

Review of Environmental Factors

Access Road and Dudley Street Upgrade

Prepared to support:

EPSDD S211 Exemption Report
EPBC Act Preliminary Documentation
NCA Works Approval

Review of Environmental Factors

Access Road and Dudley Street Upgrade

Client: Infrastructure Finance and Capital Works

ABN: 66 676 633 401

Prepared by

AECOM Australia Pty Ltd

Level 2, 60 Marcus Clarke Street, Canberra ACT 2600, Australia

T +61 2 6201 3000 F +61 2 6201 3099 www.aecom.com

ABN 20 093 846 925

24-Oct-2018

Job No.: 60533438

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

© AECOM Australia Pty Ltd (AECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Cover Page

Review of Environmental Factors prepared by

Name:	Richard Farmer richard.farmer@aecom.com	Catherine Brady catherine.brady@aecom.com
Qualifications:	BSc Env Science	Bachelor of Arts (Hons) Geography and Economics; Master of Regional and Urban Planning
Address:	Level 2, 60 Marcus Clarke Street, Canberra ACT 2600, +61 2 6201 3000	
In respect of:	Access Road and Dudley Street Upgrade	
EPBC Reference:	Decision Number 2017/8072	

Applicant, project and land details

Applicant name:	Gerard Coffey, Senior Project Manager
Proposed development (project title):	Access Road and Dudley Street Upgrade
Land to be developed:	Block 3, Section 94, Yarralumla; Block 1, Section 127, Yarralumla; Block 1, Section 113, Yarralumla; Block 1, Section 123, Curtin.
Lessee of land to be developed:	ACT Government – Transport Canberra & City Services, Roads ACT – Ken Marshall

Review of Environmental Factors

Statement of validity:	I certify that I have prepared the contents of this review of environmental factors in accordance with relevant legislation, and that to the best of my knowledge; the information contained in the environmental assessment is neither false nor misleading.
Signature:	
Date:	25-Jul-2018

Quality Information

Document Review of Environmental Factors

Ref 60533438

Date 24-Oct-2018

Prepared by Matthew McDonnell, Richard Farmer

Reviewed by Catherine Brady

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
1	05-Feb-2018	Draft	Jane Peters Project manager	Signed in original
2	10-Apr-2018	Final draft	Jane Peters Project manager	Signed in original
3	27-Apr-2018	Updated following public exhibition for DoEE and EPSDD completeness check	Jane Peters Project manager	Signed in original
4	25-Jul-2018	Updated to incorporate completeness check comments from DoEE and EPSDD	Jane Peters Project manager	Signed in original
5	18-Oct-2018	Updated following public exhibition	Cameron Granger Project Manager	

Table of Contents

Cover Page	3
List of Abbreviations and Acronyms	11
Glossary	12
Executive Summary	14
1.0 Introduction	18
1.1 Overview of the Project	18
1.1.1 Need for the Project	18
1.1.2 Key features of the Project	18
1.2 Location of the Project	19
1.3 Land administration and zoning	20
1.4 Existing environment and land uses	22
1.4.1 General	22
1.4.2 Existing road network	22
1.5 Interdependency with Canberra Brickworks Precinct development	28
1.6 Purpose of this document	28
2.0 Need for the Project	29
2.1 Strategic justification	29
2.1.1 Dudley Street Upgrade	29
2.1.2 Access Road	29
2.1.3 Project objectives	30
2.2 Design development	30
2.3 Assessment of alternatives	31
2.3.1 'Do nothing' option	31
2.3.2 Access route options	31
2.3.3 Alignment options	32
2.3.4 Intersection options	33
2.3.5 Cross section options	35
2.3.6 Uriarra Track modification options	36
2.4 Justification for the preferred option	37
3.0 Description of the Project	38
3.1 The Project	38
3.1.1 Scope of works	42
Dudley Street Upgrade	42
Access Road	42
3.1.2 Engineering constraints	42
3.1.3 Design standards	43
3.2 Construction activities	43
3.2.1 Work methodology	43
3.2.2 Plant and equipment	48
3.2.3 Working hours	48
3.2.4 Earthworks	48
3.2.5 Source and quantity of materials	49
3.2.6 Traffic access and vehicle movements	49
3.2.7 Ancillary facilities	49
3.2.8 Public utility adjustments	50
3.3 Property acquisition	52
3.4 Operation management and maintenance	52
4.0 Legislative Context	53
4.1 Commonwealth legislation	53
4.1.1 <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	53
4.1.2 <i>ACT Planning and Land Management Act 1988</i> (P&LM Act)	54
4.2 ACT Legislation	54
4.2.1 <i>Planning and Development Act 2007</i> (PD Act)	54
Section 211 EIS Exemption Application	59

	4.2.2	Planning and Development Regulation 2008	59
	4.2.3	Other ACT legislation and regulations	59
	4.2.4	ACT Government policies and strategies	64
		<i>ACT Planning Strategy 2012</i>	64
		<i>Transport for Canberra</i>	64
		<i>ACT Climate Change Strategy</i>	64
		<i>ACT's Sustainability Policy</i>	64
	4.3	Ecologically sustainable development	65
5.0		Community and Stakeholder Consultation	A-1
	5.1	Consultation strategy	A-1
	5.2	Stakeholder consultation activities	A-1
	5.2.1	Suburban Land Agency	A-2
	5.2.2	Yarralumla Uniting Church	A-2
	5.2.3	National Capital Authority	A-2
	5.2.4	Commonwealth Department of Environment and Energy (DOEE)	A-3
	5.2.5	Transport Canberra and City Services / Transport Canberra (ACTION)	A-3
	5.2.6	Utilities Authorities	A-3
	5.2.7	Inter-Directorate	A-3
	5.2.8	Walter Burley Griffin Society	A-4
	5.2.9	Indigenous heritage stakeholders	A-4
	5.2.10	Brickworks Design and TCCS	A-4
	5.2.11	Yarralumla Residents Association	A-5
	5.3	Community information session	A-5
	5.4	Ongoing consultation	A-6
	5.4.1	Commonwealth planning approvals	A-6
	5.4.2	ACT planning approvals	A-6
	5.4.3	Consultation during Project implementation	A-6
6.0		Preliminary Risk Assessment (pre-mitigation)	7
	6.1	Purpose of a Preliminary Risk Assessment	7
	6.2	Methodology of the Preliminary Risk Assessment	7
	6.2.1	Evaluating likelihood	7
	6.2.2	Evaluating consequence	7
	6.2.3	Risk rating matrix	7
	6.3	Environmental impact aspects / activities	9
	6.4	Assumptions and limitations	9
	6.5	Preliminary Risk Assessment	10
	6.6	Key risks and initial conclusions	16
7.0		Environmental Assessment	17
	7.1	Traffic and transport	17
	7.1.1	Investigations	17
	7.1.2	Environmental conditions and values	18
	7.1.3	Potential impacts	25
	7.1.4	Mitigation measures	29
	7.1.5	Residual risks	30
	7.2	Biodiversity	31
	7.2.1	Investigations	32
	7.2.2	Environmental conditions and values	33
	7.2.3	Potential Impacts	38
	7.2.4	Mitigation measures	41
	7.2.5	Biodiversity offset	42
	7.2.6	Residual risks	43
	7.3	Landscape and visual	46
	7.3.1	Investigations	46
	7.3.2	Environmental conditions	46
	7.3.3	Potential impacts	50
	7.3.4	Mitigation measures	56
	7.3.5	Residual risks	56
	7.4	Socio-economic	57

	7.4.1	Environmental conditions and values	58
	7.4.2	Potential impacts	61
	7.4.3	Mitigation measures	62
	7.4.4	Residual risks	63
7.5		Noise, Vibration and Lighting	65
	7.5.1	Investigations	65
	7.5.2	Environmental conditions and values	66
	7.5.3	Potential impacts	70
	7.5.4	Mitigation measures	73
	7.5.5	Residual risks	75
7.6		Soils and Geology	76
	7.6.1	Investigations	76
	7.6.2	Environmental conditions and values	77
	7.6.3	Potential impacts	79
	7.6.4	Mitigation measures	79
	7.6.5	Residual risks	80
7.7		Water and flooding	82
	7.7.1	Investigations	82
	7.7.2	Environmental Conditions and Values	82
	7.7.3	Potential impacts	86
	7.7.4	Mitigation measures	88
	7.7.5	Residual Risks	89
7.8		Air Quality	90
	7.8.1	Environmental conditions and values	90
	7.8.2	Potential impacts	91
	7.8.3	Mitigation measures	92
	7.8.4	Residual risks	93
7.9		Aboriginal Heritage	94
	7.9.1	Investigations	94
	7.9.2	Environmental conditions and values	94
	7.9.3	Potential impacts	95
	7.9.4	Mitigation measures	96
	7.9.5	Residual risks	96
7.10		Non-Aboriginal Heritage	97
	7.10.1	Investigations	97
	7.10.2	Environmental conditions and values	97
	7.10.3	Potential impacts	99
		Heritage significance	100
	7.10.4	Mitigation measures	102
	7.10.5	Residual risks	102
7.11		Bushfire Risk	103
	7.11.1	Environmental conditions and values	103
	7.11.2	Potential impacts	104
	7.11.3	Mitigation measures	106
	7.11.4	Residual risks	107
7.12		Utilities and infrastructure	108
	7.12.1	Investigations	108
	7.12.2	Environmental conditions and values	108
	7.12.3	Potential impacts	109
	7.12.4	Mitigation measures	109
	7.12.5	Residual risks	109
7.13		Waste and Resources	110
	7.13.1	Environmental conditions and values	110
	7.13.2	Potential impacts	111
	7.13.3	Mitigation measures	111
	7.13.4	Residual risks	112
7.14		Climate Change	113
	7.14.1	Environmental conditions and values	113

	7.14.2	Potential impacts	113
	7.14.3	Mitigation measures	114
	7.14.4	Residual risks	115
7.15		Cumulative impacts	116
	7.15.1	Existing or potential projects	116
	7.15.2	Mitigation measures	117
	7.15.3	Residual risks	117
8.0		Environmental management	118
	8.1	Environmental management plans	118
	8.2	Mitigation measures	118
	8.3	Residual risk assessment	127
9.0		Conclusion	141
10.0		References	142

Appendix A – Additional information requirements requested by DOEE on 15 December 2017

Appendix B – Protected matters search tool results

Appendix C – Landscape and visual impact assessment methodology

Appendix D – Site Auditor Response – Interim Audit Advice #8

Appendix E – Submissions Report

List of Tables

Table 1	Blocks and Sections within which the Project is located	20
Table 2	Road Hierarchy	22
Table 3	Indicative construction staging and traffic control for key activities	44
Table 4	Schedule 4, Part 4.2 - Development Proposals requiring an assessment in the Impact Track— activities	55
Table 5	Schedule 4, Part 4.3 - Development Proposals requiring an assessment in the Impact Track – areas and processes	57
Table 6	Other legislation applicable to the Project	59
Table 7	Statement of Strategic Direction principals	61
Table 8	ACT Government policies and strategies applicable to the Project	64
Table 9	Preliminary Risk Assessment (Unmitigated Risks Only)	10
Table 10	Level of service definition table	20
Table 11	Public transport provision	22
Table 12	Forecast daily traffic	27
Table 13	Residual risks for Traffic and Transport values	30
Table 14	Natural temperate grassland within the Project area (Umwelt 2017b)	33
Table 15	Golden sun moth habitat	35
Table 16	Golden sun moth habitat impacted by the Project	39
Table 17	Trees to be removed as part of the Project	39
Table 18	Residual risks for biodiversity values	43
Table 19	Impact assessment for visual receivers	47
Table 20	Impacts to landscape character zones	50
Table 21	Operational visual impact assessment	53
Table 22	Residual Risks for Landscape and visual values	57
Table 23	2016 Demographics (ABS, 2017)	58
Table 24	Household characteristics (ABS, 2017)	58
Table 25	Potential sensitive receivers in the Project area	59
Table 26	Residual risks for socio-economic values	63
Table 27	Road traffic noise logging results	66
Table 28	Maximum traffic noise levels resulting from upgraded roads in existing areas, expressed as $L_{A10(18\text{hour})}$ dB(A) (From the ACT's <i>Noise Management Guidelines (Draft)</i> , March 1996, Table 3.3)	67
Table 29	Typical ground vibration levels associated with construction activities	68
Table 30	Human perception of vibrations	68
Table 31	Examples of safe working distances for typical vibration intensive plant	69
Table 32	Traffic flows for the years 2017 and 2029	69
Table 33	Noise model validation	70
Table 34	Predicted road traffic noise levels	71
Table 35	Residual risks for noise, vibration and lighting	75
Table 36	Areas of Environmental Concern (SMEC, 2014)	78
Table 37	Residual risks for soils and geology	81
Table 38	Catchments and stormwater flows	84
Table 39	Water quality standards for the Yarralumla Creek Catchment	86
Table 40	Residual risks for hydrology, hydrogeology and water quality	89
Table 41	Background air quality data	91
Table 42	Residual risks for air quality values	93
Table 43	Residual risks for Heritage Values	96
Table 44	Assessment of Heritage Significance - Railway alignment	101
Table 45	Residual risks for Heritage Values	102
Table 46	Residual risks for Bushfire Risk values	107
Table 47	Residual risks for Utilities/Infrastructure Values	109
Table 48	Residual risks for waste and resources values	112
Table 49	Summary of the predicted changes for the ACT	114
Table 50	Summary of proposed mitigation measures	118
Table 51	Summary of the residual risks (with mitigation)	127
Table 52	DOEE information request compliance matrix	145

Table 53	Listed Threatened Flora Species identified in the PMST	149
Table 54	Listed threatened fauna species identified in the PMST	149
Table 55	Migratory species identified	150

List of Figures

Figure 1	Regional context of the Project	19
Figure 2	Land administration and zoning in the Project area	21
Figure 3	View of Dudley Street / Cotter Road intersection looking south from Dudley Street	24
Figure 4	View of Dudley Street looking east from the western extents of Dudley Street	24
Figure 5	View of Dudley Street looking west from the eastern extents of Dudley Street	25
Figure 6	View of Dudley Street looking east near to the natural temperate grassland areas	25
Figure 7	View of Dudley Street looking east towards the existing bus stops	26
Figure 8	View of Novar Street roundabout looking west towards Dudley Street	26
Figure 9	View of Uriarra Track looking east from the western extents of the Project area	27
Figure 10	View of the Denman Street looking west from near to the Yarralumla Uniting Church	27
Figure 11	Alignment options for the Access Road	32
Figure 12	Alternative intersection options considered at the feasibility stage	33
Figure 13	Intersection layout proposed as part of the Concept Design	34
Figure 14	Intersection options considered during the preliminary sketch plan design	35
Figure 15	Artist's impression of the Project looking east towards the new roundabout (<i>subject to detailed design</i>)	38
Figure 16	Project layout and surrounding environment (<i>subject to detailed design</i>)	39
Figure 17	Cross section of upgraded Dudley Street (<i>subject to detailed design</i>)	40
Figure 18	Cross section of the Access Road (<i>subject to detailed design</i>)	41
Figure 19	Stage 1 layout (<i>subject to detailed design</i>)	45
Figure 20	Stage 2 layout (<i>subject to detailed design</i>)	46
Figure 21	Stage 3 layout (<i>subject to detailed design</i>)	47
Figure 22	Proposed works area and indicative construction compound	51
Figure 23	Risk Prioritisation Matrix Summary	8
Figure 24	Daily traffic volume and speed summary	19
Figure 25	Weekday public transport routes	21
Figure 26	Weekend public transport routes	21
Figure 27	Existing formal pathways	23
Figure 28	View of the pedestrian / cycle crossing of Dudley Street near the Novar Street / Kent Street roundabout	23
Figure 29	Aerial view of approximate location of Uriarra track	24
Figure 30	View showing the unauthorised access from Dudley Street to the Yarralumla Uniting Church car park	24
Figure 31	Golden sun moth in the Proposal vicinity (source: ACTmapi)	35
Figure 32	Ecological conditions and values within the Project area and surrounds	37
Figure 33	Visual envelope map showing potentially visually affected area	48
Figure 34	Visual impact assessment receiver locations	49
Figure 35	Existing view from Dunrossil Drive (viewpoint 2) looking east to Dudley Street	55
Figure 36	Proposed view from Dunrossil Drive (viewpoint 2) looking east to Dudley Street (<i>indicative only, subject to detailed design</i>)	55
Figure 37	Noise logging locations	67
Figure 38	Erosion risk within the Project area (<i>data source: ACTMapi</i>)	77
Figure 39	Stormwater catchment master plan	85
Figure 40	Excerpt from 1951 aerial	98
Figure 41	Excerpt from 1958 aerial	98
Figure 42	Excerpt from 1968 aerial	99
Figure 43	Railway alignment cutting (highlighted) within the Project area. View north west	100

List of Abbreviations and Acronyms

Abbreviation	Definition
ACTION	Transport Canberra
ASS	acid sulphate soils
CBD	Central Business District
CEMP	Construction Environmental Management Plan
CMTEDD	Chief Minister, Treasury and Economic Development Directorate
CNVMP	Construction Noise and Vibration Management Plan
CoPC	Contaminants of potential Concern
CoRTN	Calculation of Road Traffic Noise
CTMP	Construction Traffic Management Plan
DBYD	Dial Before You Dig
DOEE	Commonwealth Department of Environment and Energy
EMP	Environmental Management Plan
EPBC Act	Commonwealth <i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EPSDD	Environment, Planning and Sustainable Development Directorate
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
GDE	Groundwater Dependent Ecosystems
IFCW	Infrastructure Finance and Capital Works
LCZ	Landscape character zones
LVIA	Landscape and Visual Impact Assessment
MNES	Matters of National Environmental Significance
NCA	National Capital Authority
NCP	National Capital Plan
PD Act	<i>Planning and Development Act 2007</i>
PM₁₀	particulate matter with a particle size less than 10 micrometres
P&LM Act	<i>Australian Capital Territory Planning and Land Management Act 1988</i>
REF	Review of Environmental Factors
SLA	Suburban Land Agency
TCCS	Transport Canberra and City Services
TEC	Threatened Ecological Community
YRA	Yarralumla Residents Association

Glossary

Term	Definition
A Weighted decibels [dB(A)]	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
AEP	The likelihood of occurrence of a flood of given size or larger occurring in any one year. AEP is expressed as a percentage (%) and may be expressed as the reciprocal of ARI (Average Recurrence Interval). For example, if a peak flood discharge of 500 m ³ /s has an AEP of 5%, it means that there is a 5% risk (ie, a risk of one-in-20) of a peak flood discharge of 500 m ³ /s or larger occurring in any one year (see also Average Recurrence Interval).
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
ARI	The likelihood of occurrence, expressed in terms of the long-term average number of years, between flood events as large as or larger than the design flood event. For example, floods with a discharge as large as or larger than the 100-year ARI flood will occur on average once every 100-years. ARI is related to AEP and Odds of Flooding as follows: ARI in years equals the reciprocal of AEP expressed in terms of chance. For example, a 1% AEP flood has a chance of occurrence in any year of 0.01, and an associated ARI of 100 years. The Odds of Flooding are equal to the ARI in years. Therefore the 100 year ARI flood is also the 100:1 flood (see also Annual Exceedance Probability).
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L90 sound pressure level is used to quantify background noise.
Clear water	Surface water runoff from vegetated or undisturbed areas of the site
Contamination	Occurrence of chemical substances with the potential to cause harm to public health, safety and/ or the environment.
Decibel [dB]	The measurement unit of sound.
Designated area	Particular land and purpose as designated under the <i>Australian Capital Territory (Planning and Land Management) Act 1988</i> .
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
Geotechnical	Describes or categorises an object, issue or study as primarily associated with the nature of geological materials.
Greenhouse gases	The gaseous constituents of the atmosphere, both natural and anthropogenic, which absorb and emit radiation from the sun, thereby trapping heating in the lower atmosphere.
Grey water	Surface water runoff from disturbed areas of the site which is potentially contaminated with sediment and other pollutants (generally corresponds to the term 'stormwater' in landfill guidelines).

Term	Definition
Groundwater	Water beneath the earth's surface, often between saturated soil and rock that supplies wells and springs.
Habitat	Environmental values suitable for use by species, populations or communities.
L₁₀	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L10.
L₉₀	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L90.
Novar Street roundabout	The roundabout intersection of Dudley Street / Novar Street / Adelaide Avenue off-ramp / Kent Street, referred to in this report as Novar Street roundabout.
Offset	Measures that compensate for the residual impacts of an action on the environment, after avoidance and mitigation measures are taken.
Proponent	The company that has put forward the Project for development, in this instance, ACT Government, Infrastructure Finance and Capital Works
Project	The construction and operation of the Access Road and Dudley Street Upgrade
Project area	The area where the Project would be undertaken, i.e. Block 3, Section 94, Yarralumla; Block 1, Section 127, Yarralumla; Block 1, Section 113, Yarralumla; Block 1, Section 123, Curtin and road reserve.
Targeted survey	Field survey specifically designed to assess presence/absence and condition of a species population and/or community.
Threatened	Flora or fauna species, populations or communities listed under Commonwealth or State legislation as Critically Endangered, Endangered or Vulnerable.
Unexpected finds	Discovery of contamination not expected within a location.
Visual amenity	The visual and aesthetic quality of a public or privately owned property.

Executive Summary

Overview

The Australian Capital Territory (ACT) Government is committed to making it easier to get around Canberra by delivering an integrated public transport network and better road infrastructure. Investing in roads provides more transport options for Canberrans and improves the safety for road users.

The ACT Government is responsible for delivering the Access Road and Dudley Street Upgrade (the 'Project') to provide improvements to Dudley Street to allow it to safely service the current (and proposed) traffic levels and to provide the publically funded access to service the proposed Canberra Brickworks Precinct development area.

This Review of Environmental Factors (REF) has been prepared to assess the environmental impacts associated with the construction and operation of the Project under the provisions of:

- Department of Environment and Energy request for additional information required for its assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Referral 2017/8072) received on 15 December 2017
- Environmental Planning and Sustainable Development Directorate (EPSDD) requirements for EIS Exemption in accordance with Section 211 of the *Planning and Development Act 2007* and other relevant legislation
- National Capital Authority (NCA) Works Approval.

The alignment of the Project falls within different administrative authority areas and therefore not all components of the Project would require the same level of statutory and development assessment considerations. To meet the various levels of development assessment that have been identified, a comprehensive assessment of the overall Project has been prepared which assesses the impacts of the Project on both land managed by the NCA and the ACT Government, and to support the Commonwealth requirements under the EPBC Act.

The Project

Dudley Street provides a link from north western Canberra to the suburbs of Yarralumla and Deakin. It connects Cotter Road to the roundabout intersection of Dudley Street / Novar Street / Adelaide Avenue off ramp / Kent Street (Novar Street roundabout). A traffic assessment undertaken in 2016 determined that Dudley Street is functioning at capacity under existing traffic use conditions. Upgrades are required to allow Dudley Street to operate safely and to meet the design requirements for a 'major collector road'.

The Canberra Brickworks Precinct is located in the central Canberra suburb of Yarralumla, around three kilometres from the Canberra Central Business District (CBD). The Canberra Brickworks Precinct is proposed to be developed into around 380 residential dwellings and would repurpose a highly valued historical amenity. A new Access Road is required to service the Canberra Brickworks Precinct from Dudley Street and is a predevelopment requirement. The development of the Canberra Brickworks Precinct is not part of this Project would be undertaken as part of a separate Proposal (by the DOMA Group).

A feasibility design, concept design and preliminary sketch plan design have been developed for the Project which have identified improvements for Dudley Street and proposed an alignment for the new Access Road, including a new intersection from Dudley Street. The Project has been optimised during each of these design stages to minimise ecological and community impacts, while meeting design objectives and road design requirements.

The key features of the Project include:

- upgrading Dudley Street
- construction of a new roundabout intersection between Dudley Street and the new Access Road to the Canberra Brickworks Precinct

- construction of a new Access Road travelling north from the new roundabout intersection on Dudley Street to the proposed Canberra Brickworks Precinct
- off road shared path to the north of Dudley Street
- provisions to maintain pedestrian access along the Uriarra Track, including a minor diversion to allow pedestrians to see passing vehicles and a pedestrian refuge for safe crossing
- ancillary works including utilities diversion and/or relocation, earthworks, drainage modifications, provision of new street lighting, upgrades to kerbs and landscaping.

Subject to approval, construction is expected to commence in 2018 and take about 12 months to complete. The Access Road is required to be open prior to the proposed Canberra Brickworks Precinct construction works commencing to minimise construction traffic impacts and disruption (including site decontamination works) for residents of Yarralumla. A detailed description of the Project is provided in Chapter 3 of this REF.

Need for the Project

Dudley Street Upgrade

The existing traffic volumes and the Roads ACT Road Hierarchy map prescribe that Dudley Street is a 'major collector road'. In order to meet current Estate Development Code guidelines for a major collector road, the typical cross section of Dudley Street must meet a minimum carriageway width of 10 metres. Dudley Street is currently six metres wide and does not have a sealed shoulder.

Traffic counts undertaken in 2015 identified that Dudley Street had daily movements of 7,487 vehicles per day while its design capacity is currently for 6,000 vehicles per day. It is estimated that the development of the Canberra Brickworks Precinct would also generate about 2,400 additional vehicle movements on Dudley Street per day. With the Canberra Brickworks Precinct development and the future development of Molonglo Valley, there will be increasing pressure on Dudley Street which is already at capacity.

Upgrades are required to allow Dudley Street to operate safely and to meet the design requirements for a major collector road. The Project would increase the width of Dudley Street to 10 metres and would cater for 9,000 vehicle movements per day.

Access Road

In order to service the Canberra Brickworks Precinct a transport connection is required from the proposed development area to the adjacent road network. There is an existing access to the Canberra Brickworks via Denman Street / Kintore Crescent, however with a classification of an 'access street' and a capacity of 1,000 vehicles per day, the addition of around 2,400 vehicles per day (to the existing recorded 500 vehicles per day) would impact traffic and the amenity of the residents located along it. As a pre-development requirement of the Canberra Brickworks Precinct, Transport Canberra and City Services (TCCS) requires the provision of a designated Access Road connecting the Canberra Brickworks Precinct to Dudley Street. The Access Road would provide a suitable access route for the proposed development and meet the Estate Development Code guidelines.

Design options considered

The key features of the Project have been refined through various design stages since its conception. A feasibility design, concept design and preliminary sketch plan design have been developed for the Project which have identified improvements for Dudley Street and proposed an alignment for the new Access Road, including a new intersection from Dudley Street. The design of the Project, including the road cross sections and alignment, has been optimised during each of these design stages to minimise ecological and community impacts, while meeting design objectives, the Estate Development Code guidelines and ACT road design standards in this constrained environment.

The development of the preferred option involved several key tasks, including assessments of existing intersection performance and identification of key deficiencies and opportunities for improving safety. The assessment of alternatives considered various aspects of the Project including:

- identification of the preferred access route to connect the proposed Canberra Brickworks Precinct to the road network
- determination of the preferred alignment options for the preferred access route
- determination of the preferred modifications to Dudley Street to meet Project objectives
- consideration and determination of the preferred intersection option between Dudley Street and the Access Road
- preferred cross section options for Dudley Street and the Access Road
- consideration of Uriarra Track options
- construction compound location options.

The determination of the preferred option considered impacts to the sensitive ecological areas during construction in the Project area. Some of the improvements to the design which have been implemented to avoid or minimise impacts to Matters of National Environmental Significance (MNES) include:

- the new intersection of the Access Road and Dudley Street was relocated to the west and reduced in size to minimise the footprint and locate the roundabout away from the identified higher quality habitat for MNES
- the alignment of the Dudley Street Upgrade has been moved south so that the higher quality habitats north of Dudley Street are avoided (while taking into consideration the steep slope on the southern side of Dudley Street)
- the proposed on road cycling and street trees along the upgraded Dudley Street have been removed from the design to reduce the width of the road cross section and minimise potential shading impacts to golden sun moth habitat. Note: An off road shared path would be provided on Denman Street by the Canberra Brickworks Precinct developer to provide bicycle access
- the gradient of the proposed Dudley Street upgrade has been optimised to more closely match the existing ground level and therefore minimise the size of the embankments required by the proposed design (therefore reducing the footprint of the Project and ground disturbance)
- the location of the proposed site compound area which would temporarily be used for the construction activities has been selected to avoid areas identified as consisting of higher quality habitats where possible.

Legislative context

The Project, with the exception of the Dudley Street road reserve, is located within land subject to the Territory Plan, administered by EPSDD in accordance with the *Planning and Development Act 2007* (PD Act)). Development approval from EPSDD is required to allow the development of the Project to proceed. The Project triggers matters under Part 4.3 of Schedule 4 of the PD Act and therefore requires assessment under the Impact Track.

Dudley Street road reserve is located within a Designated Area, which is subject to the requirements of the National Capital Plan (NCP) administered by the NCA (a Commonwealth agency). The NCA has responsibility for determining detailed conditions of planning, design and development for proposals in Designated Areas. For the Dudley Street works, development approval is required from the NCA through a Works Approval process. Works proposed in Designated Areas do not require development approval from EPSDD under the PD Act. Notwithstanding, works proposed in Designated Areas still require endorsement from the ACT agencies which administer ACT environmental regulations.

In addition to the above, the requirements of the Commonwealth EPBC Act need to be considered for the Project. On 1 December 2017, the Minister's delegate determined that the Project was a controlled action in accordance with Section 75 of the EPBC Act and requires assessment under Preliminary Documentation. As a consequence, the Project requires assessment and approval by the Minister (or delegate) under the EPBC Act, before it can proceed.

Community and stakeholder consultation

Early consultation with key stakeholders and the community has occurred since 2015. Development of the preferred design option for the Project has involved numerous meetings, workshops and engagement with key stakeholders and the community. The consultation strategy has been designed to inform the community and key stakeholders and to encourage participation to allow the Project's development to benefit from stakeholder and community input.

A community information session was held at the Yarralumla Uniting Church on 28 November 2017 which was attended by over 60 community members. The community information session provided an opportunity for members of the public to discuss the Project with key members of the Project team.

As required as part of the approval processes, this REF and supporting documentation will be placed on public exhibition. Community consultation activities would be undertaken during the public exhibition and would continue as the Project progresses to detailed design and construction.

Further information about these specific activities is included in Section 5.4 of this REF.

Environmental impact assessment

This REF identifies the potential environmental benefits and impacts of the Project and outlines the mitigation measures to reduce the identified impacts.

The following key impacts have been identified should the Project proceed:

- temporary traffic disruptions (e.g. temporary diversions) during construction
- impacts on Matters of National Environmental Significance (MNES)
- clearing of trees and other vegetation causing loss of amenity, loss of habitat, and increased erosion and water runoff
- temporary diversion of a section of the Uriarra Track (a footpath used for recreational purposes, e.g. dog walking) during construction
- use of construction equipment (e.g. excavators) causing dust and particulate matter reducing local air quality (e.g. through stockpiling, earthworks etc)
- temporary noise impacts to local residents and the community during construction
- disturbance of soil associated with construction leading to increased soil and sediment erosion
- changes to existing surface water flow paths and overland flow
- views available to occupants of nearby sensitive receivers are altered
- permanent loss of an area of public open space to cater for the Access Road.

Further information regarding these impacts is provided in Chapter 7 of the REF.

Conclusion

This REF has been prepared having regard to the Preliminary Risk Assessment undertaken to ensure that the assessment takes into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the Project.

Should the Project proceed, potential associated adverse impacts would be appropriately managed in accordance with the mitigation measures outlined in this REF, and any conditions of approval imposed. This would ensure the Project is delivered to maximise benefit to the community and minimise any adverse impacts on the environment.

In considering the overall residual impacts outlined in this REF, provided the measures and commitments specified in the REF are applied and effectively implemented during the design, construction and operational phases, the identified environmental impacts are considered to be acceptable and manageable.

1.0 Introduction

1.1 Overview of the Project

1.1.1 Need for the Project

The ACT Government is committed to making it easier to get around Canberra by delivering an integrated public transport network and better road infrastructure. Investing in roads provides more transport options for Canberrans and improves the safety for road users.

Dudley Street provides a link from north western Canberra to the suburbs of Yarralumla and Deakin. It connects Cotter Road to the roundabout intersection of Novar Street / Adelaide Avenue off Ramp / Kent Street (Novar Street roundabout). Previous traffic studies have identified concerns with the function of Dudley Street and found that it was operating at capacity under existing traffic conditions, particularly in the morning peak.

Upgrades are required to allow Dudley Street to operate safely and to meet the design requirements for a 'major collector road'. Dudley Street is currently only six metres wide and does not have a sealed shoulder to cater for traffic incidents or breakdowns. With the Canberra Brickworks Precinct development and the future development of Molonglo Valley, there will be increasing pressure on Dudley Street which is already at capacity. The Project would increase the width of Dudley Street to 10 metres and would cater for 9,000 vehicle movements per day.

Access is also required off Dudley Street to enable the development of the Canberra Brickworks Precinct, a proposed development area which would provide for about 380 residential dwellings and would revitalise this historical heritage area of Yarralumla. The Canberra Brickworks Precinct is currently only accessible via one local access road, Denman Street / Kintore Crescent, which is not suitable to support the additional traffic the development would generate. A new access is required to connect the Canberra Brickworks Precinct directly to Dudley Street reducing the traffic impact of the development on residential streets within Yarralumla. A second estate access off Dudley Street to support the Canberra Brickworks Precinct was also a predevelopment requirement from Transport Canberra and City Services (TCCS) Directorate.

