650 (TCCS Bridge Number 1154).

Underpasses 1 and 3 are at each end of the project, whilst Underpass 2 is relatively central. All underpasses have been located to suit the existing topography and longitudinal vertical grading of WHD.

The Bicentenary National Trail traverses The Pinnacle Nature Reserve directly south of the Belconnen suburbs of Hawker and Weetangera. The Bicentenary National Trail then crosses beneath WHD at Underpass 1. This underpass has approximately 3m vertical clearance. Between Underpass 1 and DBD, the Bicentenary National Trail is currently located within the WHD road reserve for approximately 370m. However; as noted above, TCCS will commence the process of adjusting the trail alignment near DBD to de-conflict the interface with the new shared path alignment.

5.1.5 Mitigation

Table 5-6 below sets out the proposed mitigation measures to manage the potential traffic and transport impacts of the Project.

Table 5-6 Traffic and transport mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Traffic volume increases at the Project Site during construction and operation not anticipated	Prepare and implement a CTMP	Moderate	Design and Construction	TCCS
Temporary loss of access and traffic disruptions (e.g. temporary diversions) during construction	Schedule works with the potential for traffic disruption, such as utility adjustments outside of peak commuting periods to minimise road user delays. Works impacting on traffic lanes to be undertaken at off peak times (or at night).	High	Construction	TCCS
Temporary traffic management measures during construction are not suitable and result in near miss incidents, crashes, injuries or death	A CTMP will be prepared by the nominated contractor in consultation with the ACT Government and provided to TCCS. The CTMP will be the primary management tool to manage potential traffic impacts associated with construction.	High	Design and Construction	TCCS
Traffic disruption during construction	Prepare and implement a CTMP. Schedule works with the potential for traffic disruption, such as utility adjustments outside of peak commuting periods to minimise road user delays. Works impacting on traffic lanes to be undertaken at off peak times (or at night).	High	Design and Construction	TCCS
Increased traffic volume during operation, causing further delays and impacting on road safety	It is likely that there will be an increase in traffic volume utilising WHD, however the increased capacity of the road as a direct result of the project will accommodate this. The duplication and intersection upgrade will improve safety on WHD.	High	Design	TCCS

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Impact of duplicated road on road safety and operation	The duplication and intersection upgrade will improve safety on WHD.	High	Design	TCCS
The proposed signalised intersection impacts road safety and operation	The duplication and intersection upgrade will improve safety on WHD.	High	Design	TCCS

5.1.6 Residual risk

Based on the mitigation measures identified in Section 5.1.5, an assessment of the residual risks associated with the Project has been considered. Table 5-7 below sets out the residual risk assessment of the Project's potential traffic and transport impacts.

Table 5-7 Traffic and transport residual risk assessment

Risk (as per Chapter 4 and scoping document)	Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
Traffic volume increases at the Project Site during construction and operation not anticipated	Medium	Unlikely	Moderate	Low
Temporary loss of access and traffic disruptions (e.g. temporary diversions) during construction	Medium	Possible	Minimal	Very Low
Temporary traffic management measures during construction are not suitable and result in near miss incidents, crashes, injuries or death	High	Remote	Major	Low
Scoping Document risks identified				
Traffic disruption during construction	High	Possible	Minor	Low
Increased traffic volume during operation, causing further delays and impacting on road safety	Medium	Unlikely	Minor	Very Low
Impact of duplicated road on road safety and operation	Medium	Unlikely	Minor	Very Low
The proposed signalised intersection impacts road safety and operation	Medium	Unlikely	Minor	Very Low

5.2 Flora and fauna

Appendix D contains the ***Biodiversity Impact Assessment: William Hovell Drive Duplication*** (SMEC, 2021) (Biodiversity Assessment). This Section summarises the findings of that Biodiversity Assessment, setting out the potential flora and fauna impacts of the Project. It also meets the following assessment requirements as identified in the Scoping Document (refer to Section 1.4 above):

- Provide an Ecological Impact Assessment prepared by a suitably qualified consultant

- Assess the direct impacts on flora and fauna in particular GSM, PTWL, Superb Parrot, Swift Parrot and any other threatened species and TECs including BGW
- Describe the impact of habitat fragmentation caused by the development, particularly the potential loss of wildlife movement corridors and habitat connections
- Discuss the impact of night lighting and noise on nocturnal fauna and flora
- Describe the impacts increased animal strikes and roadkill may have on threatened and non-threatened species, particularly kangaroos and threatened fauna and methods to mitigate these
- Discuss the potential impacts to the adjacent nature reserves, including impacts from altered hydrology patterns and spread of invasive plants
- Outline mitigation arrangement and whether an offset is likely to be required and, if so, how they comply with the EPBC Act environmental offsets policy and whether an offset management plan is likely to be required
- Consider whether ongoing management, monitoring or reporting regimes are required.

This Section and Appendix D also meet the Entity Requirements as specified by the Conservator of Flora and Fauna (refer to Section 1.4 above and Appendix B).

This Section 5.2 moreover also assesses potential impacts on Matters of National Environmental Significance (MNES) as identified in the Scoping Document:

- Describe the impact on Box Gum Woodland, Superb Parrot, Swift Parrot, Golden Sun Moth and any other MNES potentially impacted by the project
- For any matters identified as potentially impacted provide a description of the relevant impacts of the action including:
    - A detailed discussion of known threats
    - A detailed assessment of direct and indirect impacts on areas of habitat and populations of listed threatened species during pre-construction, construction and operation
    - Detailed information on the extent (in hectares) of known and potential habitat that occurs in the proposed site and surrounds which may potentially be impacted by the Project
    - A detailed assessment of the nature and extent of the likely short term and long-term relevant impacts
    - A statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible
- Outline how the Project is consistent with:
    - Australia's obligations under the Convention on Biological Diversity, the Convention on Conservation of Nature in the South Pacific (Apia Convention), or the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
        - Any relevant recovery plans or threat abatement plans
        - Any relevant strategic assessment reports
        - Any relevant Commonwealth recovery plans or threat abatement plans
- If offsets are proposed to compensate for impacts on MNES, describe the proposed offsets and how they comply with the EPBC Act environmental offsets policy.

5.2.1 Environmental conditions and values

5.2.1.1 Surrounding environment

The Study Area crosses a hillside that sweeps to the south of The Pinnacle Extension Nature Reserve and to the north of the Kama Nature Reserve. The Kama Nature Reserve is a 155ha parcel of land, sharing its northern boundary with WHD and extending from the western side of the new suburb of Whitlam. The Kama Nature Reserve was established as a nature reserve in 2008 and was listed on the ACT Heritage Register (as the Kama Woodland/Grassland) in 2012 for its natural heritage values. According to the ***Molonglo River Reserve: Kama Operational Plan 2014*** (Territory Municipal Services, 2014) "Kama is part of a key corridor between the Molonglo

River and the Belconnen Woodlands." Kama Nature Reserve is identified as an offset site under the ***Molonglo Valley Plan for the Protection of Matters of National Environmental Significance*** (ACTPLA, 2011).

The Pinnacle Nature Reserve adjoins the rear of residential development in Hawker and Weetangera. The 2016 Pinnacle Extension (an offset area under the ***Molonglo Valley Plan for the Protection of Matters of National Environmental Significance*** (ACTPLA, 2011)) runs between the western boundary of The Pinnacle Nature Reserve and the eastern side of WHD.

The western side of the Kama Nature Reserve adjoins rural property (Belconnen Block 1596 and 1593) which are provided with a heritage overlay. SMEC understands that these properties are leased to the Uniting Church and contain the Weetangera Cemetery and former location of the Weetangera Methodist Church.

5.2.1.2 Bioregion

The Project is located entirely within the Murrumbateman IBRA Subregion of the South Eastern Highlands IBRA Bioregion (IBRA v.7). The Murrumbateman IBRA Subregion covers an area of approximately 630,454ha.

5.2.1.3 Climate

Review of the Bureau of Meteorology data indicates the Study Area is within the following meteorological setting (Bureau of Meteorology, n.d.):

- The highest mean maximum monthly temperature is 30.6°C in January, while the lowest mean minimum monthly temperature is 0.0°C in July
- The Study Area has a mean annual rainfall of 600.4mm
- The highest mean maximum monthly rainfall is 75mm in December, while the lowest mean minimum monthly rainfall is 26.4mm in July.

5.2.1.4 Traffic

The existing traffic conditions of the locality are described in Section 5.1.1 above, as well as in Appendix C. These conditions can be summarised as follows:

- Based on traffic count data taken in January 2020, traffic volumes are highest on the weekdays, with Tuesday to Friday being the highest days. Eastbound traffic volumes are slightly higher than westbound volumes across the counted period
- During the AM peak, key traffic movements tend to be southbound on Kingsford Smith Drive and the right turn from DBD, accounting for 70 percent of traffic through the intersection
- During the PM peak, key traffic movements are northbound and left turn (reverse from the AM peak), accounting for 65 percent of traffic through the intersection
- The movements are typical of an outer arterial road, connecting largely residential areas in Belconnen to the employment areas of Civic, Parliamentary Zone and Woden.

WHD currently is an existing risk of vehicle strike to fauna. The wildlife which are likely to be subject to vehicle collision and roadkill along the WHD road reserve include:

- Mammals (Eastern Grey Kangaroo, Common Wallaroo, Swamp Wallaby, Red-necked Wallaby, Wombats and Spotted-tailed Quoll)
- Echidnas
- Woodland birds (Superb Parrot, Swift Parrot, Varied Sittella)
- Common birds (Galahs and Cockatoos)
- Owls (Southern Boobook, Tawny Frogmouth, Australian Owlet-nightjar)
- Reptiles (snakes, legless lizards, bearded dragon, turtles)
- Scavenger birds/raptors feeding on roadkill (Little Eagle and Wedge Tailed Eagle)

- Frog species.

Kangaroos in particular are at risk due to their behaviour and abundance in the landscape. Evidence of vehicle strike was observed during site surveys for the Project. Kangaroo corpses were observed at several locations along the road, with one location in the southern section considered a hotspot with several corpses were observed in the one area. WHD is located in an area that the ***ACT Kangaroo Management Plan*** (Territory and Municipal Services, 2010) describes as the 'hills, ridges and buffer spaces' separating the different urban areas, as well as the reserves created from the late 1990s to protect highly significant remnants of natural temperate grassland and yellow box – red gum grassy woodland. Many of these areas are ideal kangaroo habitat and important wildlife corridors (Territory and Municipal Services, 2010). The observation of kangaroos in grassy areas and reserves surrounding the Study Area combined with evidence of past vehicle strike on kangaroo reflect this. Kangaroos are recognised as an over-abundant species in the ACT and are managed, including with the use of authorised culling, in accordance with the ***ACT Kangaroo Management Plan*** (Territory and Municipal Services, 2010).

There is no existing fauna fencing or fauna specific crossing areas (under or overpasses) across the WHD road reserve within the Study Area. This presents a risk both to existing fauna and road users.

The Superb Parrot was the only threatened species recorded in the Study Area. Superb Parrots are prone to being hit by vehicles on regional roads; however, this is primarily when they feed on spilt grain after harvest. Additionally, they have a tendency to mourn the death of their own by gathering around the bodies. This combined with their camouflage with green grass on roadside verges and motorists' not being aware of their presence has resulted in many vehicle deaths of this species across its range.

Other threatened species recorded in the surrounding nature reserves include the Scarlet Robin, Varied Sittella, White-winged Triller and Swift Parrot. These birds have varied flight and foraging behaviours. All may use native vegetation along the road and could fly at vehicle height along sections of the road where vegetation height is in line with vehicle height. The two existing cut areas are where fauna vehicle strike is not considered to be an issue for birds as the vegetation is well above the vehicle height. Height of trees either side of the road and median strips is important as birds will fly above this vegetation when traversing across the Study Area. If this vegetation is higher than vehicle height, then strike is minimised. Stepping stone vegetation such as vegetated median strips are important for some smaller species to cross the road.

5.2.2 Investigations

The Biodiversity Assessment (refer to Appendix D) was undertaken to assess the potential construction and operational impacts to biodiversity associated with the Project. The assessment comprised desktop and ecological survey methods, interpretation of results to advise the likely ecological impacts, mitigation measures and offset requirements for the Project.

As part of the desktop study, SMEC undertook a review of relevant public databases and literature to identify species threatened under both the NC Act and EPBC Act, migratory species, endangered populations, TECs and their habitats that have previously been recorded within or in the vicinity of the Study Area. Threatened species, migratory species, endangered populations and TECs that have the potential to occur within the Study Area were also considered.

A search of relevant databases was undertaken to obtain records of all threatened species, endangered populations and communities previously recorded within a 10km buffer around the Study Area. Database searches were also completed to obtain information on additional listed areas of ecological importance, key habitat features, vegetation communities, aquatic habitat and ACT registered trees. All current and preliminary listings under the NC Act and EPBC Act were considered. The following databases were searched:

- EPBC Act Protected Matters Search Tool
- ACTmapi – Significant Species, Vegetation Communities and Registered Trees layer
- ACTmapi – Soil and Hydrogeological Landscapes
- ACT Threatened Species list.

The following broad vegetation communities have been mapped by the current study within the Study Area:

- Grassy Woodland (refer to Figure 5-4 and Figure 5-5 below)
- Native Riparian Sedgeland (refer to Figure 5-6 below)
- Planted River She-oak Riparian Forest (refer to Figure 5-7 below)
- Planted Native (refer to Figure 5-8 below)

Exotic riparian Woodland (refer to

- Figure 5-9 below)
- Exotic Grassland (refer to Figure 5-10 below).

These communities have been mapped to stratify vegetation structure types, dominance of native versus exotic, and dominant plant groups when particularly relevant.

The extent of each vegetation community within the Study Area and their conformity to TECs and ACTmapi vegetation communities is summarised in Table 5-8 below. A map of the delineated vegetation communities within the Study Area is provided below.

Table 5-8 Vegetation communities in the Study Area

SMEC vegetation community	ACT Vegetation Type (Act Government 2021	General ACTmapi vegetation community spatial correlation as mapped in Study Area (ACTmapi 2021)	Relationship to NC Act TEC	Relationship to EPBC Act TEC	Area within Study Area (ha)	
Grassy Woodland	ACT16: ***Eucalyptus melliodora – E. blakelyi*** Tableland Grassy Woodland	u19: Blakely's Red Gum – Yellow Box tall grassy woodland	Yellow Box–Blakely's Red Gum Grassy Woodland (critically endangered) - Moderate condition only	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (critically endangered) - Moderate condition only	Low condition: 0.14 (non-TEC) Moderate condition: 12.60 (TEC)	Total: 12.74 (TEC and non- TEC)
Native Grassland	ACT: Derived Native Grasslands	NG: Native Grasslands	Yellow Box–Blakely's Red Gum Grassy Woodland (critically endangered)	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (critically endangered)	0.82	
Native Riparian Sedgeland	N/A	AFV - Aquatic Fringing Vegetation	N/A	N/A	0.07	
Planted River She-oak Riparian Forest	N/A	P32d River She-oak Riparian Forest	N/A	N/A	0.27	
Planted Native	ACT25: Eucalyptus macrorhyncha Tableland Grass / Shrub Forest	Amenity planting native	N/A	N/A	7.06	
Exotic Riparian Woodland	NA	EXW: Exotic Woodlands	N/A	N/A	0.63	
Exotic Grassland	N/A	Exotic Grassland	N/A	N/A	18.52	



Figure 5-4 Example of Grassy Woodland



Figure 5-5 Example of native grassland



Figure 5-6 Native Riparian Sedgeland



Figure 5-7 Planted River She-oak Riparian Forest on Deep Creek



Figure 5-8 Example of Planted Native





Figure 5-10 Example of Exotic Grassland

5.2.2.1 Habitat connectivity

Corridors can connect two or more larger patches of fragmented habitat over a range of scales and for a variety of organisms.

The two nature reserves of Kama Nature Reserve and The Pinnacle Nature Reserve (including The Pinnacle Extension offset area) are currently intersected by WHD. These nature reserves form an important flora and fauna habitat link between the Murrumbidgee River Corridor and nature reserves across the north of Canberra including Black Mountain, Aranda Bushland, Mount Painter and Lower Molonglo Nature Reserve. These nature reserves provide a network of habitat connecting the remnant bushland of Canberra to Brindabella National Park.

Kama Nature Reserve adjoins the southern side of the road alignment near the central portion of the Study Area, with 1.2km frontage onto WHD (Calibre, 2018). Kama Nature Reserve is one of only two ACT reserves which contains high quality BGW TECs and Natural Temperate Grassland, both of which are critically endangered ecological communities. Some of the native vegetation within the Study Area provides connectivity between these two reserves.

WHD is currently about 18m wide where it intersects the two nature reserves. While it is an impediment to some connectivity, fauna is likely to be able to traverse the road corridor via flight or by crossing the road surface. SMEC's observations of Eastern Grey Kangaroos, Eastern Brown Snakes (***Pseudonaja textilis***) and a Short-beaked Echidna (***Tachyglossus aculeatus***) within the road reserve indicates that there is connectivity between the nature reserves for ground-dwelling fauna despite potential for collision with vehicles. There is currently an underpass between the road to facilitate human traffic between the two nature reserves, however fencing reduces the potential for significant large terrestrial fauna movement between the nature reserves.

Potential movement of fauna across the current alignment of WHD increases in areas to the north and south-east of the interface between Kama and The Pinnacle Nature Reserves. Germinated seeds from some flora species, such as Hoary Sunray, are able to cross the road reserve at any location. The most likely connection points outside of this interface occur where native vegetation occurs on both sides of the road reserve. Examples of such connection points may include the native vegetation near the Weetangera Cemetery (north of the nature

reserve interface) and the vegetation near Deep Creek (to the south-east). These locations are likely to provide the best connection points for fauna as the distance between areas of habitat is smallest. Similarly, for flora species these connection points are most likely to facilitate the transfer of plant material across WHD as seeds, pollen and other propagules have less distance to travel. Once WHD is traversed, successful movement to either nature reserve is more likely.

Fauna habitat types within the Study Area generally correspond to the vegetation communities described in Table 5-8 above. The features of each fauna habitat types and fauna species likely to utilise these habitats are described below.

Native grassland

Three small patches of native grassland have been identified in the Study Area, comprising a variety of native grasses herbs and forbs. These patches are isolated from other areas of native grassland associated with BGW TECs. While these patches are small (total area of 0.76ha), limiting their ability to provide suitable habitat for large populations of native species, they may offer suitable habitat for Perunga Grasshopper Striped Legless Lizard, PTWL, GSM, and a range of native birds that forage on native grass seed. They also provide critical stepping stone habitat connectivity for a range of smaller species in particular, as they move between higher quality grassland habitats throughout the Study Area and beyond.

Exotic grassland

Exotic grassland is the most common habitat type within the Study Area. Introduced species comprise over 90 percent of the vegetation cover, dominated by ***Phalaris aquatica***, ***Festuca arundinacea***, ***Dactylis glomerata*** and ***Avena*** species. Generally, important habitat features (such as rocks, logs, leaf litter and shrubs) are absent from this habitat. Isolated paddock trees occasionally occur. In some areas there are steep embankments topped with concrete drainage channels.

This habitat type can provide important foraging habitat values and connectivity for a range of native species, including:

- Connectivity between higher-value habitats for mammals, birds, echidnas, reptiles and amphibians
- Foraging for insects (plant material and other insects being available to feed on)
- Foraging for birds (grass seed heads, insects and small mammals/reptiles being available to feed on)
- Plant material for kangaroos and wallabies to feed on
- Ants for echidnas to feed on.

Such grasslands can provide important habitat support for a range of species during drought conditions, with some exotic grassland varieties being more palatable for kangaroos and wallabies. This diversity provided by exotic grassland is also important as an additional food source for granivorous birds. The grasslands provide habitat for a range of small mammals, reptiles and insects, which can then support predatory and insectivorous bird species. Some declining woodland bird species may also take advantage of these habitat features.

Grassy woodland

Patches of BGW TECs occur within the Study Area. These consist of a medium to tall canopy dominated by ***Eucalyptus blakelyi***, ***E. bridgesiana*** and ***E. melliodora***, with an occasional shrub layer. The ground cover is a mixture of native and non-native species of grasses, herbs and forbs. In areas with more mature trees, fallen logs and leaf litter are present. This habitat type also supports many hollow-bearing trees. Woodland vegetation provides suitable habitat for birds, reptiles and mammals including a number of threatened species. At the time of survey, this habitat and Planted Woodland were inundated with emerging Redeye Cicadas (***Psaltoda moerens***), which provide a good food source for many bird species.

This habitat type can provide important foraging habitat values and connectivity for a range of native species, including:

- Connectivity between higher-value habitats for mammals, birds, echidnas, reptiles and amphibians
- Foraging for insects (plant material and other insects being available to feed on)

- Foraging for birds (grass seed heads, insects and small mammals/reptiles being available to feed on and trees available for birds to perch on while they forage)
- Foraging for microbats (insects being available to feed on)
- Plant material for kangaroos and wallabies to feed on
- Ants for echidnas to feed on.

These plant communities can also provide important habitat support for a range of species during drought conditions, with some exotic grassland varieties being more palatable for Kangaroos and Wallabies. They also provide habitat for a range of small mammals, reptiles and insects, which can then support predatory and insectivorous bird species.

Planted woodland

The planted woodland varies considerably across the Study Area, but generally contains similar features to the more natural woodland. A range of Eucalyptus species are present including ***Eucalyptus rubida***, ***E mannifera***, ***E bridgesiana and E. blakelyi.*** Shrubs and small trees are mostly fast colonising Acacias including A mernsii, A dealbata, A pravissima and ***A boormanii***. Some of these are already commencing senescence providing some fallen woody debris. Planted areas are identified as being more highly disturbed, lacking signs of recruitment, feature fewer tree hollows and have more non-native ground covers and shrubs that show evidence of being planted. Despite the absence of some features, this vegetation still provides suitable habitat for many woodland birds, reptiles and mammals and could be used by threatened species. Dense shrub species provides good sheltering habitat for small birds and mammals. Patches of planted woodland also provide stepping stones to connect to other areas of native woodland throughout the Study Area.

Riparian habitat

Riparian habitat within the Study Area has been highly modified to facilitate drainage across WHD. Deep Creek flows parallel to WHD in the south of the Study Area before diverting to flow further south into the Molonglo River. All riparian habitat within the Study Area drains into the Molonglo River, which flows in a north-westerly direction approximately 1.6km to the south-west.

Man-made drainage lines leading to culverts passing under the road include rocks to prevent scouring. Some of these rocky drainage lines hold water but aquatic vegetation is generally absent. Similar to the remainder of the Study Area, drainage lines are dominated by exotic vegetation. These ephemeral water bodies provide temporary habitat for common frog species.

Areas of native sedges ***Schoenoplecus validus*** also provide frog habitat as do patches of native reeds including ***Phragmites australis*** and ***Typha orientalis***, found in patches along the predominantly exotic portions of Deep Creek. River-she oak trees, ***Casuarina cunninghamiana*** can provide nesting and foraging sites for a range of birds but are not considered a feed source for glossy black cockatoos, which have a preference for larger seeded ***Allocasuarina*** species. During periods of high rainfall, semi-aquatic species (such as turtles, frogs and invertebrates) may use riparian areas to traverse to other nearby areas of suitable habitat in the Belconnen nature reserves and Molonglo River valley.

5.2.2.2 Other ecological features

The Study Area and surrounding landscape contain habitat features suitable for supporting a range of native species. Thirty-three hollow-bearing trees containing around 133 hollows were recorded in the Study Area. Fallen logs also occur in areas with more mature vegetation.

Three pedestrian culverts pass under WHD, two of which contained small mud nests that may also be used by microbats for roosting. It is not expected that these culverts are currently used for fauna passage under the road due to the presence of fencing along the length of the road reserve, with gates providing pedestrian access. Eighteen drainage culverts ranging from 525-1500mm in diameter also occur along the length of the alignment. At the time of survey most of the culverts were covered by vegetation or were considered too small to provide suitable roosting habitat for microbats.

Surveys did not identify any wetlands within the Study Area, although several farm dams occur in adjacent paddocks. ACTmapi (2021) classifies all waterbodies within the immediate vicinity of the Study Area as 'Modified Waterbodies'.

Naturally occurring rocks are generally absent with the exception of the areas mapped as potential PTWL habitat.

5.2.2.3 ACT registered trees

One registered tree was identified as occurring wholly within the Study Area and with much of its canopy extending into the construction boundary. In the ACT Tree Register, this tree is identified as Nomination 81, Tree Number PTR081. Further details recorded for the tree are provided in Table 5-9 below.

Under the ***Tree Protection Act*** 2005 (refer to Section 3.1.7 above), certain criteria may apply to the registering of an important tree. The following criteria apply to tree PTR081:

> ***(2) Landscape and aesthetic value***
>
> ***The object of this value is to identify trees that are of particular importance to the community due to their substantial contribution to the surrounding landscape. A tree may be considered to be of landscape and aesthetic value if it is situated in a prominent location when viewed from a public place and it:***
>
> ***(a) contributes significantly to the surrounding landscape based on its overall form, structure, vigour and aesthetic values; or***
>
> ***(b) represents an outstanding example of the species, including age, size or habit; or***
>
> ***(c) is an exceptional example of a locally native species that reached maturity prior to urban development in its immediate vicinity.***

Table 5-9 Details of registered tree in ACT Tree Register

Tree identification	PTR081
Species name	***Eucalyptus blakelyi*** (Red Gum)
Street address	in road reserve/verge of Kingsford Smith Drive, Higgins (identified as on William Hovell Drive in the Tree Register profile) at rear of 35 O'Sullivan Street, Higgins
Description	Four trunks and crown radii ranging from 9-12m
Statement against the Criteria for nomination	***This Eucalyptus blakelyi is an exceptional example of a local native species that reached maturity prior to urban development. The tree is being nominated for inclusion to the ACT Tree Register due to its outstanding landscape contribution. This tree is located on urban open space next to William Hovell Drive in Belconnen. The tree contributes significantly to the surrounding landscape due to its large well-balanced spreading crown and low branching habit. The tree is located in a very prominent location and easily seen from the street.***

The Project's design has been updated so that works in this vicinity only impact the existing pavement area. As additional earthworks will not be undertaken, the roots of this registered tree PTR081 may be affected by temporary and minor actions, e.g. construction vehicle movements in the vicinity, and will not be significantly impacted.

5.2.2.4 Threatened ecological communities

Grassy woodlands

The ***Preliminary Environmental Assessment: William Hovell Drive Duplication*** (SMEC, 2020b) identified one TEC, Yellow Box–Blakely's Red Gum Grassy Woodland (critically endangered under the NC Act), which is considered equivalent to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (critically endangered) under the EPBC Act. The TECs are referred to as BGW or Grassy Woodlands herein.

Two patches of Grassy Woodland did not meet the condition thresholds for the BGW TECs, with one patch of 0.06ha not meeting the minimum patch size of 0.1ha, and the second patch, while meeting the minimum patch size at 0.13ha, did not have adequate important and minimum non-grass species richness.

The three patches of native grassland mapped in the Study Area have been mapped as a secondary/derived grassland component of Yellow Box–Blakely's Red Gum Grassy Woodland as species richness appears to meet the required number of important species and non-grass species in the ground-layer, with all three patches being larger than the 0.1ha minimum size to exceed the condition threshold as specified in the Yellow Box-Blakely's Red Gum Grassy Woodland Action Plan.

Natural temperate grassland

SMEC mapped approximately 0.7ha of Native Grassland across the Study Area identified as Natural Temperate Grassland under the NC Act (critically endangered) and Natural Temperate Grassland of the South Eastern Highlands under the EPBC Act (critically endangered).

The location of mapped native grassland in the Study Area was assessed to comprise derived from Grassy Woodland through clearing of woody species rather than a naturally occurring temperate grassland. This is supported by previous broad landscape scale mapping of ACTmapi mapping and ***Box-Gum Woodland in the ACT*** (Environment and Sustainable Development Directorate, 2011b)**.** The existence of Grassy Woodland generally across the Study Area's intact treed areas, and the absence of any apparent correlation of native grassland in landscape features that will naturally inhibit tree or other significant woody growth such as areas of high drying wind exposure, very shallow soil, cold air drainage such as valley floors or impeded hydrological drainage indicates that the native grasslands in the Study Area are likely a response to timber removal, grazing and weed competition.

Given the Grassy Woodland likely originally occupied these areas of the Study Area, the areas of native grassland are not considered natural and have been assessed as secondary and derived from Grassy Woodland. As such, the critically endangered Natural Temperate Grassland listed under the NC Act does not occur.

5.2.2.5 Threatened flora

The desktop assessment identified six threatened flora species with a moderate or higher likelihood of occurring in the Study Area. Five of these species were listed as threatened under the NC Act (***Leucochrysum albicans*** var. ***tricolor*** is listed as threatened under the EPBC Act). None of the five threatened flora species listed under the NC Act were recorded in the Study Area during the November/December 2020 surveys. However, ***L. albicans*** var. ***tricolor*** was identified in the Study Area.

5.2.2.6 Threatened fauna

Desktop assessment identified 34 fauna species likely to occur within the Study Area listed as threatened or migratory under the NC Act and/or EPBC Act. A likelihood of occurrence assessment was undertaken for these species after the site visit was performed, in order to determine whether suitable habitat for each species occurs within the Study Area (refer to Appendix B of Appendix D). Of the 34 species assessed for likelihood of occurrence, only 13 were identified as having a moderate or higher likelihood of occurrence in the Study Area based on the availability of suitable habitat and recent nearby sightings. These species include:

- Perunga Grasshopper (***Perunga ochracea***) (Endangered under the NC Act but not listed under the EPBC Act)
- Pink-tailed Worm Lizard (***Aprasia parapulchella***) (Endangered under the NC Act and Vulnerable under the EPBC Act)
- Striped Legless Lizard (***Delma impar***) (Vulnerable under the NC Act and EPBC Act)
- Little Eagle (***Hieraaetus morphnoides***) (Vulnerable under the NC Act but not listed under the EPBC Act)
- Regent Honeyeater (***Anthochaera phrygia***) (Endangered under the NC Act and Critically Endangered under the EPBC Act)
- Scarlet Robin (***Petroica boodang***) (Vulnerable under the NC Act but not listed under the EPBC Act)
- Superb Parrot (***Polytelis swainsonii***) (Vulnerable under the NC Act and EPBC Act)

- Varied Sittella (***Daphoenositta chrysoptera***) (Vulnerable under the NC Act but not listed under the EPBC Act)
- White-winged Triller (***Lalage sueurii***) (Vulnerable under the NC Act but not listed under the EPBC Act)
- Grey headed Flying Fox (***Pteropus poliocephalus***) (Vulnerable under the NC Act and the EPBC Act)
- Brown-treecreeper (***Climacteris picumnus***) (Vulnerable under the NC Act but not listed under the EPBC Act)
- Swift Parrot (***Lathamus discolor***) (Vulnerable under the NC Act and Critically Endangered under the EPBC Act)
- White-throated Needletail (***Hirundapus caudacutus***) (Vulnerable under the NC Act and the EPBC Act).

One species listed as vulnerable under the NC Act and EPBC Act was recorded during the survey period, being the Superb Parrot. Assessments of Significance were prepared for these species. In addition, an Assessment of Significance was also undertaken for the Golden Sun Moth.

5.2.2.7 Matters of National Environmental Significance

Leucochrysum albicans var. tricolor **(Hoary Sunray) – Endangered under the EPBC Act**

This species is not listed under the NC Act.

Desktop assessment identified the threatened flora species ***L. albicans*** var. ***tricolor*** as highly likely of occurring in the Study Area and was subsequently recorded during the site survey. ***L. albicans*** var. ***tricolor*** is a small perennial everlasting daisy (Sinclair, S.J. , 2010), and grows in woodland and grassland communities in disjunct populations in south-east NSW, the ACT, Victoria and Tasmania. Within the Study Area ***L. albicans*** var. ***tricolor*** was recorded in a cluster spanning both sides of WHD.

The species was observed in an area characterised by a low saddle intersected by the existing road alignment forming the most prominent rock cutting at the Project Site. The existing road alignment in this area separated Kama Nature Reserve in the south from The Pinnacle Nature Reserve in the north. A large population of ***L. albicans*** var. ***tricolor*** immediately adjacent to those occurring in the Study Area. This population was comprised of a greater number of larger more mature plants compared to those recorded in the Study Area.

White Box-Yellow Box-Blakeley's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered under the EPBC Act

This TEC is also Critically Endangered under the NC Act.

All occurrences of the NC Act listed Yellow Box-Blakely's Red Gum Grassy Woodland conformed to the occurrence of the EPBC Act listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Additionally, all but one small extent of Grassy Gum Woodland in the Study Area satisfied the criteria specified in the EPBC Act White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Policy Statement.

Superb Parrot – Vulnerable under the EPBC Act

This species is also listed as Vulnerable under the NC Act.

The Superb Parrot was observed flying over WHD at all bird survey locations within the Study Area. Superb Parrots were observed as individuals or in groups of up to seven birds, with a total count of 15 recorded during a 40-minute survey. Several individuals were observed perched in trees on land adjoining the Study Area.

The Study Area comprises 12.74ha of suitable foraging and breeding habitat for the species based on the presence of tree hollows in the Grassy Woodland vegetation. It should be noted that it is unknown whether the tree hollows meet specific requirements for successful breeding (Allen, C., 2021).

Migratory species

Desktop assessment identified 13 species listed as migratory under the EPBC Act likely to occur within the Study Area. Of these species, three were identified as having a moderate or higher likelihood of occurrence in the Study Area based on the availability of suitable habitat and recent nearby sightings: the Fork-tailed Swift; White-throated Needletail; and Satin Flycatcher. None of these species were recorded during recent surveys.

The Fork-tailed Swift and White-throated Needletail are aerial species, foraging above a variety of vegetation types. Although they may occur on occasion above the Study Area, the Project is unlikely to affect their life cycle or behaviour. The Satin Flycatcher may occur in parts of the Study Area and cross WHD during migration between larger areas of suitable habitat in nearby nature reserves and the Molonglo River corridor (ACT Government, 2018b).

5.2.2.8 Critical habitat

Critical habitat is defined as habitat that is critical to the survival of a threatened species, population or ecological community. Under the EPBC Act, habitat is listed on the National Critical Habitat register, however no registered areas of critical habitat occurred in the ACT at the time of the study.

Critical habitat for some species listed under the NC Act or EPBC Act have been identified in the relevant ACT action plans or national recovery plans:

- White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland – moderate to highly fertile soils of the western slopes of NSW and Queensland, the northern slopes of Victoria, and the tablelands of the Great Dividing Range from southern Queensland through NSW and the ACT. All areas of Box-Gum Grassy Woodland which meet the minimum condition criteria should be considered critical to the survival of this ecological community. In addition, degraded woodland areas not considered community may also be essential to the long-term conservation of Box-Gum Grassy Woodland, by virtue of their landscape setting or remaining flora/fauna habitat features, and should also be considered as potential habitat critical to the survival of this ecological community (Department of Environment, Climate Change and Water NSW, 2010).
- Superb Parrot – breeding and foraging habitat has been identified as critical for this species. Potential foraging habitat occurs in the Study Area (Baker-Gabb, D., 2011).

5.2.2.9 Wetlands of International Significance

Wetlands of International Significance (RAMSAR wetlands) are listed as MNES under the EPBC Act. The EPBC Protected Matters Search (Department of Agriculture Water and the Environment, 2020) identified four RAMSAR Wetlands:

- Banrock station wetland complex, 700–800km upstream
- Hattah-Kulkyne lakes, 500–600km upstream
- Riverland, 700–800km upstream
- The Coorong, and Lakes Alexandrina and Albert wetland, 800–900km upstream.

Given the distance from the Study Area and upstream location of the identified wetlands, it is not considered that the project will have any significant direct or indirect impact on a Wetland of International Significance.

5.2.3 Impacts

5.2.3.1 Key threatening processes

Two Key Threatening Processes (KTPs) are listed under the NC Act and are considered relevant to the Project:

- The loss of mature native trees (including hollow-bearing trees) and a lack of recruitment
- Unnatural fragmentation of habitats.

One KTP listed under the EPBC Act considered relevant to the Project is land clearance.

5.2.3.2 Direct impacts

Clearing of vegetation

Works associated with the Project will remove up to 19.85ha of vegetation, 6.49ha of which has been assessed as native. This native vegetation has not included planted native communities such as Planted River She-oak Riparian Forest or Planted Native. All vegetation has been stratified into the following communities:

- Grassy Woodland
- Native Grassland
- Planted River She-oak Riparian Forest
- Planted Native
- Exotic Riparian Woodland
- Exotic Grassland.

One other vegetation community was identified in the Study Area, Native Riparian Sedgeland. However, no areas of this community will be directly impacted by the Project.

A summary of the areas of direct impact to each vegetation community is provided in Table 5-10 below.

It is noted that the design of the Project and the Project objectives (refer to Section 2.2 above) have taken into consideration the following requirements:

- Retain as many hollow bearing trees as possible
- Design the overall road width to be as narrow as possible between the two Nature Reserves
- Have no more environmental impact than is necessary to deliver an optimum road design for this section of the WHD corridor
- Protection the two Nature Reserves during construction and minimise ongoing impacts to them.

Further design refinements and the provision of fauna crossing structures were also discussed with the Conservator.

Table 5-10 Vegetation communities impacted by the Project

SMEC Vegetation community	ACT Vegetation Type (*Act Government 2021*	General ACTmapi vegetation community spatial correlation as mapped in Study Area (ACTmapi 2021)	Relationship to NC Act TEC	Relationship to EPBC Act TEC	Area within Study Area (ha)	Area within Construction boundary (ha)
Grassy Woodland	ACT16: ***Eucalyptus melliodora – E. blakelyi*** Tableland Grassy Woodland	u19: Blakely's Red Gum – Yellow Box tall grassy woodland	Yellow Box–Blakely's Red Gum Grassy Woodland (critically endangered) - Moderate condition only	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (critically endangered) - Moderate condition only	Low condition (Not TEC): 0.14 Moderate condition (TEC): 12.60 Total: 12.74	Low condition (Not TEC): 0.08 Moderate condition (TEC): 6.38 Total: 6.46
Native Grassland	ACTxx: Derived Native Grasslands	NG: Native Grasslands	Yellow Box–Blakely's Red Gum Grassy Woodland (critically endangered)	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native	0.82	0.03

SMEC Vegetation community	ACT Vegetation Type (*Act Government 2021*	General ACTmapi vegetation community spatial correlation as mapped in Study Area (ACTmapi 2021)	Relationship to NC Act TEC	Relationship to EPBC Act TEC	Area within Study Area (ha)	Area within Construction boundary (ha)
				Grassland (critically endangered)		
Native Riparian Sedgeland	N/A	AFV - Aquatic Fringing Vegetation	N/A	N/A	0.07	zero
Planted River She-oak Riparian Forest	N/A	P32d River She-oak Riparian Forest	N/A	N/A	0.27	0.01
Planted Native	ACT25: Eucalyptus macrorhyncha Tableland Grass / Shrub Forest	Amenity planting native	N/A	N/A	7.06	4.41
Exotic Riparian Woodland	NA	EXW: Exotic Woodlands	N/A	N/A	0.63	0.01
Exotic Grassland	N/A	Exotic Grassland	N/A	N/A	18.52	8.94

Removal of threatened species habitat

Approximately 56 ***L. albicans*** var. ***tricolor*** (Hoary Sunray) individuals were recorded within the Study Area. Up to 13 individuals occur within the clearing boundary and will be directly impacted. Additionally, 20.56ha of Grassy Woodland, Native Grassland and Planted Native within the Study Area has been assessed as potential habitat for ***L. albicans*** var. ***tricolor*** (refer to Table 5-11 below). Approximately 10.9ha of this habitat will be cleared by works associated with the Project (refer to Table 5-11 below).

No other threatened flora species were recorded in the Study Area. As such, it is unlikely that the Study Area supports suitable habitat for the other plant species targeted in the SMEC surveys.

Table 5-11 Direct impacts on threatened flora habitat

Habitat feature	Threatened flora species	Potential habitat within Study Area (ha)	Potential habitat within clearing footprint (ha)	Individuals directly impacted	Offset required?
Grassy Woodland, Native Grassland, Planted Native	***L. albicans*** var. ***tricolor*** (Hoary Sunray)	20.56	10.9	13	Yes

The Study Area provides suitable foraging habitat for threatened woodland birds and the Grey-headed Flying-fox in the Grassy Woodland and Planted Woodland vegetation communities and is likely to form part of a larger home range for these species which includes nearby parks, reserves, streetscapes and gardens.

Vegetation in the Study Area is likely to provide stepping-stone habitat for many fauna species known to occur in the area, including Superb Parrot, White-winged Triller, Varied Sittella, Brown Treecreeper and Scarlet Robin.

PTWL habitat extends to the Study Area and further east up to The Pinnacle Nature Reserve location, and they have been recorded to occur in the locality in the Molonglo Valley to the west of the Study Area. High quality potential habitat for this species will be impacted by the Project.

The Study Area is also considered to have potential to impact the Striped Legless Lizard habitat.

Exact areas of potential threatened species habitat that will be directly impacted by the Project are provided in Table 5-12.

Table 5-12 Direct impacts on threatened fauna habitat

Threatened fauna species	Grassy Woodland-Moderate condition (ha)	Grassy Woodland-Low condition (ha)	Planted Native (ha)	Planted River She-oak Riparian Forest (ha)	Native Grassland (derived from Grassy Woodland) (ha)	Exotic grassland (ha)	Hollow-bearing trees (individuals)	Rocky habitat in native grassland (ha)	Total habitat directly impacted by the project (total area in Study Area)
Perunga Grasshopper Endangered under the NC Act Not EPBC listed	6.38	0.08	-	-	0.03	-	-	-	**6.49 ha** **(13.56 ha)**
PTWL Endangered under the NC Act Vulnerable under the EPBC Act	-	-	-	-	-	-	-	0.16	**0.16 ha** **(0.27 ha)**
Striped Legless Lizard Vulnerable under the NC Act and the EPBC Act	6.38	0.08	-	-	0.03	8.94	-	0.16	**15.43 ha** **(32.35 ha)**

Threatened fauna species	Grassy Woodland- Moderate condition (ha)	Grassy Woodland- Low condition (ha)	Planted Native (ha)	Planted River She-oak Riparian Forest (ha)	Native Grassland (derived from Grassy Woodland) (ha)	Exotic grassland (ha)	Hollow-bearing trees (individuals)	Rocky habitat in native grassland (ha)	Total habitat directly impacted by the project (total area in Study Area)
Brown-treecreeper Vulnerable under the NC Act Not EPBC listed	6.38	0.08	4.41	0.01	-	-	-	-	**10.88 ha (20.07 ha)**
Little Eagle Vulnerable under the NC Act Not EPBC listed	6.38	0.08	4.41	0.01	0.03	8.94	-	-	**19.85 ha (39.41 ha)**
Regent Honeyeater Endangered under the NC Act Critically Endangered under the EPBC Act	6.38	0.08	4.41	0.01	-	-	-	-	**10.88 ha (20.07 ha)**

Threatened fauna species	Grassy Woodland- Moderate condition (ha)	Grassy Woodland- Low condition (ha)	Planted Native (ha)	Planted River She-oak Riparian Forest (ha)	Native Grassland (derived from Grassy Woodland) (ha)	Exotic grassland (ha)	Hollow-bearing trees (individuals)	Rocky habitat in native grassland (ha)	Total habitat directly impacted by the project (total area in Study Area)
Scarlet Robin Vulnerable under the NC Act Not EPBC listed	6.38	0.08	4.41	-	0.03	8.94	-	-	**19.84 ha** **(39.14 ha)**
Superb Parrot Vulnerable under the NC Act and EPBC Act	6.38	0.08	4.41	-	-	-	-[1]	-	**10.87 ha** **(19.80 ha)** **7 potential breeding trees (33)**
Swift Parrot Vulnerable under the NC Act Critically Endangered under the EPBC Act	6.38	0.08	4.41	-	-	-	-	-	**10.87 ha** **(19.80 ha)**
Varied Sittella	6.38	0.08	4.41	0.01	-	-	-	-	**10.88 ha** **(20.07 ha)**

Threatened fauna species	Grassy Woodland- Moderate condition (ha)	Grassy Woodland- Low condition (ha)	Planted Native (ha)	Planted River She-oak Riparian Forest (ha)	Native Grassland (derived from Grassy Woodland) (ha)	Exotic grassland (ha)	Hollow-bearing trees (individuals)	Rocky habitat in native grassland (ha)	Total habitat directly impacted by the project (total area in Study Area)
Vulnerable under the NC Act Not EPBC listed									
White-throated Needletail Vulnerable under the NC Act and the EPBC Act	6.38	0.08	4.41	0.01	0.03	8.94	-	-	**19.85 ha** **(39.41 ha)**
White-winged Triller Vulnerable under the NC Act Not EPBC listed	6.38	0.08	4.41	-	-	-	-	-	**10.87 ha** **(19.80 ha)**
Grey headed Flying Fox Vulnerable under the NC	6.38	0.08	4.41	-	-	-	-	-	**10.87 ha** **(19.80 ha)**

Threatened fauna species	Grassy Woodland- Moderate condition (ha)	Grassy Woodland- Low condition (ha)	Planted Native (ha)	Planted River She-oak Riparian Forest (ha)	Native Grassland (derived from Grassy Woodland) (ha)	Exotic grassland (ha)	Hollow-bearing trees (individuals)	Rocky habitat in native grassland (ha)	Total habitat directly impacted by the project (total area in Study Area)
Act and the EPBC Act									

[1] Superb Parrots that have been observed flying over the Study Area, are likely to be part of the important population that occurs in the ACT. No individuals were observed utilising the Study Area for foraging, although suitable habitat is present in the Grassy Woodland and planted woodland. Despite the presence of hollow- bearing trees, some of which may have suitably sized hollows, the Superb Parrot is unlikely to breed within the Study Area. These are therefore considered to be seven ***potential*** breeding hollows only for this species.