For the purposes of this assessment the Access Road and Dudley Street Upgrade will be referred to as the Project. The development of the Canberra Brickworks Precinct is not part of this Project and is a separate development proposal (by the DOMA Group).

1.1.2 Key features of the Project

The key features of the Project are summarised as follows:

- upgrading Dudley Street
- construction of a new roundabout intersection between Dudley Street and the new Access Road to the Canberra Brickworks Precinct
- construction of a new Access Road travelling north from the new roundabout intersection on Dudley Street to the proposed Canberra Brickworks Precinct
- off road shared path to the north of Dudley Street
- provisions to maintain pedestrian access along the Uriarra Track, including a minor diversion to allow pedestrians to see passing vehicles and a pedestrian refuge for safe crossing
- ancillary works including utilities diversion and/or relocation, earthworks, drainage modifications, provision of new street lighting, upgrades to kerbs and landscaping.

Subject to approval, construction is expected to commence in 2018 and take around 12 months to complete. The Access Road is required to be open prior to the proposed Canberra Brickworks Precinct construction works commencing to minimise construction traffic impacts and disruption (including site decontamination works) for residents of Yarralumla.

A detailed description of the Project is provided in Chapter 3.0 of this Review of Environmental Factors (REF).

1.2 Location of the Project

The Project is located within the central Australian Capital Territory (ACT) suburb of Yarralumla, around three kilometres from the Canberra Central Business District (CBD). The Project is situated within an area of public open space to the south of the main residential areas of Yarralumla. Other residential areas in the vicinity of the Project include the surrounding suburbs of Curtin and Deakin to the south east and south west. The Royal Canberra Golf Club and Government House (the official residence of the Governor-General of Australia) are located to the north and north east.

Directly to the south of the Project is Cotter Road and the major southern infrastructure corridor of Yarra Glen/Adelaide Avenue which connects the southern ACT suburbs to the Canberra CBD. The location of the Project in its regional context is shown in Figure 1.

Dudley Street provides a link from north western Canberra to the suburbs of Yarralumla (via Novar Street) and Deakin (via Kent Street) and connects Cotter Road to the Novar Street roundabout.



Figure 1 Regional context of the Project

1.3 Land administration and zoning

All land in the ACT belongs to the Commonwealth and, under the *Australian Capital Territory Planning and Land Management Act 1988* (Commonwealth) (P&LM Act), is either:

- National land – managed through the National Capital Plan (NCP) by the National Capital Authority (NCA), or
- Territory land – managed through the Territory Plan by Environment, Planning and Sustainable Development Directorate (EPSDD) of the ACT Government under the *Planning and Development Act 2007* (PD Act).

Additionally, the P&LM Act also provides for 'Designated Areas'. These areas may include National or Territory land. The NCA has responsibility for determining detailed conditions of planning, design and development for Projects in Designated Areas, however various agencies in the ACT Government may have custodianship and manage Designated Areas on a day to day basis.

The Dudley Street road reserve and land to the south of Dudley Street is located within a Designated Area, which is subject to the requirements of the National Capital Plan. For Project elements within a Designated Area, development approval is required from the NCA through a Works Approval process. Works proposed in Designated Areas do not require development approval from EPSDD, however still require endorsement from the ACT agencies which administer ACT environmental regulations.

Land north of Dudley Street is subject to the Territory Plan, administered by EPSDD. Territory Development approvals by EPSDD under the PD Act are required for works proposed in areas subject to the Territory Plan.

There are some areas in ACT outside of the Designated Areas that are important to the National Capital but not to the extent of Designated Areas. These areas are subject to Special Requirements which are additional to the requirements of the Territory Plan. Land north of Dudley Street (Block 3, Section 95) is part of the Adelaide Avenue main avenue which is to be managed in accordance with Section 4.15 of the National Capital Plan.

In addition to the approvals required from EPSDD and NCA, the Project area, contains two Matters of National Environmental Significance (MNES) namely,

- Natural Temperate Grasslands of the South-eastern Highlands (natural temperate grassland)
- Golden sun moth (*Synemon plana*).

MNES are protected under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). Approval from the Commonwealth Minister of Environment and Energy (or Delegate) is required for the Project as a result of impacts to MNES.

The Project area traverses four blocks with differing zoning as listed in Table 1 (note this table does not include road reserves). Figure 2 illustrates the land administration and zoning of the Project area.

Table 1 Blocks and Sections within which the Project is located

Block	Section	Division	Zoning	Applicable statutory planning framework	Land Custodianship
3	94	Yarralumla	PRZ2; PRZ1*	Territory Plan	TCCS
1	127	Yarralumla	PRZ2, Designated Land	Territory Plan, National Capital Plan	TCCS
1	113	Yarralumla	Designated Land	National Capital Plan	TCCS
1	123	Curtin	Designated Land	National Capital Plan	TCCS

* Note: ACTmap1 also identifies Block 3, Section 94 as 'CZ6: Leisure and accommodation' zoning however it has been confirmed (ACT Government spatial team, *per comms*) that this is a mapping error.

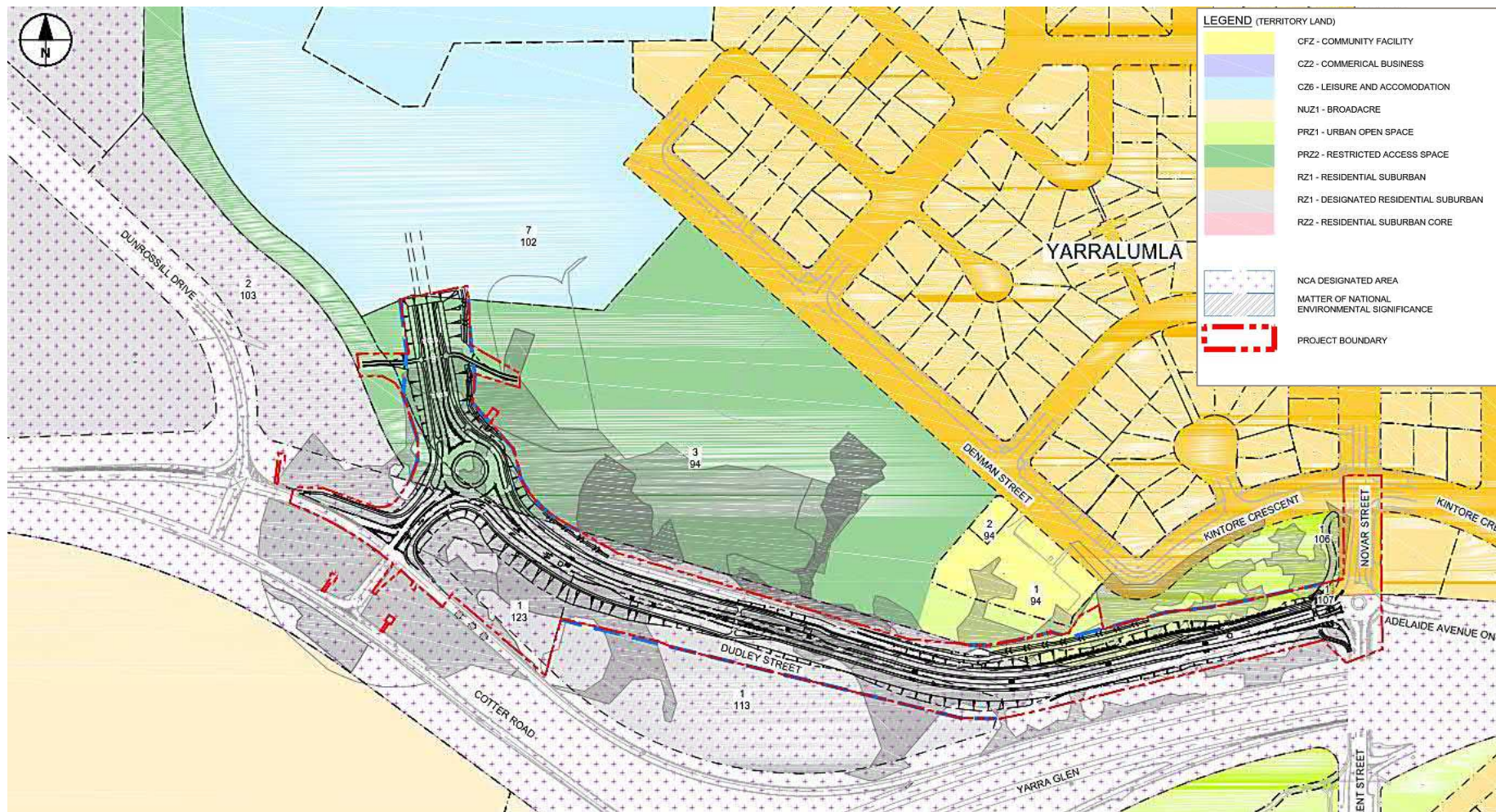


Figure 2 Land administration and zoning in the Project area

1.4 Existing environment and land uses

1.4.1 General

The Project area is characterised by an area of open space which is fragmented by the existing road network. Much of the Project area is covered with stands of exotic landscaped trees, including *Pinus canariensis*, *P. radiata*, *P. patula*, *Ulmus procera*, and *Quercus palustris*. The majority of the grassland areas are also exotic, dominated by Chilean needlegrass (*Nassella neesiana*). The exceptions are some patches of natural temperate grassland (a threatened ecological community (TEC)), which are of varying quality; and some areas of mixed grassland also of varying quality. Vegetation within the Project area is contiguous with the North Curtin Horse Paddocks and the Royal Canberra Golf Club.

The Uriarra Track, an informal gravel walking track, traverses the Project area through the open space which is used by local residents for access and recreation purposes such as dog walking.

1.4.2 Existing road network

The key roads in the local road network surrounding the Project are outlined below and detailed in terms of their road hierarchy, purpose and design. A road hierarchy summary is provided in Table 2.

Table 2 Road Hierarchy

Road Name	Road Hierarchy
Dudley Street	Major Collector Road
Cotter Road	Arterial Road
Kent Street	Major Collector Road
Adelaide Avenue	Arterial Road
Kintore Crescent	Access Road
Yarra Glen	Arterial Road
Novar Street	Major Collector Road
Denman Street	Access Road

Dudley Street is a major collector road located between Cotter Road and Novar and Kent Streets. It is a key eastbound road link between Cotter Road and the suburbs of Yarralumla and Deakin. Dudley Street is currently a two-way single-carriageway road with a single lane in each direction typically three metres in width. The current daily traffic for this road is around 8,000 vehicles per day. There are two existing bus stops located on Dudley Street that are currently not in use, and an informal access to the Yarralumla Uniting Church. There are no pedestrian or cyclist facilities. It is poorly lit with street lighting facilities at intersections either end of the road, but no lighting mid-block. The upgrading of Dudley Street is a major component of the Project.

Kent Street technically commences at the suburb boundary of Yarralumla and Deakin (in the Yarra Glen / Adelaide Avenue median), however for simplicity this report has Kent Street commencing at the Novar Street roundabout. Kent Street is a major collector road running south to a roundabout at Kitchener Street and provides connectivity between Yarralumla, Deakin and Hughes. In the vicinity of the Project, Kent Street is a two-way single-carriageway road with lane widths of around three metres immediately south of the Project. The daily traffic volumes on Kent Street directly south of the site are around 13,000 vehicles per day. Kent Street is not directly impacted by the Project.

Novar Street is a major collector road that runs north from Novar Street roundabout until it reaches the intersection with Brown Street and Alexandrina Drive. It is a major collector road with a single lane in each direction. These lanes are configured with approximate lane widths of four metres. There are currently four bus stops on Novar Street. The Project does not include works to the Novar Street roundabout.

Adelaide Avenue is an arterial road located between Kent Street overpass and the State Circle. It provides connectivity between Yarralumla/Deakin to Capital Hill and onto Canberra City. Adelaide Avenue is a two-way dual-carriageway road with two vehicle lanes and a single bus lane in each direction. The lane widths on Adelaide Avenue are around 3.5 metres with on-road cycling in both directions. Adelaide Avenue is not directly affected by the Project.

Cotter Road is an arterial road located between Weston Creek and the new development area of the Molonglo Valley in the west and Yarra Glen. In the vicinity of the Project, Cotter Road is a two-way dual-carriageway road with two lanes in each direction to the west of Dudley Street and a single lane in each direction to the east of Dudley Street. The carriageway widths of Cotter Road vary from around nine metres to around six metres wide within the vicinity of the Project. The current daily traffic volumes for this road are around 16,000 vehicles east of Dudley Street. On-road cycle lanes are located on Cotter Road in the vicinity of the Project. Access onto Cotter Road from Dudley Street is via a signalised intersection which would be altered during construction to allow efficient staging of the Project. The ultimate intersection arrangement would remain the same for vehicles, however an off ramp would be provided for on road cyclists.

Yarra Glen is an arterial road between Kent Street and Yamba Drive/Melrose Drive at the edge of Phillip. It is a two-way dual-carriageway road with two vehicle lanes and a single bus lane in the northern direction continuing onto Adelaide Avenue. The southern bus lane that continues from Adelaide Avenue merges after Kent Street. The lane widths on Yarra Glen are around 3.5 metres wide with on road cycling provided on both sides of the road. Yarra Glen is not directly affected by the Project.

Kintore Crescent is a local access road located between Denman Street and Guilfoyle Street. It provides access for local vehicles onto Novar Street. Kintore Crescent is a two-way single-carriageway road with single vehicle lanes in each direction around 3.5 metres in width. Around 1,000 vehicles per day use Kintore Crescent. It is not directly affected by the Project.

Denman Street is a two-way single carriageway local access road with a single lane in each direction, located between Kintore Crescent and the Old Canberra Brickworks. It currently provides access to the Old Canberra Brickworks, Yarralumla Uniting Church and residential areas. Lane widths on Denman Street are around four metres. Denman Street is not directly affected by the Project.

Photographs of the Project area and surrounds are provided in Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, Figure 8, Figure 9 and Figure 10.



Figure 3 View of Dudley Street / Cotter Road intersection looking south from Dudley Street



Figure 4 View of Dudley Street looking east from the western extents of Dudley Street



Figure 5 View of Dudley Street looking west from the eastern extents of Dudley Street



Figure 6 View of Dudley Street looking east near to the natural temperate grassland areas



Figure 7 View of Dudley Street looking east towards the existing bus stops



Figure 8 View of Novar Street roundabout looking west towards Dudley Street



Figure 9 View of Uriarra Track looking east from the western extents of the Project area



Figure 10 View of the Denman Street looking west from near to the Yarralumla Uniting Church

1.5 Interdependency with Canberra Brickworks Precinct development

DOMA Group are the proponent for the development of the Canberra Brickworks Precinct (within the Canberra Brickworks Precinct). Separate assessment and approvals would be prepared and submitted for the development of the Canberra Brickworks Precinct.

There is a preference for the construction of the Access Road and Dudley Street Upgrade to occur prior to the estate development to allow access via these routes for construction vehicles undertaking the Canberra Brickworks estate development. Having the Access Road operational will minimise disruption from construction traffic for the residents of Yarralumla. The new Access Road will also be used for decontamination transport when the development site is remediated prior to estate construction.

Independent of the development of the Canberra Brickworks Precinct site, upgrades to Dudley Street are required to safely operate and to meet the requirements for a major collector road. A traffic assessment (AECOM, 2016a) determined that Dudley Street is currently functioning at capacity under existing traffic use conditions as discussed in Section 2.0.

1.6 Purpose of this document

This REF has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of ACT Government's Infrastructure Finance and Capital Works. It describes the Project and assesses the risk of potential environmental impacts of the Project on the environment and community.

The REF identifies a number of protective mitigation measures to be implemented to manage environmental impacts and has been prepared in accordance with *Proponent's Guide to Environmental Impact Statement Exemptions* (EPSDD, 2017).

The REF assesses a range of environmental and social impacts associated with the Project and has been prepared to address the requirements of:

- Department of Environment and Energy request for additional information required for its assessment under the EPBC Act (Referral 2017/8072) received on 15 December 2017 (see **Appendix A** which provides details of how the additional information request has been addressed)
- EPSDD requirements for EIS Exemption in accordance with Section 211 of PD Act and other relevant legislation
- NCA Works Approval.

As the alignment of the Project falls under different administrative authorities, not all components of the Project would require the same level of statutory and development assessment consideration. To meet the various levels of development assessment that have been identified, a comprehensive assessment of the overall Project has been prepared which assesses the impacts of the Project on both land managed by the NCA and the ACT Government, and to support the Commonwealth requirements under the EBPC Act.

2.0 Need for the Project

Chapter 2.0 discusses the need for the Project, having regard to the objectives of the ACT Government planning strategies and the specific objectives of the Project. This chapter also provides a summary of the options that have been considered during development of the Project and why the preferred option has been chosen.

2.1 Strategic justification

The Project is consistent with the ACT Government's commitment to provide better transport and infrastructure as detailed in the *ACT Planning Strategy: Planning for a sustainable city* (the ACT Planning Strategy) (ACT Government, Environment and Sustainable Development, 2012).

The ACT Planning Strategy establishes how the Territory will develop into the future to meet the aspirations of the people and the environmental, social and economic challenges to 2030. The ACT Planning Strategy responds to *The Canberra Plan* vision and the community values expressed in *Time to Talk: Canberra 2030*. It was developed after considerable research and analysis, undertaken as part of the Sustainable future program, and it reinforces the intention of the 2004 *Canberra Spatial Plan* to develop a more compact and efficient city.

Dudley Street provides a link from north western Canberra to the suburbs of Yarralumla and Deakin. It connects Cotter Road to the Novar Street roundabout. Improvements to this key infrastructure route improves the amenity and safety for all road users.

The Project would also support the development of the Canberra Brickworks Precinct which would repurpose a highly valued historical amenity. The Canberra Brickworks Precinct urban renewal project would contribute positively to the economic and social development of broader Canberra and support the ACT Planning Strategy of creating a more compact and efficient city.

2.1.1 Dudley Street Upgrade

The existing traffic volumes and the Roads ACT Road Hierarchy map prescribe that Dudley Street is a 'major collector road'. In order to meet current Estate Development Code guidelines for a major collector road, the typical cross section of Dudley Street must meet a minimum carriageway width of 10 metres. Dudley Street is currently six metres wide and also does not have a sealed shoulder.

Traffic counts undertaken in 2015 identified that Dudley Street had daily movements of 7,487 vehicles per day while its design capacity is currently for 6,000 vehicles per day. It is estimated that the development of the Canberra Brickworks Precinct would also generate around 2,400 additional vehicle movements on Dudley Street per day. With the Canberra Brickworks Precinct development and the future development of Molonglo Valley, there will be increasing pressure on Dudley Street which is already at capacity.

Upgrades are required to allow Dudley Street to operate safely and to meet the design requirements for a major collector road. The Project would increase the width of Dudley Street to 10 metres and would cater for 9,000 vehicle movements per day.

2.1.2 Access Road

The Canberra Brickworks Precinct is proposed to be developed with a yield of around 380 residential dwellings and would revitalise a highly valued heritage area of Canberra. The development of the Canberra Brickworks Precinct is not part of this Project and would be undertaken as part of a separate Project by the DOMA Group. As the responsible party for developing the majority of roads in ACT, the ACT Government would provide the publicly funded access to allow the development of the Canberra Brickworks Precinct.

In order to service the Canberra Brickworks Precinct a transport connection is required from the proposed development area to the adjacent road network. There is an existing access to the Canberra Brickworks via Denman Street / Kintore Crescent, however with a classification of an 'access street' and a capacity of 1,000 vehicles per day, the addition of around 2,400 vehicles per day (to the existing recorded 500 vehicles per day) would significantly impact traffic and the amenity of the residents located along it. As a pre-development requirement of the Canberra Brickworks Precinct, TCCS

requires the provision of a designated Access Road connecting the Canberra Brickworks Precinct to Dudley Street, as this would provide a suitable access route for the proposed development and meet the Estate Development Code guidelines.

2.1.3 Project objectives

The specific objectives of the Project are to:

- Upgrade Dudley Street to meet design standards for a major collector road
- Provide a suitable access from the proposed Canberra Brickworks Precinct to the adjacent road network
- Construct a roundabout to intersect Dudley Street and the new Access Road
- Provide new bus facilities, including a complimentary shared path network and future access to the Rapid Bus Network
- Promote active travel through the use of on-road cycle paths and off-road shared paths
- Minimise impacts to the community and the environment in delivering the Project
- Improve road user safety.

There is a preference for the Project to be completed prior to the development of the Canberra Brickworks Precinct so that it can provide access for estate development construction vehicles, including decontamination works. This would negate the need for construction vehicles to access the estate development via the residential street network.

2.2 Design development

The key features of the Access Road and Dudley Street Upgrade have been refined through various design stages since its conception. A feasibility design, concept design and preliminary sketch plan design have been developed for the Project which have identified improvements for Dudley Street and proposed an alignment for the new Access Road, including a new intersection from Dudley Street. The design of the Project, including the road cross sections and alignment, has been optimised during each of these design stages to minimise ecological and community impacts, while meeting design objectives, the Estate Development Code guidelines and ACT road design standards in this constrained environment.

The development of the preferred option involved several key tasks, including assessments of existing intersection performance and identification of key deficiencies and opportunities for improving safety. The assessment identified the following deficiencies with the existing network within the Project area:

- Dudley Street is currently only six metres wide while the design standard for a major collector road is 10 metres
- Dudley Street does not have sealed shoulders to allow for road traffic incidents or breakdowns
- the current vertical alignment of Dudley Street is substandard and the works would also include improvement to the horizontal alignment
- grassed areas surrounding Dudley Street are noticeably worn through illegal vehicle movement and parking, including accessing Denman Street through the Yarralumla Uniting Church
- existing bus stops are substandard and located too far away to services the Canberra Brickworks Precinct to meet estate development code requirements
- the existing lack of trafficable width of Dudley Street is a safety concern for on-road cyclists
- there is good provision for active travel within Yarralumla, however there is limited connectivity between the local active transport network and on-road cycle lanes located on Adelaide Avenue.

Options for upgrading Dudley Street and providing access to the Canberra Brickworks Precinct were developed in consultation with the ACT Government, relevant stakeholders (including TCCS) and the project design team. Meetings were also held with DOMA Group as preferred tenderer to develop Canberra Brickworks Precinct site.

The options included determining the preferred alignment of the Access Road and layout of the proposed intersection on Dudley Street. Consideration was also given to the width of the carriageways while allowing for the utility services requirements.

2.3 Assessment of alternatives

2.3.1 'Do nothing' option

The option not to construct the Access Road and Dudley Street Upgrade was considered in the Concept Design Report (Cardno, 2016) using generated traffic volumes for the Canberra Brickworks Precinct. Without the Project, current access points in the existing residential suburb of Yarralumla (including Denman Street) would not be able to operate satisfactorily with the additional traffic expected to be generated by the Canberra Brickworks Precinct. Having a designated access road was also a predevelopment requirement of TCCS.

Independent of the development of the Canberra Brickworks Precinct site, upgrade of Dudley Street is required for this road to safely operate with the existing traffic volumes and to meet the ACT's road design requirements for a major collector road. If the Project is not undertaken, Dudley Street would remain a potential safety concern. The existing vertical alignment of Dudley Street would not readily integrate with the new roundabout for the Access Road.

The 'do-nothing' option does not meet the project objectives (listed in Section 2.1.3), does not improve the operational and safety performance of Dudley Street and does not provide a safe and functional access to the proposed Canberra Brickworks Precinct. This option has therefore not been taken forward.

2.3.2 Access route options

The feasibility design (AECOM, 2016b) considered potential access routes available to service the proposed Canberra Brickworks Precinct including a review of the existing infrastructure to determine if this could be used as a priority to provide access to the development site. It was determined that the existing infrastructure would not be suitable to support the additional proposed vehicle trips as a result of the Canberra Brickworks Precinct without significant traffic impacts to local residents. Options to access the northern extents of the development site were not considered due to the potential for increased traffic impacts to the residential suburb of Yarralumla.

Three road connection options were considered to provide a suitable access from the road network to the Canberra Brickworks Precinct:

Option A1: Connection from Canberra Brickworks Precinct to Dudley Street only

Option A2: Priority connection from Canberra Brickworks Precinct to Dudley Street with local connection from Canberra Brickworks Precinct to Denman Street

Option A3: Split access where certain blocks of the proposed Canberra Brickworks Precinct can only access Dudley Street and others only access from Denman Street.

Option A1 had the potential to lead to congestion issues at the Canberra Brickworks Precinct and Dudley Street and also the potential for greater isolation of the Canberra Brickworks Precinct due to the limited access to amenities. Option A3 would likely have greater impacts to the residents of Denman Street and the potential for isolation of parts of the Canberra Brickworks Precinct due to limited access to amenities as per Option A1. Of the alternative access options considered, Option A2 was considered the preferred option as it provided internal connectivity while minimising impacts to the local road network and providing a suitable access to the Canberra Brickworks Precinct.

Option A2 was therefore taken forward as the preferred option.

2.3.3 Alignment options

Access Road

Following the selection of the preferred access route, the development of the alignment of the Access Road and Dudley Street Upgrade has been optimised through the feasibility design, concept design and preliminary sketch plan design.

Two alignment options for the Access Road have been considered in detail including:

- Option B1: a short straight alignment leaving the intersection with Dudley Street and providing a perpendicular approach to the Canberra Brickworks Precinct. The intersection of the Access Road and Dudley Street is located around 100 metres from the intersection with Cotter Road
- Option B2: a short straight alignment which places the intersection of the Access Road and Dudley Street closer to the Cotter Road intersection with a more westerly alignment of the Access Road.

Figure 11 shows the alignments of Options B1 and B2.

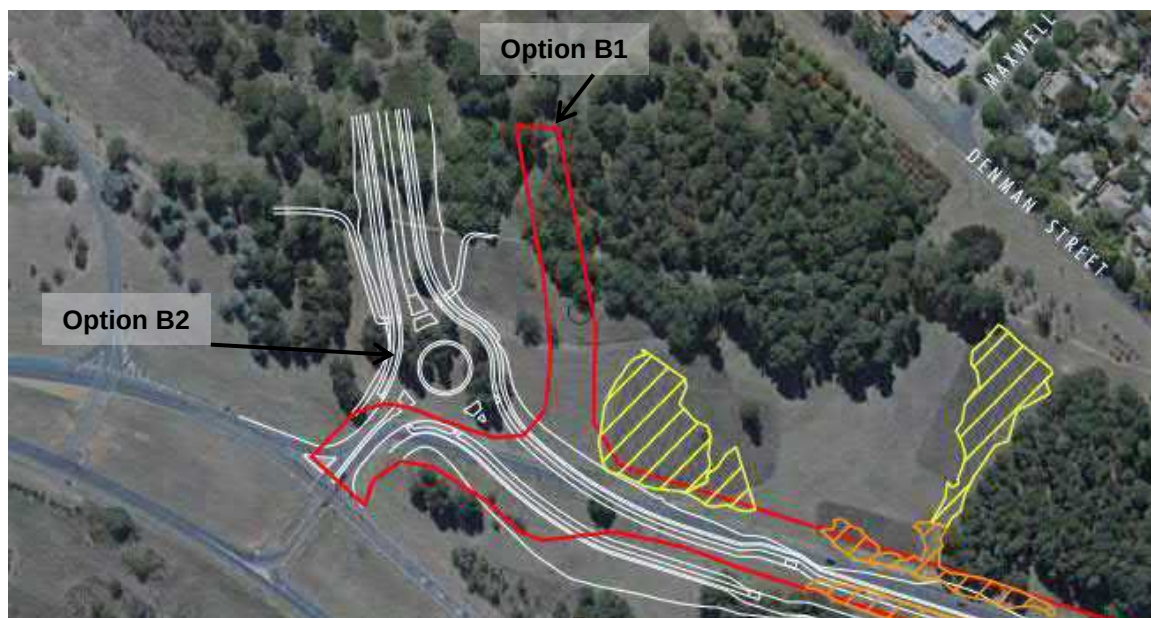


Figure 11 Alignment options for the Access Road

While Option B1 minimises the loss of trees in the Project area, it has greater impacts to areas of critically endangered golden sun moth and natural temperate grassland (a TEC) both identified as MNES protected under the Commonwealth EPBC Act and ACT *Nature Conservation Act 2014* (NC Act). Option B2 minimises the direct disturbance of MNES as golden sun moth and natural temperate grassland do not generally inhabit shaded areas of trees. Option B2 also has operational benefits in meeting grading requirements and aligning with the future Canberra Brickworks Precinct road layout. Option B2 was therefore taken forward as the preferred option.

Dudley Street

Three options were considered for the proposed widening of Dudley Street:

- Option B3: Extend Dudley Street to the north only
- Option B4: Extend Dudley Street to the south only
- Option B5: Maintain the existing centreline and extend Dudley Street to the north and south.

The grassed areas either side of Dudley Street are mostly moderate (disturbed) quality golden sun moth habitat, however the higher quality MNES areas are located to the north of Dudley Street, including an area of very high quality natural temperate grassland and moderate quality golden sun moth habitat. While the road reserve to the south of Dudley Street provides moderate (disturbed)

golden sun moth habitat this area is more fragmented (i.e. less connected to continuous habitat) than the larger habitat area to the north of Dudley Street.

Option B3 led to the greatest impacts to MNES and was therefore discounted. Option B5 would impact both areas of high quality natural temperate grassland located in the central portion of the Project area and would also impact the area of very high quality natural temperate grassland. While Option B4 has additional impacts to the poor quality mature pine trees located to the south of Dudley Street, it minimises the impacts to identified areas of natural temperate grassland and impacts the more fragmented area of golden sun moth habitat rather than the higher quality habitat to the north of Dudley Street. Option B4 was therefore taken forward as the preferred option.

Option B2 and B4 were therefore taken forward as the preferred options.

2.3.4 Intersection options

During the feasibility study (AECOM, 2016b) three intersection layouts (Options C1, C2, and C3) were considered for a potential access from Dudley Street to the Canberra Brickworks Precinct as shown in Figure 12.

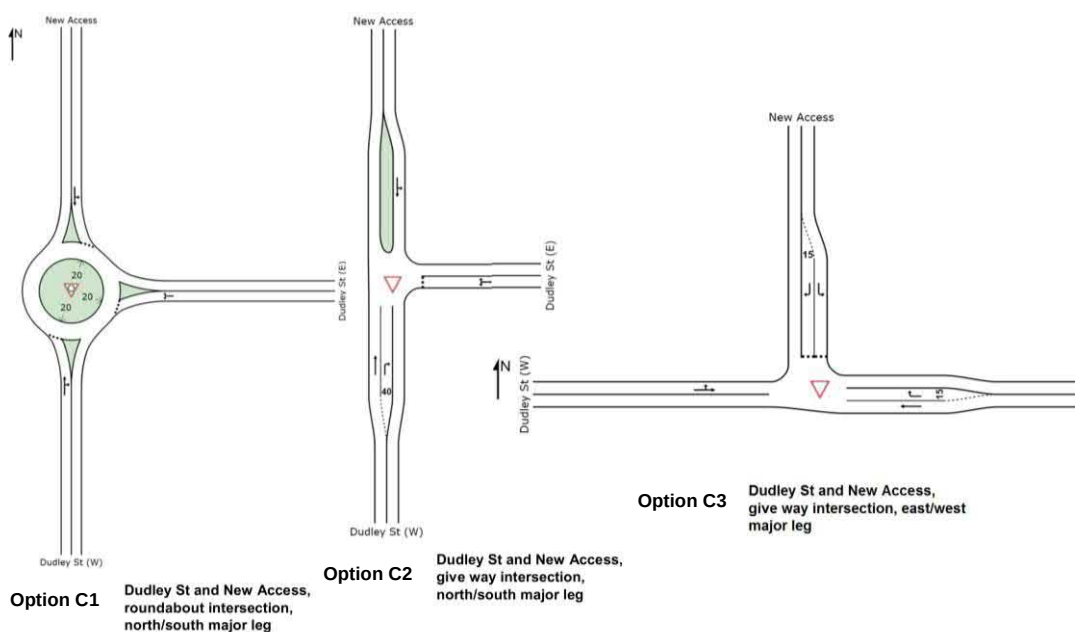


Figure 12 Alternative intersection options considered at the feasibility stage

At the feasibility stage it was initially considered that the roundabout option would be cost prohibitive and that the T-intersection options would be preferable. However during the development of the Concept Design (Cardno, 2016), four further intersection options were considered and assessed in more detail using the intersection modelling program SIDRA Intersection 7.0 to determine their operational and safety performance.

These options included:

- Option C4: Basic right, basic left on Dudley Street tee intersection configuration.
- Option C5: Channelised right, channelised left on Dudley Street tee intersection configuration
- Option C6: Single Circulating Lane Roundabout
- Option C7: Single Circulating Lane Roundabout, with Dudley Street east approach leg two lane approach.

Due to the high volume of through traffic along Dudley Street Option C4 did not promote overall intersection safety. Option C5 resulted in a poor Level of Service¹ (LOS F) on the Access Road during the PM peak period. Option C6 was also found to result in a poor Level of Service (LOS F) on the Access Road approach leg in the PM peak period. By incorporating a right turn auxiliary lane to the east Dudley Street approach leg and continuing two lanes on the departure leg, Option C7, the single circulating lane roundabout with Dudley Street east approach leg two lane approach, led to an overall good Level of Service (LOS A) for the roundabout and good Level of Service (LOS B) for the Access Road approach leg during the PM peak period.

The intersection Option C7 proposed in the Concept Design is shown in Figure 13.

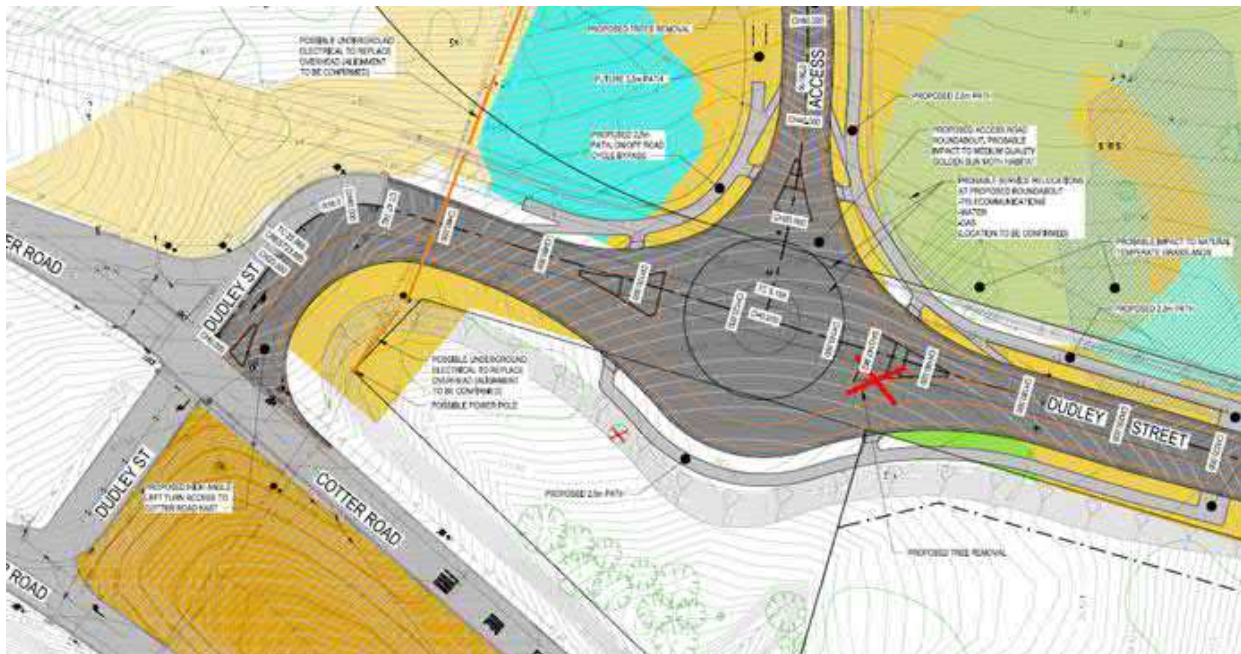


Figure 13 Intersection layout proposed as part of the Concept Design

During the preliminary sketch plan design the alignment of the proposed Access Road was revisited and an alternative alignment further to the west was developed. While this option requires more low and medium quality tree removal than the Concept Design, it significantly reduces the impacts to identified higher quality areas of golden sun moth and natural temperate grassland.

As a result of the change in alignment, further assessment was undertaken of the options for intersection arrangements between the Access Road and Dudley Street. Two further options were considered including:

Option C8: A realigned roundabout located near to the intersection of Dudley Street / Cotter Road

Option C9: A signalised T-intersection located near to the intersection of Dudley Street / Cotter Road.

The two options were assessed and consideration given to geometric design, environmental impact and operational and safety requirements in consultation with ACT Government (including TCCS), relevant stakeholders and the project design team. The overall footprint and constructability of these two design options were considered to be comparable and are shown in Figure 14.

1 Level of service is a qualitative measure used to relate the quality of traffic service ranging from A (good) to F (bad). Refer to Section 7.1.2 for further details of the level of service.

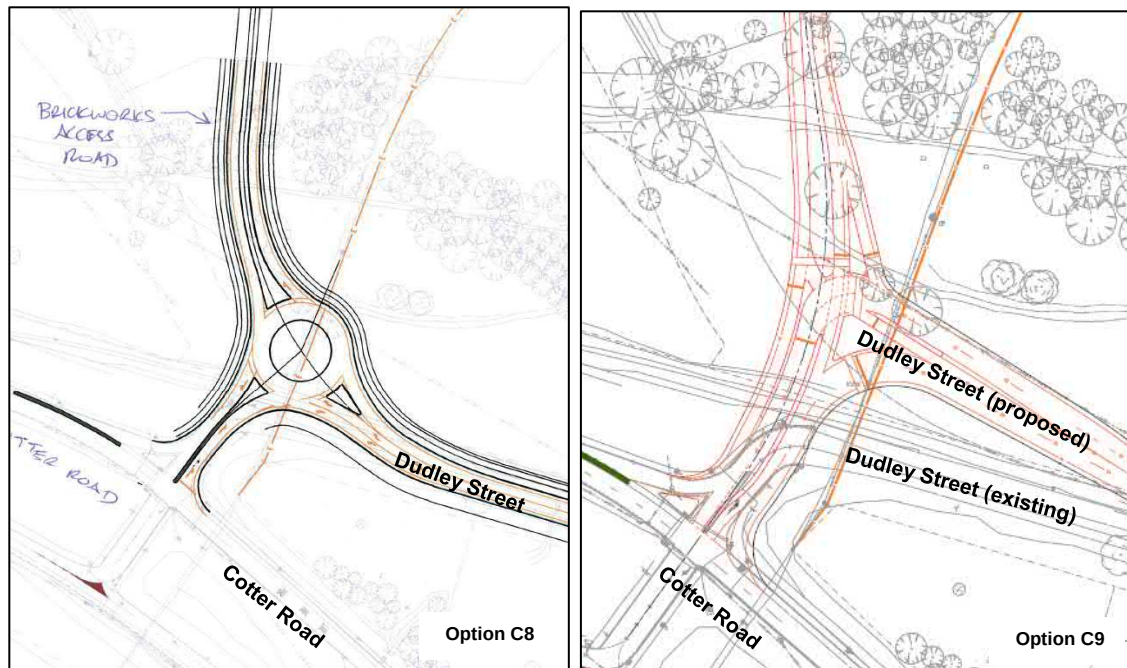


Figure 14 Intersection options considered during the preliminary sketch plan design

Intersection Options C8 and C9 were modelled using the intersection modelling program SIDRA Intersection 7.0, to determine their operational performance as a function of the adjacent intersections. The traffic volumes used in the modelling were determined using the future yields of the Canberra Brickworks Precinct and the likely distribution of the additional traffic accessing Dudley Street. The signalised Option C9 was not supported as:

- The intersection needed a second lane to cater to the expected traffic volumes. Both lanes became trap lanes where vehicles would either have to turn left or right. These lanes would likely lead to drivers swapping lanes at the last minute as most drivers would want to turn right onto Cotter Road rather than left
- Concern regarding appropriate signal phasing in relation to the Cotter Road signals which are already phased with the Lady Denman Drive signals
- Concern over the queue length along the Cotter Road approach due to the large volume of vehicles accessing Dudley Street from Cotter Road.

The primary objective of the Dudley Street / Access Road intersection is to provide safe ingress and egress to the future development of Canberra Brickworks Precinct with minimal impacts to the existing Dudley Street and surrounding road network. Option C8, the roundabout arrangement provided optimum intersection operational efficiency while minimising impacts to MNES.

Option C8 was therefore taken forward as the preferred option.

2.3.5 Cross section options

To meet the Estate Development Code guidelines, the width of Dudley Street and Access Road are to be 10 metres wide or greater. Dudley Street is currently only six metres wide and has no sealed shoulder which could be used in the event of a road traffic incident or breakdown.

During the development of the design, consideration was given to three cross section options:

Option D1: provision of Dudley Street as a single carriageway (as per the current situation)

Option D2: provision of a dual carriageway for Dudley Street providing two traffic lanes in each direction

Option D3: provision of a single carriageway with an additional length of left hand turn lane from Dudley Street to Novar Street in the eastern extents of the Project to reduce queueing..

Based on the current traffic levels along Dudley Street and the proposed additional traffic that would be added to the network as a result of the Canberra Brickworks Precinct, Option D1 is not considered adequate to cater for the additional traffic along Dudley Street which is already at capacity in the existing situation. Option D2 met the operational and safety requirements for a major collector road however this option was considered excessive for the estimated traffic volumes and required additional disturbance along the Dudley Street alignment. Option D3 minimised the disturbance area while meeting the operational and safety requirements for a major collector road.

Option D3 was therefore taken forward as the preferred option.

2.3.6 Uriarra Track modification options

Given the required vertical grade of the proposed Access Road, the Uriarra Track alignment is located in up to two metres of cut and therefore modifications are required to allow the safe crossing of the Access Road. The Uriarra Track was initially realigned in early designs to take the crossing closer to the proposed roundabout where the cut is much lower and sight distance and pedestrian safety is improved. Community feedback indicated little support for this early design and a preference for consideration of options which maintained the existing alignment of the Uriarra Track as feasible and reasonable. Four alignment options were therefore developed for the Uriarra Track modification which was presented to key community stakeholders at a meeting held on 12 September 2017.

Given that the existing track is not a formal government asset and that the path and not currently comply with *Disability Discrimination Act 1992* (DDA) requirements it was taken that the crossing does not have to meet DDA requirements. This assumption also reduces impacts to MNES.

The four Uriarra Track modification options were:

Option E1: Retain the existing track alignment and crossing location, and flatten and extend the approach cut batters to provide a steady gradient to the crossing point

Option E2: Retain the existing track alignment and crossing location, and provide stairs

Option E3: Realign the track around 10 metres to the north with a crossing located where cut depth is reduced closer to the proposed Canberra Brickworks Precinct entrance

Option E4: Provide a pedestrian overpass for the track using single super tee girder.

There is a limited difference between these options in terms of environmental impacts. Moderately (disturbed) quality golden sun moth habitat is located on the southern side of the Uriarra Track which would experience a comparable level of disturbance between the options (though this is minimal). Option 4 would likely have the greatest construction impacts.

There are trees located on both sides of the Access Road in the area of the proposed Uriarra Track crossing. Options E3 and E4 have the greatest impact on the existing trees. Option E3 moves the crossing location around 10 metres north of the existing alignment through the existing trees and Option E4's large footprint impacts more trees than Options E1 and E2. Option E3 would have an impact on the high quality and medium quality rating regulated trees whilst Option E1, E2 and E4 would mostly impact the poor quality and medium quality rating regulated trees.

Although Option E2 has the lowest cost and environmental impact, it is the least functional of the four options investigated. Option E3 was considered to be a balance between cost and functionality (especially for cyclists) while minimising environmental impact.

Option E3 was therefore taken forward as the preferred option.

2.4 Justification for the preferred option

The 'do-nothing' option does not meet the project objectives (listed in Section 2.1.3), does not improve the operational and safety performance of Dudley Street and does not provide a safe and functional access to the proposed Canberra Brickworks Precinct. This option has therefore not been taken forward.

As described in Section 2.3, the design has been developed over a number of design stages to form the preferred design which meets the project objectives and balancing between cost and operational functionality while minimising environmental and community impacts were feasible and reasonable.

Improvements to the design which have been implemented to avoid or minimise impacts to MNES include:

- the new intersection of the Access Road and Dudley Street was relocated to the west and reduced in size to minimise the footprint and locate the roundabout away from the identified higher quality habitat for MNES
- the alignment of the Dudley Street Upgrade has been moved south so that the higher quality habitats north of Dudley Street are avoided (while taking into consideration the steep slope on the southern side of Dudley Street)
- the proposed on road cycling and street trees along the upgraded Dudley Street have been removed from the design to reduce the width of the road cross section and minimise potential shading impacts to golden sun moth habitat. Note: An off road shared path would be provided on Denman Street by the Canberra Brickworks Precinct developer to provide bicycle access
- the gradient of the proposed Dudley Street upgrade has been optimised to more closely match the existing ground level and therefore minimise the size of the embankments required by the proposed design (therefore reducing the footprint of the Project and ground disturbance)
- the location of the proposed site compound area which would temporarily be used for the construction activities has been selected to avoid areas identified as consisting of higher quality habitats where possible.

3.0 Description of the Project

Chapter 3.0 describes the Project and summarises key design parameters, construction method, and associated infrastructure and activities. The description of the Project is based on the preliminary sketch plan design and is subject to detailed design.

3.1 The Project

As discussed in Section 1.1, upgrades are required to allow Dudley Street to operate safely and to meet the design requirements for a 'major collector road'. The Project would also provide access to allow the development of the Canberra Brickworks Precinct, a proposed development area which would provide for around 380 residential dwellings and would revitalise a highly valued heritage area of Canberra. The Project would include the following key elements:

- upgrading Dudley Street
- construction of a new roundabout intersection between Dudley Street and the new Access Road to the Canberra Brickworks Precinct
- construction of a new Access Road travelling north to connect the new roundabout intersection on Dudley Street to the proposed Canberra Brickworks Precinct
- provision of upgraded bus stops including associated path networks
- provision of an off road shared path north of Dudley Street
- provisions to maintain pedestrian access along the Uriarra Track
- ancillary works including services diversion and/or relocation, earthworks, drainage modifications, provision of new street lighting, upgrades to kerbs and landscaping.

Figure 15 presents an artist's impression of the Project. Figure 16 shows the general layout of key elements for the Project. Figure 17 and Figure 18 provide the proposed cross sections of Dudley Street and the Access Road (subject to detailed design).



Figure 15 Artist's impression of the Project looking east towards the new roundabout (subject to detailed design)

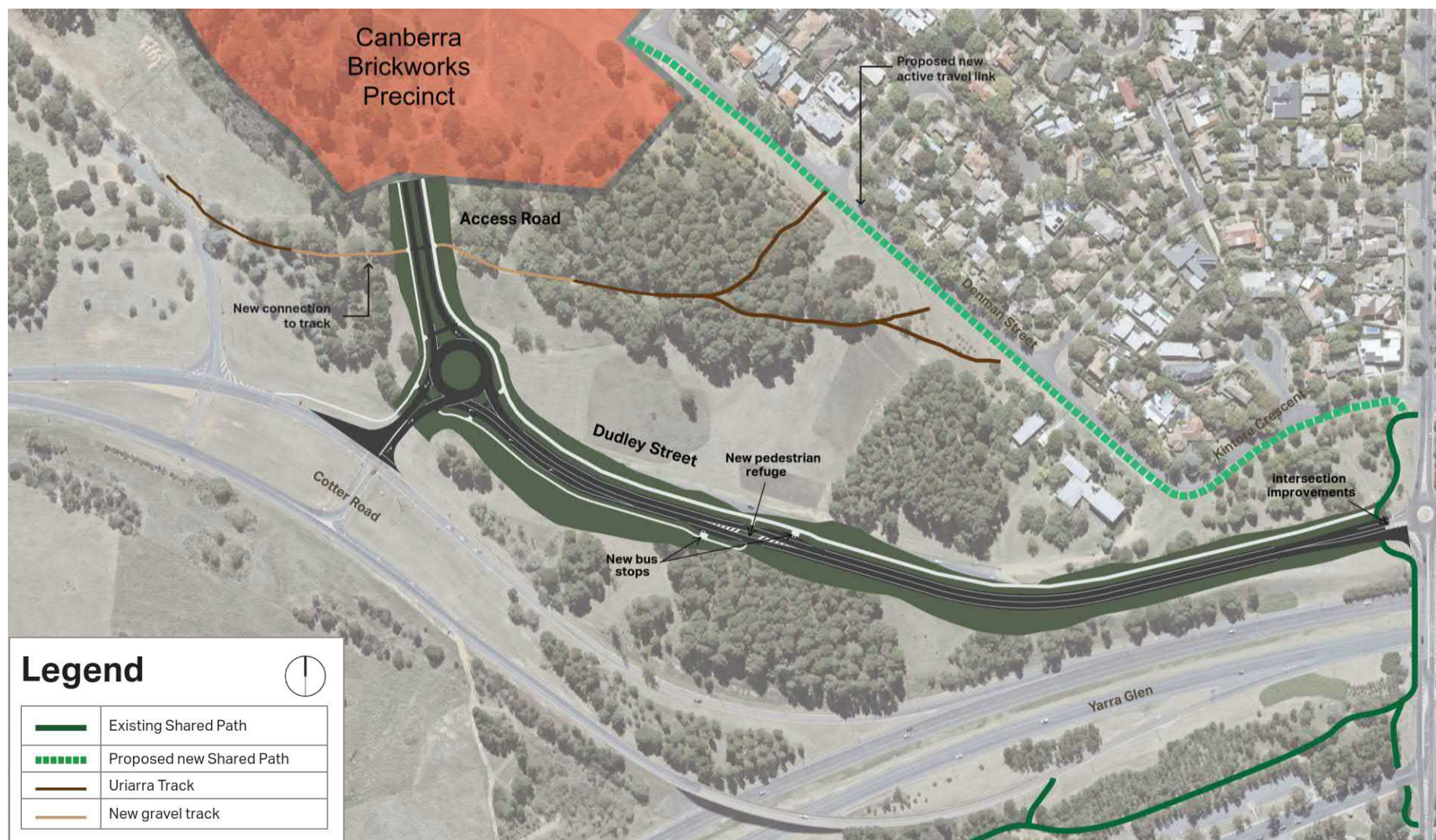


Figure 16 Project layout and surrounding environment (*subject to detailed design*)

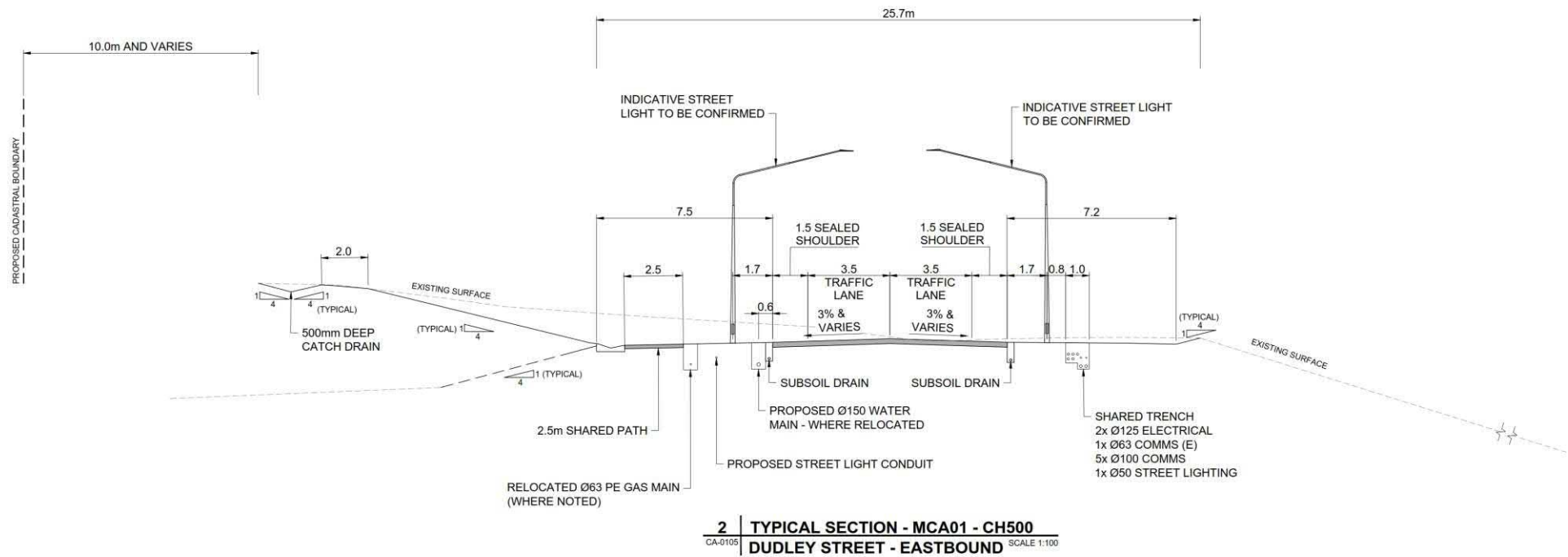


Figure 17 Cross section of upgraded Dudley Street (*subject to detailed design*)

Figure 18 Cross section of the Access Road (*subject to detailed design*)

3.1.1 Scope of works

Dudley Street Upgrade

Dudley Street would be upgraded from a six metre wide single carriageway to a 10 metre single carriageway to meet the design requirements for a major collector road and ACT Estate Development Code guidelines. The upgraded road will also compliment the new Access Road into the Canberra Brickworks Precinct. The proposed cross section on Dudley Street is as follows:

- 3.5 metre wide traffic lane with a 1.5 metre shoulder
- 7.0 metre wide verge on the northern side generally to cater for:
 - 2.5 metre wide shared path
 - Street lights and utilities.
- 4.5 metre wide verge on the southern side generally to cater for:
 - Street lights and utilities.

Bus stops and associated paths would also be provided.

Access Road

Provision of a new 180 metre long Access Road (to be classified in the ACT as a minor collector road), and intersection, connecting from Dudley Street and extending through Yarralumla Section 94 Block 3 to provide access for the future development requirements of the Canberra Brickworks Precinct. The proposed cross section of the Access Road is as follows:

- 3.5 metre wide traffic lane
- 4.5 metre wide raised median with tree planting
- 6.7 metre wide verge on the western side generally to cater for:
 - 1.5 metre wide path
 - 1.5 metre utility corridor
 - 3.7 metre verge for tree planting and street lights.
- 7.7 metre wide verge on the eastern side generally to cater for:
 - 2.5 metre wide path
 - 1.5 metre utility corridor
 - 3.7 metre verge for tree planting and street lights.

3.1.2 Engineering constraints

There are a number of constraints which have influenced the design development of the Project.

Existing structures: the Project has been designed to use the existing alignment of Dudley Street where possible to minimise ecological disturbance. The existing intersections would be used to tie the Project in with the road network where available.

Utilities: A Dial Before You Dig (DBYD) search and site inspections with utility providers has identified a number of utilities in the vicinity of the Project including:

- High Voltage (aboveground) electrical cables which cross over Dudley Street at the Dudley Street / Novar Street intersection
- High Voltage (aboveground) electrical cables which cross over Cotter Road and Dudley Street
- gas mains along the northern verge of Dudley Street and at the Dudley Street / Novar Street intersection

- telecommunications cables (underground) along the northern verge of Dudley Street and one running under the Cotter Road / Dudley Street intersection
- water supply infrastructure on the northern verge of Dudley Street that continues in a north west direction towards Dunrossil Drive across the proposed roundabout location
- stormwater infrastructure on Dudley Street and at each of the intersections.

These existing utilities have been located using environmentally sensitive potholing techniques and relocations have been incorporated into the Project (subject to detailed design).

Other considerations:

- the Project area contains two MNES, namely golden sun moth and natural temperate grassland which are protected under the EPBC Act. Disturbance of these areas, including for construction is to be minimised to the greatest extent practical
- Dudley Street is a key traffic access route and it is highly desirable for access to be maintained throughout the duration of the construction programme where possible
- the Uriarra Track is a local community asset which is used for pedestrian access and dog walking. It is desirable for the existing alignment of the track to be maintained
- it is desirable to minimise the removal and/or disturbance of any mature trees as these provide screening and have amenity value
- there is limited area available for the construction compound and it is desirable for the location to be close to the Project working area to minimise traffic impacts and promote worker safety.

3.1.3 Design standards

The Project would be designed having regard to the following:

- ACT Estate Development Code, Environment and Sustainable Development
- Design Standards for Urban Infrastructure, Transport Canberra and City Services
- Water Supply and Sewerage Standards, Icon Water
- Crime prevention through environmental design general code, EPSDD
- Relevant Austroads Standards
- Relevant Australian Standards.

3.2 Construction activities

3.2.1 Work methodology

Subject to approval, construction is expected to commence in 2018 and take around 12 months to complete. The construction methodology would be further developed during the detailed design of the Project, in consultation with ACT Government.

The proposed construction activities for the Project are identified in Table 3. This staging is indicative and is based on the current concept design and may change once the detailed design methodology is finalised. The staging is also dependent on the Contractor's preferred methodology, program and sequencing of work.

The proposed construction staging strategy for the Project is based on ensuring that Dudley Street is open to traffic throughout the construction period (as far as practicable) to minimise traffic disruption on this highly utilised asset. Temporary tie-in works would be required to enable works on the existing Dudley Street to be undertaken while maintaining access.

Table 3 Indicative construction staging and traffic control for key activities

Stage	Activities	Traffic control
Site establishment and enabling works	• Survey and setting out • Establishment of site compound (i.e. erect fencing, tree protection zones, site offices, amenities and plant/material storage areas) • Establishment of traffic control facilities (e.g. signage and safety barriers) • Removal of identified vegetation • Services relocations	Traffic would continue to use Dudley Street in its current arrangement during this stage
Stage 1 Refer to Figure 19 for the proposed layout of Stage 1	• Construction of the new roundabout and the Access Road • Construction of new pavement and earthworks north of existing Dudley Street alignment at the approach to Novar Street intersection and temporary (eastern) tie-in to existing Dudley Street • Construction of new pavement and earthworks south of the existing Dudley Street and temporary (western) tie-in to Cotter Road intersection	Traffic would continue to use Dudley Street in its current arrangement during this stage
Stage 2 Refer to Figure 20 for the proposed layout of Stage 2	• Upgrades to Dudley Street at the approach to Novar Street • Construction on existing Dudley Street between new Stage 1 works (south of existing Dudley Street) and Novar Street	Traffic would use the new pavement from Novar Street and eastern temporary tie-in constructed in Stage 1 works and back onto existing Dudley Street further west of Novar Street.
Stage 3 Refer to Figure 21 for the proposed layout of Stage 3	• Construction on existing Dudley Street between new Stage 2 works and Cotter Road • Installation of street lights • Commissioning of the new infrastructure • Site rehabilitation and demobilising including the removal of the construction compound	Traffic would use the new pavement from Novar Street and western temporary tie-in to Cotter Road constructed in Stage 1 works.

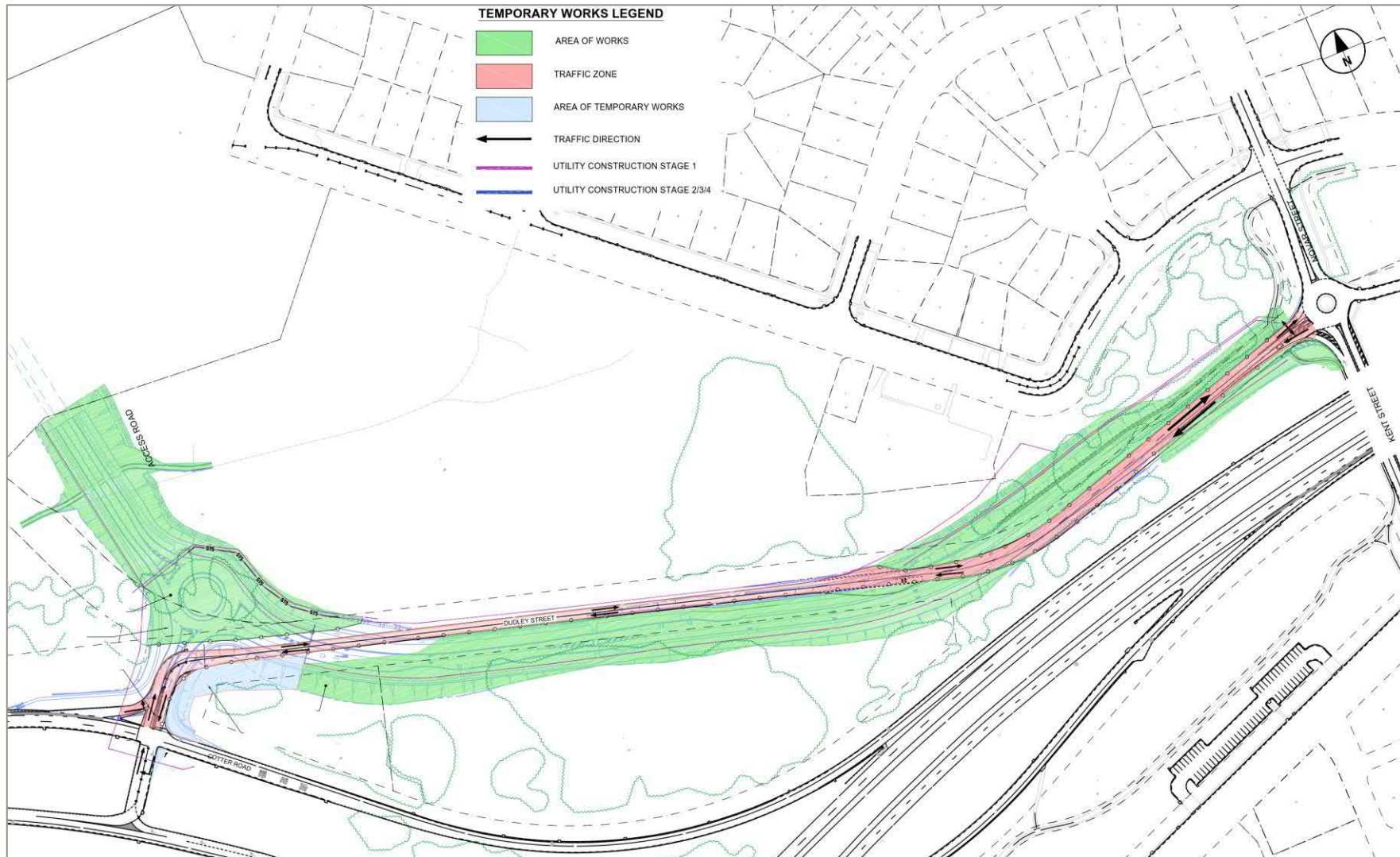


Figure 19 Stage 1 layout (subject to detailed design)

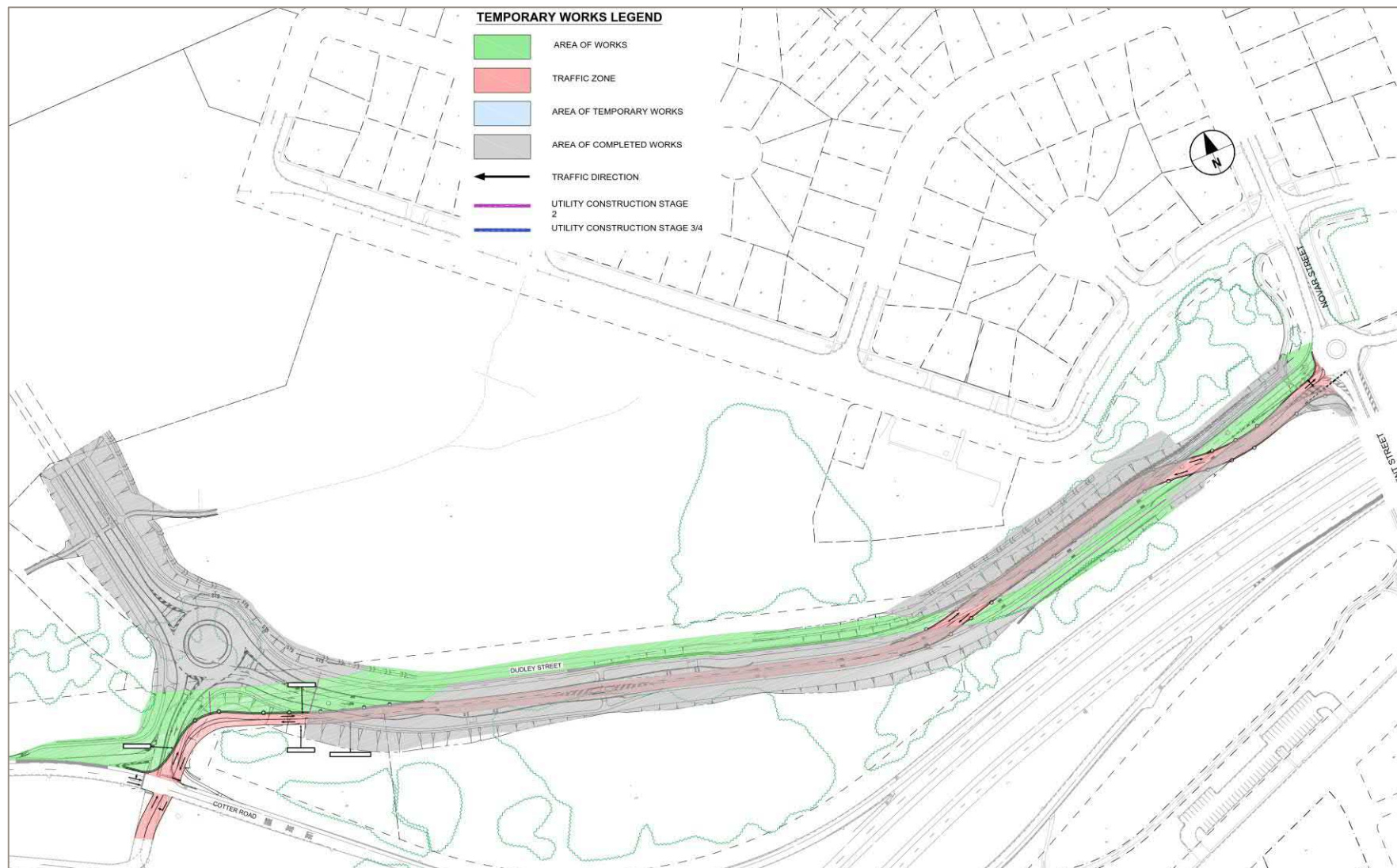


Figure 20 Stage 2 layout (subject to detailed design)

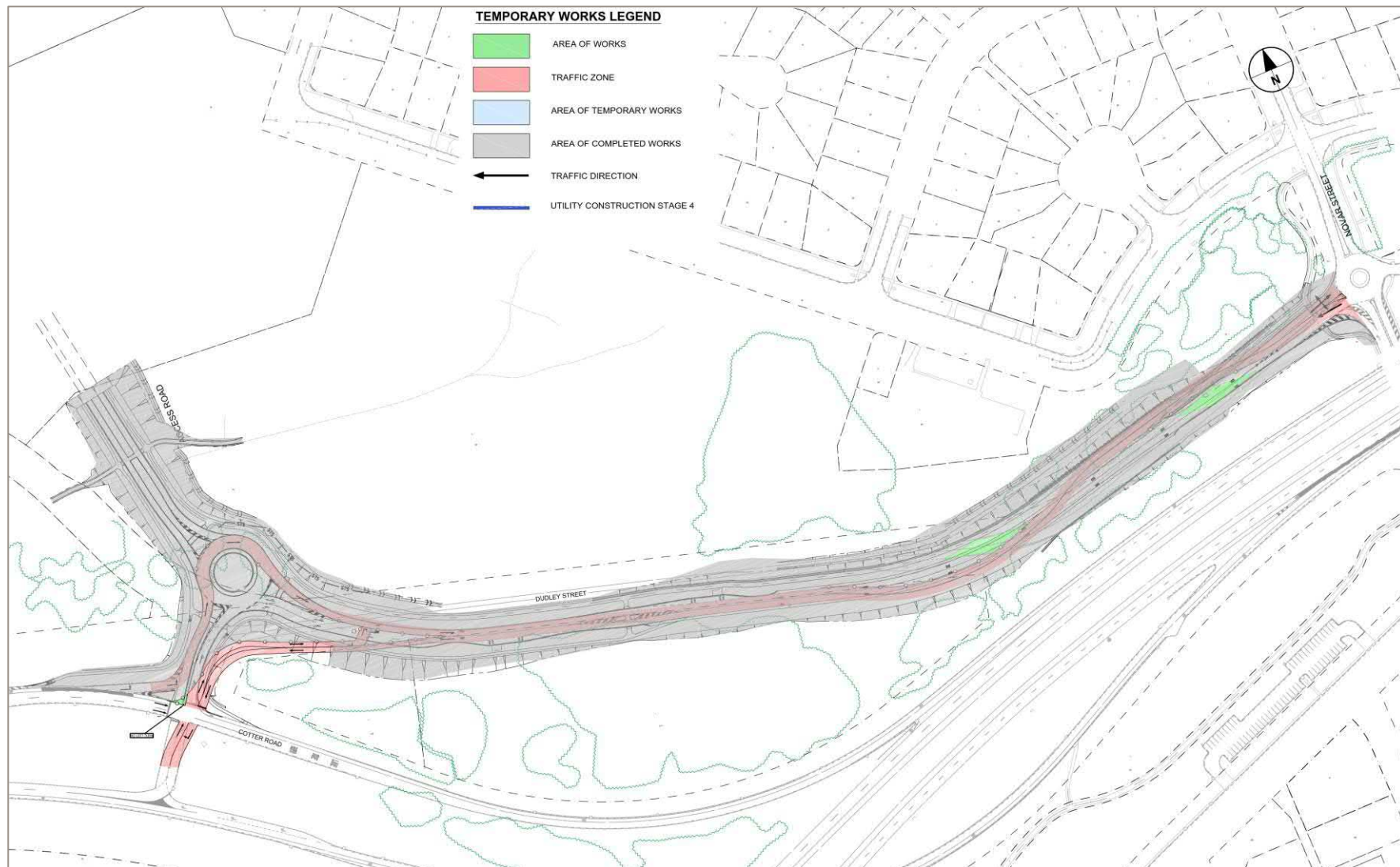


Figure 21 Stage 3 layout (subject to detailed design)

3.2.2 Plant and equipment

The plant and equipment likely to be used during construction includes:

- trucks
- graders
- scrapers
- generator
- bobcat
- hand tools
- mulcher
- concrete pump
- concrete truck
- water trucks
- moxys
- loader
- road paver
- chainsaw
- excavators
- mini-excavator
- demolition saw
- backhoe
- grinder
- manitou
- scissor lift
- franna crane
- lighting tower
- mobile crane.