Fauna injury or mortality (vehicle collision)

Injury or mortality of fauna is possible both during construction and operation of the Project. Removal of fauna habitat, including hollow-bearing trees, may result in the injury or mortality of species using this habitat, or more indirectly as they compete to establish a new territory in neighbouring habitat after being displaced. During operation, animals may be injured or killed by collisions with vehicles if they enter the road corridor. Kangaroos will remain one of the most at-risk species due to their behaviour and abundance in the landscape.

According to the Transport Assessment (refer to Appendix C) the Project will not generate any traffic, according to traditional traffic generation methodologies. However, the upgrade will result in a redistribution of traffic across the Canberra road network and may also lead to a small increase in traffic volumes due to the relatively lower congestion and easier road travel. This increase on traffic should be accompanied by a reduction in traffic volumes across other arterial and lower order roads in Belconnen (refer to Section 5.1.4 above).

The WHD shows a relatively low growth rate for the Annual Average Daily Traffic (AADT) AADT at 1% per annum. This is from an average of 18,596 vehicles to 19,925 vehicles per day. SMEC 2021 noted that it is likely that this volume growth does not accurately reflect the increase in travel demand, and some trips are using other parts of the network.

Changes to road network usage which will occur with the Project in place alongside background vehicle movement growth can be summarised as follows:

- Traffic will be redistributed throughout the network
- For some directional turns at the intersection, traffic will be subject to longer average queue times compared to the current scenario. For some directional turns, traffic will be subject to shorter average queue times compared to the current scenario
- As congestion along the road network improves, it is more likely that vehicles travelling along WHD can meet the maximum sign posted speed limit of 90km/hr
- While there is a substantial increase in overall traffic at the intersection, there is a decrease in some movements and an increase in others. In particular, the peak directional proportion along Kingsford Smith Drive and WHD appears to reverse between 2020 and 2031 (as forecast)
- In 2020, approximately 70% of the traffic at the intersection travels south (to the city) in the AM and north (to Belconnen) in the PM. In 2031, approximately 60% of the traffic is forecasted to travel in the opposite direction. It appears that this change is due to the development in Molonglo, near the southern end of WHD. The extra traffic generated by Molonglo through Glenloch Interchange and along Parkes Way is likely to force traffic from Belconnen to use an alternative route (possibly Belconnen Way/Barry Drive). In addition, some of the residents of Molonglo will travel north to Belconnen, along Bindubi Street, Coulter Drive and WHD.

These changes do not clearly demonstrate a greater likelihood of fauna vehicle strike compared to the current operational scenario. Indeed, WHD is currently an existing risk of vehicle strike to fauna. The road upgrade has been designed to an increase the capacity of the existing road network to support greater volumes of traffic during peak times. An increase in vehicle traffic may increase the risk of vehicle strike on threatened species occurring in or near the development site. The road upgrade design improves sight vision ahead from the current design, which may be beneficial in drivers seeing fauna along or on the road (particularly at night).

The wildlife likely to be subject to vehicle collision and roadkill associated with the Project include:

- Mammals (Eastern Grey Kangaroo, Common Wallaroo, Swamp Wallaby, Red-necked Wallaby, Wombats and Spotted-tailed Quoll)
- Echidnas
- Woodland birds (Superb Parrot, Swift Parrot, Varied Sittella)
- Common birds (Galahs and Cockatoos)
- Owls (Southern Boobook, Tawny Frogmouth, Australian Owlet-nightjar)
- Reptiles (snakes, legless lizards, bearded dragon)
- Scavenger birds/raptors feeding on roadkill (Little Eagle and Wedge Tailed Eagle)
- Frog species.

Stepping stone vegetation such as vegetated median strips are important for some smaller species to cross the road. Provided the vegetation height along the road and median areas will be above vehicle height during operation the impact on these species from vehicle strike will be minimised. Moreover, all threatened species at risk of vehicle strike are highly mobile and agile species. Mitigation measures will be implemented to reduce the potential increase in vehicle strike from the project.

It is proposed to mitigate these impacts by providing:

- One fauna crossing (rope bridge) to assist arboreal and avifauna to safely cross the road reserve
- Two fauna crossings (box culverts) to assist ground-dwelling fauna to safely cross the road reserve. These will be designed to be used by various wildlife
- Some batters will be laid back to allow Kangaroos and Wallabies to escape the roadway and back into the Nature Reserves. However, exclusion fencing (1.8 m tall chainmesh fence) will be included on each side of WHD in the vicinity of the Nature Reserves, extending at least 200m past the fauna crossings. This will assist in reducing the risks to native and non-native fauna from being injured or killed by road traffic. It will also improve the safety of road users by decreasing the risks of vehicle collision with large fauna species. The effectiveness of this exclusion fencing will be monitored during the operational stage of the Project.

An app (Roadkill Reporter) has recently been developed by a Sydney University Veterinary Science PhD Student, Bruce Engelfield, to allow citizen scientists to record roadkill. The app is designed to take a photograph of roadkill anywhere in Australia with a GPS-time-and-date-stamp. Users can then upload the image to a website. This data can identify roadkill hotspots, tabulate species of animals killed and potentially be used for ecological studies of roadkill numbers, species distribution, population trends, animal behaviour and disease. Initial results indicate that mammal roadkill mostly occurs at night and that of birds and reptiles during daytime. If community members are encouraged to use this app to record roadkill it will provide valuable data to identify operational hotspots. Adaptive management of the road to alleviate these hotspots can then be applied in the appropriate locations.

In addition, it is considered that the Project's commitment to replace native, mature trees at a ratio of 1:10 and native shrubs at a rate of 1:4 will assist bird and arboreal species in safely crossing the WHD road reserve: i.e. by providing closer linkages along the newly disturbed roadside corridor, meaning there is less bare distance to cross. Plantings will also be strategically located near the proposed fauna rope bridge, to act as further encouragement for arboreal and bird species to use this crossing feature. Proposed landscaping trees will either be ***Casuarina Cunninghamiana***, or one of six different species of Eucalyptus.

A review of the road's current speed limit is outside the scope of this EIS, and current 90km/hr limit is proposed to remain. Nevertheless, it is considered that altering the speed limit will not significantly reduce the frequency of fauna strike incidents. Research from Deakin University indicates that occurrence of fauna strike in Australia tends to peak with moderate speed limits of around 60-80km/hr (Anthony R., 2020).

5.2.3.3 Indirect impacts

Habitat fragmentation

Habitat fragmentation will increase, and connectivity will decrease as a result of the construction of the Project. The direct impacts to connectivity from clearing native vegetation will be by increasing the current fragmentation width (from the existing road) from about 25-30m to about 50-60m. However, the mitigation measures proposed as part of the Project will include the provision of two types of fauna crossing structures across the WHD road reserve: box culverts; and rope bridges. The proposed biodiversity offset location to the west of Kama Nature Reserve will also provide opportunity to enhance species habitats, for example through the provision of improved PTWL habitat features (emplaced rocky areas).

The two putative connection points to the north and south-east of the nature reserve interface likely provide habitat connectivity across WHD. Habitat connectivity is not restricted to the nature reserve interface as some fauna groups and plants (via seed dispersal) are able to traverse the fencing.

The increase in habitat fragmentation and the loss of habitat connectivity between the Kama and The Pinnacle Nature Reserves could trigger further indirect impacts to biodiversity. These potential impacts are difficult to predict and are often specific to the fauna, flora and ecological communities being impacted. Further impacts to

biodiversity caused by an increase in habitat fragmentation and loss of habitat connectivity across WHD may include:

- Impacts to seed dispersal
- Disruption of movement patterns
- Alteration of foraging behaviours
- Alteration of breeding behaviours and a potential increase in genetic isolation
- Decreased ability to adapt to a changing climate.

The severity of these impacts and how they affect different species groups (before mitigation measures are applied) is outlined in Table 5-13 below.

Table 5-13 Impacts of fragmentation on flora and fauna

Impact of connectivity loss	Species group	Impact description	Duration and severity
Seed-dispersal barrier	Flora	The increased distance between stands of native vegetation may decrease the likelihood that dispersed seed reaches an area of suitable habitat in which it can germinate.	Permanent Potentially severe to species with short seed dispersal distances
Disruption to movement patterns	Mammals	The increased width of WHD will increase the risk of vehicle strike to ground-dwelling mammals. The threat of vehicle strike (or the action itself) may also impede movement across WHD. The increased distances between trees on either side of WHD may also prevent arboreal mammals from safely traversing the road tree to tree. Some species of microbat may not be able to utilise the airspace over WHD if the distance between habitat increases. Increases to light, noise and vibration may disrupt the existing foraging behaviours of bats and flying foxes.	Permanent Potentially severe to ground-dwelling mammals. Potentially severe to arboreal mammals if the wider WHD cannot be crossed tree to tree. Unlikely to significantly impact bats and flying foxes.
	Birds	The increased width of WHD will increase the risk of vehicle strike to birds known to fly at lower heights. The threat of vehicle strike (and the action itself) may also impede movement of birds that move closer to the ground. The increased fragmentation of vegetation will decrease the amount of sheltering habitat within the road reserve. This may reduce the number of connection points that a bird may utilise.	Permanent Potentially severe to birds that fly closer to the ground.
	Reptiles	The increased width of WHD will increase the risk of vehicle strike to reptiles. The threat of vehicle strike (or the action itself) may also impede movement across WHD.	Permanent Potentially severe
	Amphibians	The increased width of WHD will increase the risk of vehicle strike to amphibians. The threat	Permanent

Impact of connectivity loss	Species group	Impact description	Duration and severity
		of vehicle strike (or the action itself) may also impede movement across WHD.	Potentially severe
	Invertebrates	The increased width of WHD will increase the risk of vehicle strike to invertebrates.	Permanent Unlikely to place any species or population at risk of extinction.
	Echidnas	Decreases to insect numbers may decrease the number of microbats moving over the road. Increases to light, noise and vibration may also disrupt foraging behaviour.	Permanent Impacts to foraging habitat may be harmful to some species but are unlikely to be severe.
Disruption of foraging behaviour	Mammals	The increased distance between patches of habitat either side of the road may prevent some mammals from crossing to forage. Increases to light, noise and vibration may disrupt the existing foraging behaviours of microbats. Threatened species of microbats are known to avoid well-lit areas.	Permanent Impacts to foraging habitat may be harmful to some species but are unlikely to be severe.
	Birds	The increased distance between habitat patches and increased threat of vehicle strike may prevent some species from crossing WHD to forage. This may in turn increase intra and inter species foraging competition on either side of the alignment. Increases to light, noise and vibration may disrupt the existing foraging behaviours of birds in the Study Area. Changes to insect numbers as a result of increased street lighting in the Study Area may lead to increased numbers of certain bird species foraging within the WHD road reserve at dawn and dusk (e.g. Varied Sittella, Satin Flycatcher, Scarlet Robin, Superb Parrot).	Permanent Impacts to foraging behaviour will be specific to species. The severity of inter and intra species foraging competition is unknown.
	Reptiles	Impacts to the foraging behaviour of reptiles are unknown.	Unknown
	Amphibians	The increased distance between habitat patches and increased threat of vehicle strike may prevent some species from crossing WHD to forage. This may in turn increase intra and inter species foraging competition on either side of the alignment.	Permanent Potentially severe

Impact of connectivity loss	Species group	Impact description	Duration and severity
	Invertebrates	Impacts to the foraging behaviour of invertebrates are unknown.	Unknown
	Echidnas	The increased distance between habitat patches and increased threat of vehicle strike may prevent some species from crossing WHD to forage. This may in turn increase intra and inter species foraging competition on either side of the alignment.	Permanent Potentially severe
Disruption to breeding behaviour and a potential increase of loss of genetic diversity	Flora	The increased width of WHD may prevent pollinators from crossing. This may isolate groups of individuals occurring on either side WHD, effectively creating separate populations. Impediments to pollinators is likely to cause a restriction in the exchange of genetic material and may genetically isolate occurrences of some plant species on either side of WHD.	Permanent Potentially severe to smaller populations which already have a lack of genetic diversity.
	Mammals	The upgrade to WHD may prevent (or reduce the likelihood) some individuals from crossing and finding a mate. The upgrade may subsequently increase the likelihood of a smaller number of individuals mating with each other. This will reduce the genetic diversity within the groups isolated on either side of the road. The same risk applies so arboreal mammals if connection points are removed. The genetic diversity of some species of microbats and flying foxes in the locality will not be impacted, as individuals will still be able to safely cross the WHD road reserve.	Permanent Potentially severe if populations become isolated.
	Birds	The upgrade to WHD may prevent (or reduce the likelihood) some individuals from crossing and finding a mate. The upgrade may subsequently increase the likelihood of a smaller number of individuals mating with each other. This will reduce the genetic diversity within the groups isolated on either side of the road.	Permanent Has the potential to be harmful to smaller birds that fly closer to the ground.
	Amphibians	The upgrade to WHD may prevent (or reduce the likelihood) some individuals from crossing and finding a mate. The upgrade may subsequently increase the likelihood of a smaller number of individuals mating with each other. This will reduce the genetic diversity within the groups isolated on either side of the road.	Permanent Potentially severe if populations become isolated.
	Reptiles	The upgrade to WHD may prevent (or reduce the likelihood) some individuals from crossing	Permanent

Impact of connectivity loss	Species group	Impact description	Duration and severity
		and finding a mate. The upgrade may subsequently increase the likelihood of a smaller number of individuals mating with each other. This will reduce the genetic diversity within the groups isolated on either side of the road.	Potentially severe if populations become isolated.
	Invertebrates	Unknown	Unknown
	Echidnas	The increased distance between habitat patches and increased threat of vehicle strike may prevent some species from crossing WHD to seek out mates. This may in turn decrease genetic diversity within the groups isolated on either side of the road.	Permanent Potentially severe

Edge effects

Edge effects relate to where ecological processes, interactions and conditions are altered along the boundary of two or more different adjoining habitats. Often at these boundaries, ecological conditions like air temperature, soil moisture or light intensity may be different to adjoining habitats. The differentiation of these conditions to may decrease the suitability of the altered habitat for native species yet increase its suitability for non-native and invasive species.

The remnant native vegetation along WHD is currently subject to edge effects. The vegetation clearing associated with the Project will increase edge effects to the remaining vegetation. Edge effects will also be moved inward (away from the boundary of the current alignment) which is likely to increase the adverse impacts to both Kama and The Pinnacle Nature Reserves. The edge effects that will impact the remaining vegetation along WHD may facilitate the invasion and spread of exotic species, reduce the resilience of native vegetation and change predator-prey relationships.

To help manage this, it is proposed to strategically locate dense ***Lomandra Longifolia*** and shrub plantings along the boundary of the Kama Nature Reserve and The Pinnacle Nature Reserve (and their buffers). This will enhance habitat connectivity whilst also reducing the spread of African Lovegrass and other invasive plant species.

As a result of the duplicated road, the area of hardstand would increase and there would be an associated minor increase in peak stormwater runoff. The Project would maintain or increase the stormwater drainage provisions to manage the surface water for events up to the one percent AEP, while also providing additional protection during and following major storm events. As such, there should be no change with regard to the risk for erosion and scour at the stormwater discharge points or potential for sediment discharge and pollution.

The existing transverse drainage systems under the proposed upgrade would be retained where practically possible to ensure consistency in the flow regime between existing and post-developed conditions. As such, there would only be a minor change in flow attenuation between the present day and post construction. The drainage plans provide the details and locations of the proposed culverts to protect the road from flooding for events up to 1% AEP.

Deep Creek is not being used as a water treatment or attenuation facility in the updated drainage design of the Project. Deep Creek will still receive runoff from the portion of the road reserve within its catchment area as it is a downstream facility. However, this runoff will not be included in its treatment volumes.

Where kerbs and gutters are provided, the stormwater runoff from the road surface would be collected in sumps which would then discharge into vegetated swales within the road verge. The proposed section of the road falls within Deep Creek catchments and the runoff from the road catchment will directed through vegetated swales for water quality treatment and eventually flow into Deep Creek. Further information is provided within Section 5.7 below.

Protection measures for the two Nature Reserves will therefore also include the erection of man proof fencing, treatment of drainage lines with sediment control, and a strict 'No Entry' during construction. Erosion and sediment control plans would be lodged with the DA and best practice erosion and sediment controls would be followed by the construction contractor as per the Blue Book. Any other reasonable requirements from the EPA and other Government agencies will also be implemented.

Public access directly off this arterial road to the Kama and Pinnacle Nature Reserves was not considered to be a safe option, as the William Hovell Drive road corridor will gradually hold increasing volumes of traffic under a 2031 design scenario. It is understood that Parks and Conservation will work with TCCS to ensure a new Whitlam access point into the Kama Nature Reserve is provided for the future.

5.2.3.4 Weeds and exotic flora

Non-native plants and exotic weeds were observed throughout the Study Area. The highest densities of these plants occurred in the disturbed areas adjacent to the existing roadway. Five of the observed species have been identified in the ACT Government's ***Invasive Plant Control Map and Progress Report*** (Environment, Planning and Sustainable Development Directorate - Environment, 2021) occurring within or immediately adjacent to the Study Area. The duty/management actions for these weeds are outlined in Table 5-14 below.

Table 5-14 Weeds and their duty/management actions

Weed	Duty/management action
Echium plantagineum (Paterson's Curse)	Must be contained / Herbicide name: MCPA
Hypericum perforatum (St. John's Wort)	Must be contained / Herbicide name: Triclopyr; control method: spot spray
Eragrostis curvula (African Lovegrass)	Must be contained / Herbicide name: Flupropanate; control method: spot spray
Rosa rubiginosa (Sweet Briar)	Must be suppressed / Herbicide name: Glyphosate; control method: cut and paint
Rubus fruticosus agg. (Blackberry)	Must be contained / Herbicide name: Triclopyr; control method: spot spray

The Project has the potential to increase the spread and facilitate the establishment of the weeds listed in Table 5-14 above throughout the Study Area. The spread and establishment of these weed species is most likely to occur through:

- The movement of soil (containing seed and propagules) from machinery or introduced fill
- The spread of seed and propagules through runoff
- Colonisation of previously undisturbed areas post construction
- Increased nutrient runoff, particularly an elevation in phosphorus.

The identified exotic weeds were prevalent throughout the Study Area and the adjacent nature reserves. The Project in its operational phase is unlikely to increase their abundance within the Study Area. However, if equipment and machinery are not subject to the correct hygiene protocols the weeds may be spread elsewhere. Additionally, if hygiene protocols are not followed these weeds have the potential to spread into areas of native vegetation that have been restored (such as those proposed in Kama and The Pinnacle Nature Reserves).

5.2.3.5 Changes in hydrology

The Project has the potential to change the hydrology of the Study Area. By broadening the width of the road surface, the Project will increase the area of impervious watershed. It is expected that the upgraded design will divert this run-off away from the road via a drainage system. While beneficial to the road and its supporting

infrastructure, the diversion of this water may adversely impact some areas of retained vegetation. For example, diverting water into an area of Grassy Woodland has the potential to adversely impact some of the characteristic native species yet benefit non-native species such as ***Phalaris aquatica***.

A modification to surface runoff has the potential to act as a source of pollutants - such as tyre dust and hydrocarbons - to areas of retained native vegetation. Pollutant laden runoff also has the potential to drain into Deep Creek and the un-named creek running through Kama Nature Reserve. Both creeks support areas of native vegetation and run into the Molonglo River. The Project has the potential to adversely impact the areas of native vegetation supported by these creeks and the Molonglo River if it increases pollutant levels into these water bodies.

5.2.3.6 Invasion and spread of pests

Vertebrate pests such are already likely to be present in the Study Area due to the proximity to urban areas and farmland. The European Red Fox (***Vulpes vulpes***) and domestic and feral cats (***Felis catis***) are likely to roam freely throughout the Study Area and prey on native birds, reptiles and small mammals. Fox control is not undertaken in The Pinnacle Nature Reserve due to potential effects on non-target animals (Parks and Conservation Service, 2016).

Ground-dwelling, ground-foraging (such as birds) and tree-roosting fauna species are susceptible to predation by introduced predators such as cats (***Felis catus***) and foxes (***Vulpes vulpes***). Given the proximity to urban developments and farmland, it is likely that both these species already occupy the Study Area and so there is not necessarily additional risk created by the Project and its associated vegetation clearing and provision of shared pathway routes.

The implementation of the ***ACT Cat Plan 2021-31*** (ACT Government, 2021) in conjunction with existing Cat Containment Areas in some of the suburbs surrounding the WHD road reserve is likely to assist in improving these outcomes for the locality in the long-term. Updates have been made to the Project design to ensure no significant impacts to existing off-leash dog parks. The Project allows for shared paths to be constructed along its alignment. This, alongside ACT-wide rules around dog management in public spaces will also assist the potential future management of feral foxes in the area, as baiting may be able to be considered alongside responsible dog ownership measures.

Overall, it is unlikely an invasive species that are harmful to the species of concern in the Study Area will be introduced by the Project.

Feral deer are known to exist in the region (Andrew Brown, 2021), however, are not currently recognised as a threat to the Kama or The Pinnacle Nature Reserves (Capital Ecology , December 2016); (Parks and Conservation Service, 2016). There have been changes in the movement patterns of feral deer populations recorded in the ACT since the 2019-2020 bushfire summer season (Andrew Brown, 2021). Revegetation activities at the site will be subject to monitoring to ensure the occurrence of feral animal species is not significantly hampering revegetation efforts. Fencing may be required in areas subject to grazing by herbivores (native and introduced) until plants are established.

Rabbits (***Oryctolagus cuniculus***) are known to exist in The Pinnacle Nature Reserve and undergo regular monitoring and biannual control programs (Parks and Conservation Service, 2016). Regular control programs in this nature reserve are likely to reduce the numbers of rabbits that occupy the Study Area.

Five species of introduced birds were recorded during recent surveys (refer to attachments of Appendix D). Of particular concern are the large numbers of Common Myna (***Acridotheres tristis***) and Common Blackbird (***Turdus merula***). Both are aggressive, territorial species known to displace native woodland species from their habitat. Removal of native vegetation exacerbates this process as the introduced species thrive in disturbed habitats and are territorial and aggressive towards native birds competing for nesting sites in hollow bearing trees. A Common Myna control plan for Molonglo 3 is expected to minimise the impacts of the Common Myna on the biodiversity values of Kama Nature Reserve (Capital Ecology, 2016) and is likely to have positive flow-on effects in the Study Area.

During construction works, the additional noise, vibration and lighting generated by construction equipment, vehicles, human activities and the use of construction fencing are all likely to act as a deterrent to feral animal

species, preventing them from colonising the site. Revegetation and offset plantings proposed as part of the Project will assist in supporting habitats which are favoured by native species, such that the Project will not result in feral species colonising land within the Study Area over the long-term.

5.2.3.7 Invasion and spread of pathogens and disease

Pathogens have the potential to spread disease throughout an ecosystem. Two pathogens that have the potential to cause disease and effect the biodiversity throughout the Study Area are:

- Amphibian Chytrid Fungus (***Batrachochytrium dendrobatidis***)
- Root Rot Fungus – Phytophthora (***Phytophthora cinnamomi***).

Like non-native plants, these pathogens can be spread through soil. In the case of ***P. cinnamomi***, this pathogen can also be spread through infected plant material. The incidence of ***P. cinnamomi*** in the ACT is low and the ***Offset Management Plan for the extension of The Pinnacle Nature Reserve*** (Parks and Conservation Service, 2016) states there are no records of ***P. cinnamomi*** within the Offset Area or surrounding landscape (Parks and Conservation Service, 2016). The Amphibian Chytrid Fungus may also be spread between infected animals by water. Given that permanent water bodies are absent from the Study Area, chytrid is unlikely to be present.

Psittacine Beak and Feather Disease (PBFD) is a disease affecting Australian parrot species and listed as a key threatening process under the EPBC Act. Threatened parrots, including the Superb Parrot, are at risk of contracting the disease. Increased competition for nesting habitat by the removal of hollow-bearing trees increases interactions between birds and therefore increase the risk of spread of PBFD (DoE 2015). It is unknown if the disease is present within local populations of parrots that occupy the Study Area. However, it is unlikely that the Project will result in the introduction of PBFD to the Study Area.

During construction works, it will be important that hygiene protocols – such as the cleaning of equipment and machinery prior to use onsite – be followed. Hygiene protocols to prevent the introduction and spread of these two pathogens in the Study Area are outlined in Section 5.2.4 below.

5.2.3.8 Noise, light and vibration

The Study Area is already subject to noise, vehicle light and vibration from traffic along WHD.

Fauna habitat in the immediate vicinity of the Study Area is considered to be sub-optimal habitat for most fauna species for these reasons. However, it does provide good stepping-stone habitat for fauna moving through the landscape.

There is no existing lighting along the length of the Study Area or underpasses. Exiting lighting occurs at the north and south end of the Study Area where the roads meet the suburbs of Hawker and Whitlam. The current unlit underpasses may be utilised by mammals to cross from one side of WHD to the other, providing some form of wildlife crossing between the east and west of the road and surrounding habitat.

Artificial light is known to adversely affect many species and ecological communities (Commonwealth of Australia, 2019). It can change behaviour and/or physiology, reducing survivorship or reproductive output (Commonwealth of Australia, 2019). It can also have the indirect effect of changing the availability of habitat or food resources. It can attract predators and invasive pests, both of which may pose a threat to listed species (Commonwealth of Australia, 2019).

There will be a notable increase in light from the installation of lights at approximately 65m intervals along the widened road alignment road. Additionally, two of the three underpasses will be upgraded including the addition of three 30-Watt LED strip lights per underpass. This will most likely deter mammals from utilising these structures for crossing as most mammals are nocturnal and the presence of light will make them more susceptible to predators (Bhardwaj M., Soanes K., Lahoz-Monfort JJ., Lumsden LF., van der Ree R., 2021). This increase in lighting may also alter movement and foraging behaviour of nocturnal mammals and birds that occur in the locality.

However, as set out within Section 5.3.3.7 and Appendix I, the Spill Light Assessment has established that, with the exception of the area between Chainages 2,320 and 2,440, the average horizontal illumination level is below the level of full moonlight (0.27 maximum lighting levels or lux). At the Kama Nature Reserve boundary, between

Chainages 2,320 and 2,440, the light penetration for values over 0.27 lux extends 15m. In all other locations, this penetration is less than 10m beyond the boundary. Further details about how lighting can positively impact on certain species by attracting insects to feed on is set out in Table 5-13 within Section 5.2.3.3 above.

Overall, it is therefore considered that the additional lighting introduced into the locality as a result of the Project will not generate significant impacts for species, and no specific mitigation measures are considered necessary to mitigate such impacts.

Traffic noise levels were calculated to increase naturally by 0.3dBA by 2031 if the road upgrade did not occur. The increase as a result of the project is generally less than 1dBA at most receptors modelled by the ***William Hovell Drive Duplication: Road Traffic Noise Assessment*** (SLR, 2021 – refer to Section 5.5 below and Appendix F). Receptors in this study are generally residences a moderate distance from the roadway in the suburb of Hawker already subject to between 53 and 60dBA. Varied topology of the landscape alters the extent of areas subject to increases noise exposure, however the outward shift in area subject to increase in noise exposure as shown in the noise contour mapping models, is similarly minor as sound pressure (dBA) falls with the simple inverse of distance, and intensity falls with the inverse square of distance. In keeping with the conclusion for human dwellings it is reasonable to conclude that there are no significant noise impacts associated with the project, except for a minor shift in habitat suitability away from the road alignment expected for sound sensitive species. "Road-effect-zones," areas where habitat suitability is degraded for certain types of fauna, is partially a result of traffic noise and vibration. Microbats are known to be particularly affected. In a Victorian freeway study, reduced habitat for bats spanned an average of 307m outwards from the freeway for 10 species of microbat, while the largest road-effect zone was 890m for one species (Bhardwaj M., Soanes K., Lahoz-Monfort JJ., Lumsden LF., van der Ree R., 2021).

5.2.3.9 Cumulative impacts

A cumulative impact assessment considered the combined effects of projects occurring within the same locality or region, where each impact has been assessed individually. Table 5-15 provides a summary of the projects recently or currently being undertaken in the vicinity of WHD and their associated impacts on biodiversity. Projects were identified from the ACT Government Directorate Planning website for EIS and EIS exemptions. It should be noted that only key projects have been included within the assessment. Furthermore, for some projects, there is no publicly available information about the extent of the construction and operational impacts of the project, or they are yet to be determined.

There are also no DAs or pre-DA consultations currently proposed for the Project Site.

Table 5-15 Summary of nearby projects and associated impacts

Project	Proximity to Study Area	Impact summary
John Gorton Drive Stage 3C (Jacobs 2019)	1.5km south of the Study Area on the Molonglo River	Clearing approximately 2.5 hectares BGW TEC in low to moderate condition Loss of less than one hectare of high quality PTWL Loss of hollow-bearing trees
John Gorton Drive Stage 3A (Calibre 2018)	Overlaps with the eastern end of the Study Area	Part of the Molonglo Valley Strategic Assessment Area
Molonglo Valley Stage 3 Urban Development	800ha immediately south of the Study Area, also bounded by the Molonglo River to the south, the Tuggeranong Parkway and National Arboretum to the east and Kama Nature Reserve to the west	Clearing 43ha of native vegetation including BGW and Natural Temperate Grassland TECs Loss of hollow-bearing trees Habitat loss for PTWL, woodland birds, Hoary Sunray and Tarengo Leek Orchid

Project	Proximity to Study Area	Impact summary
Molonglo Valley Stage 3 - Deep Creek Corridor Regional Water Quality Pond	South of the Study Area within the Molonglo Valley Stage 3 Urban Development site	The project area will impact on 0.76ha of low-quality habitat, 3.47ha of moderate and 0.03ha of high quality PTWL habitat.
Molonglo Stage 3 Transmission Line Relocation (Umwelt 2019)	Part of the project overlaps with the southern extent of the current project area and continues west of Coulter Drive. Additional areas south of the Study Area in the Molonglo River valley near the Tuggeranong Parkway	Loss of up to 5.9ha of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands Impacts to potential GSM and Perunga Grasshopper habitat

Most projects occurring in the region have some impact on the threatened White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands vegetation community and require the removal of habitat for threatened flora and fauna. Combined, these impacts are likely to contribute to the local extinction of these populations and communities.

5.2.3.10 Assessments of significance

EPBC Act threatened species

Assessments of significance for EPBC listed threatened entities with a higher than a moderate likelihood of occurring the Study Area are provided in Appendix C of Appendix D to this EIS and are summarised in Table 5-16.

Table 5-16 Summary of EPBC Act assessments

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland		Critically Endangered under the NC Act and the EPBC Act	The Project will directly clear 6.41 hectares of this Box-Gum Woodland TEC therefore reducing its extent in the locality. Under the National Recovery Plan for the community all areas of Box-Gum Grassy Woodland which meet the minimum condition criteria should be considered critical to the survival of this ecological community. The Project, including the proposed Offset Management Strategy, is not inconsistent with Threat Abatement Plans in place for this community.	The Project will increase the distance separating stands of this Box Gum Woodland TEC bisected by the existing road such as those occurring on the edges of Kama and The Pinnacle Nature Reserves. The existing roadway already constitutes a significant fragmentation of such patches. Widening constitutes a relatively marginal increase in fragmentation. The potential of increased nutrient levels in runoff, and a potential increase in surface water will favour some invasive species – such as ***Phalaris aquatica*** – thereby promoting their establishment within the Study Area. The increased traffic of plant, equipment and people during the construction may spread new non-native flora and weeds into the Study Area. These weeds may then be spread throughout the Study Area and into Kama and The Pinnacle Nature Reserves. The Project has the potential to spread pollutants and chemicals – such as hydrocarbons and tyre dust from cars – via a modified drainage system. These chemicals and pollutants are also likely to increase with greater traffic on WHD. The increased traffic of plant, equipment and people during the construction may spread new non-native flora and weeds. The Project has the potential to spread pollutants and chemicals – such as hydrocarbons and tyre dust from cars – via a modified drainage system.	Yes

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
				These chemicals and pollutants are also likely to increase with greater traffic on WHD.	
Leucochrysum albicans var. ***tricolor***	Hoary Sunray	Endangered under the EPBC Act	The Project will clear thirteen individuals of this species. As the species is a short-lived perennial, it is not known how many more seasons each of these individuals would have persisted at this location without clearing works to support the Project, before they would have died back and been replaced by the next generation (which is propagated by seed dispersal). The Project will also clear 10.9 hectares of potential habitat, including 6.46 hectares of Grassy Woodland, 0.03 hectares of Native Grassland and 4.41 of Planted Native habitat. All these communities have been assessed as the 'area of occupancy' for L. albicans var. tricolor within the Study Area. The 10.9 hectares of habitat (area of occupancy) within the Study Area, and the 13 individuals known to be removed as part of the project, are unlikely to be critical to the survival of the species or the population. The removal of this available habitat could cause the population to decline. However, the National Recovery Plan for this species does acknowledge that some disturbance is required for successful establishment and seedlings often appear on areas that have been scraped. The species has been observed recruiting on scraped road edges in	Currently, individuals of this species occurring on different sides of WHD are able to interact with each other as pollinators and the dispersal of seed is likely able to cross the existing alignment. The widening of the road corridor is unlikely to completely prevent seed dispersal and pollinators from crossing the road. As such, the Project is unlikely to fragment the existing population into two or more smaller populations. The species is adversely impacted from the competition of non-native and invasive flora species. Non-native grasses such as Phalaris aquatica and Festuca arundinacea (Tall Fescue) were commonly observed throughout the Study Area. It is unlikely that the Project will further increase the occurrence of these species. It is also important to note that the individuals recorded in the Study Area were growing along a ridge line with thinner soils. The recorded invasive grasses are less likely to become established in this type of habitat, preferring wetter habitat with higher nutrient levels and deeper soil.	No

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
			the ACT. Monitoring of newly created road verges as created by the Project and adaptive management to limit mowing or encourage recruiting specimens could have the potential to align with Recovery Plan if implemented. The Project, including the proposed Offset Management Strategy, is not inconsistent with Threat Abatement Plans in place for this species.		
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable under the NC Act and the EPBC Act	The Project Study Area, or the locality in general, is not critical habitat for the Grey-headed Flying-fox because it is not highly productive during winter and spring, there are not >30,000 individuals within a 50km radius. The Grey-headed Flying-fox would only be present in the locality during flowering events. Important foraging resources in the Project Study Area are likely to include Blakely's Red Gum (***Eucalyptus blakelyi***) and Yellow Box (***E. melliodora***) typical of Box-Gum Grassy Woodlands. The Project will entail the loss of 6.4 hectares of this habitat in an area of generally low tree density. There are 12.7 hectares of this habitat type in the Study Area. This area of habitat (which represents the maximum possible impact) would only support a small number (<10) individuals even during significant flowering events. Thus, the Project is unlikely to result in the long-term	The Grey-headed Flying-fox is a highly mobile species capable of extensive landscape-scale movements. The Project is not likely to cause the population to fragment. While it is likely that lactating females are sometimes likely to feed in the Study Area, the Project is not likely to disrupt the breeding cycle of the Grey-headed Flying-fox. The Project will not result in the establishment of invasive species harmful to the Grey-headed Flying-fox. The Project will not introduce disease harmful to the Grey-headed Flying-fox. The Project is not likely to interfere with the National Recovery Plan for the Grey-headed Flying-fox because it does not affect critical foraging or roosting habitat.	No

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
			decrease in the size of an important population of the Grey-headed Flying-fox The removal of this habitat is not expected to reduce the area of occupancy of the ACT population of Grey-headed Flying-fox. The Project, including the proposed Offset Management Strategy, is not inconsistent with Threat Abatement Plans in place for this species.		
Polytelis swainsonii	Superb Parrot	Vulnerable under the NC Act and the EPBC Act	The Project will require the removal of 10.87 hectares of potential Superb Parrot habitat along a major road, primarily feeding and foraging habitat. The removal of this habitat is not expected to reduce the area of occupancy of the ACT population of Superb Parrots. The Superb Parrot breeds in tree hollows with specific dimensions, most often in Blakely's Red Gums. Seven ***potential*** breeding hollows for this species will be removed. Despite the presence of hollow-bearing trees, some of which may have suitably sized hollows, the Superb Parrot is unlikely to breed within the Study Area due to its proximity to the road corridor. It is recommended that the size of these hollow entrances which could potentially support Superb Parrot breeding be confirmed and considered as part of the Draft Offset Strategy and final Offset Management Plan. This will establish whether any	Given that the species is known to fly distances of around 9km, it is considered that the Project will not have any long-term impacts on the local movement of this species across the WHD road corridor as it crosses to access a range of habitat features. Although the widening of WHD may increase collision risk, it is unlikely to fragment any important population of the species. Ground foraging activities of the Superb Parrot make them susceptible to predation by introduced predators such as cats (***Felis catus***) and foxes (***Vulpes vulpes***). Given the proximity to urban developments and farmland, it is likely that both these species already occupy the Study Area and so there is not necessarily additional risk created by the Project. The implementation of the ACT Cat Plan 2021-31 in conjunction with existing Cat Containment Areas in some of the suburbs surrounding the WHD road reserve is likely to assist in improving these	No

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
			compensatory nest box habitat needs to be established for this species. The Project, including the proposed Offset Management Strategy, is not inconsistent with Threat Abatement Plans in place for this species.	outcomes for the locality in the long-term. Updates have been made to the Project design to ensure no significant impacts to existing off-leash dog parks. The Project allows for shared paths to be constructed along its alignment. This, alongside ACT-wide rules around dog management in public spaces would also assist the potential future management of feral foxes in the area, as baiting may be able to be considered alongside responsible dog ownership measures. It is unlikely an invasive species that are harmful to the Superb Parrot will be introduced by the Project. Psittacine Beak and Feather Disease (PBFD) is a disease affecting Australian parrot species and is listed as a key threatening process under the EPBC Act. Threatened parrots, including the Superb Parrot, are at risk of contracting the disease. Increased competition for nesting habitat by the removal of hollow-bearing trees increases interactions between birds and therefore increases the risk of spread of PBFD (DoE 2015). It is unknown if the disease is present within local populations of parrots that occupy the Study Area. However, it is unlikely that the Project will result in the introduction of PBFD to the Study Area. No other diseases are known to affect the Superb Parrot.	
Lathamus discolor	Swift Parrot	Vulnerable under the NC Act and Critically Endangered	The Swift Parrot occurs as a single population across its range. Small numbers of Swift Parrots are known to regularly occur in the ACT. The Study Area supports known foraging resources (Yellow Box and likely	The Swift Parrot is a highly mobile species capable of extensive landscape-scale movements. The Project is not likely to cause the population to fragment.	No

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
		under the EPBC Act	Blakely's Red Gum) at a low tree density due to previous partial clearing. However, the Project Study Area is not recognised as a priority habitat for the species. The Project will result in the loss of a relatively small area of low quality (i.e. low tree density) foraging habitat (10.87 ha). This extent of non-breeding habitat clearing in a marginal part of its range will not cause the Swift Parrot population to decline. The Project will require the removal of 10.87 hectares of Swift Parrot foraging habitat along a major road. The removal of this habitat is not expected to reduce the area of occupancy of the Swift Parrot population. Habitat critical to the survival of the Swift Parrot (the analogue of Priority Habitat) is not present in the project Study Area. The Project, including the proposed Offset Management Strategy, is not inconsistent with Threat Abatement Plans in place for this species.	All Swift Parrots breed in Tasmania. The Project will not, therefore, impact on the breeding cycle of the Swift Parrot. The Project will not result in the establishment of invasive species harmful to the Swift Parrot. The Project will not introduce disease harmful to the Swift Parrot.	
Anthochaera phrygia	Regent Honeyeater	Endangered under the NC Act and Critically Endangered under the EPBC Act	The Project Study Area supports known foraging resources (Yellow Box and likely Blakely's Red Gum) at a low tree density due to previous partial clearing. While the Regent Honeyeater is known to breed, at least occasionally, in the ACT, it is unlikely that the timid Regent Honeyeater would breed in the Project Study Area due to current levels of	The Regent Honeyeater is a highly mobile species capable of extensive landscape-scale movements. The Project is not likely to cause the population to fragment. As it is unlikely that the Regent Honeyeater would breed in the Project Study Area, the Project will therefore not, therefore, impact on the breeding cycle of the Regent Honeyeater.	No

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
			disturbance arising from the operation of the existing road. However, the definition of habitat critical to the survival of the Regent Honeyeater merely requires the presence of foraging habitat; there is no threshold for the intensity of foraging activity (i.e. frequency of use or numbers present). Given that the species could potentially forage in the Project Study Area, it is therefore critical habitat (it is noted that, as per the National Recovery Plan, all known and potential foraging habitat for the Regent Honeyeater must be regarded as critical habitat). Despite the potential presence of critical habitat, the Project will result in the loss of a relatively small area (10.88 ha) of low quality (i.e. low tree density) foraging habitat as Grassy Woodland (6.46 ha), Planted Native (4.41 ha) and Planted River She-oak Riparian Forest (0.01 ha). This extent of non-breeding habitat clearing in a marginal part of its range will not cause the Regent Honeyeater population to decline or reduce the area of occupancy of the species. The Project, including the proposed Offset Management Strategy, is not inconsistent with Threat Abatement Plans in place for this species.	Habitat fragmentation is known to alter habitats in a way that favours the Noisy Miner, a recognised threat to the Regent Honeyeater. Due to existing levels of habitat fragmentation and partial canopy removal, it is likely that the Noisy Miner is already present in the Study Area. While the Project will cause further clearing, in light of the preceding it is unlikely that the Project will result in the establishment of invasive species harmful to the Regent Honeyeater. The Project will not introduce diseases harmful to the Regent Honeyeater.	
Hirundapus caudacutus	White-throated Needletail	Vulnerable under the	It is likely that the White-throated Needletail will occasionally to rarely forage over the	Removal of 19.85 hectares of vegetation that may be a minor or indirect source of flying insects	No

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
		NC Act and the EPBC Act	Study Area. Given the presence of two nature reserves near this area, it is likely that the terrestrial habitat provides some flying insects that will be consumed by the White-throated Needletail. However, the amount of habitat in the Study Area is not likely to be a limiting factor for the White-throated Needletail population and this habitat is not regarded as habitat critical to the survival of the White-throated Needletail. The area of occupancy of the White-throated Needletail is estimated to be 126,200km^2. The vegetated (native and exotic) area of the Project clearing footprint is 19.85 hectares (i.e. 0.198km^2). Thus, the Project will not reduce the area of occupancy of an important population of the White-throated Needletail. It is unlikely that the Project will directly or indirectly reduce the size of the Australian White-throated Needletail population. The Project, including the proposed Offset Management Strategy, is not inconsistent with Threat Abatement Plans in place for this species.	consumed. However, lighting installed as part of the Project's design is likely to act as an insect attractant, ensuring that suitable food sources remain for the species in this locality. The White-throated Needletail is a migratory species capable of very long-distance movements and can forage over a range of habitat types. The Project will not fragment the White-throated Needletail population. The White-throated Needletail breeds in Asia and Siberia. The Project will not affect breeding by this species. No invasive species are known to be harmful to the White-throated Needletail. The Project will not introduce disease harmful to the White-throated Needletail.	
Aprasia parapulchella	Pink-tailed Worm-lizard	Endangered under the NC Act and Vulnerable under the EPBC Act	The sites' proximity to the Molonglo River corridor, as well as its slope and drainage qualities increase its candidacy for PTWL habitat. Much of the Study Area falls into vegetation categories including primary and secondary grassland, or grassy woodland communities.	Increased fragmentation and disruptive inputs to foraging and breeding behaviour Marginal increase in potential for vehicle strike. The Project will not introduce disease harmful to the PTWL.	Potentially

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
			Two very small patches of treeless rocky outcrop, likely to support scattered, loosely embedded rocks, mapped on site (0.044 ha, 0.005 ha). The larger patch fell within Box Gum Woodland where native grasses (notably kangaroo grass ***Themeda triandra***) were present. The smaller patch was surrounded by dense exotic grassland. No assessment of associated ant activity was carried out. Overall, within the locality, significant patches of suitable habitat have been identified. Precautionarily, the exposed rock created by the road cuttings, has been assessed as potential habitat for PTWL. While there is very limited vegetation directly associated with the road cuttings, and the rock does not show clear significant weathering, and may have limited loosely embedded rock, the habitat has been precautionarily assessed as marginal. 0.16 ha of rocky habitat in grasslands or grassy woodland communities will be impacted by the Project. The Project, including the proposed Offset Management Strategy, is not inconsistent with Threat Abatement Plans in place for this species.		

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
Delmar impar	Striped Legless Lizard	Vulnerable under the NC Act and the EPBC Act	The Striped Legless Lizard was subject to a habitat assessment rather than directly surveying for the species. Habitat critical to the survival of the Striped Legless Lizard is present in the Study Area. This consists of a mixture of box-gum grassy woodland with a low tree density, native grassland and exotic grassland totalling 15.43 hectares within the construction footprint. The Project has the potential to directly reduce the size of this important population due to habitat clearing and indirectly by exacerbating habitat fragmentation. The area of occupancy of the Striped Legless Lizard is not known. The Project will require the permanent removal of 15.43 hectares of Striped Legless Lizard habitat along a major road. Thus, the Project has the potential of reduce the area of occupancy of an important population of the Striped Legless Lizard. However, as this area of suitable habitat which will be removed is in a marginal part this species' range, it is not sufficient to cause the species to decline. The Project, including the proposed Offset Management Strategy, is not inconsistent with Threat Abatement Plans in place for this species.	The Study Area supports habitat critical to the survival of the Striped Legless Lizard. While there is already habitat fragmentation due to the existing road, the road duplication will increase the intensity of the existing habitat fragmentation by creating a wider road corridor. It is unknown whether the species will use fauna underpasses. While it is likely that the Striped Legless Lizard will breed in the Study Area, the Project is not likely to disrupt the breeding cycle of the Striped Legless Lizard. Predation is regarded as a potential threat to the Striped Legless Lizard. Introduced predators (e.g. foxes, cats and dogs) are already present in the locality. Thus, the Project will not result in the establishment of invasive species harmful to the Striped Legless Lizard. The Project will not introduce disease harmful to the Striped Legless Lizard.	Potentially
Synemon plana	Golden Sun Moth	Vulnerable under the	BGW assemblages in the Study Area do contain suitable species for the Golden Sun	The proposed Offset Management Strategy, though not directed towards the establishment of Golden	No

Scientific Name	Common Name	Status	Direct impacts	Indirect impacts	Significant impact?
		EPBC Act and Endangered under the NC Act	Moth to inhabit, such as Kangaroo Grass (***Themeda triandra***), Poa Tussock (***Poa sieberiana***), wallaby grasses (***Rytidosperma spp***.). However, critical to the survival of the Golden Sun Moth would not be directly impacted by the Project. The species can also inhabit exotic grasslands, such as the exotic Serrated Tussock (Nassella trichotoma) which was found to be in use by the species in Taylor, ACT. As there is no recorded population within the Study Area, land clearing and earthworks to support the Project are not anticipated to result in direct impacts to Golden Sun Moths over-wintering in underground tunnels. The Project, including the proposed Offset Management Strategy, is not inconsistent with Threat Abatement Plans in place for this species.	Sun Moth habitat, will benefit local populations of this species by providing habitat enhancement. The species is diurnal and so night lighting proposed as part of the Project is not expected to impact local populations of Golden Sun Moth. Minor changes to the acoustic environment (i.e. differences of up to 4.5dB(A)) will not significantly impact local populations of this species.	

EPBC Act migratory species

The Protected Matters Database search identified 14 migratory species listed under international agreements with the potential to occur on the site. None were found to be subject to more than a low likelihood of any impact as shown in Table 5-17, and are therefore do not require further test of significance. Further details are provided in Appendix B within Appendix D to this EIS. The criteria use by the EPBC Act to determine a significant impact to a Migratory species is as follows:

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

The following eight Wetland migratory species were all given negligible likelihood of being impacted due to the lack of substantial wetland habitat on or in proximity to the Project Site: ***Actitis hypoleucos*** (Common Sandpiper), ***Calidris acuminate*** (Sharp-tailed Sandpipe), ***Calidris ferruginea*** (Curlew Sandpiper), ***Calidris melanotos*** (Pectoral Sandpiper), ***Gallinago hardwickii*** (Latham's Snipe***), Limosa lapponica*** (Bar-tailed Godwit), ***Numenius madagascariensis***, (Eastern Curlew) and ***Pandion haliaetus*** (Osprey).

Table 5-17 EPBC listed migratory species considered for likelihood of impacts

Scientific Name	Common Name	EPBC Act status	Direct impacts	Indirect impacts	Significant impact?
Apus pacificus	Fork-tailed Swift	-	Very unlikely – no breeding habitat in Australia	Negligible impact to aerial feeding range.	No
Hirundapus caudacutus	White-throated Needletail	V	Very unlikely – no breeding habitat in Australia	Negligible impact to aerial feeding range.	No
Monarcha melanopsis	Black-faced Monarch	-	Very unlikely – lack of rainforest or suitable mesic habitat.	Unlikely – lack of rainforest or mesic habitat in proximity	No
Motacilla flava	Yellow Wagtail	-	Low likelihood – No breeding habitat and presence is unknown in ACT (ALA)	Low – presence in ACT possible but unknown.	No
Myiagra cyanoleuca	Satin Flycatcher	-	Low likelihood - prefers well-wooded wet sclerophyll forest. Some potential to use grassy woodland. One sighting record approximately 10km away near Cotter dam.	Low likelihood – few indirect impacts to adjacent woodland.	No
Rhipidura rufifrons	Rufous Fantail	-	Very unlikely - primary foraging and breeding habitat wet sclerophyll forest with dense shrubby understory.	Low likelihood – Woodland adjacent to the project could provide possible passage habitat	No

Scientific Name	Common Name	EPBC Act status	Direct impacts	Indirect impacts	Significant impact?
			Drier woodland is occasionally seen to host migrating birds on passage.		

5.2.4 Mitigation

The approach to minimising fragmentation, improving connectivity and reducing the incidence of roadkill events that are being incorporated into the Project's design are:

- One fauna crossing (rope bridge) to assist arboreal and avifauna to safely cross the road reserve
- Two fauna crossings (box culverts) to assist ground-dwelling fauna to safely cross the road reserve. These will be designed to be used by various wildlife
- Some batters will be laid back to allow Kangaroos and Wallabies to escape the roadway and back into the Nature Reserves. However, exclusion fencing (1.8 m tall chainmesh fence) will be included on each side of WHD in the vicinity of the Nature Reserves, extending at least 200m past the fauna crossings. This will assist in reducing the risks to native and non-native fauna from being injured or killed by road traffic. It will also improve the safety of road users by decreasing the risks of vehicle collision with large fauna species. The effectiveness of this exclusion fencing will be monitored during the operational stage of the Project.

TCCS and SMEC have met with the Conservator and agreed a pathway forward to achieving a Draft Offset Strategy and final Offset Management Plan for the Project. This is based on the first choice of offset being located to the west of Kama Nature Reserve. The following key points have been established regarding this Draft Offset Strategy between TCCS and the Conservator:

- The agreed approach is to use the Commonwealth Offsets Calculator (for calculation of offset areas required) in conjunction with the ACT Environmental Offsets Delivery Framework
- An appropriate offset is to be provided within the ACT, as a first choice. Whilst it will be advantageous to nominate the offset area close to the Project, this is not an absolute requirement. Therefore, the first choice of offset location is to the west of the Kama Nature Reserve. This area holds additional advantages, as it includes further connectivity along the Molonglo River, both further into the ACT and north-west towards the NSW border
- Some potential issues with using an offset site to the west of Kama Nature Reserve remain unresolved, and these are currently being worked through with the Conservator:
    - There is an ACT Heritage Overlay for Kama Woodland/Grassland which needs to be respected. There is a recommendation under the EPBC Environmental Offsets Policy, which states "for direct offsets, the securing of existing unprotected habitat as an offset only provides a conservation gain if that habitat was under some level of threat of being destroyed or degraded…" As such, the suitability of the area west of Kama Nature Reserve may be questionable as it may not "be under threat of being destroyed" due to this heritage overlay
    - The area in question includes land under a sub-lease to SLA which may be currently subject to grazing. This could detract from the quality of the vegetation currently in this location, meaning it could be suitable for enhancements to improve the quality of locally occurring Box Gum Woodland and other related habitat features for the relevant species of concern.
    - This locality is being concurrently investigated as a potential site for the Big Canberra Battery project, which is still in the procurement stage. Consultations will continue with the ACT Government around the suitability of designating land in this location as a Box Gum Woodland offset with the Battery project potentially located alongside it
    - It is proposed to undertake a survey effort for this site in Autumn 2022 to confirm its suitability for providing this offset. The Conservator has confirmed in principle support for this approach on the current Project, given the potential complexity of issues surrounding the land west of Kama Nature Reserve
    - Consultations will continue with the ACT Government, the Conservator, and ACT Government Offsets Team to ensure this land can be subject to the relevant legal instruments which are required to secure an offset for the purposes of land and property law

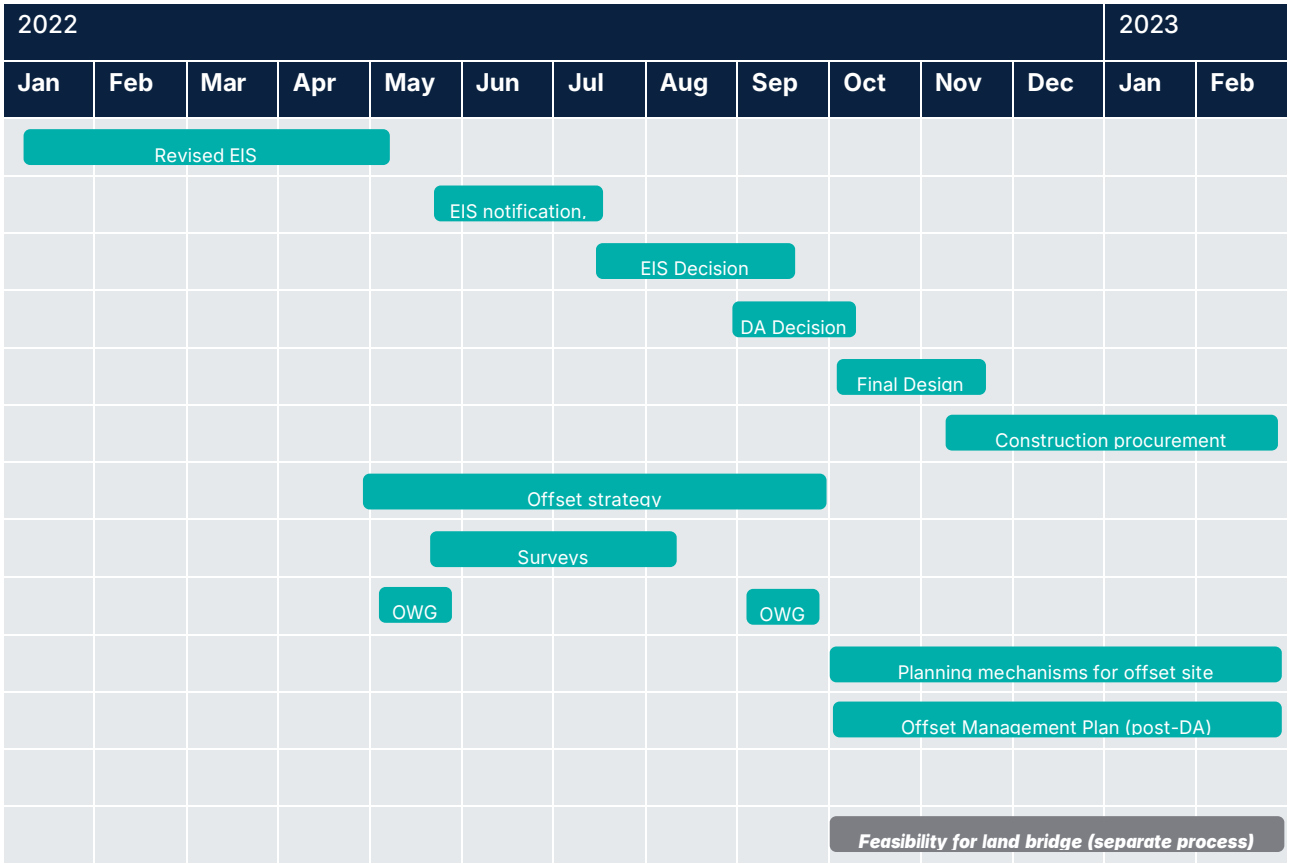
- The Draft Biodiversity Offset Strategy for the Project is expected to be established over the next two quarters of 2022
- The approach to conducting an Offset Strategy (and surveys as appropriate) in parallel to the notification of the Revised Draft-EIS is appropriate
- Should the location to the west of Kama Nature Reserve prove unsuitable to provide the required level of quality offset for the Project, an alternative offset will be devised. This could include another offset in the general location of Kama Nature Reserve – for instance, further to the south of the Molonglo River as a second option. Third and fourth tier options could include finding a suitable offset site in NSW, providing funds for urban ecology offsets within the broader ACT. These will be discussed with the Conservator only where it is apparent that the area surrounding Kama Nature Reserve cannot provide a suitable offset. However, it is considered that this is unlikely, and TCCS is committed, in the first instance, to finalising the Project's offset next to Kama Nature Reserve in consultation with the Conservator and the Offsets Working Group (OWG).

It is understood that the Conservator also wishes funds from the Project's offset package to be made available to enable data held by EPSDD on Kangaroo-vehicle collision incidents to be analysed to inform other future road design packages.

The next OWG meeting is scheduled to take place in May 2022. TCCS aims to have a Draft Offsets Strategy for review by the OWG at that time (refer to Table 5-18 below). TCCS is aware that the Project cannot commence construction procurement until an approved Offsets Management Plan is in place. An indicative timeframe for achieving these items is as per the below Table 5-18.

The relevant consultation processes will be followed during the process of finalising the Offset Management Plan for the Project.

Table 5-18 Indicative timeframe for finalising the Project's Offsets Management Plan



Whilst a potential fauna bridge will be the subject of a Future Feasibility Study (refer to Section 2.4.1 above), if it is implemented it will be in addition to the minimum offsetting measures which the Project has otherwise agreed to under the biodiversity offset strategy process, as outlined in this EIS. It is considered that a potential fauna bridge does not provide the most suitable and immediate offset for the Project at this time.

It is considered that protection of land to the west of Kama Nature Reserve will preserve nesting habitat for Superb Parrot and retain old growth trees and native grassland understorey.

Table 5-19 below sets out the proposed mitigation measures to manage the potential biodiversity impacts of the Project.

Table 5-19 Biodiversity mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Presence or extent of threatened species and ecological communities not identified prior to development design, resulting in unanticipated impacts Project activities facilitate spread of exotic flora into adjacent areas, leading to weed establishment Project attracts additional vermin and pest species, which result in greater competition for resources with native species	A Flora and Fauna Management Plan (FFMP) will be prepared and implemented as part of the CEMP. It will include, but not be limited to: • A Tree Management Plan (to be determined by the Conservator of Flora and Fauna) • Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and potential revegetation areas • Pre-clearing survey requirements • Procedures for unexpected threatened species finds and fauna handling • Protocols to manage weeds and Pathogens • Procedure for stockpiling materials including topsoils and subsoils to be stockpiled separately to avoid mixing in a manner that will facilitate the return of soils to location of original source and tracking and treatment of stockpiles. The CEMP will also outline contractor and other personnel responsibilities and actions in the event of an unforeseen environmental harm incidents, including first response and agency notification requirements. Rubbish removal is to be undertaken prior to construction and throughout construction in retained areas of vegetation in the road reserve. Revegetation and offset plantings proposed as part of the Project will assist in supporting habitats which are favoured by native species, such that the Project will not result in feral species colonising land within the Study Area over the long-term.	High	Prior to construction	TCCS Construction contractor
Incursion of vehicles, light, noise, invasive species and	Site inductions will be mandatory for all personnel working and visiting the Project area. The site induction will include information on threatened species and ecological communities, identify exclusion zones and the unexpected finds procedure for threatened species. Personnel involved in vegetation clearing and clearing of threatened	High	Prior to construction	TCCS

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
increased recreational use caused by greater human access into areas of environmental significance, causing damage to or destruction of habitat	species habitat will have a more detailed toolbox to ensure all personnel are clear on the clearing procedure and sensitive ecological features of the area to be cleared for that day.			
Removal of native vegetation and threatened species habitat	Provide an offset against the loss of Box Gum Woodland TEC habitat by the protection of land to the west of Kama Nature Reserve which will preserve nesting habitat for Superb Parrot and retain old growth trees and native grassland understorey. Development of this Draft Offset Strategy will follow these key points, as agreed to between TCCS and the Conservator: • The Commonwealth Offsets Calculator will be used (for calculation of offset areas required) in conjunction with the ACT Environmental Offsets Delivery Framework • An appropriate offset is to be provided within the ACT, as a first choice. Whilst it will be advantageous to nominate the offset area close to the Project, this is not an absolute requirement. Therefore, the first choice of offset location is to the west of the Kama Nature Reserve. This area holds additional advantages, as it includes further connectivity along the Molonglo River, both further into the ACT and north-west towards the NSW border • The Draft Biodiversity Offset Strategy for the Project is expected to be established over the next two quarters of 2022 • Should the location to the west of Kama Nature Reserve prove unsuitable to provide the required level of quality offset for the Project, an alternative offset will be devised. This could include another offset in the general location of Kama Nature Reserve – for instance, further to the south of the Molonglo River as a second option. Third and fourth tier options could include finding a suitable offset site in NSW, providing funds for urban ecology offsets within the broader ACT. These will be discussed with the Conservator only where it is apparent that the area surrounding Kama Nature Reserve cannot provide a suitable offset. However, it is considered	Moderate	Prior to construction	TCCS

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	that this is unlikely, and TCCS is committed, in the first instance, to finalising the Project's offset next to Kama Nature Reserve in consultation with the Conservator and the Offsets Working Group (OWG) • The relevant consultation processes will be followed during the process of finalising the Offset Management Plan for the Project • As requested by the Conservator, funds from the Project's offset package will be made available to enable data held by EPSDD on Kangaroo-vehicle collision incidents to be analysed so as to inform other future road design packages.			
Clearing of protected trees that have not been approved to be cleared Direct impacts on threatened flora and fauna, threatened ecological communities and non- threatened flora and fauna from clearing and other construction works	Establish exclusion zones including: • Prior to construction commencing, exclusion fencing or flagging and signs are to be installed at the limit of works • Trees to be retained are to be clearly demarked with fencing and signage • Threatened species habitat to be retained is to be clearly demarked with fencing and signage. • Contractors and site workers to be advised of criminal penalties available for unauthorised vegetation clearing in the ACT. The construction contractor will hold responsibility for ensuring that only approved vegetation is cleared.	High	Prior to construction	TCCS Construction contractor
Removal of native vegetation and threatened species habitat	Pre-clearance protocols will include: • Demarcation of habitat trees indicating which of these are to be cleared and which of these are to be retained • Pre-clearing and daily surveys • A two-staged tree clearing procedure including designated areas for release of any rescued fauna • Presence of a qualified ecologist/fauna rescue person throughout clearing.	High	Prior to construction and during Construction	TCCS Construction contractor

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Removal of native vegetation and threatened species habitat	• Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where possible throughout pre-construction and construction • Avoid where possible loss of Grassy Woodland, Native Grassland and Pink Tailed Worm Lizard habitat • Coarse woody debris and rocks will be placed in the adjoining reserves following consultation with the land manager for these reserves • Avoid loss of mature eucalypt trees over 50 cm in diameter, including all mature trees with hollows where possible • Where vegetation clearing is required, limit it to the minimum extent practicable required for the construction of the project • The limits of clearing will be clearly marked on construction work plans and on the ground prior to clearing. Vegetation to be retained will be protected through exclusion fencing (e.g. safety mesh) and 'no-go' signage • Only trees specified in the Tree Management Plan (if required) will be removed. All other trees are to be retained • Felled trees are to be stockpiled on site for re use in the landscape such as roost trees • Should any injured animals be found within the construction area, ACT Wildlife will be contacted to collect the injured animal.	High	During Detailed design and Construction	TCCS Construction contractor
Removal of native vegetation	Revegetation and rehabilitation will be undertaken during the Project and include: • Prior to revegetation works excavated or disturbed areas to be rehabilitated so that material is reinstated in original sequence i.e., topsoil at surface and subsoil below • All areas of disturbance must be revegetated immediately following construction • Revegetation to be undertaken using a cover crop of sterile Rye Grass to ensure that rapid stabilisation occurs • A suite of suitable local native species will be used in conjunction with the Rye Grass cover crop. The seed mix will be a locally collected species mix including four species.	High	During Construction	TCCS Construction contractor
Removal of a threatened ecological community	• Areas of Box-Gum Woodland TEC to be retained will be clearing marked on maps and provided to construction supervisors • Any indirect or indirect impact to Box-Gum Woodland TECs outside the designated clearing area will be immediately reported to the Conservator and DAWE • Non weedy BGW topsoil to be stockpiled for use in revegetation areas.	High	During Construction Offset strategy	Construction contractor

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
			approved before construction.	
Removal of threatened species habitat (Pink Tailed Worm Lizard)	• The requirement for exclusion (no-go) zones to be confirmed by an ecologist to mark and exclude PTWL habitat • The limits of construction works areas which are to be located inside identified PTWL habitat are to be clearly marked on construction work plans prior to the commencement of works in these areas • The limits of construction works areas within PTWL habitat are to be clearly marked out on the ground using exclusion fencing and 'no-go' signage where appropriate • No vehicles and machinery are to operate within areas of PTWL habitat which have been demarcated • No site laydown areas, vehicle parking, turning areas, temporary equipment or stockpiles will be located within PTWL habitat areas which have been demarcated. Pre-clearance surveys: • All areas of identified PTWL habitat which are within the construction footprint will be surveyed by a suitably qualified ecologist prior to construction activities taking place • Timing of these surveys will be as close to the clearing as practicable to ensure lizards present can be relocated prior to construction activities commencing • When conducting the pre-clearance surveys, all suitable habitat rocks within the disturbance area will be rolled over to check for individual lizards • Any individual PTWL found during pre-clearance surveys will be relocated by the ecologist to a nearby safe and suitable patch of habitat outside the construction area, in accordance with Animal Care and Ethics Approval and project-specific Scientific Licence held by the ecologist. PTWL habitat relocation: • Prior to construction activities commencing within PTWL habitat, and following the pre-clearance surveys undertaken by the ecologist, all surface rocks within the construction areas which are deemed by the ecologist to represent suitable habitat rocks will be relocated to a location or locations outside the construction area for preservation. Generally, suitable habitat rocks include those that are plate-like in shape with a 15-60cm basal diameter. Relocation of surface rocks will be undertaken by the ecologist and by construction personnel under supervision of the ecologist as required	High	Before, during and after Construction,	TCCS Construction contractor

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	• Suitable PTWL habitat rocks which are stockpiled will be utilised during rehabilitation of disturbed sites upon completion of construction works • The stockpile site will be located within the general vicinity of the work to avoid long cartage distances and multiple handling. During construction: • The unexpected finds protocol will include a procedure for snakes and legless lizards • Should any PTWL be observed during construction, works will cease, and the ecologist will be notified. The ecologist will be required to attend the site to relocate the lizard to a safe and suitable nearby patch of habitat, in accordance with the Scientific Licence held by the ecologist • Should any PTWL be injured during construction works, the animal will be handled in accordance with scientific licence conditions • All vehicles to operate within PTWL habitat will be free from vegetative materials and propagules • Should any trenches be left open overnight, these trenches will be inspected each morning to check for trapped PTWL. If any PTWL are observed within the trench, the ecologist will be contacted immediately to relocate the individual as per the conditions of the Scientific Licence held by the ecologist • All trenches will be inspected for the presence of PTWL immediately prior to backfilling. If any PTWL are observed within the trench, the ecologist will be contacted immediately to relocate the individual as per the conditions of the Scientific Licence held by the ecologist • The Draft Offset Strategy and the Offset Management Plan will confirm habitat rehabilitation actions for the PTWL. Actions will include: • Upon completion of the construction works, the extent and location of disturbance within the encountered PTWL habitat will be measured and recorded. The total area of disturbance will be indicated (in hectares) on a map, or by GPS locations. • Findings from this will be documented and reported to the Contractor's Representative in the form of a letter. This information must be supplied to the ACT Government as per the conditions of the Scientific Licence held by the ecologist • Upon completion of construction works, disturbed areas within identified PTWL habitat will be rehabilitated in accordance with a PTWL Rehabilitation Plan (if required).			
Removal of threatened flora	All personnel working on site will receive training to ensure awareness of the potential for the threatened flora species listed in Appendix B of the Biodiversity Assessment	High	During Construction	Construction contractor

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
species and their habitat	Report within the construction boundary. Training will include photographs of the species, key identification features, flowering times and protocols if any are identified during clearing or construction.			
Clearing of trees and other vegetation causing impacts including loss of amenity, loss of habitat, increased erosion and water runoff	Re-use of habitat features: • Hollows from hollow-bearing trees that are removed will be salvaged and re-used as habitat for ground-dwelling fauna or made into a natural hollow nest box and reattached to a suitable nearby tree • Installation of nest boxes will be undertaken by a suitably qualified ecologist • Logs will be relocated to suitable nearby habitat.	High	Prior to Construction and during Construction	TCCS
Edge effects	• Weed extent in the adjoining nature reserves will be documented before construction and monitored monthly during construction. If weed presence and/or extent has increased the construction contractor is to engage a suitably qualified regeneration specialist to undertake weed removal of these areas in line with the management plan for the reserve • African Lovegrass, a highly invasive exotic and serious pest plant, is currently well established along WHD edges. Removal of this weed will be undertaken prior to and during construction. Care will be taken for this species to not spread to the adjoining land and reserves • Dense ***Lomandra Longifolia*** and native shrub plantings will be strategically located along the boundary of the Kama Nature Reserve and The Pinnacle Nature Reserve (and their buffers) • Protection measures for the two Nature Reserves will include the erection of man proof fencing, treatment of drainage lines with sediment control and a strict 'No Entry' during construction. • Erosion and sediment control plans would be lodged with the DA and best practice erosion and sediment controls would be followed by the construction contractor as per the Blue Book. • Any other reasonable requirements from the EPA and other Government agencies will also be implemented.	High	Prior to Construction and during Construction	Construction contractor

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Weeds and exotic flora	• Prior to the commencement of works, existing weed infestations are to be treated using appropriate methods • Non weed infested areas of native dominant understorey within the road reserve will be protected and not disturbed wherever possible • All vehicles must be clean and free of visible plant propagules prior to entering and exiting the site. A vehicle brush down/washdown area will be provided • Records will be maintained demonstrating compliance. • Weedy vegetation with viable propagules (seeds, fruit, rhizomes etc) will be removed from site for safe transport and disposal at appropriate waste facility. Non-viable woody vegetation can be chipped on site • Vehicle and machinery movements will be confined to disturbed areas and existing tracks where possible. Vehicles and machinery will be cleaned (tyres brushed or washed down) prior to accessing and/or leaving areas where weeds have been identified • Use weed matting to cover any areas of exposed soil • Undertake revegetation as soon as possible post-construction • Maintain revegetated areas by undertaking weed removal until growth is enough to prevent weed invasion, as determined by a qualified ecologist • Do not stockpile vegetation containing weeds on site • Use of herbicides will be undertaken in line with the NSW Weed Control Handbook • Where reasonable possible, the contractors tasked with revegetation activities will have demonstrated capability in successfully restoring native vegetation communities • A suitably qualified ecologist will verify that revegetation activities have been undertaken to a reasonably satisfactory standard • Materials introduced into the site, such as topsoils, seeds and mulches, will be free of as much weed contamination as is reasonably possible to achieve • Revegetation seed used at the site will be fresh (or otherwise viable), and a sufficient sowing rate (kg/ha) will be used to ensure adequate coverage.	High	Prior to Construction and during Construction	Construction contractor
Changes in hydrology	• Prevent any sediment or vegetation from the site from entering waterways • Ensure the design does not change the existing hydrology of the adjoining properties and nature reserves.	High	Design and Construction	TCCS and construction contractor

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Invasion and spread of pests	• Pest species will be managed within the Project Site. This will be coordinated with surrounding landholders.	High	Construction	TCCS and construction contractor
Invasion and spread of pathogens and disease	• Maintain hygiene protocols to prevent the introduction or spread of pathogens from outside the site • Chytrid protocol in line with the latest national guidelines will be followed during construction.	High	Construction	Construction contractor
Noise, light and vibration impact on fauna	• Avoidance of lighting in the key wildlife linkage areas. Any lighting which is installed will be considered to act as a physical "barrier" to movement, likely to create a roadkill hotspot at either end where animals move around it to access nearby habitat • Lighting of underpasses will be on a sensor that is not triggered by small mammals to prevent unnecessary light • Lighting of intersections with ample escape routes through the limited use of barriers within several hundred meters (either on road edges or central median strips) • Artificial light impact to biodiversity will be minimised through detailed design. Lighting will be designed in accordance with AS 4282-1997 Control of the obtrusive effects of outdoor lighting.	High	Detailed design, Construction Operation	TCCS
Animal-vehicle collision and roadkill reduction	• During construction and operation no barriers to movement will be created that will funnel fauna directly into the road corridor • At key crossing points lowering the road or keeping high steep cuttings or other measures to encourage flying wildlife to cross the road at a height that is above the level of traffic • Prevent access by wildlife from either side of the road, where road barriers are required particularly where central safety barriers between carriageways are in place • Use of fences and other barriers (including street lighting) in a way that directs wildlife to underpasses or safer crossing points which are away from intersections, have opportunities for escape, and have good line of sight. Escape ramps near intersections where fencing ends and several points along the exclusion fencing in the event that a kangaroo does enter the road corridor • Escape routes (e.g. paths of lower gradient cut into roadside batters or cuttings) will be designed to allow the exit of animals that have become trapped on the road where there are banks, cuttings or fences	Moderate	Detailed design, Construction and Operation	TCCS and construction contractor

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	• Table drain design and management will consider management of the road verges to make it less attractive for grazing herbivores • Where there is no fencing then ensure roadside maintenance to deter herbivores from this area and good lighting and line of sight • Fauna identification road sighs will be located at each end of the road alignment to indicate to drivers the presence of animals crossing • The use of the 'Roadkill Reporter' app will be promoted within the local community • Plantings will be strategically located near the proposed fauna rope bridge, to act as further encouragement for arboreal and bird species to use this crossing feature • Roadkill will be monitored monthly during construction by a suitably qualified person and for two years during operation to determine if mitigation measures have been effective. Adaptive management (e.g. moving barriers and wildlife fencing) will be adopted based on the results of the monitoring. A report on roadkill will be written to determine if there are hotspots on the new road and include recommendations for reducing roadkill in these hotspots. Adaptive management will be used to undertake recommendations of the report.			
Increased habitat fragmentation impacting species movement	When finalising the proposed wildlife crossing structures, the following will be taken into consideration: • Two main biodiversity corridors have been identified, both are the existing large cutting areas (one near the Weetangera Cemetery and one between The Pinnacle and Kama Nature Reserves) • Installation of a rope bridge and box culvert underpasses in areas of connectivity will be employed to benefit a range of ground-dwelling and arboreal/avifauna species • An arboreal mammal specialist will be engaged to determine the location of these crossing structures • Any connectivity structures will be monitored by remote sensor cameras for a period of three years after construction • Newly created road verges will be monitored, and adaptive management undertaken to limit mowing/encourage recruiting Hoary Sunray specimens within the site. Culverts will be designed to facilitate wildlife movement including: • One fauna crossing (rope bridge) to assist arboreal and avifauna to safely cross the road reserve	Moderate (until operational modelling can demonstrate high operational effectiveness	Design, Construction and during Operation	TCCS

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	• Two fauna crossings (box culverts) to assist ground-dwelling fauna to safely cross the road reserve • Exclusion fencing (1.8 m tall chainmesh fence) to be included on each side of WHD in the vicinity of the Nature Reserves, extending at least 200m past the fauna crossings. The effectiveness of this exclusion fencing will be monitored during the operational stage of the Project. Where possible, culverts will be designed to facilitate fauna movement. This will include consideration of the size of the culvert, revegetation at the entrances to the culvert and no artificial lighting. Existing fencing blocking the culvert locations will be removed. Appropriate habitat structures will also be installed along box culverts to facilitate wildlife movement through these underpasses where possible, such as poles, logs, rocks, woody debris at ground/mid-level or other habitat structures to enable small fauna to safely pass through. The existing culvert at the south of the Study Area will not be used for pedestrians. Lighting will be designed so as to not deter fauna from utilising the rope bridge and box culvert underpasses.			
Fauna injury or mortality	Road design will include: • Fauna exclusion fencing is to be used to prevent wildlife accessing the road. • Fauna friendly fencing is to be installed between the underpasses and culverts to prevent access onto the road but guide fauna to these potential crossing areas. Fencing will be chainmesh fence 1.8 m tall is designed to exclude a range of native mammal species such as macropods, possums, Spotted-tail Quoll. • Existing gates and fencing near the underpasses will be replaced with structures that allow fauna movement through the underpasses. • Barbed wire will not be used on any fences. • Central medians designed to not to trap fauna on the road.	High	Design and Pre-construction	TCCS
Clearing of vegetation results in a loss of connectivity through fragmentation in the landscape, or obstructing local	Re-vegetation of biodiversity corridors will include: • Revegetation in areas where birds are likely to cross the alignment, particularly at the top of cuttings to encourage flight above the height of the road • Where possible revegetation will include planting along the edges of adjoining paddocks to close any vegetation gaps. This principle will extend to all areas where trees will be retained where the revegetation will enhance native species habitat values in the landscape	Moderate	Design and Construction	TCCS

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
movement corridors Clearing of protected trees that have not been approved to be cleared Increased habitat fragmentation impacting species movement Impacts to adjoining nature reserves during construction and operation	• Re-vegetation will use species that are found in the local Box-Gum Woodland TEC and include trees, shrubs and groundcovers • Tube-stock for revegetation will be sourced from local providers • Areas of re-vegetation will be maintained for a minimum of two years until plantings are established, with additional maintenance undertaken for a period of five years where required • Weed control will also be undertaken in revegetation areas • Revegetation will occur where required near fauna crossing structures to enhance connectivity and provide shelter in the approaches to the structures.			

5.2.5 Residual risk

Based on the mitigation measures identified in Section 5.2.4, an assessment of the residual risks associated with the Project has been considered. Table 5-20 below sets out the residual risk assessment of the Project's potential biodiversity impacts.

Table 5-20 Biodiversity residual risk assessment

Risk (as per Chapter 4 and scoping document)	Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
Presence or extent of threatened species and ecological communities not identified prior to development design, resulting in unanticipated impacts.	High	Possible	Minor	Low
Incursion of vehicles, light, noise, invasive species and increased recreational use caused by greater human access into areas of environmental significance, causing damage to or destruction of habitat.	High	Almost certain	Minor	Medium
Clearing of trees and other vegetation causing impacts including loss of amenity, loss of habitat, increased erosion and water runoff	High	Possible	Moderate	Medium
Vegetation clearing activities during construction disturb native animals and increase the potential for vehicle strike	High	Possible	Moderate	Medium
Project activities facilitate spread of exotic flora into adjacent areas, leading to weed establishment	High	Possible	Moderate	Medium
Project attracts additional vermin and pest species, which results in greater competition for resources with native species	High	Unlikely	Moderate	Low
Clearing of vegetation results in a loss of connectivity through fragmentation in the landscape, or obstructing local movement corridors	High	Possible	Moderate	Medium
Clearing of protected trees that have not been approved to be cleared	High	Unlikely	Minor	Very Low
Intrusive site investigations (e.g. geotechnical, contamination test pitting) are undertaken prior to PD Act and EPBC Act Approval resulting in impacts to MNES and potential non-compliance with either Act.	High	Unlikely	Moderate	Low
Scoping Document risks identified				
Direct impacts on threatened flora and fauna, threatened ecological communities and non-	High	Possible	Moderate	Medium

Risk (as per Chapter 4 and scoping document)	Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
threatened flora and fauna from clearing and other construction works				
Increased habitat fragmentation impacting species movement	High	Possible	Moderate	Medium
Loss of fauna from vehicle strikes and roadkill	High	Possible	Moderate	Medium
Impacts to adjoining nature reserves during construction and operation	High	Unlikely	Moderate	Low
Construction and operation impacts on EPBC Act listed threatened species and communities and any other matters of national environmental significance	High	Possible	Moderate	Medium
Project fails to comply with Commonwealth recovery plans or threat abatement plans	High	Possible	Moderate	Medium
Additional risks identified				
Clearing of vegetation results in a loss of connectivity through fragmentation in the landscape or obstructing local movement corridors.	Significant	Possible	Moderate	Medium
Addition of construction of barriers to movement, including safety railings, wider paved roads, more lighting, noise and disrupted water courses.	Significant	Possible	Moderate	Medium

5.3 Utilities, infrastructure and lighting

This Section assesses the Project's potential impacts on utilities, infrastructure and lighting, and meets the following assessment requirements as identified in the Scoping Document:

- Describe the existing utilities located on the land subject to this Project
- Describe any new utilities, removal or realignments required as a result of this development
- Describe the impacts of planned and unplanned service disruptions, including to vital services such as health and emergency services
- Describe the impacts of light on sensitive receivers during construction and operation, including current and future residents in Whitlam and Hawker.

5.3.1 Environmental conditions and values

The original ground survey was completed by LandData Surveys (Veris) in support of the ***William Hovell Drive Upgrade Feasibility Study Report*** (Calibre, 2018). TCCS provided this ground survey to SMEC, although the requirement for further survey along DBD and JGD intersections was also identified. This included further ground survey as well as potholing of utilities along the WHD alignment and at the DBD/WHD intersection. This was completed in April 2020 as part of the Preliminary Sketch Plan stage.

A Dial Before You Dig (DBYD) investigation was undertaken by SMEC to locate services potentially affected by the Project. The DBYD investigation revealed the following utility providers with potential assets within close proximity to the Project:

- Icon Water
- NBN
- Optus
- Telstra
- TransACT
- Electrix – Omexcom ACT
- Evoenergy
- Jemena.

Potholing was also carried out during the Preliminary Sketch Plan stage in 2020 to confirm the locations of the existing Icon Water mains along WHD and at the intersection with DBD.

5.3.2 Investigations

At the beginning of the Preliminary Sketch Plan stage, a gap analysis was undertaken on the original ground survey held by TCCS. Several matters have been identified for further investigation prior to the commencement of the Document Readiness phase, including a survey of existing structures and ensuring topographical data aligns with the road reserve boundary.

A Spill Light Assessment was also undertaken for the Project by Rudds (refer to Appendix I), focusing in particular on the potential impacts of the Project as it may spill light into The Pinnacle and Kama Nature Reserves.

5.3.2.1 Existing water mains

An initial meeting was held with Icon Water on 13 February 2020 to discuss the two Bulk Delivery Water Mains (900mm and 500mm) that fall along the project alignment. SMEC undertook potholing of the existing watermains to help identify any potential impacts resulting from the Project. Icon Water has accepted the proposed cover incorporated in the current design for the existing 900mm and 500mm bulk watermains.

Other existing water mains located within the Project Site include:

- 900mm watermain crossing perpendicular from the Higgins Reservoir underneath DBD
- 600mm watermain running parallel with the DBD along the westbound carriageway
- 675mm watermain from the Higgins Reservoir crossing DBD and running under the existing road median of WHD
- 150mm watermain on WHD on the south bound carriageway side
- 100mm crossing from Florina Place to Higgins Reservoir
- 100mm crossing 100m west of WHD and JGD intersection.

5.3.2.2 Sewerage

Icon Water has confirmed that there are no existing or future provision for sewer mains within close proximity of the Project.

5.3.2.3 Electricity

There are several existing EvoEnergy power poles located in the vicinity of the DBD and WHD intersection. Along the main WHD alignment, Evoenergy have made provision for six x 150mm diameter conduits to for future use.

5.3.2.4 Gas

Jemena have confirmed that there are no existing gas lines within the Project Site and no provisions for future use.

5.3.2.5 Telecommunications

Telstra assets

An existing Telstra line runs underneath DBD, approximately 30m west of the intersection with WHD. There is also an existing Telstra line 100m west of DBD and WHD intersection. Along the main WHD alignment, Telstra have provisioned for four x 100mm diameter conduits to accommodate future use. This proposed design has been agreed in principle by Telstra.

Optus assets

An existing Optus line crosses WHD between Florina Place and Higgins Reservoir. This proposed design has been agreed in principle by Optus.

National Broadband Network (NBN)

An existing NBN line runs underneath DBD, approximately 100m west of the intersection with WHD, located within the Telstra pit and pipe network. This proposed design has been agreed in principle by Telstra.

TransAct assets (part of TPG)

An existing TransACT line is located on the existing power poles crossing WHD near the DBD intersection. Another existing TransACT line crosses underneath DBD, approximately 100m west of the intersection with WHD. The proposed design has been agreed (verbally) in principle agreement with TPG. Complimentary design by TPG currently being developed. Liaison with TPG is ongoing to finalise the in-principle agreement of design.

Intelligent Transport Systems

Intelligent Transport Systems conduits will be provided along WHD from the DBD intersection to JGD intersection and along WHD.

5.3.2.6 Lighting

Street lighting is not consistently applied along the current alignment of WHD. Regarding the section of WHD which is subject to the Project, only the alignment between Coulter Drive and Bindubi Street currently provides lighting. This is considered to be a safety concern for motorists along this stretch of the road corridor. Currently, most other sections of the WHD road corridor outside of the scope of this Project do provide some street lighting. This is considered to contribute to the current instances of fauna strike along this section of the WHD road corridor, which creates risks for drivers and wildlife alike.

5.3.3 Impacts

5.3.3.1 Proposed and relocated water mains

SMEC has confirmed with Icon Water that no new proposed water mains are required along the WHD road reserve. However, it is likely that relocation of the following Icon Water assets may be required to accommodate the signalised intersection to DBD:

- Relocate the reflux isolation valve on DBD by approximately 10m
- Protect or relocate 90m of 600mm watermain
- Relocate 20m of 900mm watermain
- Protect or relocate 100m of 675mm watermain
- Relocate 100mm crossing from Florina Place to Higgins Reservoir
- Relocate 100mm crossing 100m west of WHD and JGD intersection.

SMEC, TCCS and Icon Water have been consulting throughout the development of the Project. In-principle design for the reconfiguration of Icon Water assets (particularly around the DBD intersection) has been received from Icon Water. Design development and liaison with Icon Water is ongoing to finalise design prior to construction works.

5.3.3.2 Sewerage

Icon Water currently has no plans to provide future sewer infrastructure along the WHD alignment as per the current engineering plans. The construction and operation of the Project will therefore not impact on Icon Water's sewer infrastructure. However, consultation with Icon Water will continue, to ensure any additional impacts at the DBD and WHD intersection are captured.

5.3.3.3 Electricity

The road widening and signalised intersection components of the Project will trigger the underground relocation of two existing overhead power poles at DBD. The Project will also accommodate for EvoEnergy's six x 150mm diameter proposed future conduits along the WHD main alignment. The proposed design has been agreed in principle by EvoEnergy. Liaison with EvoEnergy is ongoing to finalise the relocation design and preliminary electricity network advice.

5.3.3.4 Gas

As there are no existing Jemena gas lines within the Project Site and no provisions for future gas lines within the Project Site, the Project will not impact on gas infrastructure.

5.3.3.5 Telecommunications

Telstra assets

Existing Telstra assets within the Project Site will need to be protected or relocated. The Project design will also have consideration to Telstra's future provision of four x 100mm diameter conduits along the main WHD alignment.

Optus assets

An existing Optus line will need to be protected or relocated as a result of the Project.

National Broadband Network (NBN)

An existing NBN line will need to be protected or relocated as a result of the Project.

TransAct assets

An existing TransACT line crossing DBD approximately 10m west of WHD will need to be protected or relocated as a result of the Project.

Intelligent Transport Systems

The requirement is for one x 100m conduit along WHD alignment has been incorporated into the Project design.

5.3.3.6 Emergency services

Consultation will occur with the Emergency Services Agency closer to construction in order to confirm the requirements for notification of potential disruptions to telecommunications infrastructure within the locality.