3.2.3 Working hours

The majority of works required for the Project would be undertaken during standard construction hours, which are as follows:

- 7am to 6pm Monday to Friday
- 8am to 1pm Saturdays
- no work on Sundays or public holidays.

Certain works may need to occur outside standard hours and would include night works. Out of hours works are required in some cases to minimise disruptions to pedestrians, motorists and nearby sensitive receivers; and to ensure the safety of construction workers.

Any works that may disrupt traffic would occur outside peak time traffic hours from 9:30am to 3pm. All temporary traffic management is subject to approval by TCCS.

3.2.4 Earthworks

The Project requires significant earthworks due to the existing topography of the Project area. Excavations and earthworks would generally be required for the following:

- excavation of material for the Access Road to ensure that it achieves the required vertical design gradient and finished design level, which would require the removal of material up to a depth of around three metres
- excavation of the area north of Dudley Street in the eastern extents of the Project area to allow for the new left hand turn lane to be provided at the intersection with Novar Street
- placement of material to the south of Dudley Street to a similar level to the existing vertical profile of Dudley Street to allow the widening of the road to the south
- removal of the existing Dudley Street pavement and re-profiling of the vertical gradient
- trenching excavation for services within the Project area to a minimum depth of one metre
- the construction of new bus stops and footpaths (e.g. island refuge and pedestrian crossing).

There is expected to be an excess in material of around 2,400 cubic metres though opportunities to achieve an 'earthworks balance' (i.e. no net gain or loss of material) will be refined at the detailed design stage. Excavated material would be reused onsite where possible or disposed of in accordance with relevant legislative requirements. The opportunity of providing the excess material to the Canberra Brickworks Precinct estate developer will also be investigated to minimise offsite disposal. Existing topsoil is to be stockpiled and reused onsite during the rehabilitation of the Project area.

3.2.5 Source and quantity of materials

The source and quantity of materials would be determined during the detailed design phase of the Project. Materials would be sourced from local suppliers where practicable. Reuse of existing and recycled materials would be undertaken where practicable.

3.2.6 Traffic access and vehicle movements

The day to day movement of construction plant (e.g. deliveries, mobile plant movements) is anticipated to generate in the order of 5 to 10 truck movements on normal working days for the delivery of construction material. It is envisaged that the peak number of truck movements would be generated by earthworks at the site (up to about 15 heavy vehicle trips per day).

Traffic and transport impacts associated with the Project are assessed in Section 7.1 of this REF. The potential traffic and access impacts expected during the construction of the Project include:

- increased travel times due to construction zone speed limits, truck and construction machinery movements, lane closures and stop/go operation. Works with the potential for traffic disruption, such as utility adjustments along the trafficked pavement, would be scheduled to take place outside of peak commuting periods in order to minimise road user delays
- work impacting on traffic lanes may be undertaken off peak or at night
- temporary realignment of Dudley Street to maintain traffic flow during construction which would likely cause temporary traffic disruption, particularly during peak hours
- Dudley Street would remain open to traffic where possible. There would be some temporary traffic diversions provided to allow construction on the existing paved areas. There would be minor delays at the time of traffic switch-overs (when the temporary traffic diversions are implemented), with traffic controlled by stop/go staff. Traffic switch-overs would be scheduled to occur at off-peak periods
- one compound is proposed at the western end of the site adjacent Cotter Road, so as to avoid unnecessary movement of trucks and equipment on adjacent local roads
- the Project would cause minor delays to pedestrian and cyclist movements that cross Dudley Street west of the Novar Street roundabout during construction. Construction works in this area would be scheduled to avoid peak periods and access would be maintained (e.g. through diversions).

The Project staging, as described in Section 3.2.1, has been developed to maintain traffic access along Dudley Street during the construction period. This would significantly reduce the traffic impacts associated with full road closure and diversion of traffic along alternative routes.

A detailed construction methodology and associated management plans (such as a Construction Environmental Management Plan (CEMP)) would be developed during the next design phase of the Project to manage potential traffic and access impacts.

3.2.7 Ancillary facilities

A site construction compound is required for the Project and would be located south of Dudley Street in the western extents of the Project area between Dudley Street and Cotter Road. This compound area would also be used for the temporary realignment of Dudley Street to maintain traffic flow during construction of the upgrades of Cotter Road / Dudley Street intersection (during construction Stage 3).

The opportunity for an alternative location for the construction compound is currently being investigated. This would be within the Canberra Brickworks Precinct site prior to its development (with the agreement of the DOMA Group). The use of this location is highly dependent on the scheduling of the proposed activities and the existing development of the site, and also on successful contract negotiations between the responsible parties.

The construction compound would be used for site offices, construction staff amenities, storage of machinery, vehicles, equipment and material laydown areas.

Stockpile locations are to be determined during detailed design following confirmation of quantities. A site located on Lady Denman Drive has been proposed.

3.2.8 Public utility adjustments

Water supply infrastructure would require relocation or adjustment. An existing 150 mm diameter water main which crosses the location of the proposed roundabout would be relocated north to cross the Access Road. A 150 mm diameter water main would also be relocated in the eastern extents of the Project close to the Dudley Street / Novar Street intersection.

Aboveground High Voltage electrical cables cross Dudley Street in the western extents of the Project area. These overhead cables would need to be undergrounded to allow for construction of the Project.

The gas main which crosses Dudley Street in the eastern extents of the Project area near to the Novar Street roundabout would require relocation as the level of groundcover of this utility is reduced.

Telecommunications cables (underground) along the northern verge of Dudley Street would also be disturbed by the Project and would require relocation.

New services are to be provided along the Access Road and Dudley Street including electricity and telecommunications to service the proposed Canberra Brickworks Precinct. Other services such as power for street lighting along the Access Road and Dudley Street would also be provided.

A range of other utilities are located on or adjacent to the Project area, including a High Voltage (aboveground) electrical cables located in the eastern extents of the Project area near to the Dudley Street / Novar Street intersection.

Impacts to existing utilities have been avoided by the design where feasible. Affected services would be relocated by the respective utility providers or by the Contractor during site establishment. Such relocation is unlikely to occur outside the footprint of the works assessed in this REF (i.e. the area shown in Figure 22). In the event that works would be required outside of this footprint, further assessment would be undertaken. The appropriate utility providers would be consulted during the detailed design phase.

These existing utilities have been located using a Dial Before You Dig search and environmentally sensitive potholing techniques and any relocations required are being incorporated into the detailed design.

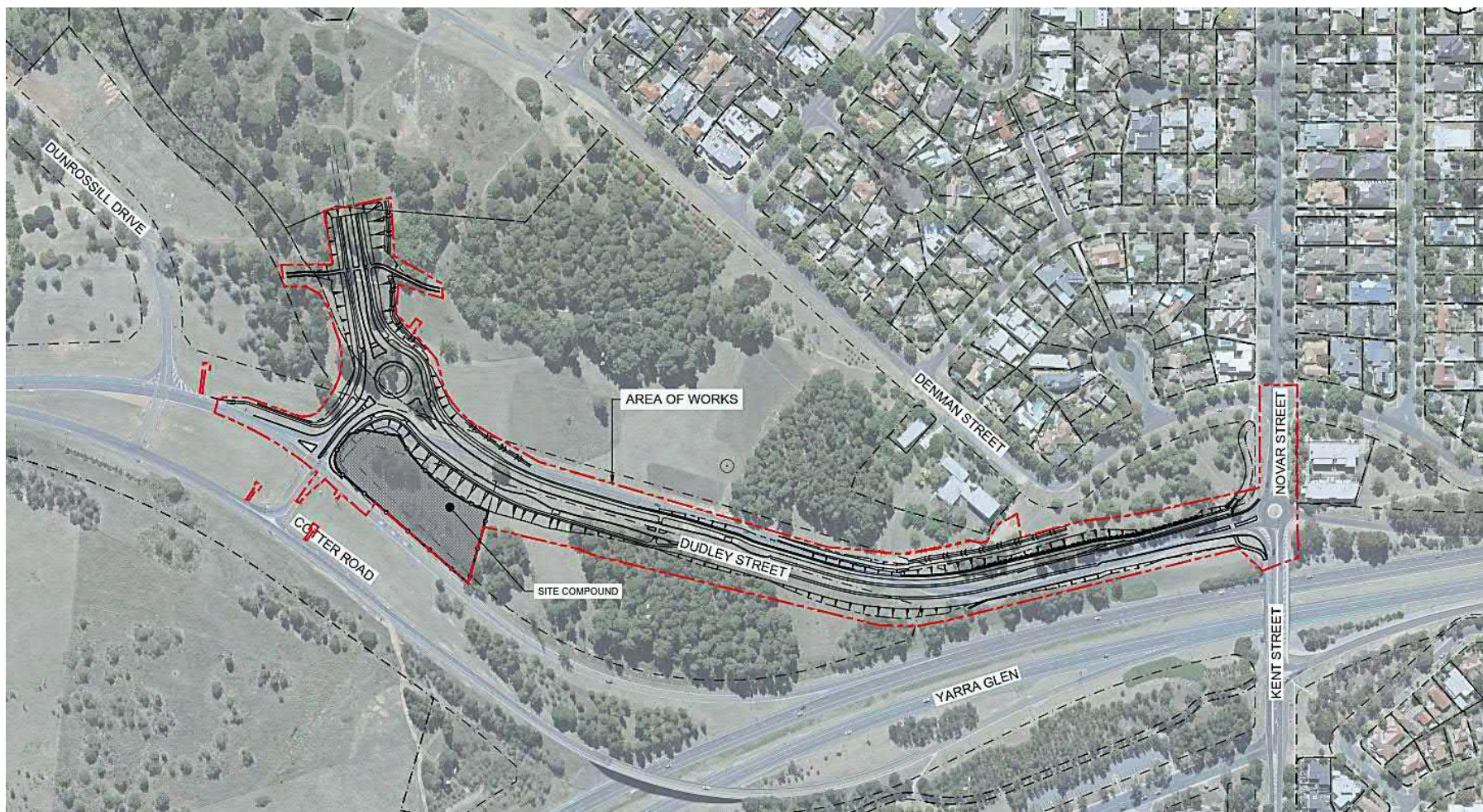


Figure 22 Proposed works area and indicative construction compound

3.3 Property acquisition

The ACT Government does not propose to acquire any property as part of the Project which would be undertaken entirely on public land. There will be a requirement however to establish appropriate road reserves and have these gazetted.

3.4 Operation management and maintenance

The future operation and maintenance of the Access Road and Dudley Street would be undertaken by TCCS, including the maintenance of landscaped areas.

4.0 Legislative Context

Chapter 4.0 provides a summary of the statutory considerations relating to the Project including a consideration of the Commonwealth and ACT legislation (particularly the PD Act) applicable to the Project as well as ACT Government policies/strategies.

4.1 Commonwealth legislation

4.1.1 *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The EPBC Act is the Australian Government's central piece of environmental legislation, providing a legal framework to protect and manage nationally and internationally important MNES including flora, fauna, Threatened Ecological Communities (TECs) and Heritage places. Under the EPBC Act, approval from the Commonwealth Minister for Environment and Energy is required for actions that are:

- Likely to have a significant impact on a MNES
- Carried out on Commonwealth Land and is likely to have a significant impact on the environment
- Undertaken outside of Commonwealth Land but is likely to have a significant impact on the environment on Commonwealth Land.

MNES include:

- World Heritage Properties
- National heritage places
- Listed migratory species
- Wetlands of International Importance
- Commonwealth Marine Areas
- TECs and threatened species
- Nuclear actions.

If the Project is likely, or potentially likely, to have a significant impact on any of the above triggers for approval, the Project must be referred to the Department of Environment and Energy for consideration. Based on a review of the referral, the Departmental delegate (on the Minister's behalf) will decide whether the proposed action is likely to have a significant impact on one or more matters protected by the EPBC Act and be nominated a 'controlled action'. If the proposed action is a controlled action, the Project will need to undergo a formal assessment and approval process under the EPBC Act before it can proceed.

Ecological surveys of the Project area (as described in Section 7.2) have identified two MNES which are likely to be impacted by the Project, including;

- the critically endangered golden sun moth
- natural temperate grassland of the south eastern highlands, a TEC.

A Referral to DOEE was submitted for the Project (2017/8072) on 13 October 2017 recommending that the proposed action (the Project) be considered a controlled action due to significant impacts on MNES. On 1 December 2017, the Minister's delegate determined that the Project was a controlled action in accordance with Section 75 of the EPBC Act and requires assessment under Preliminary Documentation. The decision was based on the relevant controlling provisions within the Act, which for this Project are: *Threatened ecological communities and threatened species (Section 18 and 18a)*.

As a consequence, the Project requires assessment and approval by the Minister (or delegate) under the EPBC Act, before it can proceed. This report provides the supplementary information requested as part of DOEE's assessment requirements. **Appendix A** responds to the additional information requirements requested by DOEE on 15 December 2017 and describes how they have been addressed.

4.1.2 ACT Planning and Land Management Act 1988 (P&LM Act)

The P&LM Act establishes the NCA and the development of the NCP. The NCP aims to ensure that development within the ACT occurs in an appropriate manner. It provides a framework for development in regards to planning and design, while advancing those aspects of Canberra and the Territory which are important to the national role of Canberra. The NCP provides a framework for the Territory Plan (see Section 4.2.3) which provides more specific guidance on the development of the region.

The NCP also provides detailed planning policies and guidelines for areas designated as having the special characteristics of the National Capital, referred to as Designated Areas. Any works in these Designated Areas require prior written approval of the NCA in the form of a Works Approval.

Works proposed in Designated Areas do not require development approval from the ACT's planning authority (EPSDD) under the PD Act. Notwithstanding, works proposed in Designated Areas still require project endorsement from the ACT agencies which administer ACT environmental regulations.

Dudley Street road reserve and the land to the south of Dudley Street (Block 1, Section 113 Yarralumla) are located within Designated Areas. A Works Approval from the NCA will therefore be required for the development proposed in Designated Areas to demonstrate that the Project complies with the applicable policies of the NCP.

This report supports the Works Approval application in providing details of the identified environmental risks and the proposed mitigation measures for managing the identified risks.

4.2 ACT Legislation

4.2.1 Planning and Development Act 2007 (PD Act)

The Project, with the exception of the Dudley Street road reserve, is located within land subject to the Territory Plan, administered by EPSDD in accordance with the PD Act. Territory Development Approvals are by the EPSDD under the PD Act and are required for works proposed in areas subject to the Territory Plan.

The Project requires approval by EPSDD under the impact track assessment in Schedule 4 of the PD Act. The types of Schedule 4 triggers for an assessment in the Impact Track are divided into:

- Activities (Part 4.2 of Schedule 4) – lists certain types of activities which trigger the need for impact track assessment, e.g. construction of a water storage dam above a certain size; and
- Areas and processes (Part 4.3 of Schedule 4) – lists certain areas or biophysical characteristics which trigger the need for impact track assessment, e.g. an area which contains listed threatened species or communities.

These activities and areas and processes are listed in Table 4 and Table 5, along with the applicability to the Project subject to the Territory Plan. While the PD Act doesn't apply to the Designated Areas, the applicability of the triggers has been shown for completeness.

Table 4 Schedule 4, Part 4.2 - Development Proposals requiring an assessment in the Impact Track— activities

Item	Proposal	Territory Plan ¹	Designated Areas ²
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 b. ambient noise or vibration so as to be detrimental to the health of persons in an adjoining residential, commercial or community facility zone	Not applicable	Not applicable
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, bio-material, solar power or co-generation— a. that is capable of supplying— i. the amount of electrical power prescribed by regulation; or ii. if no amount is prescribed—4MW or more of electrical power; or b. 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	Not applicable	Not applicable
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 000m ³ ; or iii. the recommended design flood discharge dealt with by the dam is at least 2 000m ³ 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	Not applicable	Not applicable
4	Proposal for construction of an airport or airfield (other than a helicopter landing facility used exclusively for emergency services purposes, including medical evacuation, fire fighting, retrieval or rescue)	Not applicable	Not applicable

Item	Proposal	Territory Plan ¹	Designated Areas ²
5	Proposal for construction of a wastewater treatment plant (including a plant for the treatment of sewage or other effluent) 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. 750 kL; 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— i. a plant for the treatment of stormwater; or ii. 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 iii. a residential on-site wastewater treatment system (including a septic tank)	Not applicable	Not applicable
6	Proposal for construction of a petroleum storage facility with a storage capacity greater than 500 kL of petroleum products at 1 time	Not applicable	Not applicable
7	Proposal for construction of a permanent venue for the conduct of motor racing events	Not applicable	Not applicable
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 5 kt each year, or 20 kt in total; or b. the facility will be— i. in an area with a high watertable, highly permeable soils, sodic soils or saline soils; or ii. less than 2 km from the boundary of a residential block or unit in a residential or commercial zone	Not applicable	Not applicable
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	Not applicable	Not applicable
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— a. is intended to handle more than 30 kt of waste each year; or b. will be less than 1 km from the boundary of a residential block or unit in a residential or commercial zone; but c. 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	Not applicable	Not applicable

¹ Applicability: Works proposed subject to the Territory Plan² Applicability: Works proposed in designated areas

Table 5 Schedule 4, Part 4.3 - Development Proposals requiring an assessment in the Impact Track – areas and processes

Item	Development Proposals requiring EIS (Schedule 4 of PD ACT (Part 4.3))	Territory Plan ¹	Designated Areas ²
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 provisionally listed threatened species; (f) a listed migratory species; (g) a threatened ecological community; (h) a protected native species; (i) a Ramsar wetland; (j) any other protected matter	Yes Significant impacts to golden sun moth (a critically endangered species) and natural temperate grassland (a threatened ecological community) within the Project area	
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	Not applicable	Not applicable
3	Proposal for development on land reserved under s 315 for the purpose of a wilderness area, national park, nature reserve or special purpose reserve, 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	Not applicable	Not applicable
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	Not applicable	Not applicable

Item	Development Proposals requiring EIS (Schedule 4 of PD ACT (Part 4.3))	Territory Plan ¹	Designated Areas ²
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	Not applicable	Not applicable
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	Not applicable	Not applicable
7	Proposal involving land included on the register of contaminated sites under the <i>Environment Protection Act 1997</i> .	Yes The Project extends into a site listed on the ACT register of contaminated sites. It is noted that the section impacted by the Project is not considered to be contaminated. See Section 7.6 of this Report	Not applicable
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	Not applicable	Not applicable

¹ Applicability: Works proposed subject to the Territory Plan

² Applicability: Works proposed in designated areas

Section 211 EIS Exemption Application

An Environmental Impact Statement (EIS) is required for any development application in the impact track under section 123 of the PD Act, unless an EIS exemption is granted. A proponent may apply for an EIS exemption for any Project that would trigger an EIS.

Under section 211 of the PD Act, the Minister has discretion to grant an exemption if satisfied that recent studies have adequately addressed the expected environmental impacts of the Project, whether or not the recent studies relate to the particular development Project. In deciding whether to grant an EIS exemption, the Minister must consider any submissions received during the consultation period for the EIS exemption application.

This report is provided for the information of the EPSDD as supporting documentation for a request for an exemption from requiring an EIS for the development of the Project (as described in Section 3.0). The application is sought on the basis that sufficient environmental research and studies have been undertaken, and these have adequately identified the potential environmental impacts of the development in the Project area. Information presented in this report and the accompanying risk assessment matrix (Section 6.5) demonstrates the level of knowledge and comparative risk associated with any information gaps such that further research through an EIS is not considered warranted.

4.2.2 Planning and Development Regulation 2008

This REF assessment has been undertaken generally in accordance with Section 50 of the *Planning and Development Regulation 2008* which provides for the assessment requirements for an EIS.

4.2.3 Other ACT legislation and regulations

Table 6 provides a list of other relevant legislation and regulations applicable to the Project.

Table 6 Other legislation applicable to the Project

Legislation	Considerations
<i>Environment Protection Act 1997</i> (EP Act)	The EP Act was established to protect the environment from pollution and its effects and provides a regulatory framework to help reduce and eliminate the discharge of pollutants into the air, land and water. It also establishes the Environmental Protection Authority (EPA) A person must not conduct a class A activity (as listed in Schedule 1 of the EP Act) unless the person holds an environmental authorisation in relation to that activity. No class A activities have been identified for the Project. Further, a person must not conduct a class B activity (as listed in Schedule 1 of the EP Act) unless the person – (a) is a party to an environmental protection agreement that is in effect in relation to that activity; or (b) holds an environmental authorisation in relation to that activity. As the Project triggers Item 4 “<i>the construction of public infrastructure on a site of 0.3ha or more,</i>” it requires either an environmental protection agreement or environmental authorisation to proceed. Under Section 21A, the EPA is required to keep a register of contaminated sites. The Project area is partially located within Block 1 Section 127 which is listed on the register of contaminated sites. Phase 1 and Phase 2 contamination assessments have been completed for the Project area, and a contamination due diligence assessment specific for the Project as discussed in Section 7.6. An interim site auditors opinion has been sought as is included in Appendix D. The contamination (asbestos) risk area was confirmed to be capped in an area that did not overlap with the Project area and it was concluded that contamination is unlikely to present any significant environmental constraint to the Project. Construction works associated with the Project would be covered by a CEMP, which should include an Unexpected Finds Protocol to be implemented in the unlikely event that indicators of contamination are encountered.

Legislation	Considerations
<i>Emergencies Act 2004</i>	Under the ACT's <i>Emergencies Act 2004</i> , is the Strategic Bushfire Management Plan, is the ACT's primary bushfire planning instrument. Prepared by the Emergency Services Agency, the ACT Strategic Bushfire Management Plan establishes the basis and framework for the efficient, effective and comprehensive management of fire and fire-related activities for protecting human life, property, assets and the environment. The Project area is located within mapped bushfire prone land and therefore bushfire risk it to be managed during construction, (refer Section 7.11).
<i>Fisheries Act 2000</i>	There are no waterways located within the Project area and therefore the Project is not likely to impact native fish species and their habitats. Surface water management and standard erosion and sediment control measures would be implemented during construction in accordance with the CEMP prepared for the Project (as detailed in Section 7.6).
<i>Heritage Act 2004</i> (Heritage Act)	The purpose of the <i>Heritage Act 2004</i> is to provide for the recognition, registration and conservation of places and objects of natural and cultural significance in the ACT. The ACT Heritage Council is an independent body established under the Heritage Act, which has the role of providing advice on appropriate conservation of cultural, natural and Aboriginal heritage places and objects in the ACT. Aboriginal heritage and Non-Aboriginal heritage assessments have been undertaken for the Project and are summarised in Section 7.9. Assessments concluded that there is low risk of impacts to identified heritage items during construction. If unexpected archaeological items are discovered during the construction of the Project, all works would cease and appropriate advice would be sought.
<i>Nature Conservation Act 2014</i>	The NC Act is the chief legislation for the protection of native plants and animals in the ACT and for the management of the conservation reserve network. For the works subject to the Territory Plan, endorsement from the Conservator of Flora and Fauna is required. Although approval under the PD Act does not apply to the areas of the Project which are located within Designated Areas subject to the NCP, the NCA require that endorsement for the Project is obtained from the Conservator of Flora and Fauna and provided with the Works Approval documentation. Significant impacts to species and habitats listed under the NC Act are likely as a result of the Project. Potential impacts to flora and fauna are discussed in Section 7.2.
<i>Territory Plan 2008</i>	The Territory Plan is a major statutory planning document within the ACT, identifying land zoning in all areas of the ACT. The plan provides the policy framework for the administration of planning in the ACT. An application for a variation to the Territory Plan is required if the proposed development is prohibited within the applicable development table. The Project area is partially within areas of land zoned as PRZ1 and PRZ2 under the Territory Plan (See Section 1.3). The Project is a 'minor road' development and therefore is a permissible development within the development tables of PRZ1 and PRZ2. As such, a Territory Plan variation is not required for this Project.
<i>Tree Protection Act 2005</i>	A Tree Assessment was undertaken as a part of the Project and details are discussed in Section 7.2. Around 92 trees are to be removed as part of the Project. Through the process of submitting an application under the PD Act and gaining endorsement from the Conservator of Flora and Fauna, the Conservator would fulfil its requirements under the <i>Tree Protection Act 2007</i> , which requires that the Conservator gives advice on a proposed development in relation to tree protection.

Legislation	Considerations
Water Resources Act 2007	Under section 42 of the <i>Water Resources Act 2007</i> , 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. There are no water resources within 40 metres of the Project and therefore a WWL is not required.

Statement of Strategic Direction

The Statement of Strategic Directions forms part of the Territory Plan and sets out the principles for giving effect to the main object of the Territory Plan and recognises that the ACT must be planned as both the setting for the National Capital and as a self-governing community in its own right.

The Statement includes the principles for sustainable development as well as the spatial planning and urban design principles that are intended to guide the more specific policy content of the Territory Plan. The principles include:

- Sustainable Development Principles:
 - General Principles
 - Environmental Sustainability
 - Economic Sustainability
 - Social Sustainability.
- Spatial Planning and Urban Design Principles:
 - Urban Areas
 - Urban Design.

Table 7 presents a summary of the relevant principles and a response to how they are addressed. In summary, the Project is considered to be consistent with the principles outlined in the Statement of Strategic Directions.

Table 7 Statement of Strategic Direction principals

Statement of Strategic Direction principal	Response
General Principals	
<i>Planning processes and decisions will be focused on the combined achievement of economic vitality, community wellbeing, and environmental quality. Broad community involvement will be a key element in the pursuit of sustainable development, as will complementary regional strategies and agreements.</i>	The Project facilitates ongoing best practice engineering in road design (see Section 3.0). Through the Project design process, appropriate environmental controls have been developed (see Section 7.0). Project development has included community involvement (see Section 5.0).
<i>Economic, social and environmental objectives will be pursued in a balanced and integrated way, having regard to both short-term and long-term factors, such that present needs can be met without prejudicing the welfare of future generations, and without serious or irreversible loss of life-supporting natural resources or damage to the environment.</i>	Through development of the Project, economic, social and environmental objectives have been addressed and have been considered in a number of Sections. Further discussion regarding the consideration of both short term and long term impacts is provided in Section 7.0. Inter-generational equity is discussed in Section 7.4.

Statement of Strategic Direction principal	Response
<i>Wherever appropriate, the broader global and regional context and potential cumulative impacts of decisions will be taken into account. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for failing to prevent environmental degradation.</i>	Through development of the REF consideration of potential impacts has, where appropriate, taken into account the regional context and cumulative impacts. Where potential impacts have been identified, lack of scientific certainty has been addressed through detailed studies. Furthermore, the precautionary principal has been utilised where appropriate. Further discussion of the application of the precautionary principal is provided in Section 4.3.
Environmental Sustainability	
<i>The pattern of development is to reflect land capability constraints resulting from topography, soils, geotechnical factors, drainage, natural hazards, microclimate and the sensitivity of ecosystems. Particular attention will be given to the need to conserve soil, water and vegetation; maintain biological diversity; safeguard important ecosystems and ecological processes; and provide and protect wildlife corridors.</i>	The Project design option was selected from a number of different options following consideration of planning and land use issues, environmental constraints, and engineering factors influencing the design and operational activities as described in Section 2.0.
<i>Land and water resources will be planned in accordance with the principles of integrated catchment management and water sensitive urban design. Policies will seek to protect identified environmental values, whilst focusing on opportunities for multi-purpose use of resources. Special attention is to be given to protecting sources of the Territory's water supply and to maintaining environmental flows in rivers and streams.</i>	Catchment management and water quality are addressed in Section 7.7. Potential impacts addressed included contamination, changes in groundwater availability, changes in overland flows and flooding.
<i>Integrated land use and transport planning will seek to maximise accessibility and transport efficiency, reduce energy consumption, support the preferred pattern of development, promote safety, safeguard environmental quality, and minimise greenhouse gas emissions.</i>	The preferred design option has been selected to maximise accessibility and transport efficiency, reduce energy consumption, support the preferred pattern of development, promote safety, safeguard environmental quality. Potential greenhouse gas emissions from the Project are discussed in Section 7.8.
<i>Policies for environmental planning and management will ensure amenity, minimise pollution, and protect public health and safety.</i>	Amenity, pollution, public health and safety are considered within this REF (Section 7.0).
Economic Sustainability	
<i>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.</i>	The Project will allow Dudley Street to operate safely and to meet the design requirements for a major collector road. The Project would increase the width of Dudley Street to 10 metres and would provide for a design capacity of 9,000 vehicle movements per day.
<i>In planning future development and redevelopment, particular emphasis will be placed on cost-effective provision and management of existing and new infrastructure and services, taking into account whole-of-life and whole-of- system costs, including the ecological footprint of proposed developments and activities.</i>	The Project makes efficient use of existing infrastructure and has been designed to minimise its ecological footprint while ensuring that it meets the design objectives. The measures implemented to minimise ecological impacts are detailed in Section 2.4 and 7.2.

Statement of Strategic Direction principal	Response
Social Sustainability	
<i>Urban development will be planned in a manner that promotes community vitality and safety, applying principles of crime prevention through environmental design. Provision will also be made for emergency services infrastructure necessary to ensure a high standard of safety for residents and visitors.</i>	The Project will allow Dudley Street to operate safely and to meet the design requirements for a major collector road. The design standards considered during the development of the Project are detailed in Section 3.1.3 which includes the Crime prevention through environmental design general code (ACTPLA).
<i>The needs of people with disabilities will be recognised in all facets of urban planning, particularly including the design and operation of transport and access systems and the assessment of development proposals.</i>	Shared paths would be provided along Dudley Street as part of the Project.
<i>New suburban areas will be planned with a legible and permeable hierarchy of roads; conveniently located commercial and community facilities; a network of open spaces; an off-road system for pedestrians and cyclists; and provision for accessible public transport.</i>	The Project would allow Dudley Street to operate safely and to meet the design requirements for a major collector road. The Access Road would provide an appropriate access to allow the development of the Canberra Brickworks Precinct. The widened Dudley Street would significantly improve the amenity for cyclists using this route. Off-road shared paths are also provided as part of the Project to provide a new access for pedestrians and cyclists through the area.
<i>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.</i>	Aboriginal and Non-Aboriginal heritage assessments have been undertaken for the Project area, along with the identification of potential impacts on these values that may result from the Project and the determination of mitigation measures to minimise potential impacts (see Section 7.9).
<i>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.</i>	Heritage surveys undertaken to date have confirmed that the Project will not impact on items contained in the Heritage Register. In the event that previously unidentified archaeological artefacts or sites are located during Project works, the unexpected finds procedure which has been developed for the Project would be implemented to ensure compliance with all relevant legislation and the protection of cultural heritage items.
Urban Areas	
<i>Future residential settlement will be accommodated through development of greenfields areas, subject to detailed feasibility and suitability studies; some expansion of existing towns; and appropriate use of suitable vacant or underdeveloped sites.</i>	The Project will provide the publicly funded access to allow the development of the Canberra Brickworks Precinct which would revitalise this historical heritage area of Yarralumla.
<i>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.</i>	The Project promotes this principle in providing new facilities, including a complimentary shared path network and future access to the Rapid Bus Network. The design also promotes active travel through the use of on-road cycle paths and off-road shared paths.

Statement of Strategic Direction principal	Response
<i>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.</i>	The core of the Project is to achieve this principal in allowing Dudley Street to operate safely and to meet the design requirements for a major collector road. It also provides an Access Road to the proposed Canberra Brickworks Precinct enabling safe and efficient access to a new residential area.

4.2.4 ACT Government policies and strategies

Table 8 provides an overview of other ACT Government policies and strategies relevant to the Project.

Table 8 ACT Government policies and strategies applicable to the Project

Policy /Strategy	Commitment	Comment
ACT Planning Strategy 2012	The <i>ACT Planning Strategy 2012</i> is a key strategic planning document within the ACT, setting a framework for spatially based development decision making and identifying actions required to achieve its strategic goals over a 30 year period. The ACT Planning Strategy operates alongside the Territory Plan and NCP, providing direction for land use and construction of capital works in the short, medium and long term.	The Project is consistent with the strategic direction of the ACT Planning Strategy.
Transport for Canberra	<i>Transport for Canberra – Transport for a sustainable city 2012-2031</i> (Transport for Canberra) has been prepared in conjunction with the ACT Planning Strategy so important relationships between land use and transport can be used to support a shift to more sustainable transport and a more sustainable Canberra. Transport for Canberra proposes a range of measures including bus and bus priority measures, improvements to public transport interchanges, attention to improving cycling and walking facilities and more focus on integrating land uses and the contained urban form.	The Project is consistent with Transport for Canberra in particular in promoting active travel through the use of on-road cycle paths and off-road shared paths.
ACT Climate Change Strategy	The ACT Government's approach to climate change from 2007 to 2025 has been set out in <i>Weathering the Change – The ACT Climate Change Strategy 2007-2025</i>. The strategy's main objective is to encourage smarter, more efficient use of resources in order to increase sustainability, build adaptive capacity whilst improving our understanding of climate change and how to respond. The strategy is broken down into four Action Plans, each of which includes specific targets and performance measures for the time periods 2007-2011; 2012-2016; 2017-2020 and 2021-2025. The Action Plans' staggered approach is intended to provide a structure for the ACT to develop responses in the local context.	The ACT Climate Change Strategy is relevant to the Project across a number of aspects addressed in this report. See Section 7.14 for an assessment on Climate Change impacts as a result of the Project.
ACT's Sustainability Policy	The ACT government has committed to sustainability through policy since 2003 with the release of <i>People Place Prosperity: a policy for sustainability in the ACT</i> . Since 2003 the policy has been updated highlighting the presence of sustainability as a key and permanent feature in the ACT's key guiding principles. The main objective of the policy provides a set of guiding principles to balance social, economic and environmental outcomes as well as establish a common definition of sustainability.	The Project responds to the ACT's Sustainability Policy through the Project design, minimising biodiversity impacts as far as practicable and by employing sustainable road design practices.

4.3 Ecologically sustainable development

The ACT Government is committed to ensuring that its projects are implemented in a manner that is consistent with the principles of ecologically sustainable development (ESD). The principles of ESD are generally defined under the provisions of clause 9 of the PD Act as:

- the precautionary principle – if there is a threat of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- intergenerational equity – the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations
- conservation of biological diversity and ecological integrity – the diversity of genes, species, populations and their communities, as well as the ecosystems and habitats they belong to, should be maintained or improved to ensure their survival
- improved valuation, pricing and incentive mechanisms – environmental factors should be included in the valuation of assets and services.

The principles of ESD have been adopted by ACT Government throughout the development and assessment of the Project. Section 2.3 summarises how ESD would be incorporated in the design development of the Project. Section 7.14 includes an assessment of the Project on climate change, and Section 8.2 provides a summary of the mitigation measures to ensure ESD principles are incorporated during the construction phase of the Project.

5.0 Community and Stakeholder Consultation

Chapter 5.0 discusses the consultation strategy adopted for the Project and the outcomes of consultation with the community, relevant government agencies and stakeholders.

5.1 Consultation strategy

The consultation strategy for the Project was developed to encourage stakeholder and community involvement and foster interaction between stakeholders, the community and the project team. The objectives of the consultation strategy are to:

- provide accurate and timely information about the Project and planning approvals process to relevant stakeholders
- raise awareness of the various components of the Project and the specialist environmental investigations
- ensure that the directly impacted community are aware of the Project and consulted where appropriate
- provide opportunities for stakeholders and the community to express their view about the Project
- understand and access valuable local knowledge from the community and stakeholders
- record the details and input from community engagement activities
- build positive relations with identified community stakeholders
- ensure a comprehensive and transparent approach.

5.2 Stakeholder consultation activities

This Section describes the stakeholder engagement and community consultation undertaken to date for the Project. Key stakeholders identified for the Project include:

- Suburban Land Agency (SLA) (formally Land Development Agency (LDA))
- Yarralumla Uniting Church
- National Capital Authority (NCA)
- Commonwealth Department of Environment and Energy (DOEE)
- Transport Canberra and City Services (TCCS)
- Transport Canberra (ACTION)
- Utilities Authorities
- Environment, Planning and Sustainable Development Directorate (EPSDD)
- Water Burley Griffin Society
- Indigenous heritage stakeholders
- SEE-Change
- Yarralumla Residents Association (YRA)
- Pedal Power
- Canberra Brickworks Community Panel
- Chief Minister, Treasury and Economic Development Directorate (CMTEDD).

5.2.1 Suburban Land Agency

The SLA, formally the LDA, are a key stakeholder in the design and representatives attended fortnightly project meetings during preliminary sketch plan design development.

The key issues and requirements for the SLA are:

- Alignment of the Access Road to ensure an appropriate tie-in with the Canberra Brickworks Precinct development while considering topographical and environmental constraints
- A shared path to provide a connection to the Canberra Brickworks Precinct from Cotter Road
- The proposed gradient of the Access Road to meet the maximum gradient design requirements
- A 300mm diameter water main provided by the developer outside this Project
- Stormwater design for the Access Road and Dudley Street Upgrade assumes existing run off conditions. Increased run off due to the Canberra Brickworks Precinct development would be managed and attenuated by the development
- Shared trench connecting electricity and communication conduits.

SLA has a Community Panel set up for the Canberra Brickworks Project which includes groups such as the YRA, Inner South Community Council, SEE-Change and Pedal Power etc. The SLA has presented the design as it progresses at Community Panel sessions and meetings have also been held with YRA, SEE-Change and Pedal Power.

5.2.2 Yarralumla Uniting Church

A meeting was held on 6 February 2017 with various representatives from the Yarralumla Uniting Church to discuss the stormwater drainage from the Church. It was agreed with CMTEDD that the stormwater flow from the Church would be incorporated into the Dudley Street Upgrade works. A further meeting was held on 18 August 2017 to provide an update on the proposed action.

The key points of discussion and outcomes from the meeting were:

- Uniting Church representatives noted that the stormwater drainage outlets flow in the direction towards Dudley Street as there is visible erosion close to these outlets
- The stormwater from the main church drains towards Deakin
- Uniting Church representatives raised their concern regarding the stormwater drainage from the church affecting any downstream future developments
- The property was surveyed around 12 months ago.

It was agreed that stormwater runoff from the church would be incorporated into the Dudley Street Upgrade at a further meeting held on the 18 September 2017 that provided a project update.

5.2.3 National Capital Authority

A meeting was held with Sarah Treble from the NCA on 1 February 2017 to discuss the proposed scope of works. The key points of discussion and outcomes of the meetings were:

- NCA queried the traffic numbers and impacts on Cotter Road and Dunrossil Drive that could affect dignitaries on route to or from Government House
- NCA requested that the draft alignment be provided to understand the required boundary changes prior to a Works Approval submission
- NCA would internally discuss if further additional landscaping treatments along Dudley Street would be required following receipt of cross sections for the Access Road and Dudley Street
- Both ACT Heritage and ACT Conservator should be consulted
- Public consultation should be carried out prior to the Works approval application
- The approval application would be only for Dudley Street.

Further consultation has been undertaken with NCA as the design for the project has progressed including an update meeting on 9 August 2017 and review of the preliminary sketch plan drawings and design report in early August 2017.

5.2.4 Commonwealth Department of Environment and Energy (DOEE)

A pre-referral meeting was held with the Commonwealth DOEE on 31 August 2017 to discuss the potential Project impacts on MNES and the outcomes of the ecological assessments undertaken for the Project. Further consultation with DOEE has been ongoing including the submission of a referral for the Project (2017/8072) on 13 October 2017. Further details are provided in Section 4.1.1.

5.2.5 Transport Canberra and City Services / Transport Canberra (ACTION)

An initial meeting was held with TCCS and ACTION on 23 January 2017.

The key points of discussion and outcomes of the meeting were:

- Clarified bus services will use Dudley Street to service the future development
- Current bus route on Novar Street would be retained
- Bus stop is to be indented
- Bus stop bay (gradient) is to comply with the TCCS standard
- There is to be one bus stop (in each direction) on Dudley Street and located as close as possible to the Canberra Brickworks Precinct. Local stop location to be clearly communicated to the SLA and the Developer
- A few areas of concern for ACTION included:
 - Dudley Street/Cotter Road westbound intersection – safety concern for buses turning right into Cotter road as currently the intersection is not signalised.
 - Dudley Street/Novar Street is a tight intersection.
 - Adelaide Avenue southbound off ramp/Kent Street is a tight intersection.

Further meetings occurred with TCCS as the design has progressed including discussion and agreement of the road cross section and review of the preliminary sketch plan drawings and design report in July/August 2017.

5.2.6 Utilities Authorities

During the preliminary sketch plan design process liaison with utility authorities was undertaken to discuss the proposed works and location of existing utilities. The potentially impacted utility authorities include:

- Jemena/Zinfra
- Evoenergy (previously known as ActewAGL)
- Icon Water
- Telstra
- Transact/iiNet.

5.2.7 Inter-Directorate

There have been inter-directorate discussions and a meeting with the ACT Conservator of Flora and Fauna (EPSDD) on 23 March 2017. This meeting involved discussions regarding the environmental issues and impacts.

A pre-application meeting held on 3 August 2017 had representatives from stakeholders including:

- SLA (EPSDD)
- EPA (CMTEDD)
- Conservator Liaison Officer (EPSDD)

- Impact Assessment (EPSDD)
- Icon Water
- Evoenergy
- Capital Works (TCCS)
- Roads ACT (TCCS).

Further discussions have occurred as the design has progressed with staff from EPSDD in relation to the environmental impacts and offsets required for this Project and recommended tree and grass species to plant.

5.2.8 Walter Burley Griffin Society

Civil Infrastructure Delivery of CMTEDD advised the Walter Burley Griffin Society on 5 January 2017 of the works occurring at Dudley Street as Dudley Street is part of the original road layout by Walter Burley Griffin. The Walter Burley Griffin Society mentioned that its main interests with respect to Griffin's plan and street layouts are in relation to the terminus of the Adelaide Avenue axial and Griffin's principles of designing with landforms and vistas. The Walter Burley Griffin Society has requested to be notified of public briefings regarding the draft design plans.

5.2.9 Indigenous heritage stakeholders

A Stage 1 Aboriginal Cultural Heritage Assessment was undertaken by Navin Officer Heritage Consultants Pty Ltd in 2014 (Navin Officer Heritage Consultants 2014). The assessment confirmed no Aboriginal heritage values relevant to the Project area and therefore no consultation with Aboriginal stakeholders has been carried out. See Section 7.9 of this report provides further details of the Stage 1 Aboriginal Cultural Heritage Assessment.

5.2.10 Brickworks Design and TCCS

A meeting was held on 27 July 2017 with DOMA group and TCCS to review and discuss the cross section of the Access Road into the Canberra Brickworks Precinct. The proposed design was reviewed and following the meeting the dimensions were agreed for the Access Road to ensure a consistent tie-in design. The following items were discussed and agreed:

- It is a minor collector and therefore is not required to have on-road cycling
- It basically functions as an Access Road
- It will not have on-road parking (outside of the development area)
- Soil volume is to be considered in relation to tree species planted in the median (and verge)
- Median is to be crowned with kerb, with crossfall to verge
- 4.5 metres wide median to allow for trees in accordance with TCCS requirements
- 2 x 3.5 metre wide traffic lanes
- Verge
 - 2.5 metre wide shared on western side and 1.5 metre wide pedestrian path on eastern side
 - Shared trench for utilities to service the development area
 - 300mm diameter stormwater.
- Overhead power will be undergrounded all the way to the development area
- Vertical grade of the Access Road – level is fixed at Estate boundary to keep all roads at less than 5% within the development
- Dudley Street - the road formation width needs to allow for a future on-road cycle path to be developed but does not need to be constructed as part of the works. An allowance has been made for two stops including connecting shared paths.

5.2.11 Yarralumla Residents Association

A meeting was held with representatives of the Yarralumla Residents Association including Pedal Power and SEE Change on 12 September 2017.

The proposed design was presented and discussed in conjunction with traffic modelling outcomes for signalising the Novar Street roundabout intersection as part of a separate package of works.

Various Project updates have been provided to the Yarralumla Residents Association via email correspondence including the status of the Project and proposed planning approvals, and notification of planned survey work.

5.3 Community information session

A community information session was held at the Yarralumla Uniting Church on 28 November 2017 which was attended by over 60 community members. The community information session provided an opportunity for members of the public to discuss the Project with key members of the Project team and also representatives from SLA involved with the development of the Canberra Brickworks Precinct.

The key feedback received at the community information session included:

- Concern that Dudley Street is used as a 'rat run' providing an access route for vehicle traffic to access Yarralumla through to the edge of the lake to avoid congestion on Adelaide Avenue
- Dudley Street is used to access Deakin and the adjacent suburbs which causes congestion in the morning and afternoon peaks periods
- Discussion around the proposed treatment of the existing roundabout intersection at Novar Street / Dudley Street, including concern that the Project would not resolve the congestion issues of the morning peak and questions around the need to provide signals at the Novar Street roundabout. Some of the attendees saw the signalisation as a higher priority than modifications to Dudley Street
- Querying the provision of a 2.5 metre shared path instead of a three metre wide shared path with concern with potential issues from the interaction of pedestrians and cyclists, and whether the shared path will connect to the existing cycle paths along the lake and Cotter Road
- Consideration that the Mint Interchange would be a better solution and reduce traffic on Kent Street bridge. Most attendees however felt that if the Mint Interchange was not going to happen due to cost restrictions and that they would like the signalisation and other improvements at the Novar Street roundabout and on Denison Street
- Preference that any trees removed as part of the Project along Denman Street are replaced to screen Dudley Street from residences
- Concern that the Project would cut into the ridge on the western side of Denman Street which is considered to protect Yarralumla
- Query into whether a park and ride facility has been considered for the bus stops
- Some interest in the environmental aspects of the project with discussion on the golden sun moth and comparing how NCA delineate these habitat areas versus the ACT Government approach (in reference to post markings around area in Stirling Park). Consideration from some attendees that translocating the larvae is a waste of time
- Interest in the shape and form of the Canberra Brickworks Precinct development
- Concern that there will be a through road as part of Canberra Brickworks Precinct i.e. the new Access Road would link through the Canberra Brickworks Precinct to Denman Street
- Preference that the Project is completed before the development of the Canberra Brickworks Precinct so that construction access is provided and construction of the development and will keep construction traffic off the existing residential streets of Yarralumla.

5.4 Ongoing consultation

5.4.1 Commonwealth planning approvals

This REF and supporting documentation was displayed publically from Thursday 13 September 2018 to Thursday 4 October 2018 for community and stakeholder comment as part of the EBPC Act approvals process and the DOEE request for additional information to assist with the assessment of the Project.

The REF display strategy adopts a range of consultation mechanisms, including:

- public display of the REF at various locations
- distribution of a Project update to local community and stakeholders, outlining the Project and inviting feedback on the REF
- advertisement of the REF public display in the local newspaper with a link to the publication website that includes a summary of the Project and information on how to provide feedback
- consultation with other key stakeholders.

The display period of the REF would be advertised in the week that the public display commences. Notification will be provided to the key stakeholders prior to REF display.

A total of 12 community submissions were received as part of the Commonwealth EPBC Act public exhibition period. The issues that were raised in the submissions and the responses to these issues are presented in the Submissions Report provided in **Appendix E**.

5.4.2 ACT planning approvals

Section 211 EIS Exemption Application

Concurrent with the public consultation process required for the DOEE approvals, there was also a public consultation process through the ACT Government Section 211 EIS exemption application process. The public display ran for at 15 working days from Monday 17 September or Monday 8 October 2018, where five community and 10 stakeholder submissions on the Project were received. The public submissions received were published on the EPSDD website and provided to the Project team.

The issues that were raised in the community and stakeholder submissions and the responses to these issues are presented in the Submissions Report provided in **Appendix E**.

Following the community consultation process, the submissions were considered and the application revised as appropriate to address matters raised during public consultation through the preparation of a revised Section 211 EIS exemption application. EPSDD will then assess the revised application and prepare an EIS exemption assessment report for the Minister.

Development Application

If the EIS exemption application is approved, a Development Application will be submitted to EPSDD for the Project and will also be publically displayed for community and stakeholder comments.

5.4.3 Consultation during Project implementation

Should the Project be approved, the Project team would keep the community and other key stakeholders informed of the progress, including identifying further issues as they arise, and developing additional mitigation measures (as required) to minimise the impacts of the Project. The interaction with the community would be undertaken in accordance with a Community Liaison Plan to be developed prior to the commencement of construction by the Contractor.

6.0 Preliminary Risk Assessment (pre-mitigation)

6.1 Purpose of a Preliminary Risk Assessment

To understand the potential risks that need to be mitigated and managed during the construction and operation phases, a preliminary risk assessment has been undertaken for the Project (as described in Section 3.0) by AECOM Australia Pty Ltd (AECOM). The preliminary risk assessment has been prepared as a component of the Section 211 EIS exemption application and to assist in satisfying the information requirements (*Form 1M – Application for Scoping Document; Environmental Significance Opinion; Exemption from EIS (S211)*) for assessment under the PD Act.

A risk-based approach is used for scoping the potential environmental impacts with the use of a preliminary risk assessment as described in the *Proponents guide to Environmental Impact Assessment Exemptions* (EPSDD, 2017).

The purpose of a preliminary risk assessment is to identify the degree to which the impacts of an action are known and understood, and the confidence with which they can be predicted. The preliminary risk assessment can also be updated as new information becomes available where this would affect the understanding of risk and the associated required mitigation measures. The preliminary risk assessment will assist to scope the level of impact and the requirements to address ways to minimise or mitigate impacts.

6.2 Methodology of the Preliminary Risk Assessment

The risk matrix methodology adopted for this preliminary risk assessment is derived from that proposed by the guide for *Proponents guide to Environmental Impact Assessment Exemptions*.

Risk is considered in this preliminary risk assessment to be the combination of the **consequences** of an event and the **likelihood** of its occurrence. The consequence, being the outcome of an event affecting objectives, and the likelihood being the chance of something happening.

6.2.1 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 in turn 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 Figure 23 for the 'Likelihood Table' used for this preliminary risk assessment.

6.2.2 Evaluating consequence

The consequences of an impact requires a degree of subjective assessment as the likely consequences of an impact may consist of several elements. For the purpose of this preliminary risk assessment, the elements that were considered are illustrated in Figure 23. Several of the elements are interrelated and a consequence is considered to be 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.

6.2.3 Risk rating matrix

Based on the assessment of likelihood and consequence, as described above and illustrated in Figure 23, any foreseeable impact can be assigned a risk rating. The resulting juncture of consequence and likelihood produces the risk rating on a scale of negligible to significant.

Risk matrix and criteria for Likelihood and Consequence is derived from:
ACTPLA (undated) *Preparation of an application for scoping; Preparation of an application for an Environmental Significance Opinion, A guide*

Online:
http://www.actpla.act.gov.au/__data/assets/pdf_file/0017/21617/Application_for_scoping.pdf

Likelihood	
Remote (R)	May occur in exceptional circumstances
Unlikely (U)	Not expected to occur in most circumstances
Possible (P)	May occur during the Project or beyond the Project
Likely (L)	Probably will occur during the Project or beyond the Project
Almost Certain (C)	Expected to occur during the Project or beyond the Project

		Consequence				
		Minimal (M)	Minor (I)	Moderate (D)	Major (J)	Catastrophic/ Significant (C)
Community Consequence Descriptions		Negligible complaints or concerns	Public concern limited to local communities	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 peoples livelihoods	Widespread and temporary, or, localised and permanent effects on peoples 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 affected.
Environmental Consequence Descriptions		Impacts such as localised or short term effects on habitat, species or environmental attributes.	Localised, long term degradation of sensitive habitat, species or environmental attributes.	Localised and irreversible 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.
		Negligible environmental impacts	Onsite release with minor environmental impacts	Onsite release with some detrimental effects.	Resulting in off-site releases and some detrimental effects.	Resulting in permanent offsite detrimental effect.
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 and damage	Multiple deaths or deaths, permanent significant injury
Economic Consequence Descriptions		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

		Consequence				
		Minimal (M)	Minor (I)	Moderate (D)	Major (J)	Catastrophic/ Significant (C)
Likelihood	Remote	Negligible (N)	Negligible (N)	Very Low (VL)	Low (L)	Medium (M)
	Unlikely	Negligible (N)	Very Low (VL)	Low (L)	Medium (M)	High (H)
	Possible	Very Low (VL)	Low (L)	Medium (M)	High (H)	Very high (V)
	Likely	Low (L)	Medium (M)	High (H)	Very high (V)	Significant (S)
	Almost Certain	Medium (M)	High (H)	Very high (V)	Significant (S)	Significant (S)

Figure 23 Risk Prioritisation Matrix Summary

6.3 Environmental impact aspects / activities

The aspects / activities which were considered in the preliminary risk assessment are:

- Traffic and transport
- Biodiversity
- Landscape and visual
- Socio-economic impacts
- Noise, Vibration and Lighting
- Soils and water
- Hydrology and flooding
- Climate change and air quality
- Aboriginal and non-Indigenous heritage
- Bushfire risk
- Utilities / infrastructure
- Waste and resources
- Project delays and politics
- Compliance.

6.4 Assumptions and limitations

A key feature of a preliminary risk assessment is that it is intended to be a dynamic document, which would be updated as new information becomes available.

This appraisal was based on an assumed set of circumstances and preliminary investigations and discussions with selected stakeholders. The conclusions have changed based on further investigations undertaken. Gaps in knowledge were treated conservatively, and risk ratings may be higher than actual as a result. The quality of this preliminary risk assessment was guided by the quality of the previous studies and assessments that informed it.

Only unmitigated risks have been presented in the preliminary risk assessment. It is noted that many of the risks identified have either already been or are able to be mitigated to acceptable levels with refinement of design, and the application of best practice construction and operation management techniques.

6.5 Preliminary Risk Assessment

Table 9 Preliminary Risk Assessment (Unmitigated Risks Only)

Description					Pre-Mitigation Risk Assessment		
Aspect/ Activity	Risk Scenario/ Potential Impacts	Risk #	Phase of Development	Category of Risk	Likelihood	Consequence	Risk Rating
Traffic and transport	Traffic volume increases in the Project area during construction and operation not anticipated or understood	T1	Design	Community	Possible	Major	High
	Temporary loss of access and traffic disruptions (e.g. temporary diversions) during construction	T2	Construction	Various	Almost certain	Moderate	Very High
	Temporary traffic management measures during construction are not suitable and result in near miss incidents, crashes, injuries or death	T3	Construction	Various	Unlikely	Catastrophic/ Significant	High
	Traffic volume increases in the Project area and wider road network as a result of the Project	T4	Operation	Various	Likely	Minor	Medium
Biodiversity	Presence or extent of threatened species and ecological communities not identified	E1	Design	Environmental	Unlikely	Catastrophic/ Significant	High
	Incursion of vehicles into areas of environmental significance (golden sun moth habitat and natural temperate grassland in particular) causing damage to or destruction of habitat	E2	Construction	Environmental	Possible	Major	High
	Clearing of trees and other vegetation causing impacts including loss of amenity, loss of habitat, increased erosion and water runoff	E3	Construction	Environmental	Almost certain	Major	Significant
	Vegetation clearing activities during construction disturb native animals and increase the potential for vehicle strike	E4	Construction	Environmental	Possible	Moderate	Medium

Description					Pre-Mitigation Risk Assessment		
Aspect/ Activity	Risk Scenario/ Potential Impacts	Risk #	Phase of Development	Category of Risk	Likelihood	Consequence	Risk Rating
	Project activities facilitate spread of exotic flora into adjacent areas, leading to weed establishment	E5	Construction and operation	Environmental	Possible	Major	High
	Project attracts additional vermin and pest species, which result in greater competition for resources with native species	E6	Construction and Operation	Environmental	Unlikely	Major	Medium
	Clearing of vegetation results in a loss of connectivity through fragmentation in the landscape, or obstructing local movement corridors	E7	Construction	Environmental	Possible	Moderate	Medium
	Clearing of protected trees that have not been approved to be cleared	E8	Construction	Environmental	Possible	Major	High
	Impacts on Matters of National Environmental Significance (MNES)	E9	Design and Construction	Environmental	Almost certain	Catastrophic/ Significant	Significant
	Impacts to aquatic ecology	E10	Construction, operation	Environmental	Remote	Major	Low
	Loss of soil seed bank and other native plant propagules	E11	Construction	Environmental	Almost certain	Minor	High
Landscape and Visual	Visual impacts during and following construction not anticipated	LV1	Design	Community	Possible	Moderate	Medium
	Views available to occupants of nearby sensitive receivers are altered	LV2	Construction and operation	Community	Likely	Major	Very High
	Species planted as part of the Project are inappropriate for landscape and impact on amenity of open spaces	LV3	Design, construction	Various	Unlikely	Moderate	Low

Description					Pre-Mitigation Risk Assessment		
Aspect/ Activity	Risk Scenario/ Potential Impacts	Risk #	Phase of Development	Category of Risk	Likelihood	Consequence	Risk Rating
Socio-economic impacts	Community complaints and dissatisfaction in concept development	CS1	Design	Community	Possible	Moderate	Medium
	Public comment period of REF raises significant issues that delay release of final REF report	CS2	Design	Community	Possible	Major	High
	Increased media attention and political interest affects the community interest or perceptions of the Project in general	CS3	Design	Community	Likely	Moderate	High
	Development is not consistent with values of retained heritage sites, or areas of natural environmental value	CS4	Operation	Various	Possible	Major	High
	Development impacts on recreational use/users of the area	CS5	Construction and operation	Community	Likely	Moderate	High
	Operation of the Project would result in the permanent loss of an area of public open space	CS6	Operation	Community	Almost certain	Moderate	Very High
Noise, Vibration and Lighting	Intermittent noise and vibration emitted from the equipment required to carry out the proposed construction of the Project impacting residential and non-residential receivers.	NVL1	Construction	Community	Possible	Major	High
	Long term noise and vibration impacts from the operation of the Project and use of the Access Road by new residents of the Canberra Brickworks Precinct	NVL2	Operation	Community	Possible	Catastrophic/ Significant	Very High
	Local residents in surrounding suburbs exposed to increased levels of noise and vibration due to altered traffic patterns	NVL3	Design, construction and operation	Community	Unlikely	Major	Medium

Description					Pre-Mitigation Risk Assessment		
Aspect/ Activity	Risk Scenario/ Potential Impacts	Risk #	Phase of Development	Category of Risk	Likelihood	Consequence	Risk Rating
	Increased luminance for residents impacting amenity of sensitive receivers during construction and operation	NVL4	Construction and operation	Community	Possible	Moderate	Medium
	Lighting impacts to nocturnal fauna	NVL5	Construction and operation	Environmental	Possible	Minor	Low
Soils and geology	Inadequate investigation of site geotechnical issues resulting in additional works, delays to works and contractor claims	SG1	Design	Environmental and Economic	Unlikely	Major	Medium
	Disturbance of currently unidentified contaminated soils during construction	SG2	Construction	Various	Possible	Major	High
	Contamination remediation activities reveal larger extent of contamination than expected	SG3	Construction	Various	Unlikely	Major	Medium
	Disturbance of soil associated with construction leading to increased soil and sediment erosion	SG4	Construction	Various	Likely	Major	Very High
	Soil structure decline affects viability of open space areas and health of retained trees	SG5	Construction	Environmental	Possible	Major	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	SG6	Construction	Environmental	Possible	Major	High
Hydrology and flooding	Local and regional drainage conditions altered	HYD1	Design	Various	Likely	Moderate	High
	Increase in flood levels as a result of the Project	HYD2	Construction	Environmental	Possible	Major	High

Description					Pre-Mitigation Risk Assessment		
Aspect/ Activity	Risk Scenario/ Potential Impacts	Risk #	Phase of Development	Category of Risk	Likelihood	Consequence	Risk Rating
	Changes to existing flow paths and overland flow due to proposed Project	HYD3	Construction	Environmental	Likely	Major	Very High
	Potential changes to groundwater availability due to vegetation removal or excavation including impacts on groundwater dependent ecosystems and water users within the catchment	HYD4	Construction, operation	Environmental	Possible	Moderate	Medium
Air Quality	Heavy vehicle exhaust emissions cause increase reduction in local air quality	AQ1	Construction and Operation	Environmental	Unlikely	Moderate	Low
	Use of construction equipment (e.g. excavators) causing dust and particulate matter reducing local air quality (e.g. through stockpiling, earthworks etc)	AQ2	Construction	Environmental, Community and Health	Likely	Major	Very High
	Increase in vehicle exhaust emissions impact local air quality	AQ3	Operation	Environmental	Likely	Moderate	High
	Odour issues through improper waste management and storage	AQ4	Construction	Environmental, Community and Health	Unlikely	Moderate	Low
Aboriginal heritage	Potential damage or destruction of known Aboriginal heritage items	ABH1	Design, construction	Environmental	Unlikely	Major	Medium
	Potential damage or destruction of unknown Aboriginal heritage items	ABH2	Construction	Environmental	Possible	Major	High
Non-Indigenous Heritage	Potential damage or destruction of known non-Aboriginal heritage items	HER1	Design, construction	Environmental	Almost certain	Moderate	Very High
	Potential damage or destruction of unknown non-Aboriginal heritage items	HER2	Construction	Environmental	Possible	Major	High

Description					Pre-Mitigation Risk Assessment		
Aspect/ Activity	Risk Scenario/ Potential Impacts	Risk #	Phase of Development	Category of Risk	Likelihood	Consequence	Risk Rating
Bushfire Risk	Increased risk of bushfire associated with sparks from construction equipment and vehicles	BF1	Construction	Various	Unlikely	Catastrophic/ Significant	High
	Increased risk of bushfire through vehicle accidents	BF2	Construction	Various	Unlikely	Moderate	Low
	Potential loss of life and property as a result of bushfire during construction	BF3	Construction	Environmental	Unlikely	Catastrophic/ Significant	High
Utilities/ Infrastructure	Temporary services disruption during utility works as part of the Project	U1	Design, construction	Community	Almost certain	Minor	High
	Restricted opportunities to connect to existing road network	U2	Design	Various	Remote	Major	Low
	Accidental damage to utilities and other essential infrastructure	U3	Construction	Community and Economic	Unlikely	Catastrophic/ Significant	High
	Accelerated maintenance and upgrade of roads and infrastructure due to increased use	U4	Operation	Economic	Unlikely	Moderate	Low
Waste and resources	Waste materials produced during construction of the Project not stored or managed effectively	WR1	Construction	Environmental	Possible	Major	High
	Excessive resources used in the construction of the Project	WR2	Construction	Environmental and Economic	Possible	Moderate	Medium
Climate change	Failure to consider climate change during design results in unmitigated climate change vulnerability	CC1	Construction	Various	Unlikely	Moderate	Low
Cumulative impacts	Increased sensitivity of community to Project impacts due to other projects occurring concurrently	CM1	Construction	Various	Possible	Moderate	Medium

6.6 Key risks and initial conclusions

Based on the outcomes of the preliminary risk assessment, the following list provides a summary of the most significant risks (rated very high and above) that were a focus during design. Note: the preliminary risk assessment ratings have not been subject to avoidance or mitigation measures.