Consultation with ACT Fire and Rescue was undertaken regarding the potential provision of a turnaround point for emergency service vehicles as part of the Project's design. ACT Fire and Rescue agreed that it is not feasible to provide a turnaround point as part of the Project. Key barriers to this include:

- The Project's footprint has several constraints, including environmental, land ownership, and topography, meaning the available road corridor is tight

- The road design is required to accommodate two x opposing carriageways travelling at 90km/hr and which are separated by a 4m median
- Due to the close proximity of opposing travel lanes and the speed limit, there is a requirement to provide a safety barrier for the full length of the Project's alignment. A wire rope safety barrier has been nominated
- The only possible option for a turnaround would be a section of the wire rope safety barrier transitioned into a steel guardrail and then a concrete barrier. However, there is not sufficient space within the road corridor to allow vehicles to decelerate and stop in order to access such a turnaround point. Whilst this may be possible if traffic were stopped and traffic controls were in place, it is not a preferred option in order to respond to emergency scenarios in a timely fashion, nor is it a safe one.

5.3.3.7 Street lighting

The Spill Light Assessment undertaken for the Project (refer to Appendix I), considered the potential impacts of the Project as it may spill light into The Pinnacle and Kama Nature Reserves. The lighting design for the Project has been prepared to address the following recommendations:

- The installation is required to meet the requirements of TCCS. TCCS currently requires that all luminaires have a lighting colour temperature of 4000K, which includes a component of blue light. Providing a luminaire with less blue lighting component will require specific approval and will require further assessment as the total light output per luminaire will also reduce
- Lighting has been designed to illuminate the road carriageway with reduced spill light. It has been designed to meet the minimum lighting requirements for a road of this type (i.e. has not been over-lit). The pathways have only been illuminated where the lighting from the adjacent roadway is not sufficient to meet the requirements of the Australian Standards.
- The luminaires selected are designed specifically to have light distribution to suit major roadways, or pathways, and to minimise waste light. All luminaires have been designed to be mounted with a 0 tilt, to minimise any waste upward light or directing the light beyond the roadway. The lighting design adjacent to The Pinnacle and Kama Nature Reserve boundaries has been simulated to assess the horizontal lighting at ground level leading to the nature reserve boundaries and extending into them.

The highest levels of light in the Nature Reserves are experienced between Chainages 2,320 and 2,430. This is the location where the shared user path crosses under the road corridor. At this location the path is closer to the boundary and curves. This results in a need to have the pathway lighting closer to the boundary and positioned to direct light toward the boundaries to ensure the pathway is adequately lit. This location is beyond The Pinnacle Nature Reserve extension and does not affect it. However, it is adjacent to the Kama Nature Reserve and does increase the spill light into that area. Table 5-21 outlines the calculated lighting levels along both reserve boundaries.

Table 5-21 Calculated lighting levels along reserve boundaries

Area	Average illumination (Lux)	Maximum illumination (Lux)
The Pinnacle Nature Reserve Extension	0.17	0.5
The Kama Nature Reserve (between CH 2,320 and 2,440)	0.71	3.3
The Kama Nature Reserve (excluding CH 2,320 to 2,440)	0.08	0.2

This shows that, with the exception of the area between Chainages 2,320 and 2,440, the average horizontal illumination level is below the level of full moonlight (0.27 maximum lighting levels or lux). At the Kama Nature Reserve boundary, between Chainages 2,320 and 2,440, the light penetration for values over 0.27 lux extends 15m. In all other locations, this penetration is less than 10m beyond the boundary.

AS/NZ 4282:2019 Control of the obtrusive effects of outdoor lighting provides guidance on the maximum spill lighting allowable for major roadways. However, these criteria are based on the effect on adjacent residential

dwellings and are typically calculated at the building line. The standard provides some general commentary on the effects of spill lighting on the environment but does not include any quantitative assessment criteria.

Various studies have been undertaken on spill lighting and its effect on flora and fauna. Most of these studies, however, have evaluated that night light has a different effect on different species and no clear guidelines have been established in terms of lux. These studies have provided recommendations which typically include the following:

- Utilising light sources with less light energy in the blue wavelengths
- Only providing lighting to areas that are required to be lit
- Providing light sources that are specifically designed for that usage.

A study was undertaken in recent years to measure the light levels produced by moonlight. The final conclusion was that in Sydney on a clear night with a full moon, the illumination on the ground (horizontal plane) is 0.27 lux. The moonlight levels in the ACT are similar to Sydney and this value has been used to provide guidance on the spill light into the nature reserves.

The requirements for spill lighting levels into the natural environment are not provided by the Australian Standards. These standards specifically exclude these requirements and provide some general information on how artificial light can be detrimental to flora and fauna and the fact that animals perceive light differently to humans. While specific standards providing quantitative criteria for spill lighting and the effect on nature are not available, the Project has applied best practice lighting design principles. The spill lighting simulated at the reserve boundaries is typically below the levels experienced during a full moon on a clear night. Where these lighting levels are exceeding these values, they do not extend beyond 10m from the boundary, with the exception of the Kama Nature Reserve between Chainages 2,320 and 2,440. As such the spill light is not expected to have a significant effect on the flora or fauna within the reserves. However, it will improve the safety of motorists travelling along the road corridor as they will have increased visibility compared to the current scenario. Increased lighting will also act as a deterrent to some ground-dwelling fauna from attempting to access the road corridor at night, and thus potentially reduce the likelihood of those species being impacted by fauna strike.

5.3.4 Mitigation

Table 5-22 below sets out the proposed mitigation measures to manage the potential utilities impacts of the Project.

Table 5-22 Utilities mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Impacts on existing infrastructure during construction and operation and/or requirement to install new infrastructure to service the project impacting on existing infrastructure	Relocation of Icon Water assets is undertaken where required. Seek design approval from Icon Water.	High	Design	TCCS
	Continue consultation with Icon Water to ensure any additional impacts at the DBD and WHD intersection are captured.	High	Design	TCCS
	The Project team will continue consultation with EvoEnergy in relation to the Project and the undergrounding of assets. The	High	Design	TCCS

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	Project will also accommodate for EvoEnergy's six by 150mm diameter proposed future conduits along the WHD main alignment. SMEC will continue working with EvoEnergy to confirm the preliminary electricity network advice.			
	Existing Telstra assets within the Project Site will need to be protected or relocated. The Project design will also have consideration to Telstra's future provision of four x 100mm diameter conduits along the main WHD alignment. An existing Optus line will need to be protected or relocated as a result of the Project. An existing NBN line will need to be protected or relocated as a result of the Project. This will be included with the Telstra work. An existing TransACT line crossing DBD approximately 10m west of WHD will need to be protected or relocated as a result of the Project. Intelligent Transport Systems conduits will be provided along WHD from the DBD intersection to JGD intersection and along WHD. The requirement is for one by 100m conduit along WHD alignment has been incorporated into the Project design.	High	Design	TCCS
Temporary services disruption during utility works as part of the Project	Local residents will receive prior notification regarding construction activities that may interfere with their access to the surrounding	Moderate	Construction	TCCS

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	water, sewer, electricity and gas networks.			
Accidental damage to utilities and other essential infrastructure	Continue consultation with utility stakeholders to ensure all utilities are identified and captured prior to construction.	High	Design	TCCS
Disruption to vital services due to service outages during construction	Consultation will occur with the Emergency Services Agency closer to construction in order to confirm the requirements for notification of potential disruptions to telecommunications infrastructure within the locality. Local residents will receive prior notification regarding construction activities that may interfere with their access to the surrounding telecommunications network.	Moderate	Construction	TCCS
Lighting impacts to nocturnal fauna Light impact to sensitive receivers during construction and operation	If any lighting is required, it will be managed in general accordance with the requirements in Australian Standard AS 4282:2019 Control of the Obtrusive Effects of Outdoor Lighting. Generally, lighting will be designed to minimise off-site light spill.	Moderate	Design	TCCS

5.3.5 Residual risk

Based on the mitigation measures identified in Section 5.3.4 above, an assessment of the residual risks associated with the Project has been considered. Table 5-23 below sets out the residual risk assessment of the Project's potential impacts to utilities.

Table 5-23 Utilities, infrastructure and lighting residual risk assessment

Risk (as per Chapter 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
Increased luminance for residents impacting amenity of sensitive receivers during construction and operation	High	Possible	Minor	Low

Risk (as per Chapter 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Lighting impacts to nocturnal fauna	High	Possible	Minor	Low
Requirement to install new infrastructure to service the project impacting on existing infrastructure	Significant	Likely	Minimal	Low
Temporary services disruption during utility works as part of the Project	High	Likely	Minimal	Low
Accidental damage to utilities and other essential infrastructure	High	Unlikely	Moderate	Low
Scoping Document risks identified				
Impacts on existing infrastructure during construction and operation	Extreme	Possible	Minor	Low
Disruption to vital services due to service outages during construction	Extreme	Possible	Major	High
Light impact to sensitive receivers during construction and operation	High	Possible	Minor	Low

5.4 Heritage items and places

The ***William Hovell Drive Duplication: Aboriginal and Historical Cultural Heritage Assessment*** (Past Traces Heritage Consultants, 2021) (Heritage Assessment) is found at Appendix E. This section summarises the findings of the Heritage Assessment, setting out the potential Aboriginal and non-Aboriginal heritage impacts of the Project. It also meets the following assessment requirements as identified in the Scoping Document (refer to Section 1.4 above):

- Provide a Cultural Heritage Assessment prepared by a suitably qualified consultant that includes details of all known heritage items and places, including but not limited to the Weetangera Cemetery, the Kama Nature Reserve and potential archaeological deposits
- Describe the impact of construction and operation on known and unknown heritage items and places and measures to mitigate these.

This section and Appendix E also meet the Entity Requirements as specified by the ACT Heritage Council (refer to Section 1.4 above and Appendix B).

The Cultural Heritage Assessment (CHA) component of Appendix E was also updated to provide the additional information that has been requested from the ACT Heritage Council (dated 17/4/2020) following review of the 2018 CHA (Past Traces, 2018). The additional information required is in relation to:

- The degree of impact to the heritage listed Kama Woodland/Grassland requires clarification
- Additional information on the impacts of the works on the two boundary Cypress trees at the Weetangera Cemetery is required. Clarification as to whether avoidance measures are required to protect their values is necessary
- Clarification of the five PAD boundaries identified by the 2018 (Past Traces, 2018) field survey and details of how they are defined
- Incorporation of the results of recent heritage assessments for the Whitlam Stage 3 Development and impacts on the identified areas of PAD.

To address these requirements, this CHA reviewed heritage studies undertaken since the original field survey, reviewed the 2018 (Past Traces, 2018) field notes and topographic maps to define landforms and area of

potential, and assessed impacts since their recording against these reports. To determine Ecological (natural heritage) impacts, consultation with the SMEC's ecology team was also undertaken to determine the extent of impact to the Kama Woodland/Grassland.

A Statement of Heritage Effects was also provided in Section 4 of Appendix E and is summarised in this Section 5.4.

5.4.1 Environmental conditions and value

5.4.1.1 Historic land use

The Project Site was historically part of the larger grazing properties in the region. The Project Site was originally settled as part of the Palmerville (Ginninderra) Station owned by George Palmer established in 1826. In 1829 Palmer applied for a further 14 blocks along Ginninderra Creek (Gillespie, L.L, 1992). The Dixon 1837 map of landholding show this section of the Northern Molonglo under the control of Palmer (refer to Appendix E).

With the passing of the ***Robertson Land Acts 1861***, many larger properties were broken into smaller settlements. The Parish Map of Weetangera (1912) shows the major landholder as still being Palmer but the Schumack family of Weetangera now are present to the east and the Kilbys and have gained Land End in the northern section adjacent to the holdings of William Plummer (refer to Appendix E). William and other members of the Plummer family are buried at the Weetangera Methodist Cemetery.

5.4.1.2 ACT Heritage Item: Weetangera Methodist Cemetery

Mary Smith married Cameron Ewan, a schoolteacher at Weetangera who with Levi Plummer constructed the Weetangera Methodist Church in 1872. The Church was dedicated in 1873 and continued to hold services until 1952. The church was demolished in 1955 to allow for suburban expansion. The Weetangera Methodist Cemetery (also known as the Weetangera Cemetery, as referred to in this report) that was located adjacent to the church is located on the verge of WHD at Hawker and is listed on the ACT Heritage Register.

The Weetangera Cemetery was gazetted in 2004 to the ACT Heritage Register for its early historical association with the settlement of the early and the Methodist community. The registered curtilage for the Project Site ends at the road reserve easement. Registered features include as a main component, the two Cypress trees at the entrance gate. The Project Site extends 20m to the exterior of the road reserve and will therefore affect the listing.

As a listed place, any impacts must be avoided if possible, and within this section the Project Site may not extend past the designated road reserve boundary to avoid direct impacts. Indirect impacts to the entrance trees and the cemetery may result through increased visitation and visibility from the extended road corridor. The potential for these indirect impacts needs to be investigated through the field survey and avoided through careful planning of road verges and site.

5.4.1.3 Natural Heritage: The Kama Woodland/Grassland

The Kama Woodland/Grassland is located on Blocks 1419, 1386, and parts of 1596 and 181 Belconnen, and the listing extends into the verge of WHD adjacent to blocks 1419, 1386 and 1596, Belconnen. The Kama Woodland/Grassland were gazetted in 2012 to the ACT Heritage register for natural heritage values. The biodiversity assessment found that approximately 1.16ha of the Woodlands will be impacted by the road reserve.

The Kama Woodland/Grassland is listed due to the following:

> The ***Kama Woodland/Grassland, Belconnen is significant because it includes examples of two endangered ecological communities (Yellow Box-Red Gum Grassy Woodland and Natural Temperate Grassland) together with the natural boundary (ecotone) between them. The landscape relationship between the two vegetation communities is important because it is considered to be similar to the vegetation patterns that existed prior to European settlement.***

> ***This place is also significant because there is a high diversity of native species in the Kama Woodland/Grassland including uncommon native forbs, woodland birds and riparian species. The Kama Woodland/Grassland provides important ecological connectivity between the lower Molonglo River and The Pinnacle.*** (ACT Heritage Listing No NI2012—541 – Statement of Significance).

As a listed place, impacts cannot occur that are detrimental to any of the heritage values. Based on a review of the project mapping, impacts will occur within the listing boundaries.

5.4.1.4 Aboriginal heritage context

The major language group identified in the Canberra region by Norman Tindale in his seminal work on Aboriginal tribal boundaries are the Ngunnawal people (Tindale, N., 1974). The Ngambri people hold affiliation with the central area of Canberra, where early accounts of settlers often refer to the group as the Ngambri or Ngamberry. Both groups hold cultural connections through the Canberra Region.

The boundaries of the Ngunnawal according to Tindale ran to the south east where they met the Ngarigo at the Molonglo and the Gundungara to the north of Lake George (Tindale, N., 1974). This distribution with minor amendments is still widely accepted and the review of tribal boundaries undertaken in the 1990s (Horton, D., 1994) confirmed these earlier linguistic divisions. These findings are not accepted by all members of the Aboriginal community and it is beyond the scope of the Heritage Assessment (refer to Appendix E) to report to determine connection to country. Currently the ACT Government accepts the ACT to be Ngunnawal/Ngambri Country.

The Molonglo River and the Murrumbidgee River represent the boundary between Ngunnawal and Ngarigo nations. Currently descendants of both Aboriginal groups hold cultural affiliation with the Project Site and have been consulted in relation to the Project.

The traditional lifeways of the Aboriginal people were disrupted by the arrival of European settlers in the 1830's. The impact of new disease, displacement from traditional lands and disruption of hunting practices lead to a decline in the local population, with some remaining families finding employment on the large pastoral stations that had become established in the region. Blanket distribution lists from this period show a continuity of presence with recognised members of Ngambri and Ngunnawal families. How people identified during this period is difficult to know, but in the face of the European presence, the connections between Aboriginal people will have been strengthened into a picture of Aboriginal identity.

5.4.1.5 Aboriginal Heritage: previous archaeological studies

Archaeological site patterning in the region shows a landscape dominated by low density artefact scatters focused on the areas of the Molonglo River to the south and Black Mountain to the east. Heritage studies have been undertaken in the surrounding areas for the future residential developments within the Molonglo Valley which have located numerous small artefact sites within the vicinity of the Project Site. No known heritage sites are located within the road reserve.

Previous construction of WHD has caused impacts throughout the road reserve area. The road reserve has been allowed to regenerate to a natural bush landscape. Adjoining paddocks are under rural lease and have suffered stock impacts, fencing and property access tracks.

5.4.2 Investigations

In 2018, Past Traces Pty Ltd undertook a CHA (Past Traces, 2018) to identify constraints for the proposed duplication of WHD from JGD to DBD. An area of investigation covered the existing road reserve and an additional 20m on the boundary for an approximate length of 4.7km. The assessment reviewed previous work in the area to gain background information, inform predictive modelling and complete a field survey across the Project Site.

A desktop assessment and review of previous studies conducted by Past Traces revealed that registered heritage sites (Aboriginal and Historical) are present within the wider region but none are located within the Project Site. The recorded sites in the region consist of artefact scatters or isolated finds of lithic artefacts. The

majority of these sites were allocated low significance by the report authors on both scientific and cultural values.

There are two places listed on the ACT Heritage Register located adjacent to the Project Site:

- The Weetangera Methodist Cemetery
- The Kama Woodland/Grassland.

5.4.2.1 Field survey

In addition to the Weetangera Cemetery and Kama Woodland/Grassland, one heritage site and five areas of potential archaeological deposit (PAD) were identified during the Project Site visit. PADs are areas which, based on predictive modelling are considered to hold a higher potential for subsurface or unrecorded heritage sites to be present. No areas of PAD were located in the Project Site except along Deep Creek, which contained a number of small areas of PAD at a distance from the proposed works. The design of the Project will avoid all impacts to these areas of PAD.

5.4.3 Impacts

Both the Weetangera Cemetery and Kama Woodland/Grassland are currently registered to the ACT Heritage Register as holding high heritage significance and no impacts will occur within the registered curtilages. The areas of identified PAD will be fenced during construction to ensure accidental impact does not occur.

Interrogation of the Project's design drawings confirms PAD1 is located at least 5m from the Project. This buffer will be maintained during construction works. As works are not proposed within this PAD or within any other PAD, no Excavation Permit is considered necessary.

5.4.3.1 ACT Heritage Item: Weetangera Methodist Cemetery

The Weetangera Methodist Cemetery (the Weetangera Cemetery) is listed on the ACT Heritage Register (ID20102). The curtilage (registered boundary) for this site extends to the road reserve boundary and specifically includes the two Cypress trees that flank the cemetery entrance. Impacts cannot occur within the registered site boundary unless there is no alternative and all options have been considered and found to be unacceptable.

The cemetery site is of high significance and as a result will not be impacted. No direct impact to the Weetangera Cemetery will occur as a result of the road widening and indirect impacts are considered to be unlikely. The position of the Weetangera Cemetery on the verge of the widened road has a low potential to increase visitor impacts and vandalism. However, the risks of vandalism are pre-existing and will not markedly increase as a result of the road design. The Project provides an opportunity to reduce this risk by implementing active screening on the road verge to retain the current levels of visibility of the cemetery from the road.

The design includes a small batter that goes past the cemetery, albeit not into the actual cemetery.

Interrogation of the Project's design confirms that it will not be possible to stay more than 10m away from the dripline of the Cypress trees along the boundary of the cemetery as shown on the design extract in Figure 5-11 below.

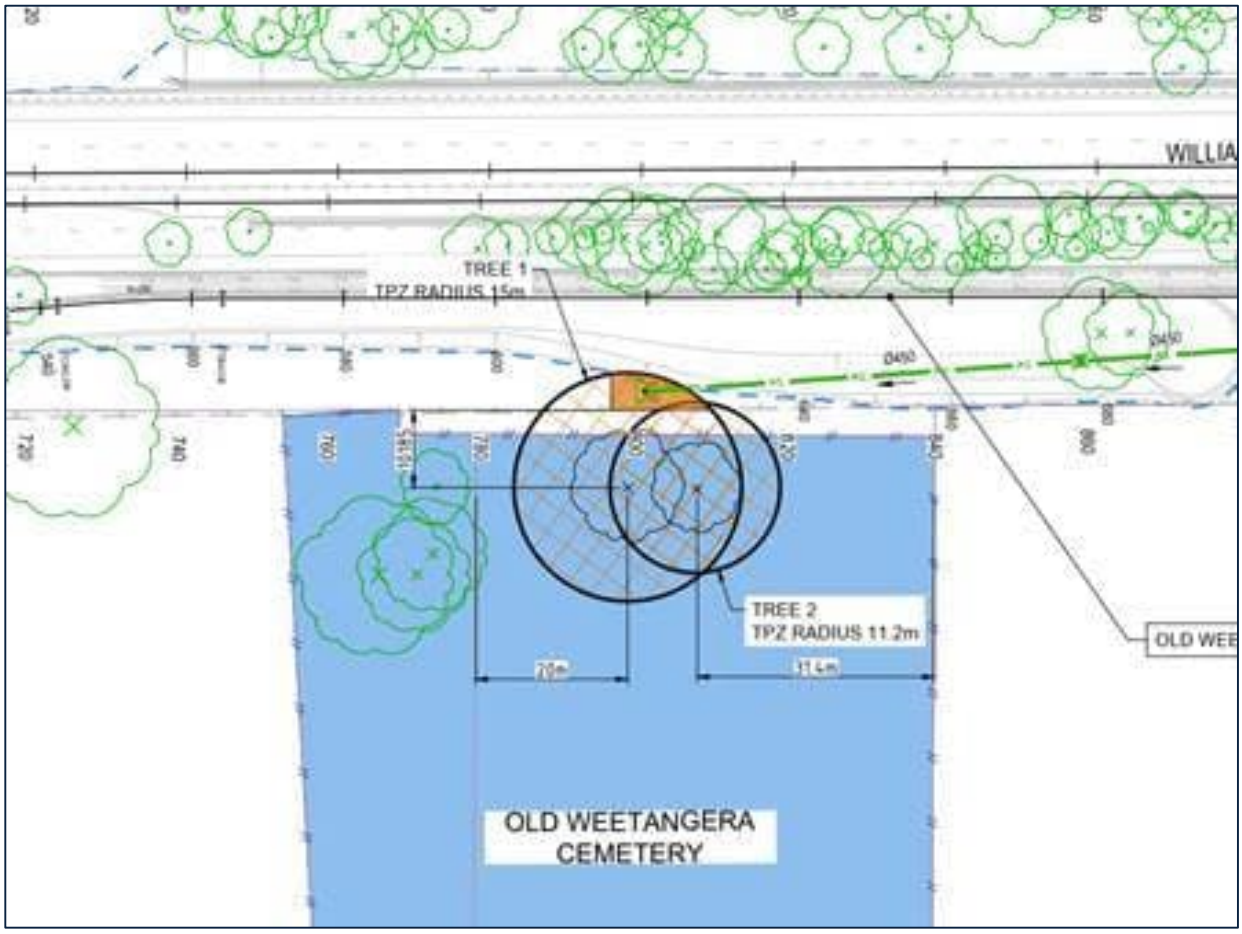


Figure 5-11 Design extract showing Cypress TPZ impacts

On calculating the standard Tree Protection Zone (TPZ) as per ***Australian Standard Protection of Trees on Development Sites AS 4970-2009***, the Project's impact to this one tree will be around 5-6% of that tree's TPZ. Under AS 4970-2009, if the impact is less than 10% of the TPZ, it is not considered to be a significant impact. Whilst the Project will cause direct impacts for this one tree, the impacts will therefore not be significant. Appropriate protection signage and demarcation to ensure the Project's construction impacts do not impact this tree further will be approved by an arborist before construction along this section of the Project's alignment before construction commences.

5.4.3.2 Kama Woodland/Grassland

The Kama Woodland/Grassland listing extends across a section of the road corridor. As impacts cannot be avoided, the degree of impact requires assessment. The assessment of harm resulting from the proposed works is provided in Table 5-24 below against the intrinsic features that hold heritage values (as stated in ACT Heritage Register listing NI2012-541). As a result of the background review, assessment of landforms and current condition, only minor heritage impacts are anticipated from the proposed road duplication works to the Kama Woodland/Grassland. These heritage impacts are not considered to be significant.

Details on ecological assessment and mitigation measures are provided in Section 5.2 and Appendix D.

Table 5-24 Impacts to Kama Woodland/Grassland

Heritage Criteria	Impact
An area of Yellow Box-Red Gum Grassy Woodland (an endangered ecological community) that is described as partially modified and retains good species diversity and habitat complexity, including the number	1.16ha of the BGW will be affected within the road reserve. This equates to 0.75% of the Kama Woodland/Grassland and will not have a significant impact on the extent, diversity or significance of listing.

Heritage Criteria	Impact
of mature age and old growth trees that provide a high density of hollows and other habitat suitable for hollow-dependent animals (such as bats, parrots and treecreepers).	
An area of Natural Temperate Grassland (an endangered ecological community.	No grassland is present within the road corridor and no impact to values will result.
The natural boundary (an ecotone) between two endangered ecological communities (Yellow Box-Red Gum Grassy Woodland and Natural Temperate Grassland) that is now rarely found in the ACT and demonstrates the landscape location of the zone of cold air drainage that is often associated with the boundary.	Not present within the road corridor and no impact to values will result.
Habitat for many native plant and animal species including several threatened species: the Brown Treecreeper, Varied Sittella, White-winged Triller and Pink-tailed Worm Lizard.	No listed species identified within road corridor – pre-clearing surveys and retention of habitat trees will be implemented for project.
A zone of ecological connectivity between the lower Molonglo River and The Pinnacle Nature Reserves (south Belconnen Hills) with a high level of ecological integrity of the area's natural values within a landscape that is mostly highly altered.	Partially impacted by road widening – mitigation measures such as underpasses, overhead paths and fauna friendly lighting will be implemented by the project – no significant impact.

5.4.4 Mitigation

The location of heritage sites and requirements for impact avoidance will be communicated to the Project Manager and personnel engaged on the project. Heritage site information will be included in site inductions.

Impacts can be avoided by considered design at all heritage sites and areas other than the Kama Woodland/Grassland listing (refer to Section 5.4.4.1 below). As heritage impacts will occur there are known heritage impacts from the Project. As a result, a submission of a Statement of Heritage Effects (SHE) for approval to the ACT Heritage Council is required. A SHE is provided within the CHA (refer to Appendix E) for approval by the ACT Heritage Council prior to works commencing.

All Aboriginal objects and places are protected under the ACT ***Heritage Act 2004***. It is an offence to disturb an Aboriginal site without approvals granted by the ACT Heritage Council. Should any Aboriginal objects be encountered during works then works must cease immediately in the vicinity of the find, and the find will not be moved until assessed by a qualified archaeologist with the participation of the Representative Aboriginal Organisation registered under the ***Heritage Act 2004*** (RAOs).

5.4.4.1 Kama Woodland/Grassland

A section of the listed Kama Woodland/Grassland is located within the road reserve. Impacts will occur to a small section of the listing and no significant impact or decrease in heritage values will result from the impacts within the road reserve.

5.4.4.2 Weetangera Methodist Cemetery

Barrier fencing must be installed to delineate the extent of construction in the vicinity of the Weetangera Methodist Cemetery to prevent potential impacts. The placement of barrier fencing must be on the exterior boundary of the site's heritage curtilages.

A buffer zone will be demarcated and signed under guidance from an arborist to protect the driplines of the two Cypress trees that are included within the Weetangera Methodist Cemetery Listing. For the single Cypress tree which will experience impacts to around 5-6% of its TPZ, appropriate protection demarcation and signage will be put in place under guidance from an arborist to ensure significant impacts are not caused for this Cypress tree.

Design where practical will be undertaken to reduce the potential for indirect impacts due to higher visibility and visitor impacts to the Weetangera Methodist Cemetery. This will take the form of screening landscaping along the road verge.

5.4.4.3 Aboriginal Heritage

No Aboriginal or historical heritage sites will be impacted by the Project as impacts can be avoided through the design phase. No impacts can occur to the site WHD1 or the three areas of PAD (PAD1, PAD3 and PAD5) located within the road corridor. Detailed mapping of these PAD sites has not been provided, as it is generally not appropriate to provide more detailed mapping of PADs in publicly available documentation.

Interrogation of the Project's design drawings shows PAD1 is located at least 5m from the Project. This buffer will be maintained during construction works. As works are not proposed within this PAD or within any other PAD, no Excavation Permit is considered necessary.

Interrogation of the Project's design drawings also confirms there is no direct impact to WHD. Therefore, there is no need to consider ***Heritage Act 2004*** approvals as part of the EIS or DA processes.

Barrier fencing must be installed to demarcate the PAD site boundaries with a buffer zone of at least 5m. Barrier fencing will consist of star pickets with high visibility flagging and will be installed by or under the direction of the RAOs and heritage team.

The areas of PAD identified within the Project Site will be avoided by the proposed works. If, due to alteration in design, these areas are to be impacted then a program of subsurface testing of the impacted areas of PAD will be required to determine the presence of cultural material.

Table 5-25 below sets out the proposed mitigation measures to manage the potential Aboriginal and non-Aboriginal impacts of the Project.

Table 5-25 Heritage mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
The Project results in impacts to the heritage values of the Weetangera Methodist Cemetery or Kama Woodland/Grassland due to the recommendations of the Conservation Management Plan not being appropriately implemented during the design phase.	Design options for avoidance are considered during design development phase. Erect temporary fencing around sensitive areas. A buffer zone will be demarcated and signed under guidance from an arborist to protect the driplines of the two Cypress trees that are included within the Weetangera Cemetery Listing. For the single Cypress tree which will experience impacts to around 5-6% of its TPZ, appropriate protection demarcation and signage will be put in place under guidance from an arborist to ensure significant impacts are not caused for this Cypress tree. Design where practical will be undertaken to reduce the potential for indirect impacts due to higher visibility and visitor impacts to the Weetangera Cemetery. This will take the form of screening landscaping on the road verge.	Moderate	Design and Construction	TCCS
Potential damage or destruction of unknown or undiscovered Aboriginal and non-Aboriginal heritage items Impacts to unknown or undiscovered heritage items and places	Should any Aboriginal objects be encountered during works then works must cease immediately in the vicinity of the find, and the find will not be moved until assessed by a qualified archaeologist with the participation of the RAOs. Adherence to the Unexpected Discovery Plan (UDP) attached at Appendix 2 of Appendix E is required.	High	Design and Construction	TCCS
Uncontrolled access by vehicles leads to damage to heritage elements (identified PADs) or trees to be retained.	Establish no-go zones, site boundaries, and fences prior to construction commencing by implementing an industry best practice CEMP to prevent unauthorised access into adjacent areas.	High	Design and Construction	TCCS

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	Inform EPSDD and DAWE immediately if any impacts outside approved area occur.			
Potential damage or destruction of known Aboriginal and non- Aboriginal heritage items Impacts to known heritage items and places	No Aboriginal or historical heritage sites will be impacted by the Project as impacts will be avoided through design. No impacts will occur to the site WHD1 or the three areas of PAD (PAD1, PAD3 and PAD5) located within the road corridor. Barrier fencing will be installed to demarcate the PAD boundaries with a buffer zone of at least 5m prior to works. Barrier fencing will consist of star pickets with high visibility flagging and will be installed by or under the direction of the RAOs and heritage team. If, due to alteration in design, these PADs will to be impacted then a program of subsurface testing of the impacted areas of PAD will be required to determine the presence of cultural material. The location of heritage sites and requirements for impact avoidance will be communicated to project manager and personnel engaged on the project. Heritage site information will be included in site inductions. Impacts can be avoided by design at all heritage sites and areas of potential other than the Kama Woodland/Grassland listing. As heritage impacts will occur, there are known heritage impacts from the proposed project. As a result a submission of the Statement of Heritage Effects in Appendix E for approval to the ACT Heritage Council is required. A SHE is provided within this CHA for approval by the ACT Heritage Council prior to works commencing.	Moderate	Design and Construction	TCCS

5.4.5 Residual Risk

Based on the mitigation measures identified in Section 5.4.4, an assessment of the residual risks associated with the Project has been considered. Table 5-26 below sets out the residual risk assessment of the Project's potential Aboriginal and non-Aboriginal heritage impacts.

Table 5-26 Heritage residual risk assessment

Risk (as per Chapter 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
The Project results in impacts to the heritage values of the Weetangera Methodist Cemetery or Kama Woodland/Grassland due to the recommendations of the Conservation Management Plan not being appropriately implemented during the design phase.	High	Unlikely	Minor	Very Low
Potential damage or destruction of unknown or undiscovered Aboriginal and non-Aboriginal heritage items	High	Unlikely	Moderate	Low
Uncontrolled access by vehicles leads to damage to heritage elements (identified PADs) or trees to be retained.	High	Unlikely	Moderate	Low
Potential damage or destruction of known Aboriginal and non- Aboriginal heritage items	High	Unlikely	Moderate	Low
Scoping Document risks identified				
Impacts to known heritage items and places	High	Unlikely	Moderate	Low
Impacts to unknown or undiscovered heritage	High	Unlikely	Moderate	Low

5.5 Noise and vibration

The ***William Hovell Drive Duplication: Road Traffic Noise Assessment*** (SLR, 2021) (Noise Assessment) is found at Appendix F. This section summarises the findings of the Noise Assessment, setting out the potential noise and vibration impacts of the Project. It also meets the following assessment requirements as identified in the Scoping Document (refer to Section 1.4 above):

- Provide an updated acoustic impact assessment prepared by a suitably qualified consultant
- Identify any existing nearby sensitive receivers that will be affected by construction and operation of this Project
- Describe the impacts of noise and vibration on sensitive receivers during construction and operation, including current and future residents in Whitlam and Hawker
- Consider noise source reduction measures attributed to both engine noise and road surface noise.

This Section and Appendix F also meet the relevant Entity Requirements (refer to Section 1.4 above and Appendix B).

SLR conducted an operational noise assessment of the Project in accordance with the ***Roads ACT Noise Management Guidelines*** (TCCS, 2018). The Noise Assessment, presented in Appendix F, was required to consider existing and predicted traffic noise level at adjacent buildings, and include an assessment based on the predicted maximum traffic flow.

Following the notification of the initial Draft EIS, numerous Hawker residents had concerns that the Project had not addressed noise adequately, as the noise monitoring was conducted during a quieter traffic period that coincided with COVID 19 lockdowns and a long weekend. TCCS responded to resident concerns and organised a peer review of the original Road Traffic Noise Assessment to confirm the adequacy of the original assessment. The peer of the Noise and Vibration Assessment was undertaken by WSP Australia – a worldwide professional engineering consultancy service. Following comments from the peer review, SLR made minor amendments to the Road Traffic Noise Assessment which is included at Appendix F.

The Noise Assessment was undertaken with reference to:

- ***Roads ACT Noise Management Guidelines*** (TCCS, 2018)
- Single Dwelling Housing Development Code (SDHDC, effective 28 October 2016)
- The Whitlam Precinct Map and Code (WPM&C, effective 31 July 2021).

Section 7 of the ***Roads ACT Noise Management Guidelines*** (TCCS, 2018) requires road upgrades to be planned to achieve compliance with the maximum noise levels stated in Table 5-27 below.

Residential development within the Whitlam residential estate will be subject to the SDHDC which outlines criteria for the eligibility of new dwellings regarding noise mitigation measures, and minimum requirements of mitigation measures, with reference to the EPR.

The WPM&C contains information relating to allotments within the Whitlam residential estate that have been designated as affected by noise from external sources. Dwellings built on those allotments must be designed and constructed in accordance with the SDHDC, which gives the proponent an option to use the "deemed-to-satisfy" constructions or undertake a specific noise intrusion assessment to determine construction requirements.

Table 5-27 Maximum traffic noise levels resulting from upgraded roads in existing noise sensitive areas (Noise levels expressed as LAeq dB(A) Daytime, Ground Level)

Existing traffic noise level at adjacent buildings	Traffic noise level at adjacent buildings after road works completed
> 60 dB(A)	Equal to existing level (not greater than 65 dB(A))
55-60	60
< 55	Not more than 5 dB(A) above existing level

In addition to the updated SLR noise assessment, SLR's original 2020 assessment was also peer reviewed by WSP under a separate engagement from the ACT Government. WSP's methodology included the following:

- Unattended noise measurements, which were recorded between 8 and 23 February 2022 to quantify the existing road traffic noise levels and support the validation of the developed road traffic noise prediction model. The noise monitoring was carried out in accordance with Australian Standard AS 1055:2018 Acoustics, Description and Measurement of Environmental Noise (Standards Australia, 2018) and Australian Standard AS 2702:1984 Acoustics – Methods for the Measurement of Road Traffic Noise (Standards Australia, 1984)
- Noise loggers were installed with microphone height at 1.5 metres and for the two properties in Hawker, at a distance of 1 metre from the most exposed building façade
- A road traffic noise prediction model was created using the SoundPLAN software package (version 8.2) implementing the Calculation of Road Traffic Noise (CoRTN, UK Department of Transport, 1988) method. The model is used to predict road traffic noise generated by the assessed roads within the study area for the following scenarios
    - Year 2022, measurement year, for current road traffic noise prediction and model validation. (supported by noise monitoring and concurrent traffic classification counts at three locations in February 2022)
    - Year 2031, 'built' scenario referring to assessment scenario when the project is constructed and operational, for predicted horizon noise levels to be used for mitigation specification

- Year 2031, 'no built' scenario referring to the assessment year without the project but with the existing roads only.

Whilst there are some minor differences, in part due to the time difference in noise and traffic readings used, the findings are generally consistent. That is, both the SLR and the WSP assessments found there to be 10 properties adjacent to WHD (from the DBD roundabout to approximately 750m south of this roundabout), which have predicted noise levels in 2031 up to 4dB higher than the criteria/target threshold.

Furthermore, both SLR and WSP assessments are consistent in that the inclusion of a noise reducing pavement (such as Open Graded Asphalt) in this area will reduce the predicted 2031 noise levels to within the criteria/target threshold.

As such, open Graded Asphalt will be included in this portion of the WHDD Upgrade to reduce the predicted 2031 noise levels to within the criteria / target threshold.

5.5.1 Environmental conditions and values

A noise monitoring survey was undertaken by SLR to establish the existing road traffic noise environment along the Project alignment. Unattended noise monitoring was undertaken at two locations from Friday 24 April to Tuesday 5 May 2020. Figure 5-12 below provides noise monitoring locations.

The unattended noise monitoring occurred when COVID-19 restrictions were in place and therefore when traffic movements were expected to be lower than normal conditions. SLR were able to correlate the noise monitoring data with traffic count data obtained by SMEC earlier in 2020 for use in the acoustic noise model. The noise model was validated and verified for use in the assessment. This methodology was confirmed with TCCS – Infrastructure Planning as acceptable.

The Noise Assessment identified 34 sensitive residential receivers along the Project alignment. These dwellings are located in the new suburb of Whitlam and existing suburb of Hawker (Florina Place, Kurundi Place, Mainoru Place, Elsey Place and Dungowan Place). Current noise levels were measured between 64dB(A) and 69.8dB(A).

The results from the noise monitoring have been analysed to establish the road traffic noise in terms of the daytime LAeq(15 hour) values as shown below in Table 5-28 below.

Table 5-28 Existing road traffic noise daytime values

Measurement Location	Daytime Noise Level (dBA LAeq) 7:00 am – 10:00 pm
Location 1	64.0[1]
Location 2	69.8

Based on noise data during the first week of the monitoring period. The noise logger results during the second week indicated acoustic drift, which resulted in much lower noise levels than expected. Consequently, those results have been excluded.



Figure 5-12 Location of noise monitoring and sensitive receivers

5.5.2 Investigations

5.5.2.1 Road traffic noise model

The Calculation of Road Traffic Noise 1988 (CoRTN) methodology was utilised to calculate existing road traffic noise at the noise monitoring locations and to predict future road traffic noise levels on land adjacent to the upgraded WHD alignment.

CoRTN incorporates the road design, the topography between the subject road and receptors, significant structures (e.g. buildings and noise barriers/fences) and traffic characteristics for the subject road (i.e. volume, composition, speed, and road surface type).

Information presented in Table 5-29 below was incorporated into the noise prediction model.

Table 5-29 Traffic data used in noise prediction model

Parameter	Direction	Value		
		2020 (verification)	2020	2031
Traffic volume (annual average daily traffic)	Eastbound	7,423[1]	9,616	10,207
	Westbound	8,703[1]	8,980	9,718
Heavy vehicles (%)	Eastbound	3.2	3.2	3.2
	Westbound	6.6	6.6	6.6
Vehicle speed (km/h)[2]	Eastbound	80 - 90	80 - 90	80 - 90
	Westbound			
Road surfaces	Existing	14mm stone chip seal (most of the WHD alignment) and Dense Graded Asphalt[3]		
	Proposed: ***Eastbound***	Predominantly 50mm AC14 + Prime (AMC00) + 7mm low cutter seal		
	Westbound	Predominantly Prime (AMC00) + 7mm sprayed seal		

1. Existing traffic volumes (based on Sydney Coordinated Adaptive Traffic System (SCAT) data) and appropriate scaling factors for future timeframes

2. As signposted.

3. Approximately 240m west of the JGD intersection and approximately 400m south of the DBD intersection.

The corrections applied in the noise model to the different road surfaces are shown in Table 5-30 below.

Table 5-30 Road surface corrections applied to model

Road surface	Relative noise level (dBA)
14mm stone chip seal	+3
Dense Graded Asphalt	0
50mm AC14 + Prime (AMC00) + 7mm low cutter seal	+2
Prime (AMC00) + 7mm sprayed seal	+2

5.5.2.2 Monitoring period

The noise monitoring was undertaken during COVID-19 restrictions which is expected to have resulted in fewer vehicles on WHD relative to "normal" conditions. However, the purpose of the monitoring was to enable a verified noise model to be established, based on SCATs traffic data obtained for the monitoring period.

Therefore, while fewer vehicles may result in lower measured noise levels which means the measured noise levels cannot be used to establish project target noise levels, this will not affect the model verification which is reliant upon the correlation of the measured noise levels and the traffic volumes at the time of the noise monitoring.

5.5.3 Impacts

The noise model produced by SLR established existing noise levels (2020), target noise levels in accordance with the ***Roads ACT Noise Management Guidelines*** (TCCS, 2018) and predicted maximum noise levels (2031). The Noise Assessment found non compliances at 10 noise sensitive receptors (refer to Table 5-31 below).

It is noted that these predicted increases in noise levels will occur incrementally as traffic volumes gradually increase on WHD. The 'predicted increase' is representative of the maximum traffic volume (at 2031) and not at the immediate commencement of road operation (expected in 2022). It is accepted that a difference of up to 4.5dB(A) would be experienced.

The increase is due to the widening of the alignment and the increase in traffic volumes together with the replacement of the DGA at the project limits with the noisier Prime/AC14 + 7 mm spray seal road surfaces. Those road surfaces however, are 'quieter' than the 14 mm stone chip seal currently used on the bulk of the alignment which partially offsets the noise increasing factors.

It is noted that the traffic noise level would increase naturally by approximately 0.3 dBA if the road upgrade did not occur, which is insignificant. The increase as a result of the project is generally less than 1 dBA at most receptors, which is also negligible. Therefore, it is reasonable to conclude that there are no significant noise impacts associated with the new Project in and of itself.

Table 5-31 Future traffic noise levels

Receptor	Address	2020 Noise Level dB(A) $LA_{eq(15\ hour)}$	2031 Predicted Noise Level dB(A) $LA_{eq(15\ hour)}$		Predicted increase dB(A) for 2020 versus the Project
			Without Project	With Project	
Target Noise Level dB(A) $LA_{eq(15\ hour)}$		**60**	**60**	**60**	
01	12 Florina Place, Hawker	60	60	**63**	3.6
02	14 Florina Place, Hawker	62	**62**	**65**	3.4
04	17 Florina Place, Hawker	58	58	**61**	3.5
05	15 Florina Place, Hawker	58	58	**62**	4.0
06	13 Florina Place, Hawker	60	**60**	**64**	4.5

Receptor	Address	2020 Noise Level dB(A) $LA_{eq(15\ hour)}$	2031 Predicted Noise Level dB(A) $LA_{eq(15\ hour)}$		Predicted increase dB(A) for 2020 versus the Project
			Without Project	With Project	
07	10 Kurindi Place, Hawker	58	58	**62**	4.1
08	12 Kurundi Place, Hawker	58	58	**62**	4.6
09	14 Kurindi Place, Hawker	57	57	**61**	3.8
13	14 Mainoru Place, Hawker	60	60	**61**	1.0
34	Whitlam Estate	60	62	**62-64**	1.5-3.7

Given the locations of existing receivers with respect to the current and proposed WHD road reserve, construction and operational vibration impacts are not considered to be significant. In particular, isolated construction activities may result in minor vibration impacts which are either barely perceptible or not perceptible for nearby receivers.

5.5.4 Mitigation

5.5.4.1 Construction noise

Noise generation during Project construction will include plant and machinery associated with the widening of the road. This is likely to cause temporary noise and vibration impacts on surrounding areas.