- temporary loss of access and traffic disruptions (e.g. temporary diversions) during construction
- clearing of trees and other vegetation causing impacts including loss of amenity, loss of habitat, increased erosion and water runoff
- impacts on MNES
- views available to occupants of nearby sensitive receivers are altered
- construction of the Project would result in the temporary loss the public open space and impact on access to the Uriarra track (footpath used for dog walking) which would be diverted
- operation of the Project would result in the permanent loss of an area of public open space
- long term noise and vibration impacts from the operation of the Project and use of Access Road by new residents of the Canberra Brickworks Precinct
- disturbance of soil associated with construction leading to increased soil and sediment erosion
- changes to existing flow paths and overland flow due to proposed Project
- use of construction equipment (e.g. excavators) causing dust and particulate matter reducing local air quality (e.g. through stockpiling, earthworks etc)
- delay in Project construction results in delays to the construction of Canberra Brickworks Precinct and increased Project construction cost.

The preliminary risks identified in this preliminary risk assessment have been considered and mitigated throughout the design and planning stages of the Project. Risk treatment measures will need to be confirmed and committed to during the REF and design processes.

Prior to and during construction, the preparation and implementation of a comprehensive CEMP would help to mitigate many of the risks identified in the preliminary risk assessment. This would need to include a robust model for monitoring and reporting against conditions of approval that have arisen from the EPBC Referral and REF approval process with the ACT Government and DOEE.

Each risk identified in Table 9 has been addressed in the relevant Environmental Assessment chapter detailed in Section 7.0. Mitigation measures have been described to mitigate the impacts of each risk. Following the implementation of mitigation measures, the residual risk has been determined for each identified risk. A summary of the residual risks is provided in Section 8.2.

7.0 Environmental Assessment

Chapter 7.0 provides a detailed description of the potential environmental impacts associated with the construction and operation of the Project. For each potential impact, the existing environment is characterised and then an assessment is undertaken as to how the Project would impact on individual aspects of the environment. Mitigation and management measures are proposed to minimise the identified impacts where feasible and reasonable. Following this analysis a residual risk rating is provided for each of the risks identified in the preliminary risk assessment (Chapter 6.0) with the application of the proposed mitigation measures.

7.1 Traffic and transport

Section Summary

- This section considers the traffic and transport impacts of the Project.
- AECOM undertook a Traffic and Transport Assessment that provides a high level assessment of the potential impacts of the Project on traffic, access and road safety.
- Temporary loss of access and traffic disruptions (e.g. temporary diversions) during construction is considered a very high risk. The implementation of the recommended mitigation measures, particularly the preparation of a Construction Traffic Management Plan (CTMP) would reduce the likelihood from 'almost certain' to 'possible' and the consequence from 'moderate' to 'minor', therefore reducing the residual risk from very high to low.
- The Project will assist traffic movements along Dudley Street in the short- to medium-term. The increased traffic demand on Dudley Street will put additional pressure on nearby intersections at either end of the Kent Street bridge. The Traffic and Transport Assessment has identified the need to do further upgrades of the surrounding road network in the future.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	No.	Likelihood	Consequence	Risk Rating
Traffic volume increases in the Project area during construction and operation not anticipated or understood	T1	Possible	Major	High
Temporary loss of access and traffic disruptions (e.g. temporary diversions) during construction	T2	Almost certain	Moderate	Very High
Temporary traffic management measures during construction are not suitable and result in near miss incidents, crashes, injuries or death	T3	Unlikely	Catastrophic/ Significant	High
Traffic volume increases in the Project area and wider road network as a result of the Project	T4	Likely	Minor	Medium

7.1.1 Investigations

A Traffic and Transport Impact Assessment was prepared by AECOM for the Project (AECOM, 2017a). The assessment included a desktop analysis and site inspection on 21 April 2017 of the existing traffic environment surrounding the Project area. Detailed traffic counts and modelling were also undertaken to model and further understand the implications of the Project on the local and regional traffic network.

The purpose of the Traffic and Transport Impact Assessment was to:

- describe the existing traffic and transport conditions on the existing road and intersections to be upgraded as part of the Project

- evaluate the design of the Project to safely and efficiently cater for future growth in traffic and transport demand on Dudley Street
- assess the potential traffic and transport impacts of the Project on Dudley Street and the surrounding road network during construction and operation
- recommend mitigation measures to manage adverse traffic and transport impacts, if required.

7.1.2 Environmental conditions and values

Road network

The classification of roads in the ACT is based on a formal road hierarchy. The classification fundamentally relates to the predominant function of a road and to the extent it serves the two basic purposes of the road network – the movement of traffic and access to property. The four road classifications and their general functions are as follows:

- **Arterial roads** predominantly serve longer distance travel within a district and through traffic from one district to another. Traffic capacity is a function of the design of the road rather than being constrained by environmental objectives.
- **Major collector roads** collect and distribute traffic within residential, industrial and commercial areas. They form the link between the primary network and the roads within local areas and should carry only traffic originating or terminating in the area. The volume of traffic carried is constrained by environmental objectives - safety and traffic noise - rather than road geometry and reflects the limited area that they serve.
- **Minor collector roads** collect and distribute traffic from access streets, linking to the major collector roads within the neighbourhood. They can also provide secondary connections direct to the external arterial road network. Traffic volumes are compatible with direct property access.
- **Access streets** are used where the residential environment is dominant, traffic is subservient, speed and traffic volumes are low and pedestrian and cycle movements are facilitated. The primary role of Access Streets is to provide direct property access. Access streets can link traffic from the local network (including rear lanes) to collector roads.

The road network surrounding the Project area is shown in Figure 24 and described in Section 1.4.2. Traffic counts undertaken for the road network in the Project area (as shown in Figure 24) indicate that the road classifications in Yarralumla are generally comparable with the recorded daily traffic volumes for the roads surveyed. However the major collector roads in the Project area, including Dudley Street, Novar Street and Kent Street exceed the environmental road capacity for a major collector road (i.e. 6,000 vehicles per day).

These exceedances can have potential amenity implications for adjoining land uses (such as access to/from properties and noise). Design standards also require certain criteria to be met for such roads, including a required width of 10 metres including shoulders for stopping vehicles. Dudley Street is currently only six metres wide with no shoulders present (and no street lights for the majority of the alignment). There are safety implications for meeting these design standards such as the potential for vehicles to run off this narrow road at night.

Some access streets in Yarralumla also exceed their environmental volume capacity in the vicinity of the shops, which would be primarily due to a higher number of trips around the shops.

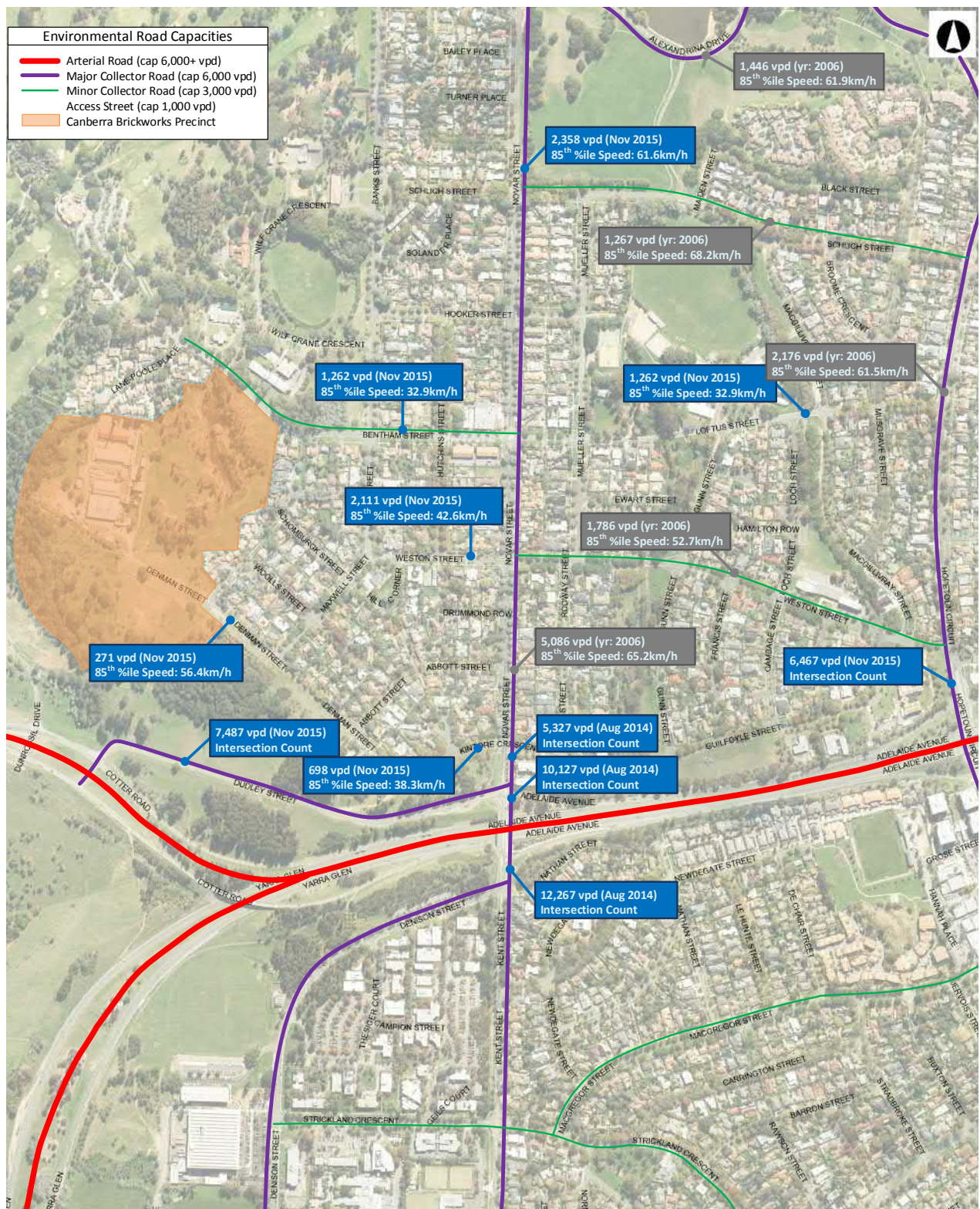


Figure 24 Daily traffic volume and speed summary

Intersection performance

Dudley Street has the following intersections:

- Dudley Street / Novar Street / Kent Street / Adelaide Avenue off-ramp (eastern extents)
- Dudley Street / Cotter Road (western extents).

Intersection traffic counts were undertaken for these key intersections in June 2017. Traffic at these intersections was then modelled using the intersection modelling program SIDRA Intersection 7.0, to determine current operational performance. The detailed results of the modelling are provided in the Traffic and Transport Assessment (AECOM, 2017a).

Level of Service

Level of Service is determined by the average delay for each vehicle. The range definitions for level of service can be seen in Table 10 below.

Table 10 Level of service definition table

Level of Service	Average Delay / Vehicle (sec/veh)	Traffic Signals, Roundabouts
A	Less than 14	Good Operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity; at signals incidents will cause excessive delays
F	>70	Roundabouts require other control mode

Overall, the average delays for the intersections were fairly low. This relates to an overall intersection level of service of A or B which would normally indicate good operation. However, some legs experience greater queuing and delays.

The main findings from the SIDRA results are:

- The Novar Street roundabout in the morning peak experiences 95th percentile queues² of 81 metres on Dudley Street and 70 metres on Novar Street. Similarly, in the afternoon peak a 95th percentile queue of 126 metres on the Kent Street approach is shown. Although overall the intersection is operating at an acceptable Level of Service (LoS B in the morning peak), these queue lengths indicate that these movements within the intersection are operating close to capacity and intersection improvement measures would likely be necessary if increases in traffic volumes are expected.
- The Dudley Street/Cotter Road (Eastbound) intersection experiences a 95th percentile queue of 192 metres on the Cotter Road approach in the morning peak and a 95th percentile queue of 178 metres on the northern Dudley Street approach in the afternoon peak. In both of these peak periods the indicated level of service for the intersection remains satisfactory (LoS C for the worst movement of each leg of the intersection).

Public transport facilities

Bus routes in the vicinity of the Project area are shown in Figure 25 and Figure 26 for weekdays and weekends, respectively. None of these buses currently use Dudley Street, although legacy bus stops exist on Dudley Street.

² 95th percentile queue indicates that 95% of the time the queue will be less than the indicated length during the peak hour modelled.

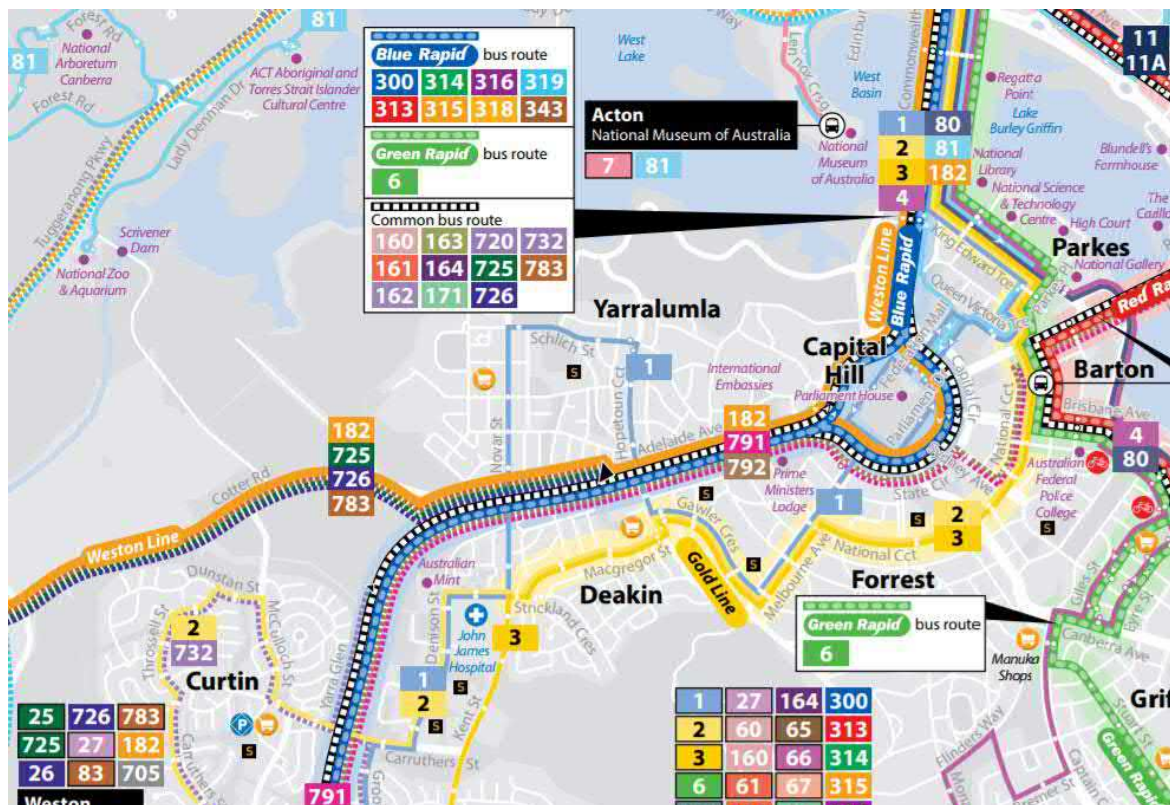


Figure 25 Weekday public transport routes



Figure 26 Weekend public transport routes

While there are a large number of bus routes which travel along Cotter Road and Adelaide Avenue past the Project area, there are currently no bus stops which give residents of Yarralumla access to these services.

A single route services Yarralumla, being Route 1 on a weekday or Route 932 on a weekend. Route 1 travels between Woden Town Centre and Dickson Group Centre and Route 932 travels between Belconnen Town Centre and Woden Town Centre. Within Yarralumla both routes travel along Novar Street, Schlich Street and Hopetoun Circuit.

A summary of bus frequencies for routes passing in the vicinity of the Project area is provided in Table 11. This indicates that bus services to the Yarralumla area are relatively frequent (around every 20 minutes) in the peak periods, but limited (around every hour) during off-peak periods and on weekends.

Table 11 Public transport provision

Service	Route #	Route Description	Frequency (Peak)	Frequency (Off Peak)
Weekday Bus	1	Woden to Dickson	20 mins	60 mins
	182	Woden to Dickson	20 mins	60 mins
	725	City to Woden	30 mins	30 mins
	726	Woden to Cooleman Court	25 mins	60 mins
	783	Woden to Chapman	25 mins	60 mins
	791	Woden to Cooleman Court	45 mins	60 mins
	792	Woden to Fairbairn Park	20 mins	Peak only
	300	Belconnen to Tuggeranong	15 mins	15 mins
Weekend Bus	300	Belconnen to Tuggeranong	15 mins	15 mins
	932	Woden to Belconnen	60 mins	60 mins

Active transport

A plan showing existing footpaths in the vicinity of the Project area is provided in Figure 27. Yarralumla has an excellent footpath system with almost all verges containing paths. The quality of the paths is generally reasonable although there are isolated areas of cracking or level differences.

No formal footpaths or on-road cycle lanes run along Dudley Street. There are pedestrian and bicycle facilities at either end of Dudley Street, on Cotter Road and Novar Street/Kent Street. An off-road cycle path crosses the eastern end of Dudley Street and connects Yarralumla with Deakin and Woden (route shown in Figure 27 and a photograph of the crossing is shown in Figure 28). During the site inspection, it was noted that cyclists crossing Dudley Street utilised the pedestrian refuge and that cars waiting in the queue for the intersection blocked cyclists from crossing requiring them to weave through the two lanes of traffic given the lack of clear road markings.

On-road cycle lanes are provided along Cotter Road, Adelaide Avenue and Yarra Glen. There is indirect connectivity between the local off-road cycle path network and on-road cycle lanes. Connections are provided city-bound to Adelaide Avenue near the eastern end of the on-ramp from Novar Street south of the intersection of Guilfoyle Street and Newman Street. There is also a connection to Cotter Road via the Kent Street bridge and an off-road cycle path south of Yarra Glen, which also connects to Yarra Glen.



Figure 27 Existing formal pathways



Figure 28 View of the pedestrian / cycle crossing of Dudley Street near the Novar Street / Kent Street roundabout

Uriarra track

The Uriarra Track is an existing informal track that traverses the Project area in an east west direction, as shown in Figure 29 and Figure 9 (Section 1.4). It is used by recreation walkers.



Figure 29 Aerial view of approximate location of Uriarra track

Parking

There is no car parking on or adjacent to Dudley Street. However, vehicles access car parking adjacent to the Yarralumla Uniting Church across the verge of Dudley Street. These cars have worn a dirt track towards the church, as shown in Figure 30.



Figure 30 View showing the unauthorised access from Dudley Street to the Yarralumla Uniting Church car park

7.1.3 Potential impacts

Construction phase

Traffic and access

Construction work is expected to impact road users on Dudley Street and the surrounding road network. The day to day movement of construction plant (e.g. deliveries, mobile plant movements) is anticipated to generate on average of around five to 10 truck movements on normal working days for the delivery of construction material. It is envisaged that the peak number of truck movements would be generated by earthworks (up to about 15 heavy vehicle trips per day). The most common size of vehicle involved in the delivery of fill to the worksite will be “medium” size dump truck or the truck and dog combination.

All construction traffic generated by the works would access the Project area via Dudley Street. Access for heavy vehicles would be predominately via Cotter Road to minimise traffic disruption during peak periods.

Potential impacts on traffic movement during construction would include increased travel times due to construction zone speed limits (for worker/road user safety reasons), truck and construction machinery movements, lane closures and stop/go operation. Construction activities with the potential for traffic disruption, such as utility adjustments along the trafficked pavement, would be scheduled to take place outside of peak commuting periods where feasible in order to minimise road user delays and improve safety for workers.

The construction staging, as described in Section 3.2.1, has been developed to maintain traffic access along Dudley during the construction period. This would significantly reduce the traffic impacts associated with full road closure and diversion of traffic along alternative routes. There would be some temporary traffic diversions provided to allow construction on the existing paved areas. There would be minor delays at the time of traffic switch-overs (when the temporary traffic diversions are put in place), with traffic controlled by stop/go staff. Traffic switch-overs would be scheduled to occur at off-peak periods.

Traffic generated by construction vehicles, including staff vehicles, is likely to be minor in relation to traffic currently using Dudley Street and most construction traffic movements to and from the Project works area would occur outside of peak periods. Traffic impacts would fluctuate depending on the construction stage. Vehicle types are expected to generally consist of light vehicles from construction workers and heavy vehicle trips for delivery and removal of materials, plant and equipment.

One site compound is proposed at the west end of the site (see Figure 22), to minimise unnecessary movement of trucks and equipment across the traffic lanes that remain open to general traffic on Dudley Street.

The delivery of large construction equipment, such as earth moving machinery, may require transport by oversize vehicles. Should these movements be necessary, it would be subject to a separate application process by the construction contractor to the relevant authorities.

Approval for temporary traffic management activities would be sought as required. Road works would be undertaken progressively and in the minimum area and timeframe required to undertake the particular phase of work. Signage would be displayed around work areas to inform the public.

The potential location of any temporary diversions would be confirmed during detailed design and identified in the Construction Traffic Management Plan (CTMP).

The peak in heavy vehicle movements would occur during earthworks and paving works. The approximate bulk earthworks quantities are 15,200 cubic metres removal and 12,800 cubic metres filling, resulting in an excess fill of around 2,400 cubic metres. However, this ‘non-balance’ will be further refined during the detailed design phase when the design is refined with the aim of achieving a cut and fill balance. If there remains an excess in fill material which can not be used within the Project area, opportunities to use the fill material as part of the Canberra Brickworks Precinct would be investigated to minimise traffic impacts.

Overall, provided the proposed traffic management measures are implemented, the likely impact to traffic during construction is expected to be manageable and would not have a major impact on the level of service of the surrounding road network.

Public transport

Generally, bus services in the vicinity of the Project would not be majorly affected by construction activities. Minor impacts may occur during off peak times due to road works and temporary road closures (e.g. during switchovers). There are currently no bus services along Dudley Street, so no impact to public transport within the Project area is expected.

Active transport

During construction, there is the potential for temporary disruptions to the existing pedestrian and cyclist facilities on local roads surrounding Project area. The pedestrian crossing in the eastern extents of Dudley Street would be temporarily impacted during the intersection works during off-peak periods. This has the potential for increased safety risks for pedestrians and cyclists due to possible interactions with construction plant and vehicles. Access would be maintained with appropriate diversions used.

The Uriarra Track would be partially diverted during construction to allow the works to be undertaken safely and to minimise the potential interaction with construction plant and vehicles.

Potential impacts to active transport during construction would be managed through the development of a CTMP. Appropriate signs and/or traffic controllers would be positioned to notify pedestrians of temporary arrangements. Interactions between heavy vehicle movements and pedestrians would be managed by traffic controllers.

Parking impacts

The Project would not impact on car parking facilities during construction. Construction worker vehicles would be accommodated within the construction compound and/or Project area. There would be no construction vehicle parking within local roads.

Property access

The Project would not impact on property access during construction.

Emergency vehicle access

Access for emergency vehicles would be maintained at the construction sites in accordance with emergency vehicle requirements. Emergency services would be advised of all planned changes to traffic arrangements prior to applying the changes. Advice would include information about upcoming traffic disruptions, anticipated delays to traffic, extended times of work and locations of road possessions (if required). Traffic controllers on site would be able to provide priority for emergency vehicles.

Operational phase

The Project would result in positive impacts by making Dudley Street safer and providing an Access Road for the development of the Canberra Brickworks Precinct. A summary of the operational traffic, transport and transport impacts are provided below.

Road network

The Project would enhance the road network providing improved operation, greater access and benefits to pedestrians and cyclists, including:

- Upgrading Dudley Street to meet design standards for a major collector road
- Providing a suitable access from the proposed Canberra Brickworks Precinct to the adjacent road network
- Constructing a roundabout to intersect Dudley Street and the new Access Road to allow optimum intersection operational efficiency along Dudley Street and the Access Road
- Promoting active travel through the use of new off-road shared path

- Improving road user safety
- Improving safety for pedestrians and cyclists crossing Dudley Street at Novar Street roundabout.

Future demand and traffic

The upgrade of Dudley Street is needed to enable an Access Road to be provided to the proposed Canberra Brickworks Precinct, to meet the design requirements for a major collector road and to cater for expected background traffic flow increases in the Yarralumla region.

Development of the Canberra Brickworks Precinct is likely to generate about 3,000 vehicles per day when fully developed. Around 80% of this traffic or 2,400 vehicles per day would access the Precinct via Dudley Street. The remaining traffic (600 vehicles per day) would access via Denman Street / Kintore Crescent. The provision of access to the Canberra Brickworks Precinct would elevate traffic levels on Dudley Street and at the adjacent intersections.

In the peak hours the majority of traffic from the Canberra Brickworks Precinct is expected to use Cotter Road to access the arterial road system (about 60%), via the short link between the proposed roundabout access on Dudley Street and the Cotter Road signals. The remaining traffic would likely use the eastern leg via the Novar Street roundabout. There would be a shift in traffic, with a greater proportion using the Cotter Road access as traffic grows and congestion builds at the Novar Street roundabout.

There will also be background growth on Dudley Street with further development and growth in Yarralumla and Deakin, as well as a change in trip patterns as a result of further development of Molonglo. Table 12 shows the recent historic and future forecast traffic growth along Dudley Street. In recent years traffic has been growing at about four per cent per annum due to growth in traffic from Deakin and Molonglo. It is expected that this background growth will continue for the next few years; that is, traffic on Dudley Street will continue to grow with or without the Project. Further traffic growth will occur as a result of the Canberra Brickworks Precinct, adding about 1,200 vehicles per day to the eastern end of Dudley Street (i.e. about 13% more traffic).

Table 12 Forecast daily traffic

Project impacts	Year	Vehicles per day on Dudley Street	
		No Canberra Brickworks Development	With Canberra Brickworks Development
Do nothing	Nov 2015	7,500	N/A
	June 2017	8,100	N/A
	2020	9,100	N/A
With Project	2020	9,100	10,300

Note: The forecasts are based on midblock traffic flows west of Novar Street and assuming the Canberra Brickworks Precinct is fully developed by 2020 (i.e. 380 dwellings)

The upgrades to Dudley Street would include improvements to the vertical alignment (i.e. reducing changes in heights) and horizontal geometry (i.e. less tight curves) which better suit the speed limits currently in place along this road. Modifications would include an improved entry angle at the Dudley Street / Cotter Road intersection making it safer for vehicles to turn left off Cotter Road into Dudley Street. There would be improvements to the Dudley Street intersection at the Novar Street roundabout with the provision of a greater length of the left hand turn lane which would reduce queuing.

Overall the Project would assist traffic movements along Dudley Street in the short and medium-term and provide for an access to the Canberra Brickworks Precinct. There are future potential opportunities to improve the level of service at the Novar Street roundabout which are considered in further detail below.

Road safety and access

The Project would improve road safety and access on Dudley Street. The primary benefits would be improved safety for road users, improved pedestrian and cycle facilities, and enabling a suitable access to the proposed Canberra Brickworks Precinct.

The provision of a shoulder along either side of Dudley Street allows for stopping vehicles and road traffic incidents to safely occupy the road without blocking access for this key access route and maintaining traffic flows. This would also reduce the occurrence of illegal parking on the vegetated areas adjacent to Dudley Street which has been significantly worn in certain areas. The shoulder also provides for the future provision of bus stops and/or on road cycling along Dudley Street.

Street lights would be provided along the full length of Dudley Street to provide lit access during night time. This would improve the safety of road users, particularly for cyclists occupying the road.

Public transport

The existing bus stops near the Yarralumla Uniting Church which are not currently serviced by buses would be removed as part of the reconstruction of Dudley Street. There would be no change to the operation of bus routes as a result of the Project and so the impacts are considered negligible.

Active transport

The Project would address the lack of pedestrian and bicycle facilities on Dudley Street, enabling safer and more efficient connections between Yarralumla, Deakin and places west of Dudley Street via Cotter Road. A 2.5 metre wide shared path is proposed on the eastern side of the Access Road to the new Dudley Street roundabout and continuing along the northern verge of Dudley Street connecting to the shared path at Novar Street. The path has been designed in accordance with Austroads Part 6A Pedestrian and Cyclist Paths.

There is a proposed off-road shared path along Denman Street to be provided as part of the Canberra Brickworks Precinct development works that would connect to the off-road system in Kintore Crescent.

The proposed cross-section for Dudley Street would include 1.5 metre wide shoulders that could be used for on-road cycling. The traffic lanes would also be wider than the existing carriageways improving safety and amenity for cyclists and other road users.

The pedestrian crossing at the eastern extents of Dudley Street would be improved with the provision of a wider median (allowing for cyclists) and improved line marking (e.g. 'keep clear' markings) to improve the safety of users crossing Dudley Street.

The provision of street lights would also improve the safety of pedestrians and cyclists along Dudley Street.

The Uriarra Track would be impacted by the earthworks and the cut batter for the Access Road. To allow for a safe crossing of the new Access Road, the crossing location has been realigned closer to the Canberra Brickworks Precinct development site to allow visibility at the crossing point. A pedestrian refuge crossing arrangement would be provided on the Access Road to serve the Uriarra Track at the crossing of the Access Road.

Parking impacts

The Project would have a negligible impact on car parking in the area.

Property access

The Project provides a suitable access to support the development of the Canberra Brickworks Precinct. There would be no changes to existing property access as a result of the Project.

As part of the Project, pine log (or similar) fencing would be constructed to assist in preventing vehicles from accessing the Yarralumla Uniting Church via an informal access off Dudley Street. This would improve traffic safety and reduce impacts to the adjoining environment. The formed access from Kintore Crescent would not be impacted by the Project.

Future development requirements

The increased traffic demand on Dudley Street would put additional pressure on nearby intersections at either end of the Kent Street bridge and at the Kent Street / Denison Street intersection in the long term. These intersections are already near capacity.

Traffic modelling of these intersections (AECOM, 2017a) indicated the need for upgrading these intersections within the next 10 years. In determining the suitability of the current network to accommodate future growth, the future volumes were applied to the current network. The resulting impact for the morning peak was an almost exponential increase in delays which is largely the result of increased background traffic growth (e.g. development of Molonglo).

The recommended option for intersection upgrade is for signalisation of each of the intersections on Kent Street bridge and at the Kent Street / Denison Street intersection. The proposed signalising of the three intersections to improve traffic safety and efficiency should be considered as a future development opportunity for the ACT Government if adequate funding can be made available.

7.1.4 Mitigation measures

Construction

A CTMP would be prepared by the nominated contractor in consultation with the ACT Government and provided to TCCS. The CTMP would be the primary management tool to manage potential traffic and pedestrian impacts associated with construction. The CTMP, at a minimum, would include:

- procedures for preparing and implementing Traffic Control Plans (TCPs) for any detours or traffic controls to manage temporary road disruptions
- details of adequate road signage to inform road users and pedestrians of the works
- procedures to maximise safety and to maintain accessibility for pedestrians and cyclists
- procedures identifying adequate sight lines and providing stop/go staff to allow for safe entry and exit from the construction site
- parking locations for construction workers away from residential areas (e.g. at site compound) and details of how this will be monitored for compliance
- routes to be used by heavy construction-related vehicles to minimise impacts on local streets by using Dudley Street, the Kent Street bridge and the surrounding arterial road system
- scheduling of works/deliveries to avoid peak commuter and school times and limiting works in the road carriageway as much as practicable
- measures to manage traffic flows around the area affected by the Project, including as required regulatory and direction signposting, line marking and variable message signs and all other traffic control devices necessary for the implementation of the CTMP.

Other specific mitigation measures to be implemented during construction, include:

- providing advance notice of upcoming works to permit drivers to avoid travel or adjust speed and safely negotiate past the work site on Dudley Street
- advising local businesses, residents, bus operators and emergency service providers of the upcoming works
- monitoring of the performance of all Project traffic arrangements during construction
- schedule works with the potential for traffic disruption, such as utility adjustments along the trafficked pavement outside of peak commuting periods in order to minimise road user delays. Works impacting on traffic lanes to be undertaken off peak (or at night)
- secure work zones to prevent unauthorised access, including pedestrian access with site perimeter fencing and secured gate(s), as required, in particular to prevent access outside work hours
- avoid traffic lane closures and diversions during peak hours where possible

- implementing temporary speed restrictions as appropriate, in consultation with TCCS
- ensuring that any work undertaken near Cotter Road does not disrupt traffic movements along Cotter Road; the construction of new pavement adjacent to the eastbound carriageway of Cotter Road may require out of hours road works to minimise disruption.

Operation

The Project will assist traffic movements along Dudley Street in the short and medium term. The primary benefits will be improved pedestrian and cycle facilities and enabling access to the proposed Canberra Brickworks Precinct.

Traffic modelling (AECOM, 2017a) has highlighted the need for the future upgrade of the intersections at either end of the Kent Street bridge and at the Kent Street / Denison Street intersection within the next 10 years. While the Project would increase the traffic demand at these intersections as a result of providing access to the Canberra Brickworks Precinct, the Novar Street roundabout is nearly at capacity in the morning peak and would require improvements due to the background increases in traffic (i.e. even without the Project).

Funding is likely to be sought by ACT Government to implement these works in future. The actual timing and need for the works will depend on future monitoring of traffic growth and the operation of the Novar Street roundabout.

7.1.5 Residual risks

Based on the mitigation measures identified in Section 7.1.4, an assessment of the residual traffic and transport risks associated with the Project have been considered. Residual risks identified for the traffic and transport values are presented in Table 13.

Table 13 Residual risks for Traffic and Transport values

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Traffic volume increases in the Project area during construction and operation not anticipated or understood	T1	A Traffic and Transport Impact Assessment (AECOM, 2017a) has been undertaken for the Project which has assessed the expected traffic volume increases likely to be generated by the Project.	Unlikely (Possible)	Major (Major)	Medium (High)
Temporary loss of access and traffic disruptions (e.g. temporary diversions) during construction	T2	The preparation of a CTMP which incorporates proposed mitigation measures will ensure access and traffic disruptions are considered and minimised as much as practicable. This would reduce the risk from very high to low.	Possible (Almost certain)	Minor (Moderate)	Low (Very High)
Temporary traffic management measures during construction are not suitable and result in near miss incidents, crashes, injuries or death	T3	The preparation of a CTMP which incorporates the proposed mitigation measures will ensure access and traffic disruptions are considered and minimised as much as practicable. This would result in a medium residual risk.	Remote (Unlikely)	Catastrophic/ Significant (Catastrophic/ Significant)	Medium (High)

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Traffic volume increases in the Project area and wider road network as a result of the Project	T4	There would likely be an increase in traffic demand on Dudley Street as a result of the access to the Canberra Brickworks Precinct which would put additional pressure on nearby intersections. The upgrades to Dudley Street would assist traffic movements along Dudley Street in the short and medium term. Future improvements to these intersections may be required in the long term.	Possible (Likely)	Minor (Minor)	Low (Medium)

7.2 Biodiversity

Section Summary
- This section describes the key ecological features of the existing environment within the Project area and the likelihood of occurrence of matters protected under the EPBC Act (MNES) and the NC Act. - A Project-specific ecological impact assessment has been prepared (Umwelt 2017). This includes a summary of site surveys undertaken in 2010, 2011, 2012, 2014 and 2016. - Impacts to MNES and other ecological features as a result of the Project has been assessed, in particular to the Commonwealth listed natural temperate grassland and golden sun moth. - The Project is expected to directly impact a total of 0.123 ha (0.01 ha of very high and 0.113 ha of high quality) of natural temperate grassland and a total of 2.64 ha of golden sun moth habitat. - The Project would have indirect impacts to a total of 0.16 ha (0.06 ha of very high and 0.1 ha of high quality) of natural temperate grassland and a total of 0.44 ha of golden sun moth habitat. - Following an EPBC Act referral of the Project to DOEE (Ref. 2017/8072), the Minister's delegate determined that the Project was a controlled action in accordance with Section 75 of the EPBC Act. - The Project has been designed to avoid or minimise impacts to MNES where possible, Project impacts include clearing of vegetation / fauna habitat, noise and lighting impacts on fauna, and the increased potential for spread of weeds and pests during construction. - The majority of potential impacts to biodiversity can be avoided or minimised through the implementation of the detailed mitigation measures. Biodiversity offsets are to be sought for the Project to compensate for the loss of MNES. An Offset Strategy (Umwelt, 2018) has been prepared to guide the implementation of offsetting

Description			Pre-mitigation Risk Assessment	
Risk Scenario	No.	Likelihood	Consequence	Risk Rating
Presence or extent of threatened species and ecological communities not identified	E1	Unlikely	Catastrophic/ Significant	High
Incursion of vehicles into areas of environmental significance (golden sun moth habitat and natural temperate grassland in particular) causing damage to or destruction of habitat	E2	Possible	Major	High

Description			Pre-mitigation Risk Assessment	
Risk Scenario	No.	Likelihood	Consequence	Risk Rating
Clearing of trees and other vegetation causing impacts including loss of amenity, loss of habitat, increased erosion and water runoff	E3	Almost certain	Catastrophic/ Significant	Significant
Vegetation clearing activities during construction disturb native animals and increase the potential for vehicle strike	E4	Possible	Moderate	Medium
Project activities facilitate spread of exotic flora into adjacent areas and weed establishment	E5	Possible	Major	High
Project attracts additional vermin and pest species, which result in greater competition for resources with native species	E6	Unlikely	Major	Medium
Clearing of vegetation results in a loss of connectivity through landscape fragmentation or obstructing local movement corridors	E7	Possible	Moderate	Medium
Clearing of protected trees that have not been approved to be cleared	E8	Possible	Major	High
Impacts on Matters of National Environmental Significance (MNES)	E9	Almost certain	Catastrophic/ Significant	Significant
Impacts to aquatic ecology	E10	Remote	Major	Low
Loss of soil seed bank and other native plant propagules	E11	Almost certain	Minor	High

7.2.1 Investigations

A number of ecological investigations have been conducted for the Project and as part of the proposed Canberra Brickworks Precinct development area including Rowell 2010, Rowell 2011, Rowell 2012, Umwelt 2014, Umwelt 2016 and Umwelt 2017. These investigations described terrestrial flora and fauna and habitat features observed and determined the likelihood of threatened species or communities listed under ACT or Commonwealth legislation being impacted by the expansion. These surveys compiled a comprehensive list of flora and fauna and likely habitat within the Project area.

An ecological Impact Assessment Report (Umwelt, 2017) prepared for the Project included a desktop assessment, literature review and site inspection with targeted surveys by two qualified ecologists in December 2016. Further to this investigation, a Biodiversity Offset Strategy (Umwelt, 2018) was prepared for the Project which provided an updated assessment of Project impacts and provided details of the proposed offset strategy which was developed in consultation with the ACT Government Conservation and Research Branch in addition to the future land manager of the proposed offset site. Findings of these assessments are summarised in this section.

An EBPC Act referral to DOEE was submitted for the Project (Ref. 2017/8072) on 13 October 2017 recommending that the proposed action (the Project) be considered a controlled action due to significant impacts on MNES. On 1 December 2017, the Minister's delegate determined that the Project was a controlled action in accordance with Section 75 of the EPBC Act.

A tree assessment of existing trees within the Project area was carried out by dsb Landscape Architects in 2015 and 2017.

7.2.2 Environmental conditions and values

Landscape context

The Project is located in an area that was formerly grazing land which has been historically cleared and modified. The vicinity of the Project area contains residential development to the north and east, open landscape to the south nestled between Cotter Road and Adelaide Avenue and a landscape buffer to the Royal Canberra Golf Club to the west.

The Project area is 1.8 kilometres to the east of the Molonglo River and one kilometre south east of Lake Burley Griffin. There is no defined watercourse through the Project area. Vegetation within the Project area is contiguous with the North Curtin Horse Paddocks and the Royal Canberra Golf Club.

There is minimal native vegetation remaining in the Project area and it is generally highly disturbed and fragmented by the existing road network. The majority of the Project area consists of exotic grassland areas, dominated by Chilean needlegrass (*Nassella neesiana*). There are some patches of natural temperate grassland TEC, which are of varying quality; and some areas of mixed grassland also of varying quality.

The Project area also contains a number of stands of exotic trees, including *Pinus canariensis*, *P. radiata*, *P. patula*, *Ulmus procera*, and *Quercus palustris*.

The majority of the grassland through the Project area is maintained by regular mowing with two patches that have been left to grow naturally. There are signs of erosion along the edge of Dudley Street with a number of locations showing very sparse vegetation cover, including on the corner near the Cotter Road intersection, near to the existing bus stops and at the Yarralumla Uniting Church.

Vegetation communities

The desktop assessment (Umwelt 2017) identified two threatened ecological communities (TECs) with the potential to occur within 10 kilometres of the Project area, namely:

- Natural temperate grassland
- White box – yellow box – Blakely's red gum grassy woodland and derived native grassland

Field assessments including vegetation and flora surveys determined that the natural temperate grassland occurs within the Project area. The area surrounding the Project area contains total of 0.75 ha of natural temperate grassland as detailed in Table 14.

Table 14 Natural temperate grassland within the Project area (Umwelt 2017b)

Natural temperate grassland vegetation association	Floristic value score	Total area (hectares)	Condition
r7: kangaroo grass – wallaby-grass – snow-grass moist tussock grassland of the south eastern highlands bioregion.	10.01	0.11	High
r5: wallaby-grass – tall speargrass – common everlasting tussock grassland of the south eastern highlands bioregion	12.56	0.12	High
r7: kangaroo grass – wallaby-grass – snow-grass moist tussock grassland of the south eastern highlands bioregion.	24.61	0.32 (consisting of two patches)	Very high
r5: wallaby-grass – tall speargrass – common everlasting tussock grassland of the south eastern highlands bioregion	19.20	0.20	Very high

Given the elevation of the Project area (less than 600 metres above sea level), it is considered unlikely that white box-yellow – Blakely's red gum grassy woodland and derived native grassland (box gum woodland) occur within the Project area (Rowell 2010). This was further confirmed during field investigations.

Threatened flora

Desktop searches identified 13 threatened flora species with the potential to occur within 10 kilometres of the Project area as detailed in **Appendix B**. Further assessment determined that two species may occur within the Project area:

- Basalt Peppercress (*Lepidium hyssopifolium*)
- Button Wrinklewort (*Rutidosia leptorrhynchoides*).

Basalt Peppercress is known to occur in highly modified areas, including beneath radiata pine (*Pinus radiata*), though it appears to rely on a lack of competition from other shade tolerant species (DOEE, 2017), as such, potential habitat for the species occurs within the Project area. Despite this, the closest known population is at Bungendore, NSW (around 30 kilometres east of the Project area) and it has not been recorded within the Project area during previous surveys or within the ACT region (ACT Government 2015; Canberra Nature Map, 2017). It has limited natural dispersal capabilities, therefore it is unlikely to occur within the Project area.

In the ACT region, Button Wrinklewort is generally associated with natural temperate grassland, though may also be found on the margins of box gum woodland (AHE, 2005). Natural temperate grassland is known to occur within the Project area; however Button Wrinklewort has not been identified within the Project area, despite numerous vegetation and flora surveys within its known flowering period since 2010. There is a record of the species east of the Project area, between Gullfoyle Street and Adelaide Avenue (ACT Government, 2015), indicating that it is likely that the species occurred in the locality historically. Given the lack of records despite numerous surveys, while potential habitat occurs within the Project area, it is unlikely that the species is present.

Overall, no threatened flora species have been recorded during numerous flora and vegetation surveys and it is therefore not considered likely that they occur within the Project area.

Threatened fauna

Desktop searches identified 31 threatened fauna species with the potential to occur within 10 kilometres of the Project area, including 16 birds; 4 fish; 2 frogs; 2 insects; 4 mammals; and 3 reptiles.

Details of these listed threatened fauna and the likelihood of occurrence within the Project area is provided in **Appendix B**.

Further assessment determined that three threatened fauna species have potential habitat within the Project area:

- golden sun moth (*Synemon plana*)
- little eagle (*Hieraaetus morphnoides*)
- spotted-tail quoll (*Dasyurus maculatus maculatus*) (south-east mainland population).

Golden sun moth

In December 2015, Umwelt carried out a vegetation assessment and golden sun moth survey in accordance with EPBC Act survey guidelines for this species. Based on the wide distribution of golden sun moth throughout the Project area, the majority of the Project area has been determined to constitute habitat, albeit of varying quality.

Further surveys for golden sun moth were carried out by Umwelt in December 2016 (Umwelt, 2017) in accordance with the EPBC Act survey guidelines for this species (refer to this technical report for a detailed methodology). These surveys identified a total of 7.39 hectares of golden sun moth habitat recorded within the defined survey area (as shown in Figure 32 on page 37). This is likely to be contiguous with a larger golden sun moth habitat extent which includes the majority of the grassland areas within the Project area. ACTmap (ACT Government) identifies an area of golden sun moth habitat (contiguous with the Project area) to be greater than 21 ha as show in Figure 31.

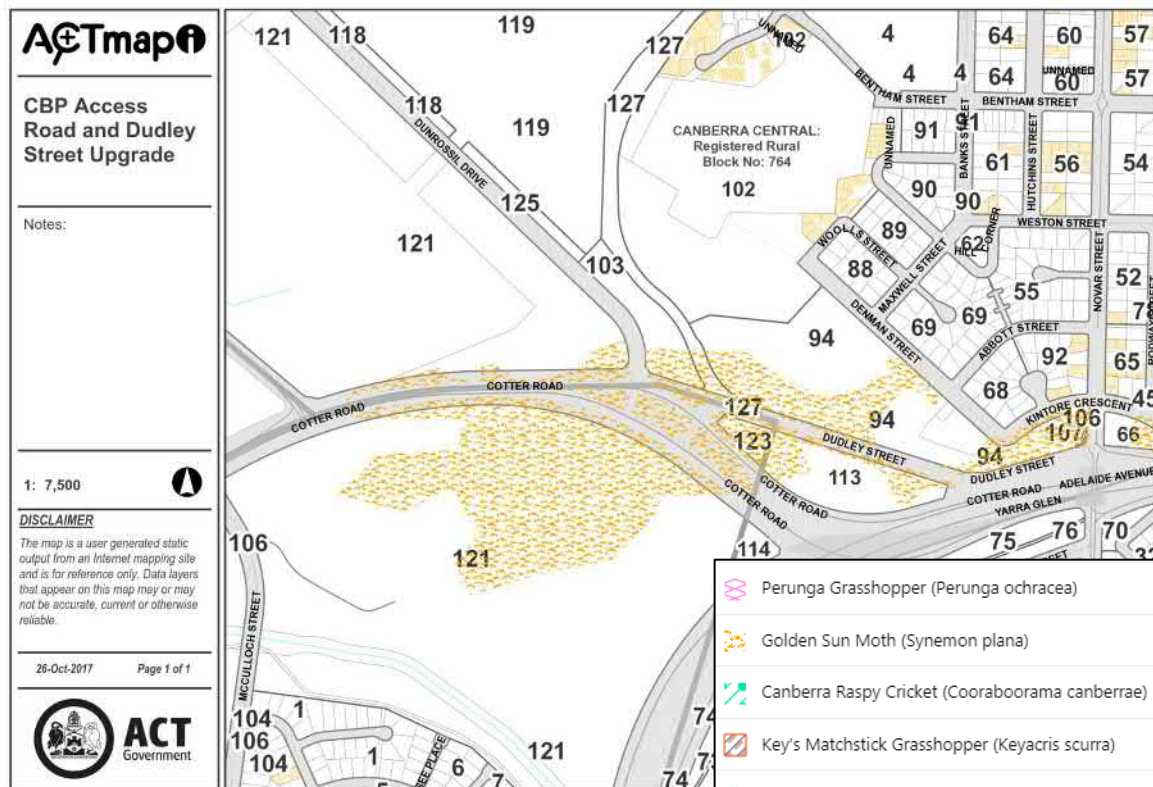


Figure 31 Golden sun moth in the Proposal vicinity (source: ACTmap)

Table 15 summarises the habitat types and quality present within the golden sun moth survey area (Umwelt, 2017). Quality was determined based on vegetation composition and moth observations.

Table 15 Golden sun moth habitat

Vegetation type	Quality	Area (Ha)
Exotic Grassland (Chilean needle grass (<i>Nassella neesiana</i>) (perennial) Dominated)	Moderate (Disturbed)	1.41
Exotic Grassland (mixed golden sun moth feed species)	Low	0.84
	Moderate	2.91
Mixed Grassland	Low	0.77
	Low-Moderate	0.78
Native Grassland (<i>Rytidosperma</i> spp.)	Low	0.21
Native Grassland (<i>Rytidosperma</i> , <i>Austrostipa</i> spp.)	Low	0.05
	Moderate	0.42
Total		7.39

Source: Impact Assessment Report (Umwelt 2017)

The 2016 survey identified a total of 617 male and six females over four non-consecutive days of survey in December. The highest density of moths was recorded in Exotic Grassland (Chilean needle grass (*Nassella neesiana*) (perennial) Dominated) and in exotic grassland (mixed golden sun moth feed species) in the north west of the survey area. Moderate numbers of golden sun moth were recorded throughout much of the remaining area. Low golden sun moth numbers were recorded on the southern verge of Cotter Road.

Golden sun moth observations fluctuate seasonally, and the quality of habitat within the Project area may vary between years based on the dominance of exotic species.

Little eagle

The little eagle occurs in a range of open habitats where they can access prey species. The species has been recorded throughout the ACT region; however most of these are associated with hunting or fly-over records. Little eagle has been recorded in the Project area (COG, 2017) which is within the ranging distance of the species.

Given the urban context, relatively small patches of open grassland and lack of open woodland, history of disturbance, and high level of traffic and human use of the area; it is not considered likely to provide substantial prey items for the species. As such, the Project is considered unlikely to result in a significant adverse environmental impact to the little eagle for the following reasons:

- The habitat within the Project area is not significant for the species, and its loss is unlikely to result in any substantial long-term effects.
- The Project is not expected to result in a cumulative or incremental effect as it is not expected to alter the species' use of the Project area over time.

Spotted-tail quoll

The spotted-tail quoll prefers mature, wet forests that contain sufficient structural diversity to supply den sites and plentiful prey. Dens are fashioned from a range of landscape features such as rock crevices, hollow logs, tree hollows, caves, dense vegetation, or in the right substrate dens are dug into the soil (DELWP, 2016). Prey varies throughout the species' distribution; however in the ACT region generally consists of brush-tailed possum, ring-tailed possum, greater glider and rabbit.

Records in the ACT region most regularly occur within the Brindabella Ranges, with scattered records throughout the urban area. There is a record from 1968 of a spotted-tail quoll in the Project area (ACT Government, 2015; Canberra Nature Map, 2017), but none more recently. Despite their preference for wet forest, the species have been recorded throughout numerous forest, woodland, heathland, grassland, rocky outcrops, and urban areas; particularly where these habitats occur adjacent to forest (DWELP, 2016). This is understood to reflect the high mobility and large home ranges of the species, rather than as evidence of a resident population.

As the preferred wet forest habitat of the species does not occur within the Project area and given the urban context; the record from 1968 is considered to be evidence of a vagrant dispersing through the landscape. The Project area is not considered likely to be regularly utilised by the species and does not meet its usual habitat requirements. The Project is not considered likely to have a significant impact on the spotted-tail quoll as there is no resident population, not habitat present; and it will not affect the ability of the species to move through the landscape.

Migratory bird species

The database searches identified 14 migratory species with the potential to occur within 10 kilometres of the Project area, as detailed in **Appendix B**. Of these 14 migratory species, the likelihood of occurrence assessment determined that only two of the species are likely to fly over the Project area, with the remaining 12 species not having suitable habitat within the Project area:

- fork-tailed swift (*Apus pacificus*)
- white-throated needletail (*Hirundapus caudacutus*).

Both the fork-tailed swift and the white-throated needletail are almost exclusively aerial; occurring over a range of habitat types. In the ACT, fork-tailed swift arrive between December and March, with several flocks passing through within this period. White-throated needletails are not very common and are usually associated with the arrival of weather fronts in the region (COG, 2017; DOEE, 2017). It is therefore considered likely that these species would fly over the Project area; however they are unlikely to be reliant upon habitats in the Project area.

Trees

A tree assessment of existing trees within the Project area was carried out by dsb Landscape Architects in 2015 and 2017. These surveys identified a number of regulated and non-regulated trees of varying quality within the Project area as shown in Figure 32.

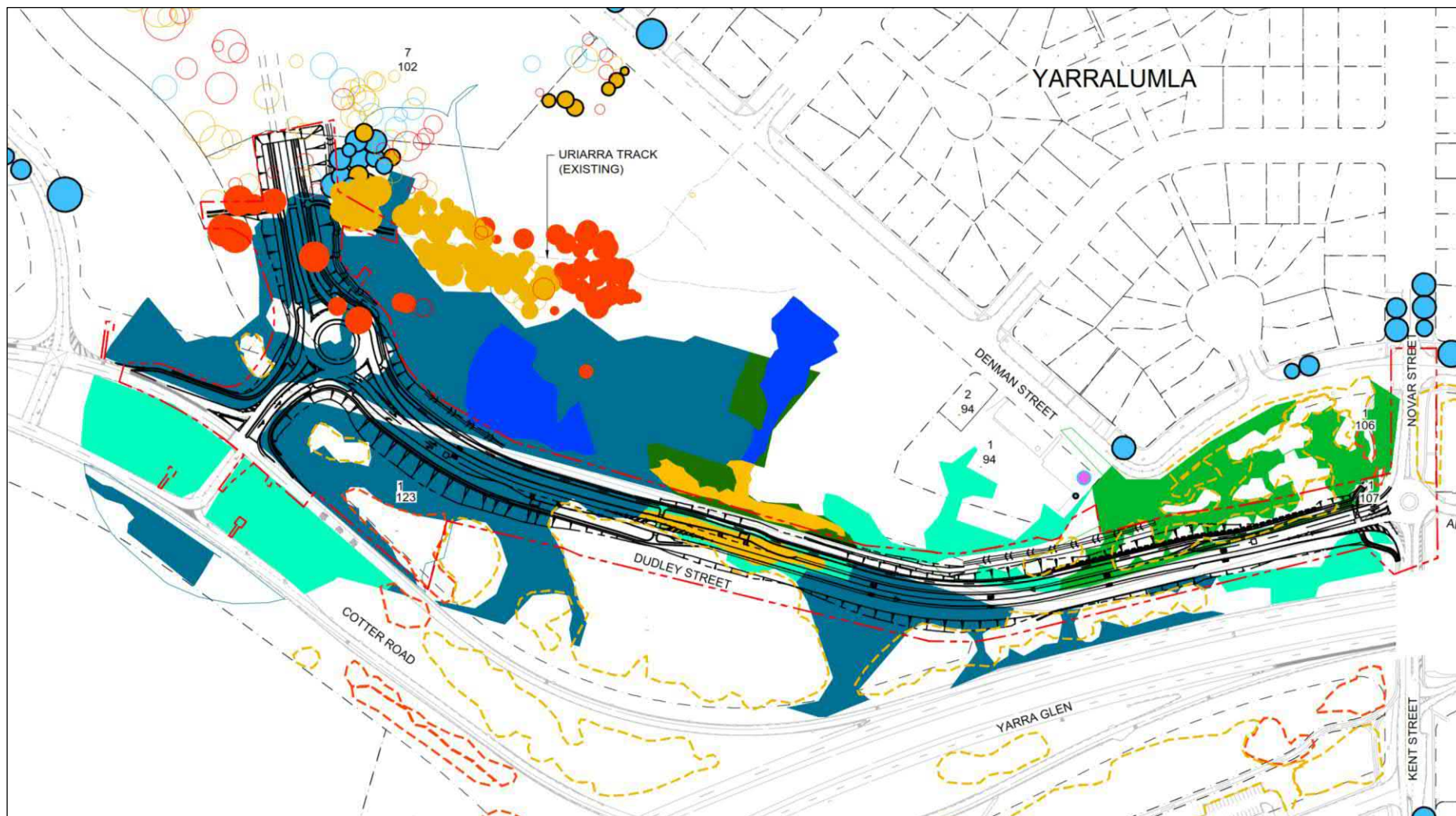


Figure 32 Ecological conditions and values within the Project area and surrounds

7.2.3 Potential Impacts

Construction phase

Clearing of native vegetation and habitats

During the development of the Project, the alignment of the Access Road and upgrade of Dudley Street was altered to avoid areas of MNES as far as feasible and reasonable. Where direct impacts could not be avoided (e.g. areas directly adjacent to the existing Dudley Street), the alignment was designed to target areas of lower quality that have a demonstrated pattern of decline. These design changes are detailed in Section 2.4.

The clearing of vegetation will be less than 0.5 ha and therefore does not trigger Schedule 4 part 4.3(2) of the PD Act.

Natural temperate grassland

The Project would result in a direct loss of 0.123 ha (0.01 ha of very high and 0.113 ha of high quality) or the equivalent of 16 per cent of natural temperate grassland within the Umwelt survey area. No clearing of the natural temperate grassland is required for the temporary construction site compound.

There are currently no published thresholds for what constitutes a significant impact to natural temperate grassland, so impacts would need to be considered in the context of the proposed alignment within the Project area. The Approved Conservation Advice (including listing advice) for the natural temperate grassland (EC 152) indicates that any clearing of a patch of the natural temperate grassland with a condition rating of high or above is considered a significant impact.

The Project would have indirect impacts to a total of 0.16 ha (0.06 ha of very high and 0.1 ha of high quality) of natural temperate grassland. These areas would not be lost as a result of construction, however may experience some degradation. As the extent of this degradation is difficult to accurately predict the estimated indirect impacts was assumed to include areas within 10 metres of the Project area. This additional area was assumed to be lost for the purpose of offset calculations.

An assessment of significant impacts to natural temperate grassland against the '*Significant Impact Guidelines 1.1*' has been undertaken - refer to the ecological Impact Assessment Report (Umwelt, 2017) for full details of the significance assessment. The assessment determined that the Project would reduce the extent of this critically endangered ecological community, including affecting its critical habitat and would result in a minor increase in fragmentation. It may also result in indirect impacts that affect remaining patches of natural temperate grassland. The loss of 0.123 ha of natural temperate grassland with a condition rating of high is considered a significant impact.

Golden sun moth

Of the 7.39 ha of suitable golden sun moth habitat recorded in the Umwelt survey area, the Project would result in a direct loss of 2.64 ha or the equivalent of 36 percent of suitable golden sun moth habitat within the survey area. Habitat areas to the south of Dudley Street are also expected to be impacted by changes in surface water run-off and small patch size; resulting in a further 0.44 ha of habitat indirectly impacted by the Project. A total of 3.08 ha or 41 percent of golden sun moth habitat is expected to be impacted by the Project (including temporary construction site compound location). Table 16 provides a breakdown of the golden sun moth habitat to be removed including habitat quality.

Table 16 Golden sun moth habitat impacted by the Project

Habitat quality	Loss of habitat in hectares (ha)
Direct impacts	
Low (native grassland with a moderate component of native C3 grasses on shallow, eroded soils; or moderately dense mixed grassland)	0.35
Low – Moderate (understorey includes a moderate cover native C3 grasses but is affected by shading of planted trees)	0.25
Moderate (native grassland with a moderate component of native C3 grasses)	0.04
Moderate (Disturbed) (exotic grassland dominated by Chilean needlegrass)	2.0
Indirect impacts	
Low (exotic grassland with mixed feed species)	0.13
Moderate (Disturbed) (exotic grassland dominated by Chilean needlegrass)	0.31
Total	3.08

Source: Umwelt Offset Strategy, July 2018

The Project is expected to reduce the area of occupancy of golden sun moth in excess of the amount stated in *Significant Impact Guidelines for the Critically Endangered golden sun moth* and also adversely affect avoided habitat such that the species may decline. The Project is therefore considered to have a significant impact to golden sun moth.

Refer to the ecological Impact Assessment Report (Umwelt, 2017) and Offset Strategy (Umwelt, 2018) for full details of the significance assessment undertaken for the Project against the *Significant Impact Guidelines for the Critically Endangered golden sun moth*.

The Project has been designed to avoid or minimise direct impacts to natural temperate grassland and golden sun moth habitat, as detailed in Section 2.4. As all possible avoidance and mitigation measures have been considered and implemented, the remaining impacts would be offset in accordance with the EPBC Act environmental offsets policy.

Trees

The Project would also result in the clearing of existing highly modified vegetation assemblages including regulated and non-regulated Turkey Oaks and *Pinus radiata* (pine weed species).

Table 17 outlines the type of tree and number to be removed as part of the Project. It is noted that while the trees provide little ecological value, they provide a physical and visual barrier between the Yarra Glen / Adelaide Avenue corridor and Dudley Street. The extent of tree clearing to *Pinus radiata* groups would also take into consideration the potential for wind throw from trees.

Table 17 Trees to be removed as part of the Project

Type of tree	Approximate number of regulated trees to be removed	Approximate number of non-regulated trees to be removed
Exceptional Quality Rating	-	-
High Quality Rating	-	63
Medium Quality Rating	1	-
Poor Quality Rating	8	20
Sub-total	9 (regulated)	83 (non-regulated)

Type of tree	Approximate number of regulated trees to be removed	Approximate number of non-regulated trees to be removed
Total	92	

Fragmentation and connectivity

Habitat fragmentation through the clearing of vegetation can increase the isolation of remnant vegetation and create barriers to the movements of small and sedentary fauna such as ground dwelling mammals, reptiles and amphibians, as well as smaller cover-dependent birds. Furthermore, habitat fragmentation can create barriers to the movement of pollinator vectors, such as insects (golden sun moth), and consequently affect the life cycle of both common and threatened fauna.

The native vegetation (natural temperate grassland) and habitat associated with the golden sun moth within, and surrounding the Project area is highly fragmented and disturbed as a result of previous urban development and road construction, exotic tree plantings, and weed incursion. Native vegetation in the Project area occurs as patches with generally low connectivity to the surrounding landscape.

As Dudley Street already fragments the golden sun moth habitat, the Project is not expected to fragment the existing habitat into two or more populations. The proposed construction of the Access Road is not expected to fragment the existing golden sun moth habitat population within the Project area. The proposed Access Road is a single carriageway design of a width golden sun moth is known to be able to cross (e.g. Cotter Road in the vicinity has known recordings of the species crossing).

Edge effects

Edge effects are zones of changed environmental conditions (i.e. altered light levels, wind speed and/or temperature) occurring along the edges of habitat fragments. These new environmental conditions along the edges can promote the growth of different vegetation types (including weeds) and allow invasion by pest animals specialising in edge habitats and/or change the behaviour of resident animals. Edge zones can be subject to higher levels of predation by introduced mammalian predators and native avian predators. It is estimated that average edge effects generally occur up to 50 metres away from a road edge (Bali, 2005).

A change in the microhabitat conditions adjacent to retained woodland and grassland vegetation as a result of vegetation clearing and earthworks increases the likelihood of the germination and establishment of exotic plants (weeds), which is evident in the Project area by the high presence of Chilean needle grass (*Nassella neesiana*) (perennial) and Wild oats (*Avena* species) (annual). The germination and establishment of weeds is most likely to occur in areas affected by construction activities, in areas of exposed soil/fill (such as topsoil stockpiles, soil cuttings and fill batters) and along edge-affected areas of remnant vegetation.

The natural temperate grassland vegetation occurring within the Project impact footprint occurs as relatively small, fragmented patches, which are subject to past and present disturbance regimes (e.g. urban development and existing road corridor), and hence, already consist of edge-affected habitats. It is considered that any marginal increase in these edge effects caused by the Project is unlikely to be significant.

Death/injury to fauna

Fauna injury or death could occur as a result of the Project during the construction phase, particularly when vegetation and habitats are being cleared.

While some mobile animals, such as adult birds, have the potential to move away from the path of clearing, others that are less mobile (e.g. nestling birds, reptiles, and insects) are at more risk. Clearing of mature remnant trees, likely to contain tree hollows which may be suitable as roosting and/or breeding habitat for hollow-dependent birds, bats and arboreal mammals, would not be required for the Project. Some of the regulated and non-regulated trees to be removed may provide hollows suitable for birds such as small parrots and tree roosting microchiropteran bat species. These trees may also be used as nesting sites for other common native birds. However, it is considered unlikely that any threatened species would utilise these trees for roosting or breeding.

Indirect impacts

There is a potential for indirect impacts to flora and fauna as a result of construction activities without the implementation of appropriate management strategies including:

- accumulation of wind-blown dust on vegetation; reducing photosynthesis and plant growth
- erosion and sediment accumulation from overland water flow; causing smothering of plants with accumulated silt and erosion of topsoil
- changes to local soil hydrological conditions due to altered surface water flows; resulting in altered vegetation composition from the loss of native species prone to waterlogging and proliferation of weeds of moist environments
- increases in noise, vibration and lighting impacting natural patterns of fauna
- introduction or spread of weeds from contaminated materials and the potential to import new weed species into the Project area on machinery.

During construction, noise, dust, light and contaminant pollution is predicted to be minimal, however there may be some indirect impacts to fauna species that may use the adjacent trees as habitat. The mitigation measures outlined in Section 7.2.4 would ensure that these indirect impacts would be minimised.

Operational phase

Noise and vibration impacts upon flora and fauna

During operation, noise and vibration levels would change in the Project area which may have the potential to drive local fauna away from the Project area. However, the Project area is adjacent to an existing road network (Dudley Street), which already generates noise and vibration through traffic flow. While there may be a moderate increase in noise and vibration during operation, the impacts are likely to be localised close to the Project (up to 100 metres) and are not likely to have a significant, long-term, impact on wildlife populations.

Lighting impacts on fauna

The Project area currently has light pollution in the form of existing street lighting, residential development and traffic flow. Light pollution is likely to be higher during operation due to the provision of additional street lighting along Dudley Street. The main fauna species of concern in regards to impacts of the Project is the golden sun moth. The golden sun moth is a day flying species, with little evidence of nocturnal activity; therefore it is unlikely the species would be significantly affected by the moderate increase in light pollution likely to be generated as a result of the Project.

Non-threatened nocturnal birds, bats and arboreal mammals inhabiting the Project area are likely to be habituated to the existing levels of light pollution and are unlikely to be significantly impacted by the moderate increase likely as a result of the Project.

7.2.4 Mitigation measures

The following mitigation measures to minimise or remove identified biodiversity impacts have been determined with a view primarily to protecting potential threatened species habitat within the Project area. Measures are largely set out to protect threatened fauna and habitat, native flora and habitat as well as control the spread of weeds and disease. Where the need for specific environmental controls is identified, requirements would be set out in the CEMP.