Nearby residents will be notified of the works prior to the commencement of construction. Any potential noise impacts are expected to be minor and short term in duration. Nonetheless, construction work outside of the recommended standard hours will not be undertaken without prior agreement with the ACT EPA and notification/consultation with affected residents.

5.5.4.2 Operational road traffic noise

Longevity being preferred, it is expected that the most robust mitigation treatment would be road traffic noise barriers and these have been considered in accordance with Schedule 3 of the Guidelines, in order to reduce noise levels from the modified alignment at the receptors. The proposed road traffic noise barriers have been located as close to the road as possible to maximise effectiveness and to yield a lower barrier height

Two barrier options for the northern end of the alignment have been considered. The barrier at the southern end of the alignment near to the Whitlam residential estate. The predicted future 2031 road traffic noise levels including the reduction effect of the noise barriers are shown in Table 5-32 for noise barrier Option 1 and Option 2 respectively.

Table 5-32 shows that the use of either noise barrier option as noise mitigation is effective, and is predicted to result in compliance with the project target noise levels at all receptor locations.

The noise contour maps in Appendix E and Appendix F of Appendix F to this EIS also show that the future noise levels following the duplication project would not exceed the Target Noise Level of 60 dBA LAeq(15hour) at the residential components of the Whitlam Estate. Therefore, compliance with the Guidelines would be achieved which indicates that no further noise mitigation would be required.

The Open Graded Asphalt (OGA) road surface and the proposed noise barrier adjacent to and south of the WHD alignment near the Whitlam Estate would result in noise levels at the Whitlam Estate below the levels anticipated in the Whitlam Estate Development Plan. This may allow the noise affectation to be removed from the blocks identified in the WPM&C. However, this would be subject to further assessment and consideration.

As an alternative to noise barriers, a low noise road pavement has been considered as a mitigation option. An OGA surface provides a -4 dBA noise reduction relative to the pavement surface proposed. A section of OGA approximately 1,410 m (starting at and heading west from the JGD intersection) for both carriageways was incorporated into the model.

To reduce noise at the residences in Hawker at the northern end of the WHD alignment, a section of OGA approximately 400 m (starting at and heading south from the DBD intersection) for both carriageways was incorporated into the model.

The predicted 2031 road traffic noise levels including those sections of OGA pavement are also shown in Table 5-32, and in Appendix G of Appendix F to this EIS. The extent of the OGA pavement surfacing required is also shown in Appendix G of Appendix F to this EIS. Table 5-32 shows that the use of OGA as noise mitigation is effective and is predicted to result in compliance with the project target noise levels at all receptor locations

In relation to the sound reduction benefits of OGA, it is expected that a -2 dB benefit (relative to DGA road surfaces) may be retained for up to five years before specific maintenance treatments, such as grinding/machining which may extend the 'acoustic life' of OGA by a further three years, or replacement would be required. Resurfacing of OGA generally occurs at approximately 10 years.

Table 5-32 2031 Future Road Traffic Noise Levels and Assessment – with noise mitigation

Receptor	Address	Target Noise Level dBA $L_{Aeq\ (15\ hour)}$	2031 Predicted Noise Level dB(A) $LA_{eq(15\ hour)}$		
			Barrier Option 1	Barrier Option 2	OGA Road Surface
01	12 Florina Place, Hawker	60	60	60	60
02	14 Florina Place, Hawker	62	62	62	62
04	17 Florina Place, Hawker	60	60	60	58
05	15 Florina Place, Hawker	60	60	60	58
06	13 Florina Place, Hawker	60	60	60	60
07	10 Kurindi Place, Hawker	60	59	59	58
08	12 Kurundi Place, Hawker	60	59	59	59
09	14 Kurindi Place, Hawker	60	60	59	58
13	14 Mainoru Place, Hawker	60	60	60	60
34	Whitlam Estate	60	60	60	59

The Noise Assessment considered various mitigation treatments to reduce road traffic noise at these sensitive receivers, including changes to road pavement surface and acoustic noise barriers. Table 5-33 below sets out the proposed mitigation measures to manage the potential noise impacts of the Project.

Table 5-33 Noise and vibration mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Intermittent noise and vibration emitted from the equipment required to carry out the proposed construction of the Project impacting residential and non-residential receivers.	The CEMP is to include a procedure to address noise and vibration impacts including: • Identification of all potential significant noise and vibration generating activities • Measures to be implemented during construction to minimise noise and vibration • Arrangements for consultation with sensitive receivers, including notification and complaint handling procedures • Where practical, equipment will be selected to minimise noise emissions. Equipment will be fitted with appropriate noise control equipment and be in good working order.	High	Construction	TCCS
Local residents in surrounding suburbs exposed to increased levels of noise and vibration	Investigate operational noise management measures such as: • Noise barriers/ mounds • Low noise road pavement surface • Building envelope treatments • Low noise road pavement surfacing will be provided.	Moderate	Operation	TCCS
Noise and vibration impacts to sensitive receivers during operation				

1. In relation to the sound reduction benefits of OGA, it is expected that the noise reduction benefit may be retained for up to five years before specific maintenance treatments, such as grinding/machining which may extend the 'acoustic life' of OGA by a further three years, or replacement will be required. Resurfacing of OGA generally occurs at approximately 10 years.

From a technical perspective, noise will be sufficiently mitigated by the use of a low noise pavement such as Open Graded Asphalt for sections of the WHD alignment that are in close proximity to the noise receptors. This low noise pavement will reduce noise at affected receptors to levels compliant with the assessment criteria. Low noise pavement is the preferred road noise mitigation approach in this instance.

As the road barriers and retaining wall will effectively reduce noise levels in Whitlam to acceptable levels, there may be opportunity to remove the construction requirements for noise affected dwellings in the Whitlam Estate Development Plan, however this will be subject to separate assessment.

5.5.5 Residual risk

Based on the mitigation measures identified in Section 5.5.4, an assessment of the residual risks associated with the Project has been considered Table 5-34 below sets out the residual risk assessment of the Project's potential noise impacts.

Table 5-34 Noise and vibration residual risk assessment

Risk (as per Chapter 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
Intermittent noise and vibration emitted from the equipment required to carry out the proposed construction of the Project impacting residential and non-residential receivers.	High	Possible	Minor	Low
Local residents in surrounding suburbs exposed to increased levels of noise and vibration	High	Possible	Minor	Low
Scoping Document identified risk				
Noise and vibration impacts to sensitive receivers during operation	High	Possible	Minor	Low
Light impact to sensitive receivers during construction and operation	Refer to Table 5-23			

5.6 Soils and geology

This section provides an assessment of potential soil and geological impacts as identified in the Scoping Document, including:

- Discuss any contamination impacts onsite and how these will be managed during construction, particularly in areas where soil is proposed to be reused
- Describe the impacts of soil erosion and sedimentation, and contaminated water run-off including from oils and other contaminants from vehicles during construction and operation and how these will be managed.

5.6.1 Environmental conditions and values

5.6.1.1 Environmental setting

Geology

Reference to 1:100,000 Geological Series Sheet for Canberra, Sheet 8727 (Abell. R. S., 1992) indicates the Project Site is underlain by Walker Volcanics (approximately Chainage 0 to Chainage 4100m) and Mount Painter Volcanics (approximate Chainage 4100 to Chainage 4900m).

Soil landscape

Reference to the 1:100,000 Soil Landscapes of Central and Eastern NSW indicates the Project Site is within the Burra Soil Landscape (NSW Office of Environment and Heritage, 2020). This soil landscape occurs on Silurian volcanics and comprises undulating to rolling low hills, gently to moderately inclined waning slopes (5-30%). Soils in this landscape contain limitations including strongly acid soils with low fertility and low available water holding capacity and moderate erosion hazard, including sheet erosion risk (NSW Office of Environment and Heritage, 2020).

Topography and hydrology

Existing Site topography has been disturbed from original construction of WHD, with cut and fill areas. The Project Site generally sits at approximately 600m Australian Height Datum, with a downward slope present along the southern portion of the Project Site toward the Molonglo River.

Hydrogeology

The Australian Capital Territory Hydrogeological Landscapes map (Muller, R., Nicholson, A., Wooldridge, A., Cowood, A., Cook, W., Jenkins, B. and Grant, S., 2017) indicates that the Project Site is located within the partially catchment-based Uriarra Road Hydrogeological Landscape. The landscape is generally relatively flat with a number of crests/rises associated with gorges.

Nine small creeks traverse, or are located adjacent to the Project Site, including Deep Creek at in the south-eastern portion, and unnamed small creeks. The creeks drain to the Molonglo River, located approximately 1.4km to the south-west from the Project Site and which flows towards the ACT/NSW border. Section 5.7 below sets out the potential water quality and hydrology impacts of the Project.

5.6.1.2 Previous investigations

Contamination

A preliminary site investigation was undertaken by WSP and was summarised in the feasibility study (WSP, 2018). A review of historical aerial photographs (including images dated 1952, 1961, 1975, 1987, 1997, 2009 and 2017) indicates the Project Site originally consisted of open pasture with scattered trees. In 1987, WHD was constructed and has remained relatively unchanged. Surrounding land use generally has remained as open pasture with scattered trees and used in recent times for grazing purposes. Several man-made features were noted including a farmhouse dwelling, former and existing sheds and farm dams.

Potentially contaminating historical activities included the use of sheep dips for pesticide application to livestock in adjacent properties (Block 1616 and Block 1592). This is likely to have occurred until the 1960s. Widespread ground disturbance (cut to fill) and possible importation of fill materials occurred during the construction of the WHD road corridor. The areas surrounding the Project Site have been used for rural grazing activities and recreational or environmental conservation activities associated with Kama Nature Reserve and The Pinnacle Nature Reserve.

A feasibility study was undertaken for Molonglo Development Stage 3 (WSP, 18 May 2016) which is located to the south of WHD identified the potential for unexploded ordinance (UXO) within the area. The report did not assess the WHD road reserve.

Geotechnical

A geotechnical desktop review of the Study Area was undertaken as part of the feasibility study for the Project (WSP, 2018) and suggested that fill of unknown origin may have been used in the original road construction.

5.6.2 Investigations

5.6.2.1 Geotechnical

In 2020, SMEC engaged Douglas Partners to undertake geotechnical investigations along the Project alignment. This investigation work included boreholes, pavement cores and material testing to provide in-depth information and recommendations on ground conditions. The primary geotechnical constraints for the Project are:

- Works that will be required to extend the existing fill embankment at the southern end of the Project Site
- Excavation in areas of deep cut
- Presence of water inundated and soft soils
- Potential to encounter groundwater
- Re-use potential for existing fill.

Contamination

SMEC prepared the ***William Hovell Drive Duplication – Detailed Design: Contamination Assessment, dated 13 November 2020*** (SMEC, 2020c) and summarised findings by Douglas Partners within the ***Contamination Factual Report, Report ref: 88231.19.R.001.Rev1, dated 19 June 2020*** (Douglas Partners, 2020). The investigation entailed opportunistic and targeted soil sampling and laboratory analysis of selected samples for contaminants of potential concern.

Anecdotal evidence from Milsearch indicated that there was no information supporting the need for further assessment of UXO within the Project Site for the WHD road duplication.

The following Areas of Environmental Concern (AEC) were identified:

- AEC1 - Potential for UXO within field firing ranges
- AEC2 - Potential for sheep dips (offsite)
- AEC3 - Potential for municipal landfill (offsite)
- AEC4 - Pindone bait burial pit (offsite)
- AEC5 - Fly tipped wastes in road verges
- AEC6 - Current and former demolished structures (offsite)
- AEC7 - Potential for acid sulfate soil/rock in fill and/or rock cuttings
- AEC8 - Fill of unknown origin and quality within road embankments.

The Project Site investigation included advancement of and sampling at 50 boreholes/testpits. No exceedances of human health and ecological investigation levels, or of management limits were detected. No indicators of acid sulfate soils were detected. Minor exceedances of ACT beneficial reuse criteria were detected in four samples selected for analysis. Based on the findings of these investigations, the likelihood for contamination along the alignment is considered low.

5.6.3 Impacts

5.6.3.1 Soil erosion and sediment impacts

There is potential for sediment and nutrient rich surface water runoff from the Project Site during construction, which may impact downstream waterways including Deep Creek and the Molonglo River if not adequately

managed. High risk areas for soil erosion include locations with elevated erosive potential with consideration for surface gradients and slope lengths.

Activities considered to have a high-risk for sedimentation and erosion impacts include:

- Any works near creeks and stormwater drainage lines
- Vegetation removal and exposure of underlying soils
- General earthworks (such as stripping of topsoil, the excavation or filling of material, or transport of soils)
- Stockpiling of spoil
- Movement of heavy vehicles across unbound or exposed soil
- Areas not successfully stabilised or revegetated following construction.

An Erosion and Sediment Control Plan will be prepared as part of the CEMP to identify and mitigate erosion impacts from construction activities.

The CEMP will also outline contractor and other personnel responsibilities and actions in the event of an unforeseen environmental harm incidents, including first response and agency notification requirements.

5.6.3.2 Contamination impacts

It is noted that subsurface conditions across the Project Site may vary due to changes in geology, fill composition and depth, and historical construction practices (i.e. source of importation of fill and UXO). Surface contamination potential can also occur where ongoing site land use as a road corridor may result in contaminated activities such as illegal dumping.

Construction activities may result in contamination of soil and/or water due to leaks and spills of potentially contaminating materials.

Importation of fill material presents a risk for importing contaminated material. Based on the current preliminary design, the project will require approximately 80,000m^3 of cut and 112,000m^3 of fill. This will require importation of approximately 32,000m^3 of fill. Imported fill will be suitably sourced for the project in accordance with ACT EPA requirements.

5.6.4 Mitigation

With consideration of potential contamination and risk of erosion, the Project is unlikely to pose significant risks to workers, residents or environmental aspects such as local water bodies. Based on the work carried out, it is recommended that:

- Contamination:
    - An Unexpected Finds Protocol be prepared and implemented under the framework of the CEMP. The purpose of the Unexpected Finds Protocol will be to address any unforeseen contamination encountered during Project earthworks stages or other disturbance, and will include, amongst other things, appropriate procedures for the identification, assessment, management, validation and disposal of potential contamination at the Project Site. Contamination indicators may include but not be limited to unusual odours or soil staining, buried wastes, burial pits, suspected asbestos containing materials, and oily or hydrocarbon sheens within surface water drainage lines. Where contamination is identified this will be required to be assessed and managed by qualified environmental consultant in accordance with the NEPM 1999 and ACT EPA requirements and/or WorkSafe requirements
    - Materials reuse opportunities to be managed during construction stages to ensure beneficial reuse onsite and/or offsite. Should offsite reuse options be considered, these will be further assessed based on additional soil sampling and testing carried out at construction stage. Consideration will be given to the preliminary site investigation data used to inform this assessment, including where slightly elevated heavy metals concentrations were noted. A material reuse and management plan may be prepared to provide further details on sampling and testing requirements, reuse potential etc.

- Where observed, removal of surface fly tipped wastes (including suspected asbestos containing materials if present) is recommended to be carried out prior to construction disturbances to prevent cross contamination with underlying soils
- Dilapidation surveys are undertaken of dwellings within proximity of the Project
- Should a spill occur onsite, it will be immediately contained and cleaned up. Contaminated soil will be excavated and transported to an appropriately licensed facility and in accordance with ***EPA Information Sheet 4 - Requirements for the reuse and disposal of contaminated soil in the ACT***.

- Geotechnical and soil erosion:
  - An Erosion and Sediment Control Plan be prepared as part of the CEMP
  - All fill batters will be constructed no steeper than 2.5:1, and will be vegetated to reduce erosion and suitably protected against erosion through suitable drainage methods
  - Existing stormwater structures such as culverts and stormwater crossings be extended and not filled over. This will minimise alterations to the existing drainage characteristics of the Project Site.

Table 5-35 below sets out the proposed mitigation measures to manage the potential soil and geological impacts of the Project.

Table 5-35 Soils and geology mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Inadequate investigation of site geotechnical issues resulting in additional works, delays to works and contractor claims	Undertake geotechnical and contamination assessment, including detailed assessment of fill. Incorporate identified geotechnical and contamination constraints and recommendations into the design and project planning decisions.	High	Construction	EPA
Disturbance to or movement of contaminated soils during construction	Undertake remediation of identified contaminated sites prior to general construction commencing. Develop a site-specific contamination management plan, incorporating an Unexpected Finds Protocol, must be prepared and implemented during site development works. Develop and implement an Unexpected Finds Protocol for all earthworks and construction activities onsite, including training personnel in Unexpected Finds procedure. All construction works are covered by an Erosion and Sediment Control Plan (ESCP) approved the EPA. Fly tipped wastes (including suspected asbestos containing materials if present) are to be	High	Design and Construction	EPA and ACT Health

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	removed using appropriately licensed persons, where applicable, prior to construction to prevent cross contamination of underlying soils.			
Contamination of soil during construction and operation	Storage of hazardous materials in appropriate manner and in accordance with CEMP. Re-fuel in designated, bunded areas only. All construction works are covered by an ESCP approved by the EPA.	High	Design and Construction	EPA
Disturbance of soil associated with construction leading to increased soil and sediment erosion	Existing vegetation onsite will be retained as long as possible and only cleared when required for construction. An ESCP will be developed prior to construction. Disturbed areas will be stabilised as soon as possible following disturbance including that installation of scour protection on any disturbed embankments immediately following excavation. All construction works are covered by an ESCP approved by the EPA.	High	Construction	EPA
Surface water runoff containing sediment and soil leaving the construction site due to inadequate surface water and sediment and erosion control measures being implemented	Design mitigation measures so they adhere to ecological limits (e.g. water flow rates or quality) of adjacent MNES and other environmental values. Undertake stormwater assessments to ensure the design of the development does not place unnecessary pressure on existing stormwater infrastructure. Design mitigation measures in accordance with relevant ACT, Australian, or otherwise best practice standards; and with any P&D Act or EPBC Act approval conditions. All construction works are covered by an ESCP approved the EPA.	High	Design and Construction	EPA

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Incorrect disposal of excess materials cut from the site	All soil subject to disposal from the Project Site must be addressed in accordance with EPA Information Sheet 4 - Requirements for the reuse and disposal of contaminated soil in the ACT, with no soil is to be disposed from the site without EPA approval	High	Construction	EPA
Incorrect use of fill transported to site, leading to onsite and offsite contamination of soil and water	All imported fill and re-use of soil within the Project will comply with the ACT EPA requirements.	High	Construction	EPA
Undertaking significant public works relating to 0.3ha or more of land, and relating to public roads, without oversight by the EPA.	TCCS will enter into an Environment Protection Agreement with the EPA	High	Pre-construction and Construction	EPA

5.6.5 Residual risk

Based on the mitigation measures identified in Section 5.6.4, an assessment of the residual risks associated with the Project has been considered Table 5-36 below sets out the residual risk assessment of the Project's potential soil and geological impacts.

Table 5-36 Soils and geology residual risk assessment

Risk (as per Chapter 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risk identified				
Inadequate investigation of site geotechnical issues resulting in additional works, delays to works and contractor claims	High	Unlikely	Moderate	Low
Disturbance of currently unidentified contaminated soils during construction	Possible	Major	High	Low
Disturbance of soil associated with construction leading to increased soil and sediment erosion	Likely	Moderate	High	Low
Surface water runoff containing sediment and soil leaving the construction site due to inadequate surface water and sediment and erosion control measures being implemented	High	Unlikely	Moderate	Low
Scoping Document risks identified				

Disturbance to or movement of contaminated soils during construction	High	Possible	Minor	Low
Disturbance of soil associated with construction leading to increased soil and sediment erosion	High	Unlikely	Moderate	Low

5.7 Water quality and hydrology

This Section 5.7 provides an assessment of potential water quality and hydrology impacts as identified in the Scoping Document:

- Describe the impacts of construction and operation on water quality in downstream waterways, including the Molonglo River and Deep Creek, including the proposed future Deep Creek Water Quality Control Pond.
- Describe the impact of sediment and road surface run-off entering nearby waterways. Describe the impacts of changes to water flow regimes, including consequences of increased water flow during large rainfall events
- Rain event causing flooding, erosion or damage to road infrastructure.

5.7.1 Environmental conditions and values

The current natural flow of surface water occurs from The Pinnacle Nature Reserve and passes beneath WHD through existing transverse culverts, and discharges into the future Deep Creek dam on the western side of Whitlam and tributaries of Molonglo River to the northern section of the Project. Deep Creek runs south-west, towards the Molonglo River, to the south-south-west of the Project. The Molonglo River runs west and north-west towards the ACT/NSW border. Refer to Figure 5-13 below.

There are 27 culvert crossings within the proposed upgrade section of the road. The culvert catchments generally comprise non-residential areas which include the nature reserve and native open areas. The proposed road upgrade is only impacted by the local catchments which drain into the cross-drainage systems.



Figure 5-13 Deep Creek tributary

5.7.2 Investigations

The Project is located in the Molonglo catchment between Coulter Drive and DBD downstream of The Pinnacle Nature Reserve. The Molonglo River runs on the downstream side of the road receiving runoff from Deep Creek. There are twenty-three culvert crossings within the proposed upgrade section of the road. The culvert

catchments generally include Non-residential areas which include the nature reserve and native open areas. The proposed road upgrade is only impacted by the local catchments drain to the cross-drainage systems.

5.7.3 Water quality and hydrology assessment

This section provides an assessment of potential water quality and hydrology impacts as identified in the Scoping Document:

- Describe the impacts of construction and operation on water quality in downstream waterways, including the Molonglo River and Deep Creek, including the proposed future Deep Creek Water Quality Control Pond.
- Describe the impact of sediment and road surface run-off entering nearby waterways. Describe the impacts of changes to water flow regimes, including consequences of increased water flow during large rainfall events.

An assessment of water quality and hydrology was carried out by reviewing aerial photographs and the following previous studies:

- Molonglo Catchment and Scrivener Dam Flood Hydrology Review - Phase 2 (SKM, 10 June 2011)
- Molonglo 3 - Stormwater Masterplan- Deep Creek - (GHD, July 2015)
- Molonglo 3 - Stormwater Management WSUD Strategy - (GHD, December 2015)
- Whitlam Concept Masterplan - (Roberts Day, June 2016)
- Deep Creek Corridor Water Quality Pond, Concept Design Report - (GHD, March 2019)
- Memo - Whitlam / Molonglo 3 Regional Pond - (Calibre, September 2018).

The existing transverse drainage systems under the proposed upgrade have been retained where practically possible to ensure consistency in the flow regime between existing and post-developed conditions. There are six additional cross drainage pipes that have been proposed since the PSP design to improve water quality outcomes for the Project. these additional proposed pipes will drain road pavement only for treatment in swales. As such, there will only be a minor change in flow attenuation between the present day and post construction. The drainage plans provide the details and locations of the proposed culverts to protect the road from flooding for events up to 1% AEP.

Previous flood studies carried out for Lake Burley Griffin and Scrivener Dam shows the proposed road upgrade is further upstream of Molonglo River and is not impacted by the river for rainfall events up to 1% AEP. A relevant flood impact map (SKM for ACTPLA, 2011, 'Molonglo Catchment and Scrivener Dam Flood Hydrology Review – Phase 2') is reproduced at Figure 5-14.

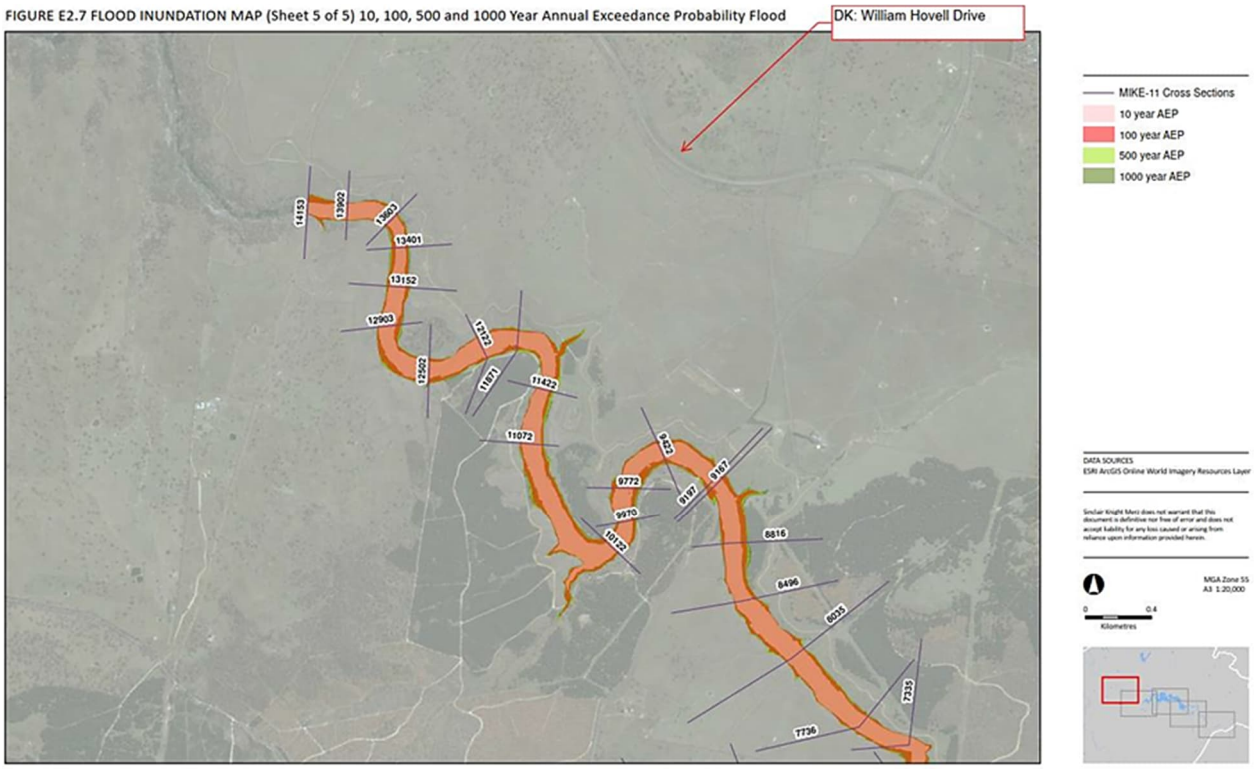


Figure 5-14 Flood impact map included in the Molonglo Catchment and Scrivener Dam Flood Hydrology Review and the location of WHD

5.7.4 Climate change

Climate change analysis was conducted on the proposed drainage network. The rainfall intensities were increased by 20 percent to account for the potential future effects of climate change in accordance with Section 3.1.4 of MIS08.

Analysis found no ponding onsite, and surface flow for the 20 percent AEP flood widths remained within limits stipulated in MIS08.

5.7.5 Water quality

The proposed drainage catchments reflect the existing drainage catchment scenario where practically possible. The main catchment characteristic is dense grass with sparse trees. The WHD also contains three existing underpasses which help provide some additional relief for the transverse culverts during larger storm events.

Vegetated swales are an effective way of reducing sediment transportation. Generally vegetated swales will be provided within the road verge on both sides of the road to collect runoff from the road surface to remove pollutant particles including sediments. This will continue the current characteristics of WHD and provide ease of maintenance. As the runoff passes through the swales, the contaminants will be removed via filtration and infiltration.

Where kerbs and gutters are provided, the stormwater runoff from the road surface will be collected in sumps which will discharge into vegetated swales within the road verge. The proposed section of the road falls within Deep Creek catchments and the runoff from the road catchment will be directed through vegetated swales for water quality treatment and eventually flow into Deep Creek.

ACT Waterways: WSUD General Code (February 2020) outlines the reduction of the pollutants target for major road development (refer Figure 5-15). The targets are also consistent with ACT Government Municipal Infrastructure Standards 08 Stormwater, MIS08, April 2019.

Rules	Criteria
3.2 Stormwater quality target – major roads	
R7 This rule applies to development of major roads, including the duplication of an existing major road in full or in part. The average annual stormwater pollutant export is reduced when compared with a road catchment of the same area with no water quality management controls for all of the following: a) gross pollutants by at least 90% b) suspended solids by at least 60% c) total phosphorous by at least 45% d) total nitrogen by at least 40%. **Note:** Compliance with this rule is consistent with the ACT Practice Guidelines for Water Sensitive Urban Design and is demonstrated by a report by a suitably qualified person, using the MUSIC model. If a tool other than the MUSIC model is used then a report by an independent suitably qualified person must be submitted demonstrating and confirming compliance with the rule. If parameters that are non-compliant are used then a report must also be submitted by an independent suitably qualified person stating how and why the parameters are appropriate.	C7 If it can be demonstrated that the stormwater quality measures specified in the rule are unable to be provided, then a contribution to the construction of offsite measures as a means of offset may be approved by the Planning and Land Authority. **Note:** Compliance with this criterion is consistent with the ACT Practice Guidelines for Water Sensitive Urban Design and is demonstrated by a report by a suitably qualified person, using the MUSIC model. If a tool other than the MUSIC model is used then a report by an independent suitably qualified person must be submitted demonstrating and confirming compliance with the criterion. If parameters that are non-compliant are used then a report must also be submitted by an independent suitably qualified person stating how and why the parameters are appropriate.

Figure 5-15 WSUD General Code 3.2

The design was modelled using MUSIC Version 6 software to determine the water quality reduction factors for the Project. The design was reviewed and updated from PSP to improve water quality outputs of the Project by isolating road pavement runoff from clean water runoff from external catchments where possible and treating pavement runoff in grass channels. The grass channels help to remove pollutant particles as the runoff passes through the grassed area, the contaminants are removed via filtration and infiltration. The grass channel approach will also continue the current characteristics of WHD and provide ease of maintenance.

SMEC has considered the following site-specific factors when reassessing the WHDD project water quality target. These are:

- PSP water quality strategy
- MUSIC model design parameters, and
- Site constraints for the developed conditions such as:
- Space constraints and project boundary
- Existing network outlets and connections
- Ecological sensitive area, and
- Terrain surrounding the site.

Table 5-37 outlines the water quality targets as per Rule 7 in the WSUD general code and the design outcomes. The water quality reduction target for the detailed design, considering new pavement area only, is compliant with the WSUD General Code R7 requirements.

Table 5-37 Water quality targets and design outcomes

Detail	Targets (WSUD General Code R7)	Detailed Design Effectiveness
Gross Pollutants	90%	100%
Suspended solids	60%	96.5%

Detail	Targets (WSUD General Code R7)	Detailed Design Effectiveness
Total Phosphorus	45%	81.3%
Total Nitrogen	40%	40.4%

5.7.6 Impacts

As a result of the duplicated road, the area of hardstand will increase and there will be an associated minor increase in peak stormwater runoff. The Project will maintain or increase the stormwater drainage provisions to manage the surface water for events up to the one percent AEP, while also providing additional protection during and following major storm events. As such, there will be no change with regard to the risk for erosion and scour at the stormwater discharge points or potential for sediment discharge and pollution.

Other potential water and hydrological impacts include:

- Erosion and sedimentation during construction works
- Impact on flooding as some of the proposed civil works for the shared path and road widening may impact the existing head available for the transverse drainage culverts, which may affect capacity for events larger than the one percent AEP
- Spill management as a result of refuelling, maintenance of machinery and storage of potential pollutants
- Potential flood threats and appropriate protection or removal of dispersible materials, hazardous materials and equipment containing such materials
- Disturbed areas which have not undergone suitable stabilisation.

5.7.7 Mitigation

Table 5-38 below sets out the proposed mitigation measures to manage the potential hydrological impacts of the Project.

Table 5-38 Water quality and hydrology mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Water quality impacts to Deep Creek	As Detailed Design progresses, consultation with the EPA would take place to confirm whether a WWL is required due to the proximity of Deep Creek. Water quality discharge from the site to meet the Waterways: Water Sensitive Urban Design General Code (21 February 2020)	High	Pre-construction and Construction	EPA
Local and regional drainage conditions altered Impact on flooding as some of the proposed civil works for the shared path and road widening may impact the existing head available for the transverse drainage	Stormwater assessments has concluded that the design of the development does not place unnecessary pressure on existing stormwater infrastructure	High	Construction and Operational	TCCS

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
culverts, which may affect capacity for events larger than the one percent AEP				
Changes to existing flow paths and overland flow due to proposed Project				
Potential changes to groundwater availability due to vegetation removal or excavation including impacts on groundwater dependent ecosystems and water users within the catchment	To mitigate the groundwater impacts, it is proposed to plant new evergreen trees alongside the locations where existing trees would be removed. Indeed, where possible, established trees would be retained to provide landscape screening. A schedule of additional plantings would therefore be provided to soften the impact on the predominantly rural landscape.	High	Operational	EPA
Additional run off from new impervious surfaces increases flow downstream and impact areas beyond the Project boundaries	An approved ESCP must be implemented to cover all construction works. Water quality discharged from the construction site is to meet the EPA requirements under the Environment Protection Act 1997 (the Act). Permanent treatment swales also proposed to capture and treat pavement runoff to achieve the agreed water quality target.	High	Construction and Operational	EPA
Reduction in water quality in waterways due to runoff and sedimentation during construction and operation				
Change to water flow regimes in waterways due to construction and operation	It is proposed to provide additional sales at the outlets to provide treatments and storage to mitigate the adverse impact on water quality and quantity. In addition, the effect of time of concentration and lag time is also taken into consideration for water quality analysis. Implementing appropriate ESC treatments such as check dam, sediment fences, and straw bale barriers at the outlets during construction will provide a positive outcome.	High	Construction and Operational	EPA

5.7.8 Residual risk

Based on the mitigation measures identified in Section 5.7.7, an assessment of the residual risks associated with the Project has been considered Table 5-39 below sets out the residual risk assessment of the Project's hydrology impacts.

Table 5-39 Water quality and hydrology residual risk assessment

Risk (as per Chapter 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
Local and regional drainage conditions altered	High	Possible	Minimal	Very Low
Changes to existing flow paths and overland flow due to proposed Project	High	Possible	Minimal	Very Low
Potential changes to groundwater availability due to vegetation removal or excavation including impacts on groundwater dependent ecosystems and water users within the catchment.	High	Possible	Minimal	Very Low
Additional run off from new impervious surfaces increases flow downstream and impacts areas beyond the project boundaries.	High	Possible	Minimal	Very Low
Scoping Document risks identified				
Reduction in water quality in waterways due to runoff and sedimentation during construction and operation	High	Possible	Minimal	Very Low
Change to water flow regimes in waterways due to construction and operation	High	Possible	Minimal	Very Low
Rain event causing flooding, erosion or damage to road infrastructure.	High	Possible	Minimal	Very Low

5.8 Landscape and visual

This Section 5.8 provides an assessment of potential landscape and visual impacts as identified in the Scoping Document, including:

- Undertake a visual assessment and/or provide perspectives of the Project from local vantage points
- Describe the visual impact of the development on sensitive receivers during operation, including to current and future residents in Whitlam and Hawker.

5.8.1 Environmental conditions and values

The proposed alignment of the WHD duplication is contained within the existing road reserve. Duplication of the road will not impact the visual integrity of the Kama Nature Reserve (visible on the southern side of WHD) and The Pinnacle Nature Reserve (visible on the northern side of WHD), or any of the surrounding hills and ridges that provide a natural vista. As the Project will be contained within the road reserve it will not directly impact the Weetangera Cemetery or its visual curtilage.

Where possible, established trees are to be retained to provide landscape screening. A schedule of additional plantings will be provided to soften the impact on the predominantly rural landscape.

The new or widened section of the road has the potential to be visually prominent, but whether this visual impact is significant will depend on whether the road can actually be seen from locations which are used by people. Such locations include residences which may overlook the road and public land. The potential visual impact of the road may be strongly influenced by its design, as well as landscaping and retention of trees within the road corridor.

It may be appropriate to also consider the appearance of the road at night, particularly in relation to the movement of car lights, compared with the existing situation. While the visual impact of the road may turn out to be minor, it is nevertheless an issue warranting further analysis and discussion in the EIS.

5.8.2 Investigations

5.8.2.1 Visual Impact Assessments

Seven representative public viewpoints with photographs, descriptions, and impact assessment and associated ratings for each have been prepared and are discussed in Section 5.8.2.1 and 5.8.2.2. The visual impacts included consideration of the landscape and urban design features proposed for the duplication works. One representative visual perspective of the proposed alignment of the WHD duplication from selected viewpoint is provided in Figure 5-16 below. The existing view is also shown below in Figure 5-17.



Figure 5-16 WHD: Proposed Alignment



Figure 5-17 WHD: Existing View

The impact significance ratings have been determined through a combination of the sensitivity and magnitude of change assessments, in accordance with the scale defined within Table 5-40 below (Adapted from EIA-N04

Guideline). Using the rationale outlined within these tables, a judgement is made regarding the significance of the impact.

Table 5-40 Visual Impact Rating Matrix

Visual Impact Rating Matrix		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Visual impacts are rated as ***High, Moderate, Low*** or ***Negligible***, and can be adverse (negative), beneficial (positive), or neutral (subjective). There is often a gradual transition between levels of significance, and where impacts lie on the borderline they may be described, for example, as ***Moderate to Low***. Magnitude of visual change which is barely perceptible is considered to be ***Negligible***.

Impacts which are graded as being ***Moderate*** to H***igh*** are those which will be given greatest consideration, relative to other levels of landscape and visual impacts, in decision making. ***Low*** to ***Moderate*** levels of impact are of progressively reducing importance, but nonetheless important.

Representative Viewpoint Assessments Table 5-41 below provides a detail assessment of the seven Representative Public viewpoints and associated Impact Ratings. Refer to

Figure 5-18 for locations of each Representative Public Viewpoint. Refer to Section 5.8.2.2 for photographic representation of existing condition and simulated view of each individual viewpoint.

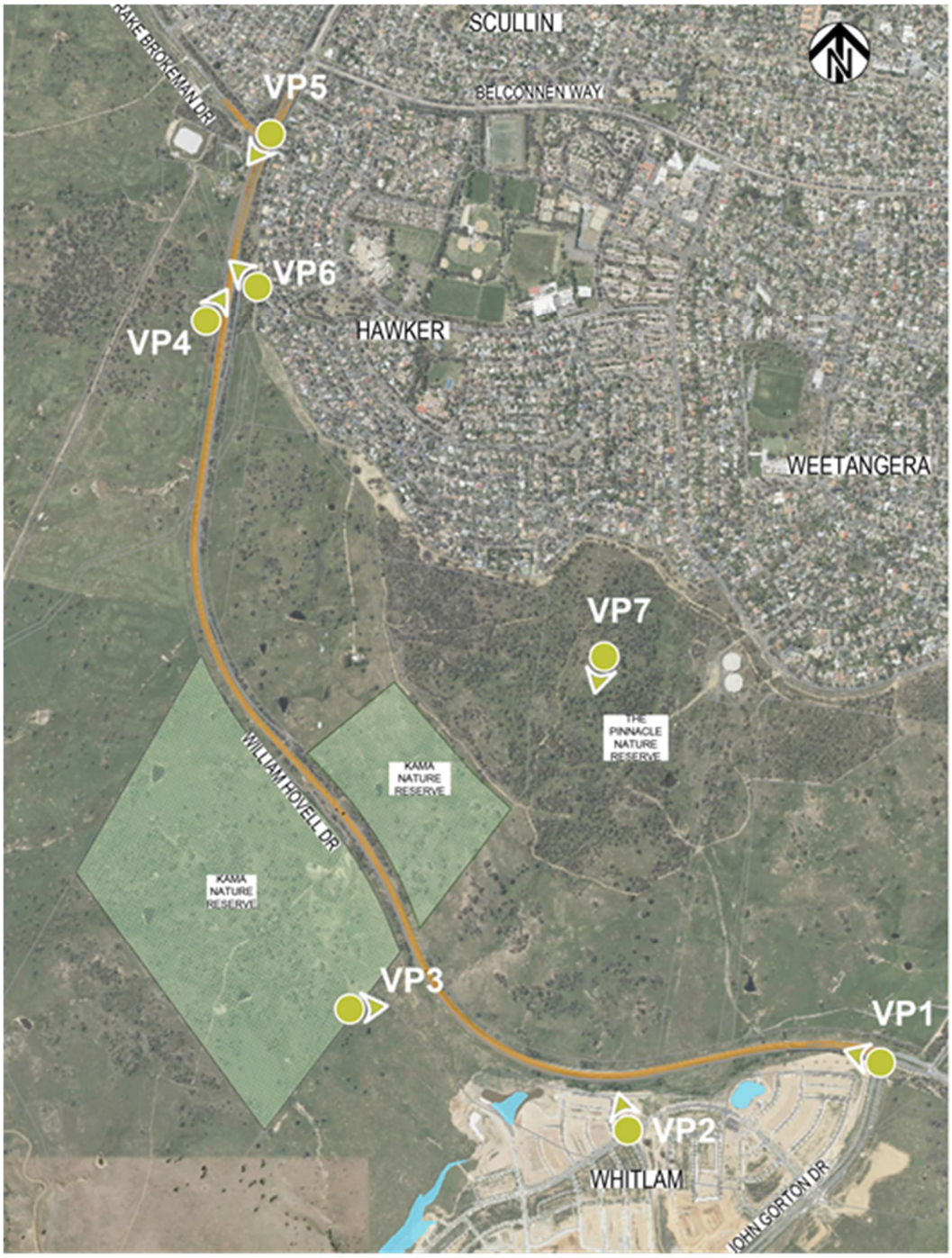


Figure 5-18 Viewpoint locations plan

Table 5-41 Representative Viewpoint Assessments

Viewpoint	Visual Sensitivity	Magnitude of Visual Change	Visual Impact
Viewpoint 01 Intersection of John Gorton Drive and WHD	View towards the west from John Gorton Drive and WHD intersection. The view is dominated by existing roadways, roadside vegetation and traffic signals and signages. The Project elements visible from this viewpoint will include shared user path and widened verge along the northbound lanes. This viewpoint is considered to be of up to **Low** visual sensitivity.	Although the Project will be visible from this viewpoint, it is situated within the existing road corridors, and adjacent to a new residential site (Whitlam) under development. Built elements within the landscape dominate the immediate surroundings. The magnitude of visual change for this viewpoint has been assessed as **Low**.	This viewpoint is within an existing road intersection, and existing built form of the roads in the foreground dominate, therefore the proposed change will be considered a minor feature. The visual impact will be **Low**.
Viewpoint 02 Whitlam new residential	The viewpoint is located in the future residential area of Whitlam and will be experienced by high numbers of local residents who will typically experience this view often. The view is considered representative of the worst-case view of dwellings as well as users of public open space within Whitlam residential development. Overall, this viewpoint is considered to be of up to **High** visual sensitivity.	The Project will be contained within the road reserve and its elevated nature in relation to the residential lots mean the visual change to the road alignment will be considered as barely perceptible. However, the construction of the new retaining walls of various height from 4.3m to 9m along the southern side of the Project will require removal of existing vegetation that currently screen the WHD. The removal of vegetation will open views to the retaining structures. Overall, this View beyond the road corridor is dominated by the rising vegetated landform of The Pinnacle Nature Reserve and Kama Nature Reserve in the background, therefore, the proposed change will form relatively small proportion of the overall view.	The overall potential visual impact from this viewpoint will be **Moderate**.

Viewpoint	Visual Sensitivity	Magnitude of Visual Change	Visual Impact
		The magnitude of visual change for this viewpoint has been assessed as **Low**.	
Viewpoint 03 Eastern boundary of Kama Nature Reserve	Viewed north from the western boundary of the Kama Nature Reserve, the view is considered representative of the worst-case view of users in the Reserve. This view is experienced by a low number of visitors, who are specifically interested on the landscape of the Molonglo Valley and views from this elevated point. The view from Kama Nature Reserve towards north is typically dominated by the elevated landform of The Pinnacle Nature Reserve which reaches the highest point at approximately 705m. WHD is visible in the foreground but relatively a small element within the overall view. Overall, this viewpoint is considered to be of up to **High** visual sensitivity.	From this viewpoint, the WHD is visible. The proposed duplication is contained within the road corridor and therefore will form a relatively small proportion of the overall view. The magnitude of visual change for this viewpoint has been assessed as **Low**.	Although the proposed change will be visible from this viewpoint, it is contained within the road reserve and will be a minor feature. The overall potential visual impact from this viewpoint will be M**oderate**.
Viewpoint 04 Weetangera Cemetery	From this viewpoint, WHD is partially visible through gaps of the existing vegetation that line along the road reserve. In addition, the Cemetery is situated up to 3m higher than the road corridor thus limits direct impact. Due to close proximity, this viewpoint is considered to be of up to **High** visual sensitivity.	The Project will be contained within the road reserve and level difference in relation to the Cemetery means the visual change as the result of the duplication will be considered as minor and will not have a direct impact to the Cemetery. However, the construction of the alignment duplication requires removal of trees therefore will open visibility to the WHD and the retaining walls of various heights from 0.5m to 4.2m along	Although the proposed change will be visible from this viewpoint, it is contained within the road reserve and will be a minor feature. Mitigation measures such as screen planting along the road reserve will greatly reduce any visual impact from this viewpoint. The overall potential visual impact from this viewpoint will be M**oderate**.

Viewpoint	Visual Sensitivity	Magnitude of Visual Change	Visual Impact
		the western side of the Project. The concrete barrier and safety rail behind the retaining walls and located along the same level as the new access road in the foreground will be fully visible to this view. To mitigate this, screen planting is recommended along the locations where existing vegetation will be removed and where possible, between the concrete barrier and access road and shared path. The magnitude of visual change for this viewpoint has been assessed as **Medium**.	
Viewpoint 05 Intersection of DBD and Kingsford Smith Drive.	This view is experienced by path users and road users who are likely to be transient and with limited interest in their surroundings. Overall, this viewpoint is considered to be of up to **Low** visual sensitivity.	From this viewpoint the Project is highly visible due to its close proximity. The view is dominated by existing roadways and vegetated woodland. As the proposed change will occur within the existing road corridor, the new alignment and new retaining walls will form less discernible elements and will integrate into the view. The magnitude of visual change for this viewpoint has been assessed as **Low**.	Although the Project will be visible from this viewpoint, it is contained within the road reserve and integrates into the existing viewed landscape of a roadway, as a result, the proposed alignment will be a minor feature. Overall, the potential visual impact from this viewpoint will be **Low**.

Viewpoint	Visual Sensitivity	Magnitude of Visual Change	Visual Impact
Viewpoint 06 Hawker residential and The Bicentennial National Trail	This view is from the residences in Hawker looking west towards the Project. The view is considered representative of the worst-case view of residences located west of Hawker. Other users including local residents of the areas, those using Bicentennial National Trail and accessing The Pinnacle Nature Reserve often, therefore have a familiarity with this view. The foreground and midground are the existing vegetation that lines the eastern boundary of the WHD, forming a continuous screen to views beyond. Furthermore, due to the level differences the existing road corridor is not visible from this viewpoint. Overall, this viewpoint is considered to be of up to **High** visual sensitivity.	Due to close proximity from this viewpoint, the new shared user path that deviates from the existing path alignment runs through the existing vegetation in the foreground will be partially visible. The construction of the shared user path requires removal of trees therefore will open some visibility towards the proposed change. To mitigate this, planting of new evergreen trees has been proposed along the locations where existing trees will be removed. The proposed duplication of the road alignment will be contained in the current elevation will therefore remain not visible from this viewpoint. The magnitude of visual change for this viewpoint has been assessed as **Low**.	From this location it is likely the Project's new shared user path will be partially visible through gaps in the existing vegetation. This combined with the mitigation measure to replant trees to offset tree removal, and the proposed duplication of the WHD alignment remained in the current elevation, will mean the proposed change will not be sufficient to alter the character of the view. The overall visual impact will be **Moderate**.
Viewpoint 07 The Pinnacle Nature Reserve	View south from The Pinnacle Lookout at the highest point of the reserve, this view is experienced by a low number of visitors to the Reserve, specifically focused on the landscape and views from this elevated point. Networks of gravel paths which are also part of the Bicentennial National Trail provide walkers and cyclists access to different points of the reserve. The most sensitive visual receptors are expected to be local residents who will use the reserve and the	From this viewpoint, the majority of the WHD is not visible except for the intersection of Copping Crossing Road to the left of this view. Only small parts of the Project will be visible from various locations of the trail due to the landform and groups of matured trees that limit views to the road corridors. Overall, the magnitude of visual change from this viewpoint is considered to	Due to limited or no visibility from The Pinnacle Nature Reserve, the overall potential visual impact will be N**egligible to Low.**

Viewpoint	Visual Sensitivity	Magnitude of Visual Change	Visual Impact
	trails often, therefore have a familiarity with this view. Viewer distance to the WHD range from 0.5km to 1.5km. Overall, this viewpoint is considered to be of up to **High** visual sensitivity.	be a **barely perceptible change**.	

5.8.2.2 Representative Viewpoints

A one-day site visit was undertaken on 24 March 2021 and attended by two landscape architects.

During the site visit the representative viewpoints were confirmed and an assessment was made of each potential representative public viewpoint against the known extent of the proposed development.

The resultant identified viewpoints are considered to be representative of:

- The variety of landscape types within the Study Area
- The range of public views and the types of viewers likely to be affected by the Project.

It is important to note that viewpoints for this visual impact study have been taken only from accessible public land. Once the viewpoint had been selected, panoramic photographs were taken at eye level from the viewpoints toward the Project Site. Photographs were taken with a digital SLR camera through a 50mm lens to best represent the perspective of the human eye. The visual impact of the viewpoint was then assessed both onsite and with the topographic and aerial information to ensure accuracy. Viewpoint photographs and each simulated view showing indicative extent of the proposed alignment have been included below (refer Figure 5-19 to Figure 5-32). The findings of the viewpoint analysis have been quantified and are summarised in Table 5-41.



Figure 5-19 Viewpoint 1: Existing View



Figure 5-20 Viewpoint 1: Simulated View (Mitigation measure not shown)



Figure 5-21 Viewpoint 2: Existing View



Figure 5-22 Viewpoint 2: Simulated View (Mitigation measure not shown)



Figure 5-23 Viewpoint 3: Existing View



Figure 5-24 Viewpoint 3: Simulated View (Mitigation measure not shown)



Figure 5-25 Viewpoint 4: Existing View

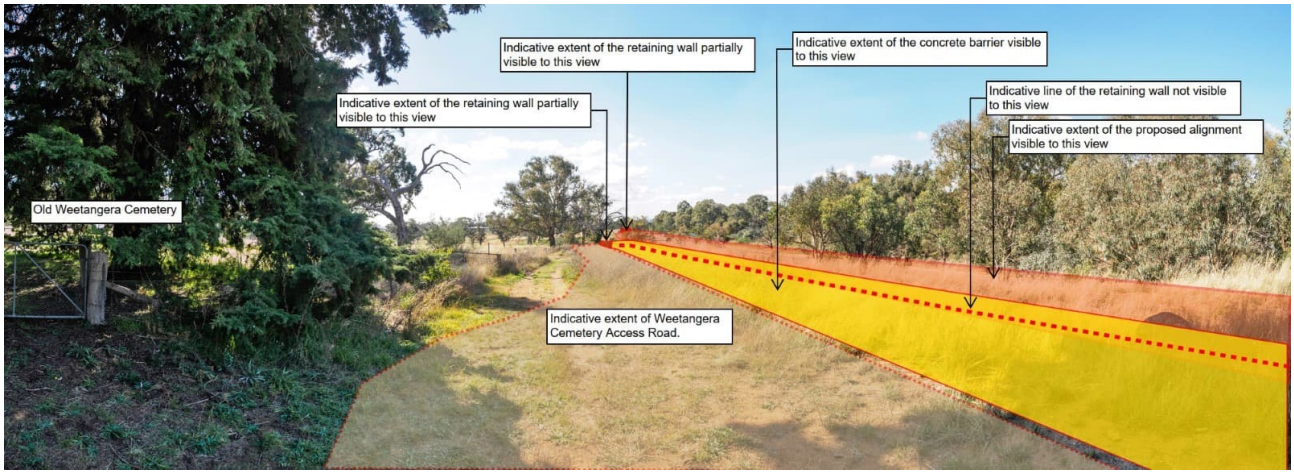


Figure 5-26 Viewpoint 4: Simulated View (Mitigation measure not shown)



Figure 5-27 Viewpoint 5: Existing View

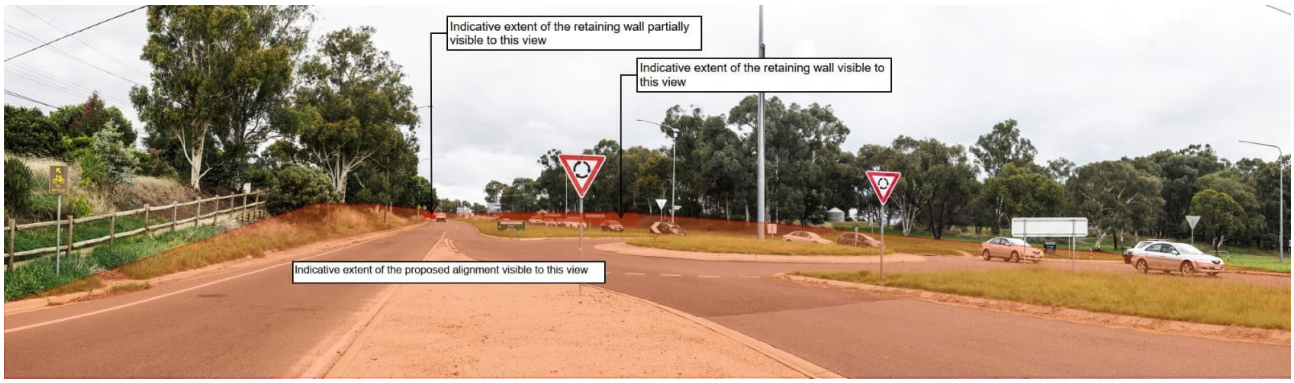


Figure 5-28 Viewpoint 5: Simulated View



Figure 5-29 Viewpoint 6: Existing View



Figure 5-30 Viewpoint 6: Simulated View (Mitigation measure not shown)



Figure 5-31 Viewpoint 7: Existing View



Figure 5-32 Viewpoint 7: Simulated View

5.8.3 Impacts

As previously identified, it is anticipated that the overall visual impacts of the Project will range from Low to Moderate for the landscape character and surrounding visual receiver locations. If required, mitigation measures will be considered during design development and construction planning to minimise the level of visual impact of the construction and operation phases of the Project.

5.8.4 Mitigations

Measures to mitigate visual impacts during construction will be included in a CEMP for the Project and will include measures such as minimising light spill during night works, screening of compound areas and minimising tree removal.

It is recommended that landscaped screening be established in the road reserve alongside the Weetangera Cemetery to screen the heritage site from view from the road. The intent of the screening will be to minimise incidental public visitation and vandalism, in accordance with the recommendations of the CHA prepared by Past Traces (Past Traces, 2018). It is also recommended to establish a row of planting between the access road and concrete barrier which would be fully visible to the Cemetery to minimise visual impact.

The Project requires the construction of several retaining walls to minimise batter areas and the extent of clearing required. A total of eight retaining walls are required along the length of the Project, ranging in height from 0.5m to 9.5m. The largest retaining wall is adjacent to Whitlam and is required due to the fill required to duplicate the road. TCCS is exploring options for the colour and material selection for the retaining wall to minimise visual impact. Three retaining walls adjacent to the Cemetery access road and shared user path between the Cemetery and DBD would be partially visible from the Cemetery. Mitigation measures such as screen planting along the road reserve should reduce any visual impact from this viewpoint.

Table 5-42 below sets out the proposed mitigation measures to manage the potential landscape and visual impacts of the Project.

Table 5-42 Landscape and visual mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Visual impacts during and following construction	Undertake a Visual and Landscape Assessment during design to anticipate / understand impact on sensitive receivers	High	Design	TCCS
Visual impacts to sensitive receivers during operation	Develop and implement industry best practice CEMP which includes rehabilitation/ landscaping plan. Plan for early establishment of landscaping features as described in detailed designs.			

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	Erect fences and other barricades around construction site such that they reduce the visual impacts of the construction phase.			
Views available to occupants of nearby sensitive receivers are altered	Long term maintenance (and replacement as necessary) of tree planting within the Project Site to maintain visual filtering and screening of external views.	High	Construction and Operation	TCCS
Species planted as part of the Project are inappropriate for landscape and impact on amenity of open spaces	A Landscape Plan to identify appropriate species to be planted as part of the Project to minimise the visual impact on amenity of open spaces. Ensure selected species do not compete with native vegetation or cast an additional shadow on sensitive areas	Moderate	Design and Construction	TCCS
Public comment period of EIS raises significant issues that delay release of the final EIS report	Keep stakeholders up to date as Project progresses.	Moderate	Design and Construction	TCCS
Increased media attention and political interest affect the community interest or perceptions of the Project in general				TCCS
Development is not consistent with values of retained heritage sites, or areas of natural environmental value	Consider the Conservation Management Plan and its recommendations throughout the design phase	Moderate	Design and Construction	TCCS

5.8.5 Residual risk

Based on the mitigation measures identified in Section 5.8.4 an assessment of the residual risks associated with the Project has been considered. Table 5-43 below sets out the residual risk assessment of the Project's potential landscape and visual impacts.

Table 5-43 Landscape and visual residual risk assessment

Risk (as per Chapter 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
Visual impacts during and following construction	Very Low	Unlikely	Minimal	Negligible
Views available to occupants of nearby sensitive receivers are altered	Very Low	Unlikely	Minimal	Negligible
Species planted as part of the Project are inappropriate for landscape and impact on amenity of open spaces	Medium	Unlikely	Minor	Very Low
Development is not consistent with values of retained heritage sites, or areas of natural environmental value	High	Possible	Minor	Low
Development impacts on recreational use/users of the area – Bicentennial Nature Trail	High	Possible	Minor	Low
Scoping Document risks identified				
Visual impacts to sensitive receivers during operation	Medium	Possible	Minor	Low

5.9 Materials and waste

Section 5.9 provides an assessment of potential materials and waste impacts as identified in the Scoping Document, including how construction waste will be managed, including disposal to landfill.

5.9.1 Environmental conditions and values

Resource use and waste impacts due to the Project has been assessed qualitatively by reviewing the likely waste and resource streams during construction and operation and consideration for the ACT Waste Management Strategy 2011-25 (Environment and Sustainable Development Directorate, 2011a).

A desktop assessment of materials and waste management identified options for avoiding, mitigating and managing major waste streams in accordance with the waste hierarchy.

5.9.2 Investigations

Resource use and waste impacts due to the Project has been assessed qualitatively by reviewing the likely waste and resource streams during construction and operation and applying the waste hierarchy.

5.9.3 Impacts

Potential construction wastes associated with the Project include:

- Asphalt from the existing road
- Excess spoil unsuitable for reuse onsite
- Cleared vegetation
- General garbage and refuse

- Waste associated with maintenance of construction vehicles and plant, including liquid waste and any onsite spillage of fuels or oils.

Waste associated with construction will be appropriately managed, classified (as necessary) and disposed in accordance with a Waste Management Plan to be incorporated into the CEMP. Safeguards will be implemented through the CEMP to avoid and minimise disturbance to the environment as a result of construction of the Project.

The Project Site has undergone widespread disturbance as a result of the original construction of WHD in the 1980s. Fill mounds are present within the road reserve, which are likely a result of cut undertaken during construction, and there is a potential for previous importation of fill material of unknown origin. As such, the reuse of soil within the Project will need to be assessed during the construction phase to ensure compliance with ACT soil classification requirements.

Surplus excavated material generated from site works or material deemed unsuitable for onsite reuse will likely be disposed of offsite at an appropriately licenced facility and in accordance with the ***Information Sheet 4 - Requirements for the reuse and disposal of contaminated soil in the ACT*** (EPA, 2019).

5.9.4 Mitigation

The following mitigation measures will be undertaken to reduce impacts of the Project on materials and waste:

- A Waste Management Plan will be prepared and incorporated into the CEMP to advise the appropriate management of expected waste streams. Resource management options for the Project must be considered against a hierarchy of the following order in accordance with the ACT Waste Management Strategy 2011-25 (Environment and Sustainable Development Directorate, 2011a):
    - Reduce waste generation
    - Reuse goods and material
    - Recycle material into new products
    - Recover energy from suitable sorted materials
    - Dispose to landfill (last resort)
- Consideration will be given for use of recycled materials onsite where possible
- Cleared vegetation free of weeds will be mulched and reused onsite in landscaped areas where possible
- Adequate spill prevention and containment measures will be used when refuelling equipment onsite
- All oils, chemicals and wastes will be managed in a manner that minimises the risks of spills to the environment and having in place appropriate contingency plans in the event of a spill
- Waste will be segregated according to its origin allowing separate assessments to be made. All waste will be stored in separate clearly labelled containers or stockpiles. Each waste container and stockpile will be numbered and labelled as appropriate for the material and stored in a designated waste zone on the Project Site
- Any excavated material must be temporarily stored in a bunded area or with appropriate environmental controls in place to prevent runoff of contaminants into surrounding areas
- All soils requiring offsite disposal, including unexpected finds, are to be characterised in accordance with the ACT EPA ***Information Sheet 4 - Requirements for the reuse and disposal of contaminated soil in the ACT*** and to an appropriately licensed facility
- All contaminated wastes require tracking and will be transported by an appropriately licensed waste transport company
- Waste materials are to be removed from the construction site regularly before receptacles or holding areas reach capacity.

Table 5-44 below sets out the proposed mitigation measures to manage the potential materials and waste impacts of the Project.

Table 5-44 Materials and waste mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Waste materials produced during construction of the Project not stored or managed effectively	Storing of hazardous materials required for the operation and maintenance of the Project in accordance with relevant ACT EPA guidelines and use of an appropriately licensed contractor to remove contaminated waste, under current ACT EPA Guidelines.	High	Construction	EPA
Excessive resources used in the construction of the Project	Investigate opportunities to re-use or recycle other construction and demolition waste, and apply the waste hierarchy (avoid, minimise, re-use/recycle, dispose) throughout construction.	Moderate	Design and Construction	EPA
Increase in waste to landfill during construction	Investigate opportunities to re-use or recycle other construction and demolition waste, and apply the waste hierarchy (avoid, minimise, re-use/recycle, dispose) throughout construction.	Moderate	Design and Construction	EPA

5.9.5 Residual risk

Based on the mitigation measures identified in Section 5.9.4, an assessment of the residual risks associated with the Project has been considered. Table 5-45 below sets out the residual risk assessment of the Project's materials and waste impacts.

Table 5-45 Materials and waste residual risk assessment

Risk (as per Chapter 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
Waste materials produced during the construction of the Project were not stored or managed effectively	High	Unlikely	Minor	Very Low
Excessive resources used in the construction of the Project	Very Low	Possible	Minor	Low
Scoping Document risks identified				
Increase in waste to landfill during construction	High	Likely	Minimal	Low

5.10 Climate Change

This Section 5.10 describes the potential impacts the Project may have on climate change. The Project is required to consider the potential for climate change vulnerability during construction and operation. Given the relatively small scale of the Project, it is unlikely climate change impacts associated with construction and operation will be significant or widespread. Nevertheless, the Scoping Document requirements as follows have been considered:

> ***The EIS must include information on how the proposal will reduce the risks from climate change impacts and include proposed adaptation measures to reduce vulnerability and increase resilience of the community and the Territory, particularly the extreme events of heatwaves, droughts, storms with flash flooding and bushfires. The information must address impacts on the local microclimate and how it will avoid contribution to urban heat and positively contribute to urban cooling measures.***
>
> ***Additionally, the EIS must address the contribution the proposal will make to reducing greenhouse gas emissions and meeting the legislated target for a net zero emissions Territory (by 2045 at the latest).***
>
> ***Preparation of the EIS must consider the relevant sections of the following ACT Government policies:***
>
> - ***ACT Climate Change Strategy 2019-2025***
> - ***Canberra's Living Infrastructure Plan: Cooling the City.***

This Section 5.10 therefore provides a high-level assessment of the GHG emissions associated with the Project. The scope of this assessment includes the estimation of GHG emissions from typical operation of the Project, including fuel consumption from vehicles using the road and electricity consumption from road assets. The GHG emissions have been calculated out to 2045, the year when the ACT Government has committed to having net zero GHG emissions.

Due to the high-level and preliminary nature of this GHG assessment and the limited available data, GHG emissions attributed to the following sources have been excluded:

- Construction related GHG emissions such as:
  - Fuel usage in construction vehicle fleet
  - Embedded emissions within construction materials
  - Fuel used to produce electricity
  - Consumption of electricity
  - Construction workers travel emissions
- Operational related GHG emissions such as:
  - Fuel usage in road maintenance vehicles
  - Fuel usage for emergency power generation
  - Maintenance staff travel emissions.

5.10.1 Environmental conditions and values

There is a need to ensure the design of the Project is adaptive to changes in climate and to understand the limitations (if any) of the adaptation. The effects of climate on the Canberra region can be assessed in terms of weather changes, storm intensity, flooding and increased risk of fire. Climate change could lead to an increase in the intensity of rainfall events and more frequent flooding.

5.10.2 Investigations

The 'greenhouse effect' refers to the natural process whereby gases in the atmosphere cause warming of the Earth's surface. The GHGs in the atmosphere absorb solar radiation released by the Earth's surface and then radiate some heat back towards the ground, increasing the surface temperature. Human activity, especially burning fossil fuels and deforestation, is increasing the concentration of GHGs in the atmosphere and hence

increasing the absorption of outgoing heat energy. Even a small increase in long-term average surface temperatures has numerous direct and indirect consequences for climate change.

The main GHG, in terms of emissions, is carbon dioxide (CO_2) but other gases such as sulphur hexafluoride (SF6), methane (CH_4) and nitrous oxide (N_2O) have the same warming effect. These gases vary in effect and longevity in the atmosphere.

A parameter referred to as the Global Warming Potential (GWP) allows each gas to be described in terms of CO_2 (the most prevalent GHG). Thus, a given quantity of CH_4, N_2O or SF6 can be expressed in terms of carbon dioxide equivalents (CO_2-e). A unit of one tonne of CO_2-e is the basic unit used in carbon accounting. In simple terms, the GHG emissions associated with a project can be expressed as the sum of the emission rate of each GHG multiplied by its associated GWP. For example:

$$\textbf{tonnes CO2-e = tonnes } CO_2^{(x\ 1)} \textbf{ + tonnes } SF6^{(x\ 22{,}600)} \textbf{ + tonnes } CH_4^{(x\ 25)} \textbf{ + tonnes } N_2O^{(x\ 310)}$$

The emissions of GHGs is governed internationally through panels, frameworks and agreements including the Intergovernmental Panel on Climate Change, United Nations Framework Convention on Climate Change, the Kyoto Protocol and the Paris Agreement.

Australia ratified the Paris Agreement in November 2016 with a target to reduce its Nationally Determined Contribution (NDC) GHG emissions by 26-28 per cent below 2005 levels by the year 2030. In 2021, prior to COP26 in Glasgow, Australia reaffirmed its NDC under the Paris Agreement as follows:

- Economy-wide target to reduce greenhouse emissions to by 26-28% below 2005 levels by 2030
- Adopt a target of net zero emissions by 2050. This is an economy-wide target, covering all sectors and gases included in Australia's national inventory.

Further to Australia's adoption of net zero emissions by 2050, the ACT Government has committed to achieving net zero emissions by 2045.

Further information about the ACT Climate Change Strategy 2019-2025 (ACT Government, 2019c) and ***Canberra's Living Infrastructure Plan: Cooling the City*** (ACT Government, 2019c) is provided within Section 3.2 above. The report ***Mapping surface urban heat in Canberra*** (CSIRO, 2017) was also reviewed. This shows that the land immediately adjacent to the existing WHD corridor tends to be 4-11°C above the average temperature compared to its surroundings. This can be largely attributed to the extensive, surrounding grassland habitat, as well as the WHD corridor itself.

5.10.3 Impacts

5.10.3.1 Greenhouse gas emissions

An increase in GHG emissions, primarily carbon dioxide, will be expected during construction of the Project due to exhaust emissions from construction machinery and vehicles transporting materials and personnel to and from the construction work area.

Given the relatively small scale of the Project and the short-term temporary nature of the construction works, it is considered that GHG emissions resulting from the construction of the Project will be minimal.

Annual GHG emissions have been calculated out to 2045 using literature based GHG emission factors. GHG emission sources considered in this assessment are the exhausts of vehicles using the 14km stretch of road. Electricity in the ACT is now provided by 100% renewable sources, therefore any electricity used by the Project does not result in GHG emissions.

Annual traffic volume in 2022 for the Project is predicted to be 6.8 million vehicles. A growth factor of 1% per annum out to 2045 has been assumed. This results in an annual traffic volume of 8.2 million vehicles by 2045. In order to calculate the annual GHG emissions attributable to vehicles using the Project, the following data on vehicle fleet composition was acquired from the traffic count study:

- Cars – 95.2%

- Light commercial vehicles (LCV) – 3.6%
- Rigid trucks – 0.6%
- Buses – 0.6%

For 2022, all vehicles were assumed to run on petrol fuel (cars) and diesel (LCV, rigid trucks and buses). However, research has projected that by the year 2031, approximately half of the vehicles (50%) could be electric vehicles, with zero GHG emissions. A linear EV uptake factor has been applied between 2022-2031. Between 2032 and 2045 a linear uptake factor to achieve 100% EVs has been assumed.

Table 5-46 shows the GHG emission factors used in this assessment and

Figure 5-33 shows the annual traffic numbers broken down by fleet composition.

Figure 5-34 details the annual GHG emissions estimated for the Project out to 2045. The data shows:

- Total GHG emissions to 2045 are estimated to be **304,438 t CO_2-e**
- Annual GHG emissions are highest in 2022 at **24,566 t CO_2e** and reduce to zero in 2045
- Petrol cars are the main contributor to GHG emissions. Focusing on replacing petrol cars with EVs will help to reduce GHG emissions in the short term.

Table 5-46 GHG emission factors

GHG Emission Source	Emissions Factor (g CO_2-e/litre)	Fuel Consumption (litres/100km)	Reference
Cars – petrol	2,282.399	11	1
Cars - EV	0	0	2
LCV	2,282.634	12.8	1
Rigid truck	2,671.246	28.6	1
Buses	2,671.264	27.8	1

[1] ***Australian Transport Assessment and Planning***

[2] ***Electric Vehicle Council, State of Electric Vehicles, August 2020***

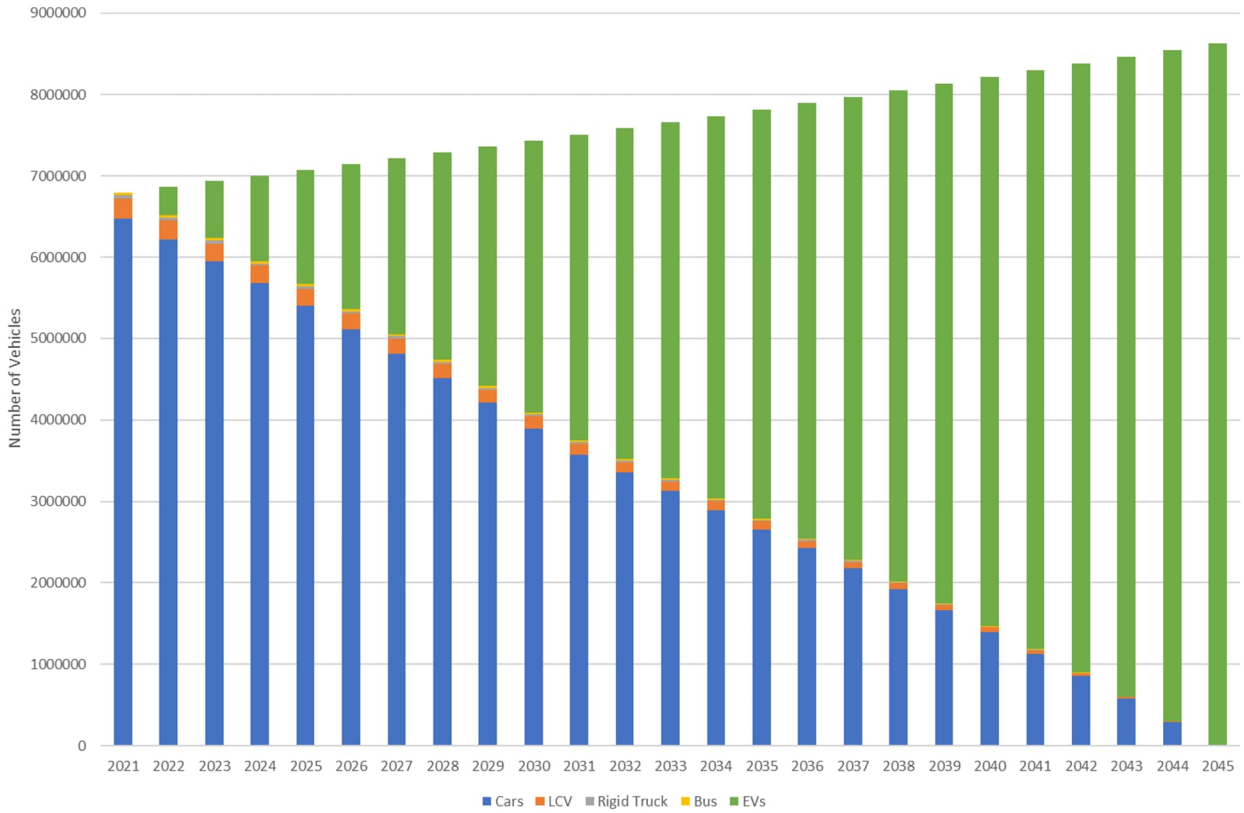


Figure 5-33 Annual vehicle numbers for the Project

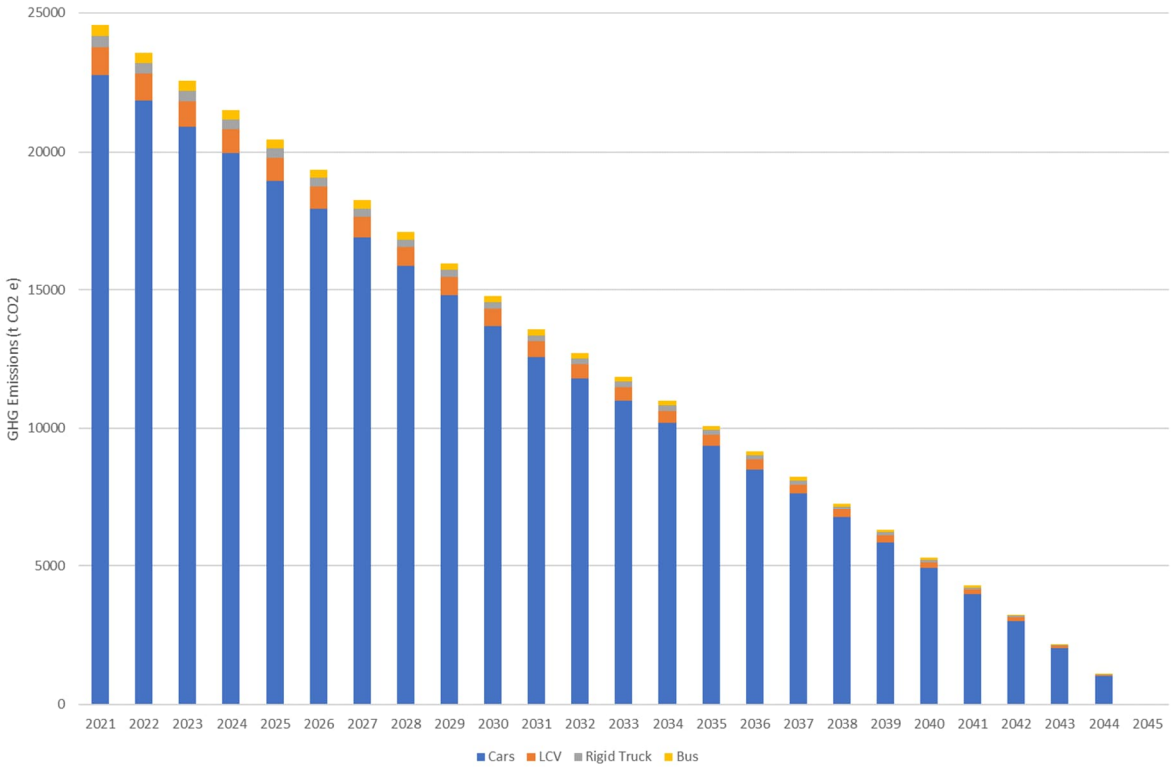


Figure 5-34 Annual GHG emissions estimated for the Project

5.10.3.2 Climate change

Climate change projections are published by the NSW Office of Environment and Heritage (2014) through the NSW and ACT Regional Climate Modelling (NARCliM) project for years 2030 and 2070 (NSW Department of

Planning, Industry and Environment, 2021). These represent the years for which the majority of climate change models apply, and therefore the years for which the most reliable climate projections are available. As the Project has a long design life, climate change impacts have been considered for both 2030 and 2070.

Predicted future conditions are provided in Table 5-47 below as per the Australian Capital Territory Climate Change Snapshot (NSW Office of Environment and Heritage, 2014). The following provides a summary of the climatic changes that are considered likely to affect the Project.

Table 5-47 Summary of predicted changes for the ACT

Variable	Current Conditions	Change by 2030	Change by 2070
Annual maximum temperatures	Average 26 to 28°C	+ 0.5 to + 1.0°C	+1.5 to + 2.5°C
Annual minimum temperatures	Average 2 to 4°C	+0.5 to + 1.0°C	+ 1.5 to + 2.0°C
Number of hot days per year - maximum temperatures above 35°C	10	+ 1 to + 5	+ 10 to + 20
Number of cold nights per year - minimum temperatures below 2°C	70 to 90	-20 to -10	-30 to -20
Rainfall	Average annual 400–800mm between 100–300mm each season	Summer (0% to +5%) Autumn (+5% to +10%) Winter (-5% to +0%) Spring (-10% to -5%)	Summer (+10% to +20%) Autumn (+5% to +20%) Winter (-5% to 0%) Spring (-10% to -5%)
Average daily Forest Fire Danger Index (FFDI)	Summer (11.4) Autumn (7.2) Winter (2.6) Spring (6.4)	Summer (+0.5 to +1.0) Autumn (-0.5 to -<0) Winter (>0 to +0.5) Spring (+0.5 to +1.0)	Summer (+0.5 to +1.0) Autumn (>0 to +0.5) Winter (>0 to +0.5) Spring (+1.0 to +1.5)
Severe fire weather days (FFDI above 50)	Summer (0.8) Autumn (0.2) Winter (0.0) Spring (0.2)	Summer (>0 to +0.5) Autumn (-0.5 to -<0) Winter (0.0) Spring (>0 to +0.5)	The magnitude of change is not yet known

Once operational, the WHD duplication will tie in with the existing road network with a new signalised intersection at DBD. The duplication will enhance traffic flow and relieve congestion, vehicle idling, and start and stop traffic patterns which can lead to increased vehicle emissions as a result of inefficient vehicle movement.

Expansion of the WHD road corridor will also contribute to localised urban heat island effect, as is already recognised for the broader locality under ***Mapping surface urban heat in Canberra*** (CSIRO, 2017) (due to existing grasslands and the existing WHD road corridor). The Project has committed to tree and shrub replacement ratios of 1:10 and 1:4 respectively. In addition, landscaping plans for the Project will consider the use of lighter colours in delivering hard infrastructure components of the Project where reasonable and feasible to do so, and where road safety/legibility will not be compromised.

5.10.4 Mitigation

By enhancing the potential future options for private journeys to be taken as active transport into Civic through the provision of additional shared pathways, the Project could also, in future, lead to a small, beneficial impact on the ACT's overall emissions as the residential population in this part of the Territory increases.

Works associated with the Project will remove up to 19.85ha of vegetation, 6.49ha of which has been assessed as native. However, the Project proposes to provide an offset against the loss of BGW TEC habitat by protection

of land to the west of Kama Nature Reserve which will preserve nesting habitat for Superb Parrot and retain old growth trees and native grassland understorey.

Revegetation and rehabilitation will be undertaken during the Project and include:

- Prior to revegetation works excavated or disturbed areas to be rehabilitated so that material is reinstated in original sequence i.e., topsoil at surface and subsoil below
- All areas of disturbance must be revegetated immediately following construction
- Revegetation is to be undertaken using a cover crop of sterile Rye Grass to ensure that rapid stabilisation occurs
- A suite of suitable local native species will be used in conjunction with the Rye Grass cover crop. The seed mix will be a locally collected species mix including four species.

To mitigate these impacts, it is proposed to plant new evergreen trees alongside the locations where existing trees will be removed. Indeed, where possible, established trees will be retained to provide landscape screening. A schedule of additional plantings will therefore be provided to soften the impact on the predominantly rural landscape.

Table 5-48 below sets out the proposed mitigation measures to manage the potential materials and waste impacts of the Project.

Table 5-48 Climate change mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Greenhouse gas emissions from vehicles and machinery working.	Detailed Design and CEMP are to take into account efficient vehicular movements in designing construction methodology and managing these impacts during the construction stage of the Project.	High	Design and Pre-construction and Construction	TCCS
More regular Inspection of road surface and associated infrastructure required	Maintenance inspection/requirements and working procedures to consider increase in heat and extreme climate events and use of energy and fuel-efficient vehicles.	High	Pre-construction and Construction	TCCS
Greenhouse gas emissions from construction and operation contributing to climate change	Construction plant and equipment to consider energy and fuel efficiency to minimise greenhouse gas emissions. Site compounds to consider solar panels instead of non-renewable energy. Consider 'green' travel for construction staff.	High	Pre-construction and Construction	TCCS
Urban heat island effect for areas of cleared vegetation at the Project Site.	To mitigate these impacts, it is proposed to plant new evergreen trees alongside the locations where existing trees will be removed. Indeed, where possible, established trees will be retained to provide landscape screening. A schedule of additional plantings will therefore be	Moderate	Post construction	Conservator of Flora and Fauna

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	provided to soften the impact on the predominantly rural landscape. Native, mature trees removed as a result of the Project will be replaced at a ratio of 1:10. Native shrubs removed as a result of the Project will be replaced at a ratio of 1:4. The locations of these plantings must be considered as part of the landscaping and offset plans prepared for the Project. Proposed landscaping trees will either be ***Casuarina Cunninghamiana***, or one of six x different species of Eucalyptus. Landscaping plans for the Project will consider the use of lighter colours in delivering hard infrastructure components of the Project where reasonable and feasible to do so, and where road safety/legibility will not be compromise.			

5.10.5 Residual risk

Based on the mitigation measures identified in Section 5.10.4, an assessment of the residual risks associated with the Project has been considered. Table 5-49 below sets out the residual risk assessment of the Project's climate change impacts.

Table 5-49 Climate change residual risk assessment

Risk (as per Chapter 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
Greenhouse gas emissions from vehicles and machinery working	Very High	Likely	Minimal	Low
More regular Inspection of road surface and associated infrastructure required	High	Likely	Minimal	Low
Scoping Document risks identified				
Greenhouse gas emissions from construction and operation contributing to climate change	Medium	Likely	Minimal	Low
Increased impervious surfaces, adding to the urban heat island effect.	Medium	Likely	Minimal	Low

5.11 Socio-economic and health

Section 5.11 provides an assessment of potential socio-economic and health impacts as identified in the Scoping Document, including:

- Describe the impact on recreational users of the surrounding areas, including but not limited to the Bicentennial National Trail and adjacent open spaces and nature reserves
- Provide details of any potential contaminants that may pose health risks to workers during construction.

5.11.1 Environmental conditions

A review of the demographics of the Study Area and its surrounds has been undertaken to inform this EIS. The population of the ACT as at the 2016 census was 396,857 (ABS, 2017) and is projected to be 500,000 by 2033. As shown in Table 5-50 below, the total population of the district of Belconnen in 2018 was 98,740 and the population of the Molonglo was 5,847 (ACT Government, 2018a). Both districts are expected to experience significant growth in population with Molonglo projected to increase in population to 51,400 by 2041 (ACT Government, 2018a).

The median age for Belconnen and Molonglo is 34 and 30 respectively, which indicates these areas contain young families and young professionals

Table 5-50 Population overview (ACT Planning Strategy (ACT Government, 2018a))

Demographic	Belconnen	Molonglo
Population in 2017	98,740	5,847
Projected Population in 2041	128,000	51,400
Median Age (2016 Census)	34	30
Employment	30,207 (12.85% of ACT share)	342 (0.15% of ACT share)
Low Density housing %	71	39
Medium Density housing %	17	25
Higher Density Housing %	12	36
People per household %	2.6	2.5
Private dwellings - % of urban share	24.1	1.2

5.11.2 Investigations

A desktop assessment has been undertaken and is summarised in this Section 5.11 of the EIS.

5.11.3 Impacts

The immediate area of impact is typically considered to be any property or neighbouring property that is impacted by the development of a project. For the current Project, this will include existing residential areas of Higgins, Weetangera and Holt and the future suburb of Whitlam. Direct impacts could include the acquisition, use of land or placement of site infrastructure on adjoining properties. In the case of this Project, no acquisition of land is proposed as all works, including construction, are to be contained to the road reserve.

Indirect impacts will be experienced by residents in properties adjoining the road reserve, who may experience construction and operational impacts such as noise, air quality or visual impacts. Consideration of the potential social and economic impacts will be undertaken as part of this EIS, with potential impacts provided with appropriate mitigation measures. It is also important to note that there are economic benefits associated with the Project due to increased road capacity that will reduce road congestion.

Access to surrounding areas utilised for recreational purposes including Bicentennial National Trail, The Pinnacle and Kama Nature Reserves, the Weetangera Cemetery and adjacent open spaces will experience some

temporary impacts to access during the construction of the Project. The construction contractor will be tasked with scheduling construction tasks so as to minimise these disruptions where reasonable and feasible to do so.

Contaminants associated with areas of environmental concern in a Preliminary Site Investigation and summarised by WSP (WSP, 2018) including fill of unknown origin, sheep dips, UXO, a historical municipal landfill and a pindone bait burial pit. Further assessment of the identified areas of environmental concern will be undertaken to inform any remedial requirements prior to commencement of construction.

Potential exposure to contaminants during construction may be associated with potential unexpected finds, exposure to any hazardous materials required for the construction of the roadway and fuel and oils required for maintenance of construction vehicles and plant.

5.11.3.1 Sensitive receivers

Table 5-51 below identifies the sensitive receivers which may be impacted by the Project.

Table 5-51 Summary of sensitive receivers

Type of sensitive receivers	Comments
Local residents	The closest residential receivers to the Project are: Single and two storey residences in Hawker in Andado Place, Florina Place, Kurundi Place and Mainoru Place are located approximately 30m at the nearest point of DBD intersection. The Project does not traverse any residential areas or private residential properties that require acquisition or relocation. Other users of the Study Area include: Pedestrians and cyclists (on- and off-road) Bicentennial Track users (pedestrians, hikers and horse riders) Road users (motorists, cyclists, emergency services etc).
Local businesses	There are no local businesses located adjacent to the Study Area. The closest local centre is Hawker Local shops - approximately 1.5km from the Project.
Government institutions	Key government institutions near the Study Area include: Molonglo Brigade ACT Rural Fire Station (located on DBD).
Religious and community centres	The closest religious centres are located in the suburb of Hawker: Capital Bible Church – approximately 700m from project Anglican Christ Church Hawker – approximately 1.5km from Project.
Educational and childcare facilities	There are three educational facilities within 2km of the Study Area: Hawker Primary School – approximately 700m from the Project Hawker College – approximately 500m from the Project Weetangera Primary School – approximately 2km from the Project. There are no childcare facilities near the Study Area.
Other sensitive receivers	Mt Stromlo Observatory – approximately 8km south of the Project.

5.11.4 Mitigation

The following will be undertaken to reduce risk of workers during construction:

- Preparation and implementation of an unexpected finds protocol will be undertaken,
- A Waste Management Plan will be prepared to outline management for stockpiled contaminated materials
- Use of an appropriately licensed contractor to remove contaminated waste under current ACT EPA Guidelines
- Storing of hazardous materials required for the operation and maintenance of the Project will be done in accordance with relevant ACT EPA guidelines
- Dust suppression.

Overall, there are positive socio-economic impacts as a result of the Project as it provides the West Belconnen and Molonglo residents with an improved road network, including with respect to both vehicular travel times and road safety more generally. By enhancing the potential future options for private journeys to be taken as active transport into Civic through the provision of additional shared pathways, the Project will, in future, lead to a significant additional socio-economic impact for residents and visitors of the ACT.

As such, social and economic impacts are not considered to be a key risk for the Project. Any risks identified with regards to worker exposure to contaminants will be addressed with the appropriate management plans including an unexpected finds protocol and waste management plan.

Table 5-52 below sets out the proposed mitigation measures to manage the potential socio-economic impacts of the Project.

Table 5-52 Socio-economic mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Impact on recreational users of reserves and open space adjacent to the current road alignment	Access to surrounding areas utilised for recreational purposes including Bicentennial National Trail, The Pinnacle and Kama Nature Reserves, the Weetangera Cemetery and adjacent open spaces will experience some temporary impacts to access during the construction of the Project. The construction contractor will be tasked with scheduling construction tasks so as to minimise these disruptions where reasonable and feasible to do so	Moderate	Construction	Construction contractor
Work, health and safety risk to workers during construction	A CEMP will be prepared and include an unexpected finds protocol. A Waste Management Plan will be prepared and include stockpile management procedures for contaminated material.	High	Design and Construction	EPA

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
	Hazardous materials are to be stored in accordance with relevant ACT EPA guidelines.			

5.11.5 Residual risk

Based on the mitigation measures identified in Section 5.11.4, an assessment of the residual risks associated with the Project has been considered. Table 5-53 below sets out the residual risk assessment of the Project's potential socio-economic impacts.

Table 5-53 Socio-economic residual risk assessment

Risk (as per Chapter 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Document risks identified				
Impact on recreational users of reserves and open space adjacent to the current road alignment	Very Low	Remote	Minor	Negligible
Work, health and safety risks to workers during construction	Moderate	Possible	Minor	Low
Public comment period of EIS raises significant issues that delay release of final EIS report	Possible	Moderate	Medium	Medium
Increased media attention and political interest affect the community interest or perceptions of the Project in general	Possible	Moderate	Medium	Medium

5.12 Bushfire risk

5.12.1 Environmental conditions and values

The ***ACT Strategic Bushfire Management Plan*** (ACT Government, 2019b) (SBMP) is based on the risk assessment process used across the ACT. This bushfire risk assessment process has been used to map bushfire prone areas (BPAs) across the ACT that have a high bushfire risk. The BPA map defines areas of the ACT that are assessed as being high risk to life and property due to bushfires. Rural areas and areas adjacent to forest and/or grassland are identified as bushfire prone.

As shown in Figure 5-35 below, the Project is within a designated BPA and is considered to have a high bushfire risk.

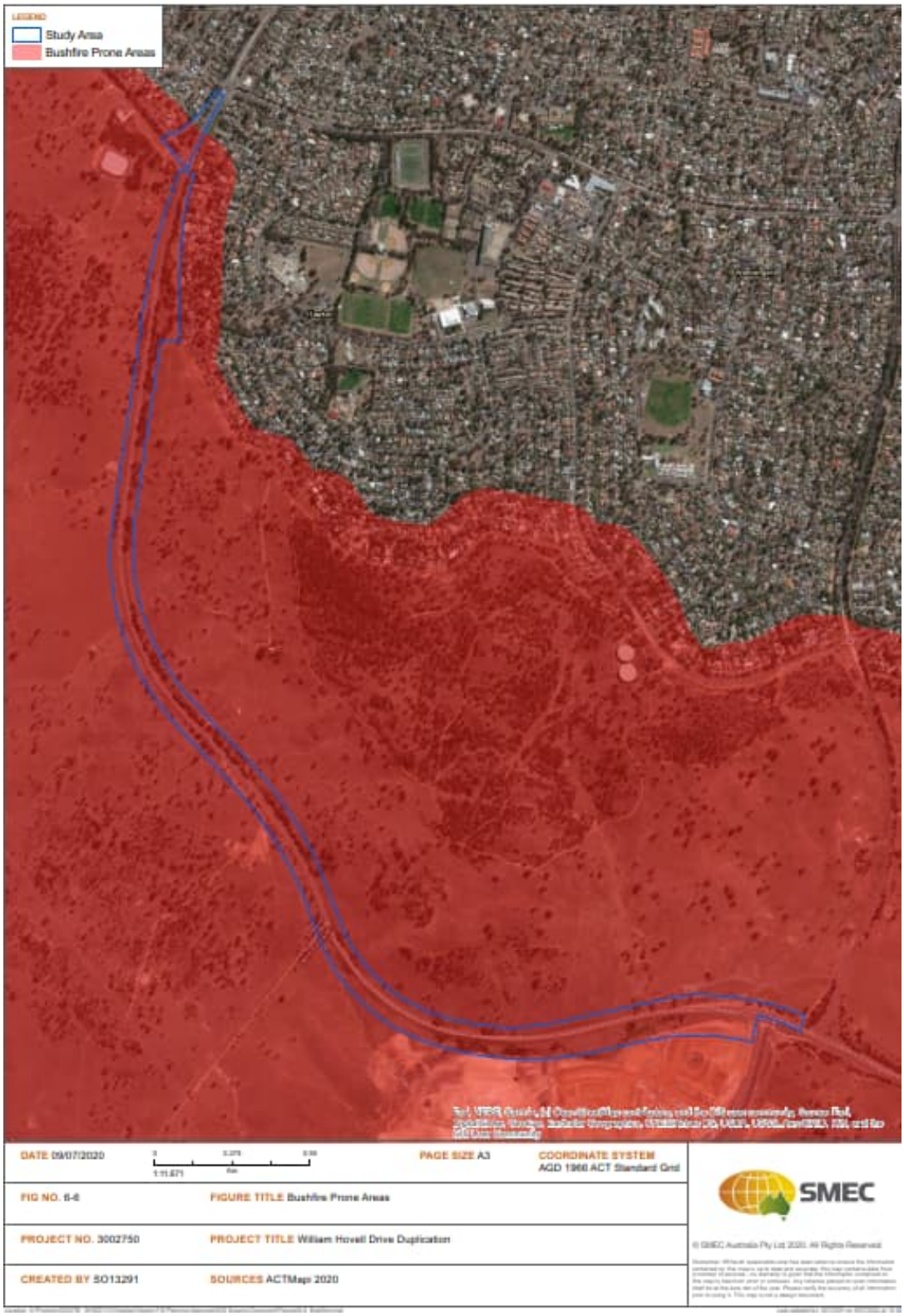


Figure 5-35 Bushfire prone areas

5.12.2 Impacts

Bushfire risk will be considered as part of the development of the EIS to determine the potential risk to the existing and proposed infrastructure. This will need to consider the bushfire asset protection zone requirement around construction compounds and mitigation measures to manage the potential risk from fire during construction.

The construction of the Project is the period during which bushfire risks will be most significant. Hot works or the storage of chemicals and use of other plant and equipment at the site can, in some situations, represent an ignition source.

Project construction will also cause temporary traffic congestion for limited periods of time. During an actual bushfire situation, this could hamper the evacuation efforts of surrounding residents and other personnel. The Project could also hamper the ability of emergency services personnel to travel to and respond to a bushfire situation.

5.12.3 Mitigation

The CEMP will contain standard mitigation measures to manage the use of hot works, chemicals storage and the use of plant and equipment at the site in order to reduce the risk of onsite ignition. No hot works will take place during total fire ban days, except with a suitable permit in place.

During the construction of the Project, Asset Protection Zones will be maintained around construction compounds as per the ***ACT Bushfire Management Standards*** (ACT Emergency Services Commissioner, 2014). This generally requires a distance of 30m be kept between forest and woodland vegetation, which same area is maintained to the standard of the Inner Protection Zone.

The CEMP will have regard to the need for surrounding residents and personnel to be able to evacuate the locality during a potential bushfire event. It will also consider the need for emergency services personnel to be able to access the surrounding locality, including major roads, minor roads and bushfire trails, during a bushfire event.

However, it should also be noted how the Project, once operational, will reduce vehicular congestion and therefore improve road travel times along WHD. As such, the Project is considered to have a minor, beneficial impact on bushfire risks for the locality overall.

Table 5-54 below sets out the proposed mitigation measures to manage the potential bushfire impacts of the Project.

Table 5-54 Bushfire mitigation measures

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Increased risk of bushfire associated with sparks from construction equipment and vehicles	The CEMP will contain standard mitigation measures to manage the use of hot works, chemicals storage and the use of plant and equipment at the site in order to reduce the risk of onsite ignition. No hot works will take place during total fire ban days, except with a suitable permit in place.	High	Construction	TCCS
Increased risk of bushfire through vehicle accidents				

Potential Impact	Mitigation Measure	Effectiveness	Timing	Responsible Agency
Potential loss of life and property as a result of bushfire during construction	During the construction of the Project, Asset Protection Zones will be maintained around construction compounds as per the ***ACT Bushfire Management Standards*** (ACT Emergency Services Commissioner, 2014). This generally requires a distance of 30m to be kept between forest and woodland vegetation, which same area is maintained to the standard of Inner Protection Zone.	High	Construction	TCCS
Bushfire started during construction and operation impacting assets and people off site	For all work, mandate requirements for Job Safety Analysis to incorporate fire ignition risk assessment and controls for prevention of fire ignition in grass by vehicle exhaust systems. Project to be incorporated into an Asset Management Plan applying to Vegetation Management (bushfire and environmental) Works Plan.	High	Construction and Operation	TCCS
Bushfire started offsite impacting the Project and people on site	Project to be incorporated into an Asset Management Plan applying to Vegetation Management (bushfire and environmental) Works Plan.	High	Construction and Operation	TCCS

5.12.4 Residual risk

Based on the mitigation measures identified in Section 5.12.3, an assessment of the residual hazards and risks associated with the Project has been considered Table 5-55 below sets out the residual risk assessment of the Project's bushfire impacts.

Table 5-55 Bushfire residual risk assessment

Risk (as per 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Scoping Report preliminary risks identified				
Increased risk of bushfire associated with sparks from construction equipment and vehicles	High	Unlikely	Moderate	Low
Increased risk of bushfire through vehicle accidents	High	Unlikely	Moderate	Low
Potential loss of life and property as a result of bushfire during construction	High	Unlikely	Moderate	Low
Scoping Document risks identified				
Bushfire started during construction and operation impacting assets and people off site	Medium	Unlikely	Moderate	Low

Risk (as per 4 and scoping document)	Original Risk Rating	Residual Likelihood	Residual Consequence	Residual Risk Rating
Rain event causing flooding, erosion or damage to road infrastructure	Refer to Table 5-39			

6 Stakeholder Engagement and Consultation

This Chapter provides details of the community and stakeholder consultation that has been, and will continue to be, carried out for the Project. Table 6-1 sets out the Scoping Document requirements relating to community and stakeholder consultation and where these have been addressed in this EIS.

Table 6-1 Scoping document consultation requirements

Scoping Document reference	Requirement	Where addressed in this EIS
Section 9.1	Consultation must be undertaken with: • Lease holders and land managers of land potentially impacted by the proposal • Any recreational groups which may be affected by the proposal • Any volunteer conservation, landscape management or land care groups active in the area to be affected by the proposal • The local community, community groups, business owners and employees.	Sections 6.1.2 and 6.2 and Appendix J
Section 9.2	Consultation methods and documentation requirements: • A variety of communication methods must be used to ensure all stakeholders are engaged appropriately, such as face to face, email/letters, community meetings and information sessions, digital/online tools and website notifications • A plain English statement explaining the proposal and conceptual drawings must be made available to the community and stakeholders during consultation • Consultation must occur as early as possible and avoid, or make allowances for public holidays, school holidays and the summer holiday (Christmas) shutdown period. The level of engagement must be comparable with the size, location and nature of the development and potential impact on the wider community.	Sections 6.1, 6.2, 6.3 and Appendix J
Section 9.3	Provide a consultation report that includes: • A description of the methodology and criteria for identifying stakeholders and how they were identified. Details and plans must be provided showing potential	A Stakeholder Engagement Report has been prepared and is attached as Appendix J

Scoping Document reference	Requirement	Where addressed in this EIS
	impacts on the local and wider community to justify how stakeholders were identified • An outline of the communication methods used • A copy of the information provided during the community consultation process • A summary of the responses and the main comments raised. Evidence must be provided demonstrating that consultation has been undertaken with each relevant group/person • A description on how concerns have been considered and addressed. It must be identified where changes have been made to the proposal to account for community comments.	
Section 9.4	Consideration of public representations from Draft EIS notification. The revised EIS must include a consultation report outlining the representations received, issues raised in the representations and a response to the issues and values identified. The summary response must clearly identify the representation(s) to which the responses relate.	A Stakeholder Engagement Report has been prepared and is attached as Appendix J

6.1 Consultation method

A Stakeholder Engagement Report was prepared to outline the proposed engagement approach that has been undertaken to date, to support and address the requirements of this revised EIS (refer to Appendix J).

6.1.1 Engagement objectives

The key objective outlined in the Stakeholder Engagement Report is to engage with a broad range of stakeholders and community members in a transparent, clear, and open manner to seek feedback about the community values and concerns associated with the construction of the Project.

Communication activities were centred on respect, trust, openness, and accountability and guided by the International Association for Public Participation (IAP2) Core Values and Code of Ethics. In following this framework, TCCS strived to:

- Ensure a best practice approach in all stakeholder and community engagement activities
- Develop and foster an environment of trust and confidence between the community, key stakeholders and TCCS
- Ensure that a broad range of community members and stakeholders were consulted and given the opportunity to provide feedback
- Engage with the community in a transparent and open way to support good decision making.

6.1.2 Identification of key stakeholders

An analysis was undertaken in the initial stages of the Project and during preparation of the Stakeholder and Engagement Report to identify key stakeholders and their level of interest and influence in the Project. The key stakeholders identified for the Project are summarised in Table 6-2.

Table 6-2 Key stakeholders identified

Stakeholder	Name
ACT Government	TCCS (Various) EPSDD (Various) Conservator of Flora & Fauna ACT Heritage, EPSDD Shared Services ICT TCCS ITS & Signals SLA (Various)
Commonwealth Government	Dept of Agriculture, Water and the Environment (Kelly Steele)
Utility Authorities	Icon Water Jemena Telstra Evo Energy iiNet / TPG NBN Optus Infrastructure Projects
Landholders / Land Custodians	Parks and Conservation Service Suburban Land Agency
Local community and specialist groups	Bicentennial National Trail ACT Equestrian Association Pedal Power Friends of Grasslands Belconnen Community Council
General public	Community
Local residents	Property Owners

6.1.3 Consultation and engagement tools

The Stakeholder Engagement Report identifies a range of communication and engagement tools to ensure the Project had as many opportunities as possible for a wide representation of community members and stakeholders to have their say.

These included a variety of both traditional and digital tools to ensure that Project information was available and accessible to all stakeholders. The COVID-19 pandemic and social distancing requirements meant the Project implemented both face-to-face and online engagement tools during the consultation process.

Targeted consultation occurred after representations started to evidence trends in the issues and concerns from impacted stakeholders. TCCS prepared key messaging and various collateral in preparation for the online and in-person information drop-in sessions.

The consultation and engagement process is described in more detail in Section 6.2 and in the Stakeholder Engagement Report, located at Appendix J.

6.2 Consultation activities

6.2.1 Draft EIS consultation and engagement

A Draft EIS and concurrent development application (DA) was lodged for the Project. The application number for the EIS is EIS202000014 and the DA is DA202138722. The public consultation period for the concurrent application was 35 working days, commencing on 5 July 2021. The public consultation period was extended and closed on 30 September 2021. Within these periods, the public could view the Draft EIS and provide written comments (a representation) on the Project.

Additional community consultation on this project was undertaken from 8 November to 19 December 2021. Face to face stakeholder and community meetings occurred and feedback on the Project was encouraged via the ACT Government 'Your Say Conversation' online portal. The YourSay conversations feedback portal closed at 11.59 pm Sunday 19 December 2021. Consultation with the local community and stakeholders was undertaken as part of the concurrent DA and EIS processes.

6.2.2 Public exhibition

During the exhibition period the EIS was made available on the EPSDD website and was available upon request through the Access Canberra Land, Planning and Building Services Shopfront (8 Darling Street, Mitchell, ACT, 2911).

6.2.3 Community information and drop in session

During the exhibition period, a series of community information drop-in sessions were held to allow the community to clarify the information presented in the EIS, as well as discuss other aspects of the Project with members of the project team. The information sessions provided information and graphic displays about the Draft EIS and also included other communication materials related to the project.

The community information drop-in sessions were held at the following times and locations:

- Belconnen Community Council, Tuesday 19 October 2021 (The PowerPoint presentation is available on the YourSay website)
- Kippax Group Centre, Saturday 27 November (for the wider community)
- Open space behind Hawker, Monday 29 November 2021 (for Hawker residents)
- Belconnen Community Council, Tuesday 14 December 2021 (Presentation was given via Zoom).

The sessions were attended by various members of the TCCS Project team.

6.2.4 Project information line and websites

Free call phone number and email

A free call (1800) number and project email were established in June 2019 and have been maintained to assist the community to provide their thoughts and comments on the project, to make enquiries and discuss details of the Project. Calls and emails were answered during business hours and a mailbox was available outside business hours that enabled callers to leave a message and have their call returned the next business day.

Project Website

The dedicated project website is:

https://www.cityservices.act.gov.au/Infrastructure-Projects/woden-weston-creek-and-molonglo/william-hovell-duplication.

The consultation approach in relation to the website was discussed at Sections 6.2.2 and 6.2.3. In addition to the website providing information about the Project, project timing, purpose and the works to be undertaken, the website has provided updates throughout the Draft EIS exhibition and EIS revision periods.

The website contains maps, images and a video of the Project.

The website information includes:

- Project Description
- Key features
- Project background
- Noise studies
- Shared Path
- Environmental considerations
- Development approvals process, and
- A current updates section.

YourSay Website

An additional website to the dedicated project website, specifically enabling community and stakeholder feedback is:

https://yoursayconversations.act.gov.au/WHDupgrade

The YourSay website contains project information, design details, a Project video, timeline, frequently asked questions, and a document library. It also has a 'follow' button, where interested parties can nominate to receive email updates on the Project. Importantly, during the consultation periods outlined in Section 6.2.1, the 'YourSay' website enabled stakeholder, community members and any other interested parties to submit feedback via the online feedback portal. More recently, and in response to the trends becoming established from representations, the 'YourSay' website was been updated to include a short three question survey in relation to the green space area next to Hawker and its usage.

Department Website

http://www.planning.act.gov.au/

6.2.5 Information distribution

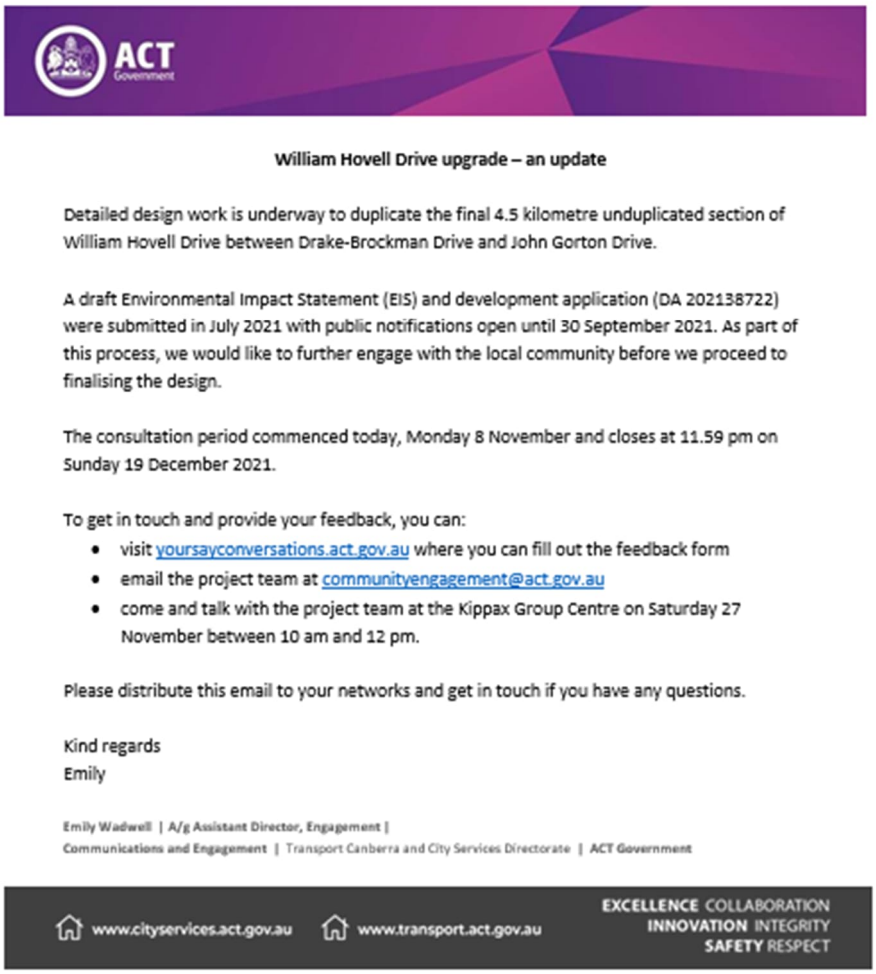
Letterbox drops

A targeted information letter was sent to Hawker residents closest to the Project, including an invitation to attend an onsite meeting on 29 November 2021. Approximately 1500 letters were sent to all residential properties in Hawker.

Approximately 500 general information letters were sent to residences in Higgins and Scullin.

Emails

Targeted emails were sent out to identified stakeholders and community members on the day that the YourSay consultation period commenced, notifying them of the website and process for providing feedback. The full list of email recipients is in the Stakeholder Engagement Report at Appendix J.



William Hovell Drive upgrade – an update

Detailed design work is underway to duplicate the final 4.5 kilometre unduplicated section of William Hovell Drive between Drake-Brockman Drive and John Gorton Drive.

A draft Environmental Impact Statement (EIS) and development application (DA 202138722) were submitted in July 2021 with public notifications open until 30 September 2021. As part of this process, we would like to further engage with the local community before we proceed to finalising the design.

The consultation period commenced today, Monday 8 November and closes at 11.59 pm on Sunday 19 December 2021.

To get in touch and provide your feedback, you can:

- visit yoursayconversations.act.gov.au where you can fill out the feedback form
- email the project team at communityengagement@act.gov.au
- come and talk with the project team at the Kippax Group Centre on Saturday 27 November between 10 am and 12 pm.

Please distribute this email to your networks and get in touch if you have any questions.

Kind regards
Emily

Emily Wadwell | A/g Assistant Director, Engagement |
Communications and Engagement | Transport Canberra and City Services Directorate | ACT Government

www.cityservices.act.gov.au www.transport.act.gov.au
EXCELLENCE COLLABORATION
INNOVATION INTEGRITY
SAFETY RESPECT

Figure 6-1 Copy of email sent to targeted stakeholders and community members

6.2.6 Targeted consultation

Targeted consultation occurred after representations started to identify trends in the issues and concerns from impacted stakeholders. The main Project concerns and issues and responses are discussed in further detail in the Stakeholder Engagement Report at Appendix J. A summary of these key issues is provided below.

Noise

Many of the Hawker residents had concerns that the Project had not addressed noise adequately, as the noise monitoring was conducted during a quieter traffic period that coincided with COVID 19 lockdowns and a long weekend. TCCS responded to resident concerns and organised a peer review of the original Road Traffic Noise Assessment (Appendix F of the Draft EIS) to confirm the adequacy of the original assessment. The peer of the Noise and Vibration Assessment was undertaken by WSP Australia – a worldwide professional engineering consultancy service. Following comments from the peer review, SLR made minor amendments to the Road Traffic Noise Assessment.

The noise model produced by SLR (noise consultant) established existing noise levels (2020), target noise levels in accordance with the ***Roads ACT Noise Management Guidelines*** (TCCS, 2018) and predicted maximum noise levels for the Project during a 2031 design scenario.

The study undertook noise monitoring during the 2020 COVID-19 pandemic. However, the actual traffic volumes did not modify the outcome of the assessment. The purpose of undertaking noise monitoring is to establish the model which then uses traffic volume data that has been collected by TCCS over previous years and predicted future traffic volumes. This unattended noise monitoring was undertaken at two locations from Friday 24 April to Tuesday 5 May 2020. While these locations are not adjacent to the residential areas, they are adjacent to the

road and are used to setup the modelling. The separation of the noise monitors from residential areas will result in more accurate vehicle noise readings from WHD only, and not affected by other roads / sources, or affected by interference with noise transmission (e.g. buildings), associated with the residential area.

The noise monitoring data was then put into a computer-generated 3D noise model of the current road alignment and surrounds. While traffic volumes were lower than normally experienced, the actual traffic volumes used for the purpose of model calibration are not relevant to the outcome of the Study. The purpose of the 3D noise model is to 'calibrate' the project model and to understand how noise travels in the area.

As explained in Section 5.5.2 above, the Calculation of Road Traffic Noise 1988 (CoRTN) methodology was utilised to calculate existing road traffic noise at the noise monitoring locations and to predict future road traffic noise levels on land adjacent to the upgraded WHD alignment. This calibrated noise model was then used to establish project noise criteria at all nearby receptors based on "normal" 2020 traffic volumes, and then modified with the proposed upgraded alignment to determine what the road noise levels will be in 2031 under full traffic volumes for that year. As a result, the noise levels in the study represent noise generated by existing traffic volumes on a normal weekday, and the assumed traffic volumes for 2031.

This noise model was validated and verified for use in the assessment. This methodology was confirmed with TCCS – Infrastructure Planning as acceptable.

A number of noise mitigation measures are proposed to reduce traffic noise experienced at residences (refer to Sections 5.5.4 above and 7 below).

Shared user path

Feedback during the Draft EIS and DA phases, indicated there were concerns from the local community about the alignment of the shared path adjacent to the residential properties at Hawker. Following community consultation, a revised alignment of the shared user path has been developed to relocate the path (for the section between DBD and the underpass near the Weetangera Cemetery) to the western side of WHD. This alignment will now be made available to view concurrently with the revised EIS.

Biodiversity

There were many comments on the Draft-EIS relating to Biodiversity loss and offset strategies. TCCS has had numerous meetings with the Offsets Working Group at EPSDD, to clarify many of the concerns raised. Consultation with the Office of the Conservator for Flora and Fauna has been ongoing and consistent throughout the Project.

Community concerns were also raised regarding the spread of weeds (especially African Lovegrass) within the locality, habitat loss, loss of mature Eucalypts, the need to offset BGW, and replanting.

6.3 Legislative requirements

Under Section 220 (2) of the PD Act, the planning and land authority must—

> (***a) make a copy of the representation available on the authority website***
>
> ***(b) give a copy of the representation to the proponent of the development proposal as soon as practicable after the public consultation period for the draft EIS ends.***

TCCS understands that any matters raised in representations made during the public consultation period must be addressed in the revised EIS for consideration by the authority. Representations received after public consultation closes may be provided by authority to TCCS for their consideration. The Stakeholder Engagement Report and its appendices document all stakeholder responses received and TCCS responses.

6.4 Issues raised/responses

6.4.1 Pre EIS issues

During initial consultation, some issues raised by the stakeholders and community included:

ACT Government

- MS Teams and in-person discussions and meetings with the EPSDD, Conservator Liaison Officer and ACT Government Ecologists to discuss strategies for the minimisation of the project footprint, specifically around areas of potential connectivity between nature reserves on both sides of the road
- MS-Teams and in-persons discussions with ACT Parks and Conservation Service regarding vehicular access into The Pinnacle and Kama Nature Reserves
- MS Teams meetings with the Suburban Land Agency regarding the urban interface with the new suburb of Whitlam.

ACT Residents and Community Groups

- Telephone conversations with interested Hawker residents to provide general project information (via Access Canberra)
- Telephone and email discussions with The Uniting Church in Australia (ACT Synod) regarding the access and parking requirements for the Weetangera Cemetery
- An in-person meeting, email and telephone discussions with ACT Equestrian Association with regard to the interface with the Bicentennial National Trail
- Email communication with ACT Pedal Power to provide project details and request their feedback.

All concerns were either addressed or raised with the project manager for further discussion. Insight was gained into matters that concerned or interested stakeholders and this insight informed future consultation throughout the course of the Project.

Section 6.5 of the Draft EIS (i.e. previous version of this EIS) provided a table that outlined the issues raised in consultation. Issues raised during consultation are outlined in Table 6-3.

Table 6-3 Stakeholder Identification summary

Comment/Issues Raised	Response
Minimisation of project footprint at key areas to maximise the connectivity in vegetation between adjacent nature reserves	Design has been kept as tight as possible within the road design guidelines, to minimise the impact on the project footprint. This has included seeking a relaxation on shared path longitudinal grade so that the cut batters do not fall outside the existing road reserve

6.4.2 YourSay Summary

The Draft EIS and DA were submitted concurrently in July 2021 with public notifications open until 30 September 2021. Additional community consultation on this project was undertaken from 8 November to 19 December 2021.

Feedback from the YourSay feedback portal was received primarily from local residents and those who regularly use the recreational corridors alongside WHD (the green space in Hawker as well as the two nature reserves).

TCCS received submissions from key stakeholders including the Belconnen Community Council, Conservation Council ACT and the ACT Equestrian Association.

TCCS received 50 completed feedback forms. 54% of those who filled out the feedback form indicated that they use the green space located between the back of Hawker and WHD. Of those who use it, 80% are there for exercise/informal sport with 32% making use of the off-leash dog area.

The majority of respondents were in the 35-54 age group (50%).

In addition to the feedback forms, TCCS received 15 emails and spoke to around 60 people at the pop-up sessions.

6.4.3 Summary of representations

The following tables provide an insight into the number of times certain issues were mentioned by the public/ community groups (Table 6-4) and agencies (Table 6-5).

The Stakeholder Engagement Report and its appendices document all stakeholder responses received and TCCS responses.

Table 6-4 Summary of issues on Draft EIS - public/community groups

Issue	Subcategories	Approximate mentions	Total
Traffic	Noise	6	14
	Congestion	3	
	Safety	5	
Shared Path	Biodiversity	3	8
	Project Design	5	
Public Domain	Recreation	3	4
	Public Access	1	
Biodiversity	Re-Vegetation	4	15
	Weed Control	4	
	Offsets/Mitigation	3	
	Other Impacts	3	
Consultation		5	5
Wording of EIS		1	1

Table 6-5 Summary of issues on Draft EIS - agencies

Issue	Subcategories	Approximate mentions	Total
Traffic	Noise	3	6
	Congestion	1	
	Safety	2	
Biodiversity	Re-Vegetation	3	35
	Weed Control	1	
	Mitigation/Offsets	8	
	Corridors	6	
	Other Impacts	5	

Issue	Subcategories	Approximate mentions	Total
	Connectivity	12	
Wording of EIS		10	10
Aboriginal Heritage		5	5
European Heritage		5	5
Project Design		3	5
Water	Water Quality	4	5
	Groundwater	1	
Contamination		6	6
Climate Change		6	6

6.5 Changes to the Project

Based on feedback from the stakeholder and community consultation to date, numerous design changes have been made to the Project and the revised EIS has been updated to incorporate these changes. There are ongoing investigations and designs are being finalised. Hence the report cannot definitively report on all detailed design of the Project, as this will be developed after the revised EIS is submitted. The main issues and areas of concern, that have received widespread attention from TCCS are summarised below.

The full details of how concerns and issues have been adopted into the detailed design of the Project are in the Stakeholder Engagement Report at Appendix J.

No design changes were considered necessary for the Project to achieve compliance with the relevant noise and vibration impact criteria.

6.5.1 Shared Path

Feedback during the Draft EIS and DA phases indicated there were concerns from the local community about the alignment of the shared path adjacent to the residential properties at Hawker. The main issues related to the way in which the proposed shared path interacted with the dog off-leash recreation area, vegetation removal and the close proximity of the path to the residential properties with associated noise, safety and amenity impacts.

As a result, TCCS held a conversation online and face to face from Monday 8 November to Sunday 19 December 2021. The online engagement was via a feedback form and live question and answer forum on YourSay. The focus of the feedback form was on the proposed alignment of the shared path as we had received commentary from the community querying its location.

This information session, along with received representations and ongoing consultation, has informed Project design changes that are discussed in full in the Stakeholder Engagement Report at Appendix J.

There were three new routes suggested as part of the consultation. The consensus was for a new proposed route of the shared path to be on the western side of WHD between DBD and the underpass near Weetangera Cemetery in Hawker. The shared path will now run alongside the cemetery access road and will not impact the Weetangera Cemetery. To avoid conflict with the equestrian path / users, TCCS us undertaking the process of realigning the portion of the Bicentennial National Trail in the area near DBD. The equestrian path will have a new route to the west. The revised EIS now provides for both an on-road cycle path in addition to an off-road shared user path. The shared path begins and ends at intersections.

The alignment of the shared path was optimised to make the path as safe as possible, whilst minimising environmental impact. By pushing the shared path further away from the road in numerous places, required extensive cut batters that would then impact additional vegetation (including the nature reserves) as well as crossing property boundaries.

The shared path designed is designed to be safe and in accordance with Australian Standards and Road Design Guidelines (the nominated 3m wide shared path is in accordance with the ACT Design Standards, and also in accordance with the Austroads technical guidelines (the peak organisation of Australasian road and transport agencies)). If the shared path is close to the road, it is separated by road safety barriers. Additionally, there will be a much smaller interface between cyclists and the off-leash dog area which greatly improves safety for shared path users. Moreover, the shared user path caters for pedestrians as well as cyclists that are not overly confident.

The altered location on the western side of WHD will mean that there is a smaller environmental impact and fewer trees being removed, particularly in the area between the underpass near the Weetangera Cemetery and Drake-Brockman Drive. There will be some tree removal required, however replacement planting will occur. The shared path not only provides access for residents of Hawker and Higgins along WHD and to the Nature Reserves, but it also provides a path for residents of suburbs such as Whitlam that wish to travel north.

The shared path remains within the road reserve and so does not take on additional land which has not been designated for roads and related road infrastructure uses. The shared path runs for the extent of the project, continuing through to Bindubi Street to provide for a missing link in the current path network between Higgins and City. Whilst the suburb of Whitlam is still being developed, the path will also connect with that area.

Fencing adjacent to the path on the eastern approach to the underpass will be removed, as will some vegetation to improve sight lines into the underpass. Signage will be installed to instruct both horse riders and cyclists to dismount before crossing through the underpass. Signage will also be installed to instruct pedestrians or cyclists to remain outside the underpass if it is already occupied by a horse. Safety mirrors will be installed at the bends in the path.

The alignment of the Bicentennial National Trail will be changed so that only a small section of the Bicentennial National Trail will coincide with the shared user path. At this location, there will be extensive signage and safety mirrors, as well as the removal of fencing that may provide the feeling of being trapped for horses as they are being ridden along the pathway.

With regards to the timing of the provision of this shared path infrastructure, there may be some parts of the shared path that may be able to be constructed before the road, however other parts of the shared path will not be able to be constructed early as they required retaining walls to be constructed as part of the main road Project, and require significant fill material, much of which will be won from the construction project itself.

Public access directly off this arterial road to the Kama and Pinnacle Nature Reserves was not considered to be a safe option, as the William Hovell Drive road corridor will gradually hold increasing volumes of traffic under a 2031 design scenario. It is understood that Parks and Conservation will work with TCCS to ensure a new Whitlam access point into the Kama Nature Reserve is provided for the future. It is acknowledged that more visitation into the Kama Nature Reserve is inevitable given the development nearby. Parks and Conservation will assess the need for upgrades of the track network in the coming year.

The design of the new access point in Whitlam has as yet not been finalised so no details are available. However, these will be shared on the Parks website once they are ready for public viewing. The exact timing of the new access point from Whitlam is also as yet unknown but will be communicated via the Parks website as soon as it is known.

Key matters which were considered in finalising the shared path alignment included:

- Public access directly off this arterial road to the Kama and The Pinnacle Nature Reserves was not considered to be a safe option, as the William Hovell Drive road corridor will gradually hold increasing volumes of traffic under a 2031 design scenario. It is understood that Parks and Conservation will work with TCCS to ensure a new Whitlam access point into the Kama Nature Reserve is provided for the future.

- Protection of the two Nature Reserves during construction and minimising any ongoing impacts was identified early as a key priority of the project.

Overall, this updated shared path alignment avoids unnecessary impacts to mature vegetation, with impacts being limited to only what is reasonably required to deliver this infrastructure. It also means the shared path can function alongside this Major Road without safety concerns.

6.5.2 Biodiversity and connectivity

As set out within Section 5.2.4 above, the approach to minimising fragmentation, improving connectivity and reducing the incidence of roadkill events that is being incorporated into the Project's design is:

- One fauna crossing (rope bridge) to assist arboreal and avifauna to safely cross the road reserve
- Two fauna crossings (box culverts) to assist ground-dwelling fauna to safely cross the road reserve. These will be designed to be used by various wildlife
- Some batters will be laid back to allow Kangaroos and Wallabies to escape the roadway and back into the Nature Reserves. However, exclusion fencing (1.8 m tall chainmesh fence) will be included on each side of WHD in the vicinity of the Nature Reserves, extending at least 200m past the fauna crossings. This will assist in reducing the risks to native and non-native fauna from being injured or killed by road traffic. It will also improve the safety of road users by decreasing the risks of vehicle collision with large fauna species. The effectiveness of this exclusion fencing will be monitored during the operational stage of the Project.

TCCS and SMEC have met with the Conservator and agreed on a pathway forward to achieving a Draft Offset Strategy and final Offset Management Plan for the Project. Whilst it will be advantageous to nominate the offset area close to the Project, this is not an absolute requirement. Therefore, the first choice of offset location is to the west of the Kama Nature Reserve. This area holds additional advantages, as it includes further connectivity along the Molonglo River, both further into the ACT and north-west towards the NSW border.

Should the location to the west of Kama Nature Reserve prove unsuitable to provide the required level of quality offset for the Project, an alternative offset will be devised. This could include another offset in the general location of Kama Nature Reserve – for instance, further to the south of the Molonglo River as a second option. Third and fourth tier options could include finding a suitable offset site in NSW, providing funds for urban ecology offsets within the broader ACT. These will be discussed with the Conservator only where it is apparent that the area surrounding Kama Nature Reserve cannot provide a suitable offset. However, it is considered that this is unlikely, and TCCS is committed, in the first instance, to finalising the Project's offset next to Kama Nature Reserve in consultation with the Conservator and the Offsets Working Group.

Consultations will continue with the ACT Government, the Conservator, and ACT Government Offsets Team to ensure this land can be subject to the relevant legal instruments which are required to secure an offset for the purposes of land and property law.

An indicative timeframe for bringing about an agreed Offsets Management Plan for the Project is also set out within Section 5.2.4 above.

Commitments have also been made to ensure that native, mature trees removed as a result of the Project will be replaced at a ratio of 1:10. Native shrubs removed as a result of the Project will be replaced at a ratio of 1:4.The locations of these plantings must be considered as part of the landscaping and offset plans prepared for the Project. Proposed landscaping trees will either be ***Casuarina Cunninghamiana***, or one of six x different species of Eucalyptus.

6.5.3 Peer review of noise assessment

In addition to the updated SLR noise assessment being prepared as part of this Revised EIS, SLR's original 2020 assessment was also peer reviewed by WSP under a separate engagement from the ACT Government. Whilst there are some minor differences, in part due to the time difference in noise and traffic readings used, the findings are generally consistent. That is, both the SLR and the WSP assessments found there to be 10 properties adjacent to WHD (from the DBD roundabout to approximately 750m south of this roundabout), which have predicted noise levels in 2031 up to 4dB higher than the criteria/target threshold.

Furthermore, both SLR and WSP assessments are consistent in that the inclusion of a noise reducing pavement (such as Open Graded Asphalt) in this area will reduce the predicted 2031 noise levels to within the criteria/target threshold.

As such, open Graded Asphalt will be included in this portion of the WHDD Upgrade to reduce the predicted 2031 noise levels to within the criteria / target threshold.

6.6 Conclusion

TCCS has engaged with stakeholder and community members extensively since the inception of the Project and continues to work through concerns and issues raised. The broad and targeted consultation has resulted in numerous design changes which are expected to remediate many of the stakeholder and community concerns.

TCCS has addressed all matters that were raised in Section 9 of the Scoping Document.

The Stakeholder Engagement Report, at Appendix J of the EIS shows how TCCS has:

- Described the methodology and criteria for identifying stakeholders and how they were identified
- Outlined the communication methods used
- Provided copies of information distributed during the community consultation process
- Summarised responses and the main comments raised
- Described how concerns have been considered and addressed
- Described how comments have led to Project changes.

The consultation process has demonstrated thorough engagement with stakeholders and community members and the issues raised have been afforded due consideration, resulting in updates to the Project design. The main concerns pertaining to the shared path alignment, dog off-leash area, the noise assessment and biodiversity impacts have been resolved, or are being resolved. TCCS are committed to ongoing stakeholder and community engagement as the Project progresses.

7 Recommendations

A Construction Environment Management Plan (CEMP) will be prepared and approved prior to construction works commencing. All works, including excavation, vehicle movement, stockpiling, topsoil management and spoil disposal will be undertaken in accordance with the approved CEMP and relevant sub-plan protocols to prevent further spread of weed species during and after construction, or unidentified impacts to native vegetation, particularly along buffers with the two nature reserves.

Prior to construction, the CEMP will be required and be approved by the Environment Protection Authority (EP and other relevant Government environmental agencies. The following additional plans and strategies will also be prepared to support the Project (some of which will be in the form of sub-plans to the CEMP):

- Draft Offset Strategy and final Offset Management Plan. This is based on the first choice of offset being located to the west of Kama Nature Reserve (refer to Section 5.2.4 above and Table 7-1 below for more details)
- Flora and Fauna Management Plan
- Tree Management Plan
- Unexpected Discovery Plan for heritage items
- Erosion and Sediment Control Plan
- Landscape Plan
- Waste Management Plan
- Asset Management Plan applying to Vegetation Management (bushfire and environmental) Works Plan
- Construction Traffic Management Plan.

Management plans which are required to be prepared to guide the potential environmental impacts of the Project's construction would be guided by the Environment Protection Policies applicable to works within the ACT as per the EP Act and the EPR (refer to Section 3.1.5.2 above).

In addition, The following monitoring measures are committed to in Sections 5.2.4 and 7 of this EIS:

- Weed extent in the adjoining nature reserves should be documented before construction and monitored monthly during construction. If weed presence and/or extent has increased the construction contractor is to engage a suitably qualified regeneration specialist to undertake weed removal of these areas in line with the management plan for the reserve
- Roadkill should be monitored monthly during construction by a suitably qualified person and for two years during operation to determine if mitigation measures have been effective. Adaptive management (e.g. moving barriers and wildlife fencing) should be adopted based on the results of the monitoring. A report on roadkill should be written to determine if there are hotspots on the new road and include recommendations for reducing roadkill in these hotspots. Adaptive management should be used to undertake recommendations of the report
- Any connectivity structures will be monitored by remote sensor cameras for a period of three years after construction
- Newly created road verges will be monitored, and adaptive management is undertaken to limit mowing/encourage recruiting Hoary Sunray specimens within the site
- Exclusion fencing (1.8 m tall chainmesh fence) to be included on each side of WHD in the vicinity of the Nature Reserves, extending at least 200m past the fauna crossings. The effectiveness of this exclusion fencing will be monitored during the operational stage of the Project.

These measures would ensure the Project's compliance with relevant statutory requirements under key statutory provisions applicable to the Project, including the P&D Act, the EP Act, the Heritage Act, ***Heritage Act 2004***, the NC Act, and the EPBC Act. TCCS would review and approve all management plans prepared by the Construction Contractor or similar. EPSDD, the Conservator and other key ACT agencies would approve the Project's overall mitigation measures which have been committed to within Section 7 of this EIS.

The Project would also be delivered under an Environment Protection Agreement entered into between TCCS or its construction contractor under the EP Act, to drive compliance with the EP Act. (refer to Section 3.1.5 above). The EPA would therefore approve the terms of this Environment Protection Agreement.

Table 7-1 provides a consolidated summary of all of the proposed mitigation measures relating to the construction and operation of the Project.

Table 7-1 Summary of mitigation measures

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
CEMP				
Project construction is not managed appropriately so as to mitigate environmental impacts	Prior to construction a Construction Environment Management Plan (CEMP) will be required and be approved by the Environment Protection Authority (EPA) and other relevant Government environmental agencies.	High	Construction	Construction contractor TCCS
Environmental management measures are not appropriately communicated to construction contractors, staff and workers				
Traffic and Transport				
Traffic volume increases at the Project Site during construction and operation not anticipated	Prepare and implement a Construction Traffic Management Plan (CTMP)	Moderate	Design and Construction	TCCS
Temporary loss of access and traffic disruptions (e.g. temporary diversions) during construction	Schedule works with the potential for traffic disruption, such as utility adjustments outside of peak commuting periods to minimise road user delays. Works impacting on traffic lanes to be undertaken at off peak times (or at night).	High	Construction	TCCS
Temporary traffic management measures during construction are not suitable and result in near miss incidents, crashes, injuries or death	A CTMP will be prepared by the nominated contractor in consultation with the ACT Government and provided to TCCS. The CTMP will be the primary management tool to manage potential traffic impacts associated with construction.	High	Design and Construction	TCCS
Traffic disruption during construction	Prepare and implement a CTMP. Schedule works with the potential for traffic disruption, such as utility adjustments outside of peak commuting periods to minimise road user delays. Works impacting on traffic lanes to be undertaken at off peak times (or at night).	High	Design and Construction	TCCS

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
Increased traffic volume during operation, causing further delays and impacting on road safety	It is likely that there will be an increase in traffic volume utilising WHD, however the increased capacity of the road as a direct result of the project will accommodate this. The duplication and intersection upgrade will improve safety on WHD.	High	Design	TCCS
Impact of duplicated road on road safety and operation	The duplication and intersection upgrade will improve safety on WHD.	High	Design	TCCS
The proposed signalised intersection impacts road safety and operation	The duplication and intersection upgrade will improve safety on WHD.	High	Design	TCCS
Flora and Fauna				
Presence or extent of threatened species and ecological communities not identified prior to development design, resulting in unanticipated impacts Project activities facilitate spread of exotic flora into adjacent areas, leading to weed establishment Project attracts additional vermin and pest species, which results in greater competition for resources with native species	A Flora and Fauna Management Plan (FFMP) will be prepared and implemented as part of the CEMP. It will include, but not be limited to: • A Tree Management Plan (to be determined by the Conservator of Flora and Fauna) • Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and potential revegetation areas • Pre-clearing survey requirements • Procedures for unexpected threatened species finds and fauna handling • Protocols to manage weeds and Pathogens • Procedure for stockpiling materials including topsoils and subsoils to be stockpiled separately to avoid mixing in a manner that will facilitate the return of soils to location of original source and tracking and treatment of stockpiles. The CEMP will also outline contractor and other personnel responsibilities and actions in the event of an unforeseen environmental harm incidents, including first response and agency notification requirements.	High	Prior to construction	TCCS Construction contractor

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	Rubbish removal is to be undertaken prior to construction and throughout construction in retained areas of vegetation in the road reserve. Revegetation and offset plantings proposed as part of the Project will assist in supporting habitats which are favoured by native species, such that the Project will not result in feral species colonising land within the Study Area over the long-term.			
Incursion of vehicles, light, noise, invasive species and increased recreational use caused by greater human access into areas of environmental significance, causing damage to or destruction of habitat	Site inductions will be mandatory for all personnel working and visiting the Project area. The site induction will include information on threatened species and ecological communities, identify exclusion zones and the unexpected finds procedure for threatened species. Personnel involved in vegetation clearing and clearing of threatened species habitat will have a more detailed toolbox to ensure all personnel are clear on the clearing procedure and sensitive ecological features of the area to be cleared for that day.	High	Prior to construction	TCCS
Removal of native vegetation and threatened species habitat	Provide an offset against the loss of Box Gum Woodland TEC habitat by protection of land to the west of Kama Nature Reserve which will preserve nesting habitat for Superb Parrot and retain old growth trees and native grassland understorey. Development of this Draft Offset Strategy will follow these key points, as agreed to between TCCS and the Conservator: • The Commonwealth Offsets Calculator will be used (for calculation of offset areas required) in conjunction with the ACT Environmental Offsets Delivery Framework • An appropriate offset is to be provided within the ACT, as a first choice. Whilst it will be advantageous to nominate the offset area close to the Project, this is not an absolute requirement. Therefore, the first choice of offset location is to the west of the Kama Nature Reserve. This area holds additional advantages, as it includes further connectivity	Moderate	Prior to construction	TCCS

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	along the Molonglo River, both further into the ACT and north-west towards the NSW border • The Draft Biodiversity Offset Strategy for the Project is expected to be established over the next two quarters of 2022 • Should the location to the west of Kama Nature Reserve prove unsuitable to provide the required level of quality offset for the Project, an alternative offset will be devised. This could include another offset in the general location of Kama Nature Reserve – for instance, further to the south of the Molonglo River as a second option. Third and fourth tier options could include finding a suitable offset site in NSW, and providing funds for urban ecology offsets within the broader ACT. These will be discussed with the Conservator only where it is apparent that the area surrounding Kama Nature Reserve cannot provide a suitable offset. However, it is considered that this is unlikely, and TCCS is committed, in the first instance, to finalising the Project's offset next to Kama Nature Reserve in consultation with the Conservator and the Offsets Working Group (OWG) • The relevant consultation processes will be followed during the process of finalising the Offset Strategy for the Project • As requested by the Conservator, funds from the Project's offset package will be made available to enable data held by EPSDD on Kangaroo-vehicle collision incidents to be analysed so as to inform other future road design packages.			
Clearing of protected trees that have not been approved to be cleared Direct impacts on threatened flora and fauna, threatened ecological communities and non-threatened flora and fauna from clearing and other construction works	Establish exclusion zones including: • Prior to construction commencing, exclusion fencing or flagging and signs is to be installed at the limit of works • Trees to be retained are to be clearly demarked with fencing and signage • Threatened species habitat to be retained is to be clearly demarked with fencing and signage. • Contractors and site workers to be advised of criminal penalties available for unauthorised vegetation clearing in the ACT. The construction contractor will	High	Prior to construction	TCCS Construction contractor

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	hold responsibility for ensuring only approved vegetation is cleared.			
Removal of native vegetation and threatened species habitat	Pre-clearance protocols will include: • Demarcation of habitat trees indicating which of these are to be cleared and which of these are to be retained • Pre-clearing and daily surveys • A two-staged tree clearing procedure including designated areas for release of any rescued fauna • Presence of a qualified ecologist/fauna rescue person throughout clearing.	High	Prior to construction and during Construction	TCCS Construction contractor
Removal of native vegetation and threatened species habitat	• Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where possible throughout pre-construction and construction • Avoid where possible loss of Grassy Woodland, Native Grassland and Pink Tailed Worm Lizard habitat • Coarse woody debris and rocks will be placed in the adjoining reserves following consultation with the land manager for these reserves • Avoid loss of mature eucalypt trees over 50 cm in diameter, including all mature trees with hollows where possible • Where vegetation clearing is required, limit it to the minimum extent practicable required for the construction of the project • The limits of clearing will be clearly marked on construction work plans and on the ground prior to clearing. Vegetation to be retained will be protected through exclusion fencing (e.g. safety mesh) and 'no-go' signage • Only trees specified in the Tree Management Plan (if required) will be removed. All other trees are to be retained • Felled trees are to be stockpiled on site for re use in the landscape such as roost trees • Should any injured animals be found within the construction area, ACT Wildlife will be contacted to collect the injured animal.	High	Detailed design and Construction	TCCS Construction contractor

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
Removal of native vegetation	Revegetation and rehabilitation will be undertaken during the Project and include: • Prior to revegetation works excavated or disturbed areas to be rehabilitated so that material is reinstated in original sequence i.e., topsoil at surface and subsoil below • All areas of disturbance must be revegetated immediately following construction • Revegetation to be undertaken using a cover crop of sterile Rye Grass to ensure that rapid stabilisation occurs • A suite of suitable local native species will be used in conjunction with the Rye Grass cover crop. The seed mix will be a locally collected species mix including four species.	High	During construction	TCCS Construction contractor
Removal of a threatened ecological community	• Areas of Box-Gum Woodland TEC to be retained will be clearly marked on maps and provided to construction supervisors • Any indirect or indirect impact to Box-Gum Woodland TECs outside the designated clearing area will be immediately reported to the Conservator and DAWE • Non weedy BGW topsoil to be stockpiled for use in revegetation areas.	High	During construction. Offset strategy approved before construction.	Construction contractor
Removal of threatened species habitat (Pink-tailed Worm-lizard (PTWL))	• The requirement for exclusion (no-go) zones to be confirmed by an ecologist to mark and exclude PTWL habitat • The limits of construction work areas which are to be located inside identified PTWL habitat are to be clearly marked on construction work plans prior to the commencement of works in these areas • The limits of construction work areas within PTWL habitat are to be clearly marked out on the ground using exclusion fencing and 'no-go' signage where appropriate • No vehicles and machinery are to operate within areas of PTWL habitat which have been demarcated • No site laydown areas, vehicle parking, turning areas, temporary equipment or stockpiles will be located within PTWL habitat areas which have been demarcated. Pre-clearance surveys:	High	Before, during and after construction	TCCS Construction contractor

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	• All areas of identified PTWL habitat which are within the construction footprint will be surveyed by a suitably qualified ecologist prior to construction activities taking place • Timing of these surveys will be as close to the clearing as practicable to ensure lizards present can be relocated prior to construction activities commencing • When conducting the pre-clearance surveys, all suitable habitat rocks within the disturbance area will be rolled over to check for individual lizards • Any individual PTWL found during pre-clearance surveys will be relocated by the ecologist to a nearby safe and suitable patch of habitat outside the construction area, in accordance with Animal Care and Ethics Approval and project-specific Scientific Licence held by the ecologist. PTWL habitat relocation: • Prior to construction activities commencing within PTWL habitat, and following the pre-clearance surveys undertaken by the ecologist, all surface rocks within the construction areas which are deemed by the ecologist to represent suitable habitat rocks will be relocated to a location or locations outside the construction area for preservation. Generally, suitable habitat rocks include those that are plate-like in shape with a 15-60cm basal diameter. Relocation of surface rocks will be undertaken by the ecologist and by construction personnel under supervision of the ecologist as required • Suitable PTWL habitat rocks which are stockpiled will be utilised during rehabilitation of disturbed sites upon completion of construction works • The stockpile site will be located within the general vicinity of the work to avoid long cartage distances and multiple handling. During construction: • The unexpected finds protocol will include a procedure for snakes and legless lizards • Should any PTWL be observed during construction, works will cease, and the ecologist will be notified. The ecologist will be required to attend the site to relocate the lizard to a safe and			

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	suitable nearby patch of habitat, in accordance with the Scientific Licence held by the ecologist • Should any PTWL be injured during construction works, the animal will be handled in accordance with scientific licence conditions • All vehicles to operate within PTWL habitat will be free from vegetative materials and propagules • Should any trenches be left open overnight, these trenches will be inspected each morning to check for trapped PTWL. If any PTWL are observed within the trench, the ecologist will be contacted immediately to relocate the individual as per the conditions of the Scientific Licence held by the ecologist • All trenches will be inspected for the presence of PTWL immediately prior to backfilling. If any PTWL are observed within the trench, the ecologist will be contacted immediately to relocate the individual as per the conditions of the Scientific Licence held by the ecologist The Draft Offset Strategy and the Offset Management Plan will confirm habitat rehabilitation actions for the PTWL. Actions will include: • Upon completion of the construction works, the extent and location of disturbance within the encountered PTWL habitat will be measured and recorded. The total area of disturbance will be indicated (in hectares) on a map, or by GPS locations. • Findings from this will be documented and reported to the Contractor's Representative in the form of a letter. This information must be supplied to the ACT Government as per the conditions of the Scientific Licence held by the ecologist • Upon completion of construction works, disturbed areas within identified PTWL habitat will be rehabilitated in accordance with a PTWL Rehabilitation Plan (if required).			
Removal of threatened flora species and their habitat	All personnel working on site will receive training to ensure awareness of the potential for the threatened flora species listed in Appendix B of the Biodiversity Assessment Report within the construction boundary. Training will include photographs of the	High	During construction	Construction contractor

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	species, key identification features, flowering times and protocols if any are identified during clearing or construction.			
Clearing of trees and other vegetation causing impacts including loss of amenity, loss of habitat, increased erosion and water runoff	Re-use of habitat features: • Hollows from hollow-bearing trees that are removed will be salvaged and re-used as habitat for ground-dwelling fauna or made into a natural hollow nest box and reattached to a suitable nearby tree • Installation of nest boxes will be undertaken by a suitably qualified ecologist • Logs will be relocated to suitable nearby habitat.	High	Prior to construction and during construction	TCCS
Edge effects	• Weed extent in the adjoining nature reserves will be documented before construction and monitored monthly during construction. If weed presence and/or extent has increased the construction contractor is to engage a suitably qualified regeneration specialist to undertake weed removal of these areas in line with the management plan for the reserve • African Lovegrass, a highly invasive exotic and serious pest plant, is currently well-established right along WHD edges. Removal of this weed will be undertaken prior to and during construction. Care will be taken for this species to not spread to the adjoining land and reserves • Dense ***Lomandra Longifolia*** and native shrub plantings will be strategically located along the boundary of the Kama Nature Reserve and The Pinnacle Nature Reserve (and their buffers) • Protection measures for the two Nature Reserves will include the erection of man proof fencing, treatment of drainage lines with sediment control, and a strict 'No Entry' during construction • Erosion and sediment control plans would be lodged with the DA and best practice erosion and sediment controls would be followed by the construction contractor as per the Blue Book. • Any other reasonable requirements from the EPA and other Government agencies will also be implemented.	High	Prior to construction and during construction	Construction contractor

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
Weeds and exotic flora	• Prior to the commencement of works, existing weed infestations are to be treated using appropriate methods • Non weed infested areas of native dominant understorey within the road reserve will be protected and not disturbed wherever possible • All vehicles must be clean and free of visible plant propagules prior to entering and exiting the site. A vehicle brush down/washdown area will be provided • Records will be maintained demonstrating compliance. • Weedy vegetation with viable propagules (seeds, fruit, rhizomes etc) will be removed from site for safe transport and disposal at appropriate waste facility. Non-viable woody vegetation can be chipped on site • Vehicle and machinery movements will be confined to disturbed areas and existing tracks where possible. Vehicles and machinery will be cleaned (tyres brushed or washed down) prior to accessing and/or leaving areas where weeds have been identified • Use weed matting to cover any areas of exposed soil • Undertake revegetation as soon as possible post-construction • Maintain revegetated areas by undertaking weed removal until growth is enough to prevent weed invasion, as determined by a qualified ecologist • Do not stockpile vegetation containing weeds on site • Use of herbicides will be undertaken in line with the NSW Weed Control Handbook • Where reasonable possible, the contractors tasked with revegetation activities will have demonstrated capability in successfully restoring native vegetation communities • A suitably qualified ecologist will verify that revegetation activities have been undertaken to a reasonably satisfactory standard • Materials introduced into the site, such as topsoils, seeds and mulches, will be free of as much weed contamination as is reasonably possible to achieve	High	Prior to construction and during construction	Construction contractor

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	• Revegetation seed used at the site will be fresh (or otherwise viable), and a sufficient sowing rate (kg/ha) will be used to ensure adequate coverage.			
Changes in hydrology	• Prevent any sediment or vegetation from the site entering waterways • Ensure the design does not change the existing hydrology of the adjoining properties and nature reserves.	High	Design and construction	TCCS and construction contractor
Invasion and spread of pests	• Pest species will be managed within the Project Site. This will be coordinated with surrounding landholders.	High	Construction	TCCS and construction contractor
Invasion and spread of pathogens and disease	• Maintain hygiene protocols to prevent the introduction of the spread of pathogens from outside the site • Chytrid protocol in line with the latest national guidelines will be followed during construction.	High	Construction	Construction contractor
Noise, light and vibration impact on fauna	• Avoidance of lighting in the key wildlife linkage areas. Any lighting which is installed will be considered to act as a physical "barrier" to movement, likely to create a roadkill hotspot at either end where animals move around it to access nearby habitat • Lighting of underpasses will be on a sensor that is not triggered by small mammals to prevent unnecessary light • Lighting of intersections with ample escape routes through the limited use of barriers within several hundred meters (either on road edges or central median strips) • Artificial light impact to biodiversity will be minimised through detailed design. Lighting will be designed in accordance with AS 4282-1997 Control of the obtrusive effects of outdoor lighting.	High	Detailed design Construction Operation	TCCS
Animal-vehicle collision and roadkill reduction	• During construction and operation no barriers to movement will be created that will funnel fauna directly into the road corridor • At key crossing points lowering the road or keeping high steep cuttings or other measures to encourage flying wildlife to cross the road at a height that is above the level of traffic	Moderate	Detailed design, construction and operation	TCCS and construction contractor

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	• Prevent access by wildlife from either side of the road, where road barriers are required particularly where central safety barriers between carriageways are in place • Use of fences and other barriers (including street lighting) in a way that directs wildlife to underpasses or safer crossing points which are away from intersections, have opportunities for escape (limited barriers to road crossing, particularly in central median strips), and have good line of sight. Escape ramps near intersections where fencing ends and several points along the exclusion fencing in the event that a kangaroo does enter the road corridor • Escape routes (e.g. paths of lower gradient cut into roadside batters or cuttings) will be designed to allow the exit of animals that have become trapped on the road where there are banks, cuttings or fences • Table drain design and management will consider management of the road verges to make it less attractive for grazing herbivores • Where there is no fencing then ensure roadside maintenance to deter herbivores from this area and good lighting and line of sight • Fauna identification road signs will be located at each end of the road alignment to indicate to drivers the presence of animals crossing • The use of the 'Roadkill Reporter' app will be promoted within the local community • Plantings will be strategically located near the proposed fauna rope bridge, to act as further encouragement for arboreal and bird species to use this crossing feature • Roadkill will be monitored monthly during construction by a suitably qualified person and for two years during operation to determine if mitigation measure have been effective. Adaptive management (e.g. moving barriers and wildlife fencing) will be adopted based on the results of the monitoring. A report on roadkill will be written to determine if there are hotspots on the new road and include recommendations for reducing road-			

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	• kill in these hotspots. Adaptive management will be used to undertake recommendations of the report.			
Increased habitat fragmentation impacting species movement	When finalising the proposed wildlife crossing structures, the following will be taken into consideration: • Two main biodiversity corridors have been identified, both are the existing large cutting areas (one near the cemetery and one between The Pinnacle and Kama Nature Reserves) • Installation of a rope bridge and box culvert underpasses in areas of connectivity will be employed so as to benefit a range of ground-dwelling and arboreal/avifauna species • An arboreal mammal specialist will be engaged to determine the location of these crossing structures • Any connectivity structures will be monitored by remote sensor cameras for a period of three years after construction • Newly created road verges will be monitored, and adaptive management undertaken to limit mowing/encourage recruiting Hoary Sunray specimens within the site. Crossings will be designed to facilitate wildlife movement including: • One fauna crossing (rope bridge) to assist arboreal and avifauna to safely cross the road reserve • Two fauna crossings (box culverts) to assist ground-dwelling fauna to safely cross the road reserve • Exclusion fencing (1.8 m tall chainmesh fence) to be included on each side of WHD in the vicinity of the Nature Reserves, extending at least 200m past the fauna crossings. The effectiveness of this exclusion fencing will be monitored during the operational stage of the Project. Design considerations for the culverts (to facilitate fauna movement) will include the size of the culvert, revegetation at the entrances to the culvert and no artificial lighting. Existing fencing blocking the culvert locations will be removed. Appropriate habitat structures will also be installed along box culverts in particular to facilitate wildlife movement through these underpasses where possible, such as poles, logs, rocks, woody debris at ground/mid-	Moderate (until operational modelling can demonstrate high operational effectiveness	Design, construction and during operation	TCCS

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	level or other habitat structures to enable small fauna to safely pass through. The existing culvert at the south of the Study Area will not be used for pedestrians. Lighting will be designed so as to not deter fauna from utilising the rope bridge and box culvert underpasses.			
Fauna injury or mortality	Road design will include: • Fauna exclusion fencing is to be used to prevent wildlife accessing the road. • Fauna friendly fencing is to be installed between the underpasses and culverts to prevent access onto the road but guide fauna to these potential crossing areas. Fencing will be chainmesh fence 1.8 m tall is designed to exclude a range of native mammal species such as macropods, possums, Spotted-tail Quoll. • Existing gates and fencing near the underpasses will be replaced with structures that allow fauna movement through the underpasses. • Barbed wire will not be used on any fences. • Central medians are designed to not to trap fauna on the road.	High	Design and pre construction	TCCS
Clearing of vegetation results in a loss of connectivity through fragmentation in the landscape, or obstructing local movement corridors Clearing of protected trees that have not been approved to be cleared Increased habitat fragmentation impacting species movement Impacts to adjoining nature reserves during construction and operation	Re-vegetation of biodiversity corridors will include: • Revegetation in areas where birds are likely to cross the alignment, particularly at the top of cuttings to encourage flight above the height of the road • Where possible revegetation will include planting along the edges of adjoining paddocks to close any vegetation gaps. This principle will extend to all areas where trees will be retained where the revegetation will enhance native species habitat values in the landscape • Re-vegetation will use species that are found in the local Box-Gum Woodland TEC and include trees, shrubs and groundcovers • Tube-stock for revegetation will be sourced from local providers	Moderate	Design and construction	TCCS

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	• Areas of re-vegetation will be maintained for a minimum of two years until plantings are established, with additional maintenance undertaken for a period of five years where required • Weed control will also be undertaken in revegetation areas • Revegetation will occur where required near fauna crossing structures to enhance connectivity and provide shelter in the approaches to the structures.			
Utilities, Lighting and Infrastructure				
Impacts on existing infrastructure during construction and operation and/or requirement to install new infrastructure to service the Project impacting on existing infrastructure	Relocation of Icon Water assets is undertaken where required. Seek final design approval from Icon Water	High	Design	TCCS
	Continue consultation with Icon Water to ensure any additional impacts at the DBD and WHD intersection are captured.	High	Design	TCCS
	The Project team will continue consultation with EvoEnergy in relation to the Project and the undergrounding of assets. The Project will also accommodate for EvoEnergy's six by 150mm diameter proposed future conduits along the WHD main alignment. SMEC will continue working with EvoEnergy to confirm the Preliminary Electricity Network Advice and finalise the design.	High	Design	TCCS
	Existing Telstra assets within the Project Site will need to be protected or relocated. The Project design will also have consideration to Telstra's future provision of four x 100mm diameter conduits along the main WHD alignment. An existing Optus line will need to be protected or relocated as a result of the Project. An existing NBN line will need to be protected or relocated as a result of the Project.	High	Design	TCCS

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	An existing TransACT line crossing DBD approximately 10m west of WHD will need to be protected or relocated as a result of the Project. Intelligent Transport Systems conduits will be provided along WHD from the DBD intersection to JGD intersection and along WHD. The requirement is for one by 100m conduit along WHD alignment has been incorporated into the Project design.			
Temporary services disruption during utility works as part of the Project	Local residents will receive prior notification regarding construction activities that may interfere with their access to the surrounding water, sewer, electricity and gas networks.	Moderate	Construction	TCCS
Accidental damage to utilities and other essential infrastructure	Continue consultation with utility stakeholders to ensure all utilities are identified and captured prior to construction.	High	Design	TCCS
Disruption to vital services due to service outages during construction	Consultation will occur with the Emergency Services Agency closer to construction in order to confirm the requirements for notification of potential disruptions to telecommunications infrastructure within the locality. Local residents will receive prior notification regarding construction activities that may interfere with their access to the surrounding telecommunications network.	Moderate	Construction	TCCS
Lighting impacts to nocturnal fauna Light impact to sensitive receivers during construction and operation	If any lighting is required, it will be managed in general accordance with the requirements in Australian Standard AS 4282:2019 Control of the Obtrusive Effects of Outdoor Lighting. Generally, lighting will be designed to minimise off-site light spills.	Moderate	Design	TCCS
Heritage				
The Project results in impacts to the heritage values of the Weetangera Cemetery or Kama Nature Reserve due to the recommendations of the	Design options for avoidance are considered during design development phase. Erect temporary fencing around sensitive areas.	Moderate	Design and Construction	TCCS

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
Conservation Management Plan not being appropriately implemented during the design phase.	A buffer zone will be demarcated and signed under guidance from an arborist to protect the driplines of the two Cypress trees that are included within the Weetangera Cemetery Listing. For the single Cypress tree which will experience impacts to around 5-6% of its TPZ, appropriate protection demarcation and signage will be put in place under guidance from an arborist to ensure significant impacts are not caused for this Cypress tree. Design where practical will be undertaken to reduce the potential for indirect impacts due to higher visibility and visitor impacts to the Weetangera Cemetery. This will take the form of screening landscaping on the road verge.			
Potential damage or destruction of unknown or undiscovered Aboriginal and non-Aboriginal heritage items Impacts to unknown or undiscovered heritage items and places	Should any Aboriginal objects be encountered during works then works must cease immediately in the vicinity of the find, and the find will not be moved until assessed by a qualified archaeologist with the participation of the RAOs. Adherence to the Unexpected Discovery Plan (UDP) attached at Appendix 2 of Appendix E is required.	High	Design and Construction	TCCS
Uncontrolled access by vehicles leads to damage to heritage elements (identified PADs) or trees to be retained.	Establish no-go zones, site boundaries, and fences prior to construction commencing by implementing an industry best practice CEMP to prevent unauthorised access into adjacent areas. Inform EPSDD and DAWE immediately if any impacts outside approved area occur.	High	Design and Construction	TCCS
Potential damage or destruction of known Aboriginal and non- Aboriginal heritage items Impacts to known heritage items and places	No Aboriginal or historical heritage sites will be impacted by the Project as impacts will be avoided through design. No impacts will occur to the site WHD1 or the three areas of PAD (PAD1, PAD3 and PAD5) located within the road corridor. Barrier fencing will be installed to demarcate the PAD boundaries with a buffer zone of at least 5m prior to works. Barrier fencing will consist of star pickets with high visibility flagging and will be installed by or under the direction of the RAOs and heritage team.	Moderate	Design and Construction	TCCS

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	If, due to alteration in design, these PADs will to be impacted then a program of subsurface testing of the impacted areas of PAD will be required to determine the presence of cultural material. The location of heritage sites and requirements for impact avoidance will be communicated to project manager and personnel engaged on the project. Heritage site information will be included in site inductions. Impacts can be avoided by design at all heritage sites and areas of potential other than the Kama Woodland/Grassland listing. As heritage impacts will occur, there are known heritage impacts from the proposed project. As a result a submission of the Statement of Heritage Effects in Appendix E for approval to the ACT Heritage Council is required. A SHE is provided within this CHA for approval by the ACT Heritage Council prior to works commencing.			
Noise and Vibration				
Intermittent noise and vibration emitted from the equipment required to carry out the proposed construction of the Project impacting residential and non-residential receivers.	The CEMP is to include a procedure to address noise and vibration impacts including: • Identification of all potential significant noise and vibration generating activities • Measures to be implemented during construction to minimise noise and vibration • Arrangements for consultation with sensitive receivers, including notification and complaint handling procedures Where practical, equipment will be selected to minimise noise emissions. Equipment will be fitted with appropriate noise control equipment and be in good working order.	High	Construction	TCCS
Local residents in surrounding suburbs exposed to increased levels of noise and vibration	Investigate operational noise management measures such as:	Moderate	Operation	TCCS

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
Noise and vibration impacts to sensitive receivers during operation	• Noise barriers/ mounds • Low noise road pavement surface • Building envelope treatments Low noise road pavement surfacing will be provided.			
Soils and Geology				
Inadequate investigation of site geotechnical issues resulting in additional works, delays to works and contractor claims	Undertake geotechnical and contamination assessment, including detailed assessment of fill. Incorporate identified geotechnical and contamination constraints and recommendations into the design and project planning decisions.	High	Construction	Construction contractor
Disturbance to or movement of contaminated soils during construction	Undertake remediation of identified contaminated sites prior to general construction commencing. Develop a site-specific contamination management plan, incorporating an Unexpected Finds Protocol, must be prepared and implemented during site development works. Develop and implement an Unexpected Finds Protocol for all earthworks and construction activities onsite, including training personnel in Unexpected Finds procedure. All construction works are covered by an Erosion and Sediment Control Plan (ESCP) approved by the EPA. Fly tipped wastes (including suspected asbestos containing materials if present) are to be removed using appropriately licensed persons, where applicable, prior to construction to prevent cross contamination of underlying soils.	High	Design and Construction	Construction contractor
Contamination of soil during construction and operation	Storage of hazardous materials in an appropriate manner and in accordance with CEMP. Re-fuel in designated, bunded areas only.	High	Design and Construction	Construction contractor

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	All construction works are covered by an ESCP approved by the EPA.			
Disturbance of soil associated with construction leading to increased soil and sediment erosion	Existing vegetation onsite will be retained as long as possible and only cleared when required for construction. An ESCP will be developed prior to construction. Disturbed areas will be stabilised as soon as possible following disturbance including the installation of scour protection on any disturbed embankments immediately following excavation. All construction works are covered by an ESCP approved by the EPA.	High	Construction	Construction contractors
Surface water runoff containing sediment and soil leaving the construction site due to inadequate surface water and sediment and erosion control measures being implemented	Design mitigation measures so they adhere to ecological limits (e.g. water flow rates or quality) of adjacent MNES and other environmental values. Undertake stormwater assessments to ensure the design of the development does not place unnecessary pressure on existing stormwater infrastructure. Design mitigation measures in accordance with relevant ACT, Australian, or otherwise best practice standards; and with any P&D Act or EPBC Act approval conditions. All construction works are covered by an ESCP approved by the EPA.	High	Design and Construction	Design contractor
Incorrect disposal of excess materials cut from the site	All soil subject to disposal from the Project Site must be addressed in accordance with EPA Information Sheet 4 - Requirements for the reuse and disposal of contaminated soil in the ACT, with no soil is to be disposed from site without EPA approval	High	Construction	Incorrect disposal of excess materials cut from the site

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
Incorrect use of fill transported to site, leading to onsite and offsite contamination of soil and water	All imported fill and re-use of soil within the Project will comply with the ACT EPA requirements.	High	Construction	Incorrect use of fill transported to site, leading to onsite and offsite contamination of soil and water
Undertaking significant public works relating to 0.3ha or more of land, and relating to public roads, without oversight by the EPA.	TCCS will enter into an Environment Protection Agreement with the EPA	High	Pre-construction and Construction	Undertaking significant public works relating to 0.3ha or more of land, and relating to public roads, without oversight by the EPA.
Water quality and hydrology				
Water quality impacts to Deep Creek	As Detailed Design progresses, consultation with the EPA would take place to confirm whether a WWL is required due to the proximity of Deep Creek. Water quality discharge from the site to meet the Waterways: Water Sensitive Urban Design General Code (21 February 2020)	High	Pre-construction and Construction	EPA
Local and regional drainage conditions altered impact on flooding as some of the proposed civil works for the shard path and road widening may impact the existing head available for the	Stormwater assessment has concluded that the design of the development does not place unnecessary pressure on existing stormwater infrastructure.	High	Construction and Operational	TCCS

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
transverse drainage culverts, which may affect capacity for events larger than the one percent AEP	Existing flow paths have been maintained and further augment to allow for flow capacity up to the one percent AEP event.			
Changes to existing flow paths and overland flow due to proposed Project.				
Potential changes to groundwater availability due to vegetation removal or excavation including impacts on groundwater dependent ecosystems and water users within the catchment.	To mitigate the groundwater impacts, it is proposed to plant new evergreen trees alongside the locations where existing trees will be removed. Indeed, where possible, established trees will be retained to provide landscape screening. A schedule of additional plantings will therefore be provided to soften the impact on the predominantly rural landscape.	High	Operational	EPA
Additional run off from new impervious surfaces increases flow downstream and impacts areas beyond the project boundaries.	An approved ESCP must be implemented to cover all construction works. Water quality discharged from the construction site is to meet the EPA requirements under the ***Environment Protection Act 1997*** (the Act)	High	Construction and Operational	EPA
Reduction in water quality in waterways due to runoff and sedimentation during Construction and Operation.				
Change to water flow regimes in waterways due to Construction and Operation	It is proposed to provide additional swales at the outlets to provide treatments and storage to mitigate the adverse impact on water quality and quantity. In addition, the effect of time of concentration and lag time is also taken into consideration for water quantity analysis. Implementing appropriate ESC treatments such as check dam, sediment fences, and straw bale barriers at the outlets during construction will provide a positive outcome.	High	Construction and Operational	EPA
Landscape and visual				
Visual impacts during and following construction		High	Design	TCCS

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
Visual impacts to sensitive receivers during operation	Undertake a Visual and Landscape Assessment during design to anticipate / understand impact on sensitive receivers Develop and implement industry best practice CEMP which includes rehabilitation/ landscaping plan. Plan for early establishment of landscaping features as described in detailed designs. Erect fences and other barricades around construction site such that they reduce the visual impacts of the construction phase.			
Views available to occupants of nearby sensitive receivers are altered	Long term maintenance (and replacement as necessary) of tree planting within the Project Site to maintain visual filtering and screening of external views.	High	Construction and Operation	TCCS
Species planted as part of the Project are inappropriate for landscape and impact on amenity of open spaces	A Landscape Plan to identify appropriate species to be planted as part of the Project to minimise the visual impact on amenity of open spaces. Ensure selected species do not compete with native vegetation or cast additional shadow on sensitive areas	Moderate	Design, construction	TCCS
Public comment period of EIS raises significant issues that delay release of final EIS report	Keep stakeholders and community members up to date as the Project progresses.	Moderate	Design, construction	TCCS
Increased media attention and political interest affect the community interest or perceptions of the Project in general				
Development is not consistent with values of retained heritage sites, or areas of natural environmental value	Consider the Conservation Management Plan and its recommendations throughout the design phase	Moderate	Design and Construction	TCCS
Materials and waste				

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
Waste materials produced during construction of the Project not stored or managed effectively	Storing of hazardous materials required for the operation and maintenance of the Project in accordance with relevant ACT EPA guidelines and use of an appropriately licensed contractor to remove contaminated waste, under current ACT EPA Guidelines.	High	Construction	EPA
Excessive resources used in the construction of the Project	Investigate opportunities to re-use or recycle other construction and demolition waste, and apply the waste hierarchy (avoid, minimise, re-use/recycle, dispose) throughout construction.	Moderate	Design and Construction	EPA
Increase in waste to landfill during construction	Investigate opportunities to re-use or recycle other construction and demolition waste, and apply the waste hierarchy (avoid, minimise, re-use/recycle, dispose) throughout construction.	Moderate	Design and Construction	EPA
Climate change				
Greenhouse gas emissions from vehicles and machinery working.	Detailed Design and CEMP are to take into account efficient vehicular movements in designing construction methodology and managing these impacts during the construction stage of the Project.	High	Design and Pre-construction and Construction	TCCS
More regular Inspection of road surface and associated infrastructure required	Maintenance inspection/requirements and working procedures to consider increase in heat and extreme climate events and use of energy and fuel-efficient vehicles.	High	Pre-construction and Construction	TCCS
Greenhouse gas emissions from construction and operation contributing to climate change	Construction plant and equipment to consider energy and fuel efficiency to minimise greenhouse gas emissions. Site compounds to consider solar panels instead of non-renewable energy. Consider 'green' travel for construction staff.	High	Pre-construction and Construction	TCCS
Urban heat island effect for areas of cleared vegetation at the Project Site.	To mitigate these impacts, it is proposed to plant new evergreen trees alongside the locations where existing trees will be removed. Indeed, where possible, established trees will be retained to provide landscape screening. A schedule of additional plantings	Moderate	Post construction	Conservator of Flora and Fauna

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
	will therefore be provided to soften the impact on the predominantly rural landscape. Native, mature trees removed as a result of the Project will be replaced at a ratio of 1:10. Native shrubs removed as a result of the Project will be replaced at a ratio of 1:4. The locations of these plantings must be considered as part of the landscaping and offset plans prepared for the Project. Proposed landscaping trees will either be ***Casuarina Cunninghamiana***, or one of six x different species of Eucalyptus. Landscaping plans for the Project will consider the use of lighter colours in delivering hard infrastructure components of the Project where reasonable and feasible to do so, and where road safety/legibility will not be compromised.			
Socio-economic and health				
Impact on recreational users of reserves and open space adjacent to the current road alignment	Access to surrounding areas utilised for recreational purposes including Bicentennial National Trail, The Pinnacle and Kama Nature Reserves, the Weetangera Cemetery and adjacent open spaces will experience some temporary impacts to access during the construction of the Project. The construction contractor will be tasked with scheduling construction tasks so as to minimise these disruptions where reasonable and feasible to do so	Moderate	Construction	Construction contractor
Work, health and safety risk to workers during construction	A CEMP will be prepared and include an unexpected finds protocol. A Waste Management Plan will be prepared and include stockpile management procedures for contaminated material. Hazardous materials are to be stored in accordance with relevant ACT EPA guidelines.	High	Design and Construction	EPA
Bushfire risk				

Potential Impact	Mitigation Measure	Effective-ness	Timing	Responsible Agency
Increased risk of bushfire associated with sparks from construction equipment and vehicles	The CEMP will contain standard mitigation measures to manage the use of hot works, chemicals storage and the use of plant and equipment at the site in order to reduce the risk of onsite ignition. No hot works will take place during total fire ban days, except with a suitable permit in place.	High	Construction	TCCS
Potential loss of life and property as a result of bushfire during construction	During the construction of the Project, Asset Protection Zones will be maintained around construction compounds as per the ***ACT Bushfire Management Standards*** (ACT Emergency Services Commissioner, 2014). This generally requires a distance of 30m be kept between forest and woodland vegetation, which same area is maintained to the standard of Inner Protection Zone.	High	Construction	TCCS
Bushfire started during construction and operation impacting assets and people off site	For all work, mandate requirements for Job Safety Analysis to incorporate fire ignition risk assessment and controls for prevention of fire ignition in grass by vehicle exhaust systems. Project to be incorporated into an Asset Management Plan applying to Vegetation Management (bushfire and environmental) Works Plan.	High	Construction and operation	TCCS
Bushfire started offsite impacting the Project and people on site	Project to be incorporated into an Asset Management Plan applying to Vegetation Management (bushfire and environmental) Works Plan.	High	Construction and operation	TCCS

8 Conclusion

SMEC has prepared this Environmental Impact Statement to undertake the detailed design of the duplication of a 4.5km portion of WHD between JGD and DBD.

The portion of WHD proposed to be upgraded is the only section of the road that remains unduplicated, and operates at over 20,000 vehicles per day which significantly exceeds the capacity of a single carriageway road. Additional traffic generated by new residential development in the estate of Ginninderry (West Belconnen) and the new suburbs of Strathnairn and Macnamara will also be accommodated by the upgrade works. A SIDRA analysis found that the intersection of WHD and DBD in its current form is expected to fail in 2031, with some movements operating at very high delay in the AM and PM peak periods and as such the overall average performance of the intersection falls below the required level of service. This resulting congestion also creates road safety concerns. The duplication of the road and provision for future delivery of a safe active travel route is expected to reduce congestion and resulting crashes. In addition, increased arterial capacity is expected to reduce the likelihood of east-west rat-running through Hawker, Weetangera, Cook, and Aranda.

This Environmental Impact Statement was prepared to inform consideration of the project by the Environment, Planning and Sustainable Development Directorate, and meets the requirements of the ***Planning and Development Act 2007*** the ***Planning and Development Regulation 2008***, and the Scoping Document issued for the Project on 19 October 2020. In accordance with Section 123(b) of the P&D Act, the Project is categorised as Impact Track due to the fact that it is described in Schedule 4 to the Act, and also due to Section 123(e) of the ***Planning and Development Act 2007***, as the Project is a controlled action under the EPBC Act which may be assessed under the bilateral process.

This Environmental Impact Statement was required to be prepared under Section 127(2) of the P&D Act as the Project is likely to have a significant impact on species listed under the NC Act and the EPBC Act. The relevant triggers are with respect to "Areas and Processes," due to the Project's predicted impacts to listed species (as confirmed via the EPBC Act referral), and the proposed clearing of more than 0.5 ha of native vegetation.

Beneficial effects of the Project will include the provision of an increased capacity for vehicles to meet the forecast demand of the road, including increased traffic from nearby developments at West Belconnen, Strathnairn and Macnamara. The Project will also increase the safety of road travel within this part of the ACT. It will furthermore include improved shared path provision for the ACT, which could have a beneficial impact on the broader community as well as the ACT Government's targeted strategies to increase active transport journeys and reduce vehicular emissions.

As the Project will generally be within the existing road easement which is a highly modified environment, it largely avoids impacts on environmental values and land use. Despite best efforts to avoid impacts, there are some adverse environmental effects, most temporary in nature, which are likely to occur, and which therefore require mitigation measures.

The Project would be delivered under an Environment Protection Agreement entered into between TCCS or its construction contractor under the ***Environment Protection Act 1997*** (refer to Section 3.1.5 below), as the Project involves a Class B activity as listed under Clause 1.3 of Schedule 1 to the Act, being for:

> ***major land development or construction activities, being—***
>
> ***a) land development, or the construction of a commercial building, on a site of 0.3ha or more and including the construction of associated public infrastructure; or***
>
> ***b) the construction of public infrastructure on a site of 0.3ha or more.***

During discussions with the Environment Protection Authority, consensus would be reached as to whether the Project requires a Waterway Works Licence under Section 42 of the ***Water Resources Act 2007*** due to the proximity of works to Deep Creek.

The Project will also be delivered in conjunction with an Offset Management Plan to manage potentially significant impacts for threatened species and ecological communities; namely Box Gum Woodland, the Hoary Sunray, Superb Parrot, Pink-tailed Worm-lizard and Striped Legless Lizard.

This Environmental Impact Statement has assessed the potential impacts of the Project, and has found that, with suitable mitigation measures in place, the environmental and social risks generated through the construction and operation of the Project can be managed to a general overall risk rating level of Low, except for certain biodiversity and socio-economic impacts which are considered to have a Medium level of significance (and noting that the Medium level of socio-economic impacts only relates to the timing of this finalised EIS).

Adverse environmental impacts will be minimised by implementing mitigation measures outlined in this Draft Environmental Impact Statement and will include preparing and implementing a Construction Environmental Management Plan. Transport Canberra and City Services also enter into an Environment Protection Agreement with the Environment Protection Authority.

The Project will result in both beneficial and adverse impacts, however the mitigation measures summarised in this revised EIS will manage and mitigate the identified adverse impacts. The Project is also directly aligned with various Statements of Strategic Directions as recognised within the ***Territory Plan 2008***, and furthermore meets the principles of Ecologically Sustainable Development as recognised under Section 9 of the ***Planning and Development Act 2007*** and Section 3A of the ***Environment Protection and Biodiversity Conservation Act 1999***.

Overall, it is recommended that the Project be approved, subject to suitable mitigation measures.

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Appendix A **William Hovell Drive Duplication: General Arrangement Plans (SMEC, 2022)**

Appendix B **Scoping Document and Entity Requirements**

Appendix C **Transport Assessment Report: William Hovell Drive Duplication (SMEC, 2022)**

Appendix D **Biodiversity Impact Assessment: William Hovell Drive Duplication (SMEC, 2022)**

Appendix E **William Hovell Drive Duplication: Updated Aboriginal and Historical Cultural Heritage Assessment (Past Traces Heritage Consultants, 2022)**

Appendix F **William Hovell Drive Duplication: Road Traffic Noise Assessment (SLR, 2022)**

Appendix G **EPBC Referral Decsion Notice Letter**

Appendix H **Study Team**

Technical area	Team members	Qualifications and experience
Planning and assessment	**SMEC:**	
	Greg Tallentire	Master of Science and Law Bachelor of Science Infrastructure Sustainability Accredited Professional v2.0 Advanced Diploma of Project Management 18+ years' experience
	Jessica Miller	Advanced Diploma of Applied Environmental Management Bachelor of Arts/Laws 11 years' experience
	Rachel Gray	Master of Science (Research) Bachelor of Science (Environmental Biology) 4+ years' experience
Traffic and Transport	**SMEC:**	
	Josh Everett	Bachelor of Engineering (Hons) Master of Transport Master of Traffic 15+ years' experience
Biodiversity	**SMEC:**	
	Larissa Abbott	Bachelor of Science (Hons) 13 years' experience
	Gregg Goldin	BAM Accredited Assessor Master of Science Bachelor of Science (Hons) 7 years' experience
	James Taylor	Bachelor of Environmental Science 11 years' experience
	Lachlan Laurie	BAM Accredited Assessor 15+ years' experience
Heritage	**Past Traces Heritage:**	
	Lyn O'Brien	Bachelor of Arts (Hons), Prehistory, History, Classics 20+ years' experience
Noise and Vibration	**SLR Consulting Australia:**	
	Matthew Bryce	Graduate Diploma, Environmental Quality Bachelor of Science, Australian Environmental Studies 20+ years' experience
	Antony Williams	Bachelor of Science, Audio Technology

		20+ years' experience
Soils and geology (Geotechnical)	**SMEC:**	
	Alex Williams	Bachelor of Engineering (Scholars Program) – Environmental Engineering (Hons 1) 10+ years' experience
	Daniel Cramer	Bachelor of Engineering (Civil) Master of Environmental Studies (Waste Management Member of Environmental Institute Australia and New Zealand 25+ years' experience
	Douglas Partners:	
	Alexandra Radulovich	Bachelor of Engineering Masters of Geotechnical Engineering 10+ years' experience
	Michael Jones	Bachelor of Civil Engineering 23+ years' experience
Contamination	**SMEC:**	
	Alex Williams	Bachelor of Engineering (Scholars Program) – Environmental Engineering (Hons 1) 10+ years' experience
	Daniel Saunders	Bachelor of Environmental Science Member of Australian Land and Groundwater Association Blue Book training Erosion and Sediment Control training – NSW "Blue Book" 15+ years' experience
	Douglas Partners:	
	Peter Storey	Master of Science, Environmental Biogeochemistry Bachelor of Science, Environmental Geoscience 13+ years' experience
	Dean Woods	Bachelor of Engineering, Environmental 22+ years' experience
Water quality and hydrology	**SMEC:**	
	Anton Kandiah	Master of Engineering Bachelor of Engineering (Civil) (Hons) Member of Institution of Engineers Australia Chartered Professional Engineer Member of National Engineering Register 26+ years' experience

	Rosie Robinson	Bachelor of Civil Engineering Bachelor of Physiotherapy Certificate in Commerce 5 years' experience

Appendix I **Spill Light Assessment**

Appendix J **Stakeholder Engagement Report**

Appendix K **Tree Protection Zone**

Appendix L **Fauna crossing design**

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