Mitigation measures during the construction period would include:

- construction methodologies would be developed during design and by the Construction contractor with the aim of minimising the Project footprint where feasible and reasonable
- all workers would be provided with an environmental induction prior to commencing work onsite. This induction would include information on the protection measures to be implemented to protect vegetation, penalties for breaches and locations of areas of sensitivity
- exclusion zones would be established to protect vegetation and fauna habitat outside of the approved clearing limits, including the threatened ecological communities. Vegetation to be retained is to be clearly defined on ground and 'no-go zones' clearly signposted and fenced to

prevent unauthorised clearing and vehicular and/foot traffic or materials storage. During the early phases of the Project, flagging would be used along the north and south boundary of the site to create a visual indication of ecologically sensitive areas and minimise the potential for unauthorised access from vehicular and foot traffic. The flagging would be replaced with ATF temporary fencing (or similar) prior to the main construction works

- a diversion would be provided for the duration of the Uriarra Track closure to encourage foot and bicycle traffic to avoid golden sun moth habitat
- a suitably qualified ecologist or environmental scientist would check for the presence of flora and fauna species and habitat on site before clearing begins including the presence of threatened species, bird nests and arboreal mammals
- a suitably qualified ecologist or environmental scientist would be on site during habitat removal; i.e. the felling of woodland habitat and removal of surface rock and debris
- In order to control the potential impacts of weeds and disease, the following measures would be implemented:
 - ensure machinery, equipment and other plant are washed down prior to entry to the impact area to avoid the spread of weeds and other pathogens
 - minimise the overall disturbance of soils where possible to avoid providing further disturbed ground for colonisation by weeds
 - minimise the import or export of soil material from the site where possible to avoid the inadvertent movement of weed seed and where practical, preserve top soil from excavation for reuse later over the top of excavations areas
 - remove weeds immediately within the Project area and dispose without stockpiling, (disposal of weed-contaminated soils at appropriate weed disposal facilities).
- further to dust mitigation measures outlined in Section 7.8, particular attention would be given to dust control during the golden sun moth breeding season (generally mid-October to early January, depending on local climate conditions)
- in the event of any tree to be retained becoming damaged during construction, the Contractor would immediately notify the ACT Government nominated Project Manager to coordinate the response which may include contacting an arborist to inspect and provide advice on remedial action, where possible
- opportunities to retain the large pine trees located within the proposed site compound area would be investigated by the Contractor
- disturbed areas with known native grasses including food plants for golden sun moth would be revegetated with 'C3' native grasses as appropriate, such as indigenous Wallaby Grasses.
- the Biodiversity Offset Strategy (described in Section 7.2.5) would be implemented.

A number of mitigation measures detailed in other sections would also be relevant to ecology, including:

- mitigation relating to minimising noise, vibration and lighting in Section 7.5 (Noise, vibration and lighting)
- mitigation relating to erosion and sediment control, and the storage and handling of hazardous substances and dangerous goods as detailed in Section 7.6 (Soils and geology) and Section 7.7 (Water and flooding); and management of waste in Section 7.13 (Waste and resources).

7.2.5 Biodiversity offset

As discussed above, there are significant unavoidable impacts to natural temperate grassland and golden sun moth as a result of the Project. An offset has been considered to be the only remaining and feasible option for mitigating the impact of the Project to be delivered in accordance with the EPBC Act Environmental Offsets Policy (DOEE, 2012).

The ACT Government proposes to secure an offset site that supports a golden sun moth population and natural temperate grassland, consistent with the requirements of the EPBC Act Environmental Offsets Policy and the outputs of the associated EPBC Act offset calculator. Offsets would be secured for golden sun moth habitat and natural temperate grassland vegetation removal to ensure a gain to ACT's biodiversity that is equivalent to the loss resulting from the permitted clearing of natural temperate grassland vegetation and golden sun moth habitat.

Offset discussions with ACT Parks and Conservation Service have been undertaken and an offset area (the North Mitchell Grasslands i.e. Block 4 Section 47 Franklin) has been identified. Initial advice from ACT Parks and Conservation Service confirmed that it is supportive of using the North Mitchell Grasslands as the proposed offset area for the Project with the prerequisite that it be given the opportunity to provide input on any conditions of approval for how the site needs to be managed in the long term.

An Offset Strategy was prepared by Umwelt (July, 2018) to refine the definition of the Project's impact and identify whether the proposed site is appropriate to offset the proposed impact of the Project, which was developed in consultation with the ACT Government Conservation and Research Branch in addition to the future land manager of the proposed offset site.

The assessment of the suitability of the proposed offset strategy included the consideration of the type, importance and size of the habitat being impacted and the scale of improvement and averted loss as a result of the offset – refer to the Offset Strategy report (Umwelt, July 2018) for full details of the assessment. The assessment determined that the offset site (North Mitchell Grasslands) would provide 229% of the required offset for the natural temperate grassland and 90% for the golden sun moth.

The offset strategy also identified the risk of the offset not succeeding and that an associated offset management plan would be prepared by ACT Parks and Conservation to guide management, monitoring and ongoing improvement activities.

Overall, the North Mitchell Grasslands would provide a high value offset and was recommended by Umwelt for use to offset the proposed impact of the Project. Management of the offset site and the associated costs would be delivered by ACT Government into perpetuity. The site is currently owned and maintained by ACT Government. A Territory Plan Variation is currently being processed which would change the offset site to a 'nature reserve' zoning to protect this area from future development.

7.2.6 Residual risks

An assessment of the residual biodiversity risks associated with the Project was carried out following implementation of the mitigation measures and biodiversity offsets discussed above. Residual risks identified for the biodiversity values are provided in Table 18.

Table 18 Residual risks for biodiversity values

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Presence or extent of threatened species and ecological communities not identified	E1	The Project area has been surveyed numerous times in recent years. Threatened species have been recorded and a Referral to the Commonwealth regarding the Project's impact on these species has occurred. The surveys undertaken provides a good deal of certainty that all threatened species and ecological communities have been identified and mapped in the Project area, therefore reducing the risk from high to medium.	Remote (Unlikely)	Catastrophic/ Significant (Catastrophic/ Significant)	Medium (High)

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Incursion of vehicles into areas of environmental significance causing damage to or destruction of habitat	E2	Through the implementation of mitigation measures such as the establishment of exclusion zones around vegetation and fauna habitat to be retained, and the implementation of 'no-go zones' clearly signposted and fenced to prevent unauthorised clearing and vehicular and/foot traffic, the residual risk is medium.	Unlikely (Possible)	Major (Major)	Medium (High)
Clearing of trees and other vegetation causing impacts including loss of amenity, loss of habitat, increased erosion and water runoff	E3	Through the implementation of the proposed mitigation measures and the biodiversity offset strategy the Project impacts will be minimised or offset. The residual risk is high	Likely (Almost certain)	Moderate (Catastrophic/ Significant)	High (Significant)
Vegetation clearing activities during construction disturb native animals and increase the potential for vehicle strike	E4	Through the implementation of proposed mitigation measures such as having a suitably qualified ecologist or environmental scientist for the presence of flora and fauna species and habitat on site before clearing begins including the presence of threatened species, bird nests and arboreal mammals, results in a low residual risk.	Unlikely (Possible)	Moderate (Moderate)	Low (Medium)
Project activities facilitate spread of exotic flora into adjacent areas, leading to weed establishment	E5	Specific mitigation measures to control the spread of weeds have been proposed which would result in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)
Project attracts additional vermin and pest species, which result in greater competition for resources with native species	E6	Through the implementation of standard mitigation measures and appropriate waste management this results in a very low residual risk.	Remote (Unlikely)	Moderate (Major)	Very Low (Medium)

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Clearing of vegetation results in a loss of connectivity through fragmentation in the landscape, or obstructing local movement corridors	E7	Project impacts will be offset as described in Section 7.2.5 which results in a very low residual risk.	Unlikely (Possible)	Minor (Moderate)	Very Low (Medium)
Clearing of protected trees that have not been approved to be cleared	E8	Through the implementation of mitigation measures such as such as the establishment of exclusion zones around vegetation and fauna habitat to be retained, and the implementation of 'no-go zones' clearly signposted and fenced to prevent unauthorised clearing this results in a medium residual risk.	Unlikely (Possible)	Major (Major)	Medium (High)
Impacts on Matters of National Environmental Significance (MNES)	E9	The Project disturbance footprint has been designed to minimise impacts to MNES as feasible and reasonable and would be further refined during the detailed design phase of the Project. Impacts to MNES would occur as a result of the Project, however through the implementation of an offset strategy the overall Project impacts would be compensated reducing the consequence to minor.	Almost certain	Minor (Catastrophic/ Significant)	High (Significant)
Loss of soil seed bank and other native plant propagules	E11	Topsoil would be reused onsite where possible. This results in a low residual risk.	Likely (Almost certain)	Minimal (Minor)	Low (High)

7.3 Landscape and visual

Section Summary

- This section considers the potential landscape and visual implications arising from the Project
- The discussion provides a broad overview of the visual environment from a number of vantage points, the potential impacts on the landscape as a consequence of the Project during construction and operation, and mitigation and management measures which would be applied to address adverse changes to the visual environment.
- With mitigation measures implemented, the impact on existing landscape ranges from Low to Moderate, depending on the view.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk #	Likelihood	Consequence	Risk Rating
Visual impacts during and following construction not anticipated	LV1	Possible	Moderate	Medium
Views available to occupants of nearby sensitive receivers are altered	LV2	Likely	Major	Very High
Species planted as part of the Project are inappropriate for landscape and impact on amenity of open spaces	LV3	Unlikely	Moderate	Low

7.3.1 Investigations

A Landscape and Visual Impact Assessment (LVIA) has been undertaken by AECOM generally in accordance with the NSW Roads and Maritime Services *Environmental Impact Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment* (Reference number EIA-N04, 2013). The assessment methodology is described in **Appendix C** and the findings summarised in this section.

7.3.2 Environmental conditions

Landscape character

The landscape character of the Project area is typical of a suburban road and area of open green space. The residential suburb of Yarralumla is located to the north of the Project consisting of low density housing generally comprising single and double storey dwellings on the northern side of Denman Street. Much of the Project area consists of an area of public open space with areas of open grassland and large groups of mostly non-native landscaped trees. The existing single lane road of Dudley Street dissects these open space areas providing a physical barrier for movement through these areas. Along the southern boundary of the Project is the infrastructure corridor of Yarra Glen/Adelaide Avenue, which provides the main connection from the southern suburbs of the ACT to central Canberra. The Yarralumla Uniting Church and its grounds (opened in 1967) are located in the north eastern extents of the Project area.

The landform generally slopes from north to south with a steady decline from Denman Street (in the north) to Dudley Street and down to Yarra Glen/Adelaide Avenue (to the south). The groups of mature landscaped trees and the scattered trees along Denman Street provide screening of the Project area from the residential properties to the north. There are a few distinct locations where residences along Denman Street have direct views of the Project area through breaks in the trees. Dudley Street is elevated above Yarra Glen/Adelaide Avenue by around four to six metres and is partially screened by mature trees.

There are aboveground High Voltage electrical cables running in a north-south direction in the western extents of the Project and along Novar Street and Kent Street in the eastern extents of the Project

which are visually prominent elements. There are currently no street lights along Dudley Street apart from at the stretches around 50 metres from the intersections at either end of Dudley Street.

The current condition of the vegetation within the urban open space ranges from high to very high quality natural temperate grassland (a threatened ecological community) to poor quality vegetation with exotic trees and exotic grassland with weed infestations. The native vegetation within and surrounding the Project area is highly fragmented and disturbed as a result of previous urban development and road construction, exotic tree plantings, and weed incursion. The majority of the grassland through the Project area is maintained by regular mowing with two patches that have been left to grow naturally. There are signs of erosion along the edge of Dudley Street with a number of locations showing very sparse vegetation cover, including on the corner near the Cotter Road intersection, near to the existing bus stops and at the Yarralumla Uniting Church.

An informal gravel walking pathway, the Uriarra Track, traverses the Project area in an east to west direction which is used by local residents for access and recreation purposes such as dog walking.

Visual receivers

Visual receivers are individuals and/or groups of people whose views may be affected by the Project. These include users of residential dwellings, community or commercial properties and open space, and generally comprise residents, road users and pedestrians. Figure 33 represents the area that is likely to be visually affected by the Project.

Nine visual receiver locations have been identified to represent key viewpoints to and from the Project. An assessment was undertaken to understand the potential impacts on views as a result of the Project at these locations. These locations are described in Table 19 and shown in Figure 34.

Table 19 Impact assessment for visual receivers

No.	Visual receiver	Description
1	View from Dunrossil Drive (north)	Views south-east from Dunrossil Drive towards the Project. Views of the Project will be experienced along a narrow vegetated corridor and filtered by existing tree cover and cultural tree planting.
2	View from Dunrossil Drive (south)	Views east towards the Project from stationary vehicles waiting at the intersection of Dunrossil Drive and Cotter Road.
3	View from Cotter Road	Views of the Project from Cotter Road experienced by road users.
4	View south-east towards the Project from Denman Street	Middle to background views of Dudley Street are framed by an opening in an existing stand of pines trees.
5	View from Kintore Crescent	View south from Kintore Crescent towards the Project. Views will be partially screened by existing tree cover, cultural planting and low undulating landform.
6	View from Novar Street	View from Novar Street south-west towards the Project. Foreground views of the Project will be experienced at the intersection of Dudley Street and Novar Street.
7	View from Yarra Glen main alignment	Due to the elevation of the terrain the views of the Project from the Yarra Glen are screened by the topography and partially by the existing mature pine trees.
8	View from Kent Street bridge over Adelaide Avenue	Views of the Project from the Kent Street bridge experienced by road users and pedestrians using the bridge.
9	View from Yarra Glen off-ramp	Views of the Project from the Yarra Glen off-ramp experienced by road users and pedestrians using the bridge.



Figure 33 Visual envelope map showing potentially visually affected area

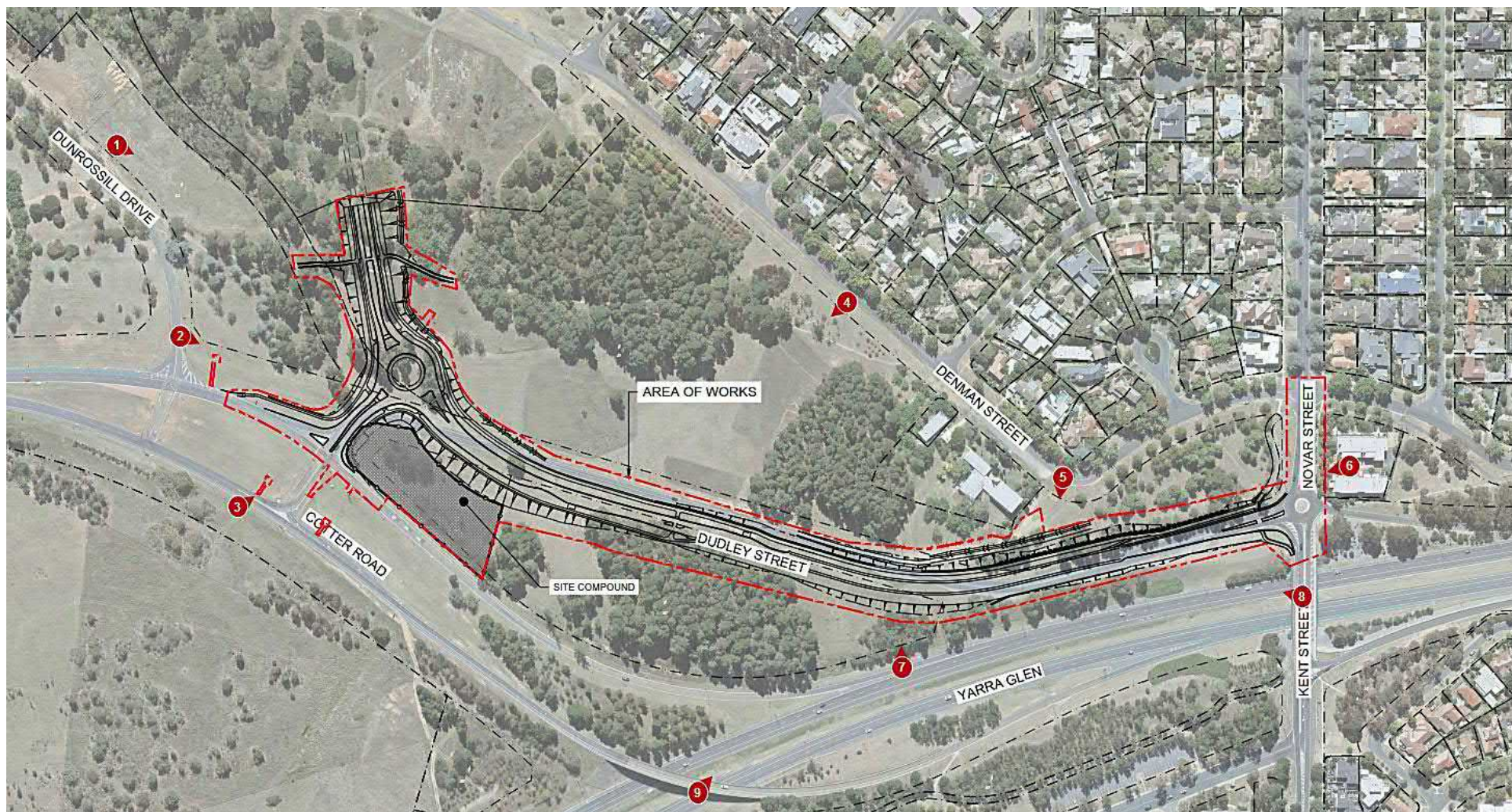


Figure 34 Visual impact assessment receiver locations

7.3.3 Potential impacts

The Visual Impact Assessment was prepared in accordance with the NSW Roads and Maritime Services *Environmental Impact Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment* (RMS, 2013). In accordance with this guideline, an impact grading matrix was used to assess both landscape and visual impacts. The sensitivity and magnitude of the impact was determined to produce a combined impact rating of negligible, low, moderate and high.

Landscape character assessment

To assess landscape character impact, landscape character zones (LCZ) were identified within the Project area and surrounds. The landscape character zones are defined as areas of landscape with similar properties or strongly defined spatial qualities that are visually distinct from adjoining areas. Three landscape character zones were determined as representative of the key land uses surrounding the Project, including:

- LCZ 1: Infrastructure corridors (Dudley Street, Cotter Road and Yarra Glen/Adelaide Avenue)
- LCZ 2: Residential
- LCZ 3: Urban open space.

A landscape character assessment was undertaken to determine the impacts of the Project to these three landscape character zones during construction and operation n Table 20.

Table 20 Impacts to landscape character zones

Zone	Potential Impacts	Impact Assessment
Infrastructure corridors landscape character zone	<i>Construction</i> • presence of temporary construction compound located in the western extents of the Project earthworks and stockpiling activities would be visually prominent elements of the construction process, including the use of erosion and sediment control measures • traffic management control measures would be implemented throughout construction • removal of trees required for the Project would partially open up views in the area • temporary fencing and hoarding, road barriers, signage, VMS, temporary site offices, amenities, plant and machinery • temporary use of machinery for the undergrounding of the High Voltage cables and relocation of telecommunication cables. <i>Operation</i> • new wider road infrastructure would be visible including new pedestrian access paths and street lighting • removal of trees required for the Project would partially open up views in the area • undergrounding the High Voltage electrical cables would marginally improve the character setting by reducing the visibility and number of overhead cabling	The visual impact of the Project for the infrastructure zone is considered to be low as the land use, pattern and scale have the capacity to accommodate the type of change proposed and the road design would be similar to surrounding roads. Therefore the change is considered to be minor within the context of the broader landscape setting. The Project would be most noticeable as a landscape impact during construction due to the use of construction hoardings, traffic management controls, earthworks, stockpiling and machinery, and result in a minor-moderate change in landscape character in the operation phase.
Residential landscape character zone	<i>Construction</i> • presence of temporary construction compound located in the western extents of the Project lighting required for night-time works would be	The visual impact of the Project for the residential zone is considered to be low as the land use, pattern and scale have the capacity to

Zone	Potential Impacts	Impact Assessment
	visible from this landscape character zone - earthworks and stockpiling activities would be visually prominent elements of the construction process, including the use of erosion and sediment control measures - removal of trees required for the Project would partially open up views in the area, including views of the Yarra Glen infrastructure corridor, though it is not considered likely to change the setting for these residences - temporary fencing and hoarding, road barriers, signage, VMS, temporary site offices, amenities, plant and machinery - temporary use of machinery for the undergrounding of the High Voltage electrical cables and relocation of telecommunication cables. <i>Operation</i> - new road infrastructure (including street lighting, drainage systems, bus stops and the shared paths) would be visible from Denman Street through breaks in the trees and from Novar Street - removal of trees required for the Project would partially open up views in the area, including views of the Yarra Glen infrastructure corridor, though it is not considered likely to change the setting for these residences - changes to the elevation of the road (i.e. vertical alignment) are not considered to significantly change the visual setting of the Project area - undergrounding the High Voltage electrical cables would marginally improve the character setting by reducing the visibility and number of overhead cabling.	accommodate the type of change proposed and the road design would be similar to existing and surrounding roads. Therefore the change is considered to be minor within the context of the broader landscape setting. The Project would be most noticeable as a landscape character impact during construction. In operation, the upgrade represents a minor change to this landscape character zone given the distance to receivers and presence of screening from existing trees. The introduction of street lighting along Dudley Street and the Access Road would be visible from this landscape character zone during operation. The impacts are not considered significant due to the relatively large distances from the residential receivers on Denman Street to Dudley Street and the existing screening provided by vegetation. Operational lighting would be designed to minimise light spill to the surrounding residences. There are existing street lighting at the Dudley Street / Novar Street / Kent Street intersection and so the Project would not represent a significant change to the existing conditions for the residences on Novar Street.
Urban open space landscape character zone	<i>Construction</i> - presence of temporary construction compound located in the western extents of the Project - lighting required for night-time works would be visible from this landscape character zone - earthworks and stockpiling activities would be visually prominent elements of the construction process, including the use of erosion and sediment control measures - removal of trees required for the Project would partially open up views in the area - temporary fencing and hoarding, road barriers, signage, VMS, temporary site offices, amenities, plant and machinery - temporary use of machinery for the undergrounding of the High Voltage electrical cables and relocation of telecommunication cables. <i>Operation</i> - new road infrastructure (including street lighting, drainage systems, bus stops and the shared	The visual impact of the Project for the urban open space landscape character zone is considered to be moderate as the Project would be more visible and prominent than the existing infrastructure, including the provision of street lighting. Changes to vertical alignment of Dudley Street is not considered to significantly change the visual setting of this zone. Therefore the change is considered to be moderate within the context of the broader landscape setting. The Project would be most noticeable as a landscape character impact during construction. In operation, the upgrade represents a moderate change to this landscape character zone given the close distances between the receivers and the visual elements of the Project. The

Zone	Potential Impacts	Impact Assessment
	- paths) would be visible - removal of trees required for the Project would partially open up views in the area - changes to the elevation of the road (i.e. vertical alignment) are not considered to significantly change the visual setting of the Project area - views along the Uriarra Track would be impacted by the Access Road providing a prominent visual element of new infrastructure - undergrounding the High Voltage electrical cables would marginally improve the character setting by reducing the visibility and number of overhead cabling.	Access Road would provide a new physical barrier for views along the Uriarra Track impacting receivers using this access, including for recreation purposes.

Visual impact assessment

Construction phase

Construction activities would tend to be more visible than the operation of the Project, however impacts would be temporary and would change throughout the different stages of construction. Views toward construction activities would be partially restricted by the undulating topography of the Project area and existing mature tree cover.

Temporary elements likely to be introduced into the visual environment during the 12 month construction period include:

- fencing and hoarding
- road barriers, signage and VMS systems
- earthworks and stockpiles of material
- erosion and sediment control devices
- lighting for night time works
- construction equipment/plant
- site office and amenities.

Night works are also likely to be required for the Project which would involve temporary lighting for operational, safety and security purposes. Night lighting would include building and pole mounted directional spot lighting and pole mounted pedestrian lighting. The Project would avoid broad area or floodlighting where possible. Light installations would be installed in accordance with the Australian Standard Control of the obtrusive effects of outdoor lighting (AS 4282- 1997), and avoid light spill to adjoining road corridors and residential areas. In summary, night time lighting is not anticipated to have an adverse impact.

Views towards construction activities from the residential areas to the north would be partially screened by the existing mature trees. There would be direct views of the Project west from the residences on Novar Street, however this would mainly occur during the stage 2 works only. The overall visual impact of the construction of the Project is considered to be moderate, given the scale and length of construction activities however impacts would be temporary and minimised where possible.

Operational phase

An assessment of the visual sensitivity and magnitude of each visual receiver location (refer to Figure 34) was undertaken for the operational phase of the Project, and the results of this assessment are provided in Table 21. Overall, the Project is considered to have a moderate to low visual impact on the majority of people living, working in or travelling through the urban landscape surrounding Dudley Street during operation.

The majority of surrounding receivers would not be significantly impacted by the Project including sensitive residential receivers along Denman Street and Novar Street. Pedestrians and motorists travelling along local road corridors, including Cotter Road and Yarra Glen, would not experience a major change with regard to the Project. Views toward the Project would be partially screened by existing mature tree and shrub planting surrounding the Project area. Potential visual impacts would also be limited due to the transitory and relatively short term nature of views from the surrounding road corridors.

Table 21 Operational visual impact assessment

No.	Visual receiver	Sensitivity	Magnitude	Rating
1	View from Dunrossil Drive (north)	The sensitivity would be moderate given the use of Dunrossil Drive by dignitaries accessing Government House. Views of the Project would be experienced along a narrow vegetated corridor, filtered by mature trees.	The magnitude of change would be negligible . Views towards the Project would be substantially screened and filtered by existing vegetation and the topography of the land. The Access Road would be in around two metres of cut so would not likely be visible from this view point.	Negligible
2	View from Dunrossil Drive (south)	The sensitivity would be moderate given the use of Dunrossil Drive by dignitaries accessing Government House.	The magnitude of change would be low . Vehicles travelling east along Cotter Road would have an appreciation of the extent of the Project. The middle foreground would comprise the loss of the existing pine trees (closest to Dudley Street) with open views of the proposed roundabout.	Low - Moderate
3	View from Cotter Road	The sensitivity would be low given that views would be from road users only.	The magnitude of change would be low . Vehicles travelling east along Cotter Road would have an appreciation of the extent of the Project. The middle foreground would comprise the loss of the existing pine trees (closest to Dudley Street) with open views of the proposed roundabout.	Low
4	View south-east towards the Project from Denman Street	The sensitivity would be moderate , given the low number of residents with direct views to the Project.	The magnitude of change would be moderate . Views towards the Project would be substantially screened and filtered by existing vegetation. There would be some visible loss of mature trees from this view point south of Dudley Street. There would be a permanent change in views through the introduction of a widened road and street lighting.	Moderate

No.	Visual receiver	Sensitivity	Magnitude	Rating
5	View from Kintore Crescent	The sensitivity would be moderate , given the low number of residents with direct views to the Project.	The magnitude of change would be moderate . Views south from Kintore Crescent towards the Project would be partially screened by existing tree cover, cultural planting and low undulating landform.	Moderate
6	View from Novar Street	The sensitivity would be moderate , given the low number of residents with direct views to the Project. The undulating landform of Dudley Street limits views of the Project from this location.	The magnitude of change would be low . The Project would introduce constructed elements which would complement the scale and form of the existing road infrastructure. There would be a noticeable loss of trees to the north of Dudley Street at the Novar Street / Kent Street intersection.	Low-Moderate
7	View from Yarra Glen main alignment	The sensitivity would be low given that views would be from road users only.	The magnitude of change would be negligible . Given the elevation of Dudley Street above Yarra Glen, views of the Project from this view point are screened by the topography and also the existing vegetation.	Negligible
8	View from Kent Street bridge over Adelaide Avenue	The sensitivity would be low given that views would be from road users and pedestrians only.	The magnitude of change would be low . Road users and pedestrians travelling north along the Kent Street bridge would have an appreciation of the extent of the Project. The Project would introduce constructed elements which would complement the scale and form of some of the existing road infrastructure.	Low
9	View from Yarra Glen off-ramp	The sensitivity would be low given that views would be from road users and pedestrians only.	The magnitude of change would be low . Road users and pedestrians looking north from the Yarra Glen off-ramp would have an appreciation of the extent of the Project. The Project would introduce constructed elements which would complement the scale and form of some of the existing road infrastructure.	Low

Photomontages

Figure 35 provides a photograph of the existing view to the Project from Dunrossil Drive and Figure 36 a photomontage of the Project as viewed from that location. The photomontage is conceptual, however it illustrates the likely visual changes and focus on viewing the Project in the wider setting in terms of bulk and scale. The materials and finishes used are indicative only and would be further investigated during detailed design.



Figure 35 Existing view from Dunrossil Drive (viewpoint 2) looking east to Dudley Street



Figure 36 Proposed view from Dunrossil Drive (viewpoint 2) looking east to Dudley Street (indicative only, subject to detailed design)

7.3.4 Mitigation measures

The overall visual impacts of the Project have been determined to range from low to moderate for the landscape character and surrounding visual receiver locations. Mitigation measures would be considered during design development and construction planning to minimise the level of visual impact of the construction and operation phases of the Project.

Measures to mitigate visual impacts during construction would be included in a CEMP for the Project and would include measures such as minimising light spill during night works, screening of the compound and minimising tree removal.

Design

Mitigation measures during detailed design should consider:

- specific design measures for construction ancillary to prevent crime, based on principles of crime prevention through environmental design
- the urban design of the Access Road addressing the design of the adjoining Canberra Brickworks Precinct to ensure a consistent landscape and views
- 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 and to be contingent with the development of the Canberra Brickworks Precinct.

Construction

Mitigation measures during the construction period should consider:

- installation of screen hoarding and/or shade cloth screens around compound locations and working areas
- minimisation of tree and vegetation removal
- avoidance of temporary light spill beyond the construction site where temporary lighting is required (e.g. during night time works)
- rehabilitation of disturbed areas as soon as practical following works in specific areas
- removal of graffiti (as required)
- landscaping and weeding of grassed areas within the Project area to continue as per existing arrangements to minimise areas of overgrown vegetation
- traffic management and provision of parking for construction site vehicles within the construction working area to minimise parking impacts on surrounding roads.

Operation

Mitigation measures during the operational period should consider:

- ongoing maintenance and repair of constructed elements
- replacement of damaged or missing constructed elements
- long term maintenance (and replacement as necessary) of tree planting within the Project area (e.g. along Access Road) to maintain visual filtering and screening of external views
- soft and hard landscape works maintenance.

7.3.5 Residual risks

Based on the mitigation measures identified in Section 7.3.4, an assessment of the residual landscape and visual risks associated with the Project have been considered (for risks previously identified as being medium or above). Residual risks identified for the landscape and visual values are presented in Table 22.

Table 22 Residual Risks for Landscape and visual values

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Visual impacts during and following construction not anticipated	LV1	This Section provides an assessment of the likely visual impacts during and following construction. The construction sites would be managed in accordance with the CEMP prepared for the works. This would result in a low residual risk.	Negligible (Possible)	Moderate (Moderate)	Low (Medium)
Views available to occupants of nearby sensitive receivers are altered	LV2	Tree losses have been minimised during design development. Mitigation measures as defined in Section 7.2.4 would minimise visual impacts of the Project, resulting in a high residual risk	Likely (Likely)	Moderate (Major)	High (Very High)

7.4 Socio-economic

Section Summary

- This section provides an overview of potential social, economic and health impacts, and identifies the areas likely to have the most noticeable impacts, and recommends mitigation measures. This allows the Project to proceed and operate with any negative socio-economic impacts minimised.
- Overall, there are positive socio-economic impacts as a result of the Project in that it provides the Yarralumla area and local residents with an improved road network along Dudley Street that will also provide access (via the Access Road) to the proposed Canberra Brickworks Precinct development providing an economic boost to the area.
- Key negative socio-economic impacts include the permanent loss of open space in the Project area to allow the Project to be constructed and temporary loss of access to the Uriarra Track during construction.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk #	Likelihood	Consequence	Risk Rating
Community complaints and dissatisfaction in concept development	CS1	Possible	Moderate	Medium
Public comment period of REF raises significant issues that delay release of final REF report	CS2	Possible	Major	High
Increased media attention and political interest affects the community interest or perceptions of the Project in general	CS3	Likely	Moderate	High
Development is not consistent with values of retained heritage sites, or areas of natural environmental value	CS4	Possible	Major	High

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk #	Likelihood	Consequence	Risk Rating
Construction of the Project would result in the temporary loss of public open space and access to the Uriarra track (footpath used for dog walking)	CS5	Likely	Moderate	High
Operation of the Project would result in the permanent loss of an area of public open space	CS6	Almost certain	Moderate	Very High

7.4.1 Environmental conditions and values

The Project is located within the suburb of Yarralumla, nearby to the residential suburbs of Deakin, Forrest and Curtin, and located around three kilometres from the Canberra CBD. The Project is located within Territory land with the exception of Dudley Street, which is within a Designated Area (National land) under the management of the NCA. The Project traverses four blocks with differing zoning consisting of urban open space (PRZ1), restricted access recreation zone (PRZ2), Designated Land and road reserve. Section 1.3 provides more details on the land administration of the Project.

Dudley Street is a road with a single lane in each direction connecting Cotter Road and the Novar Street roundabout. The Project is located in an area that was formerly grazing land which has been previously cleared and modified. The vicinity of the Project area contains residential development to the north and east, open landscape to the south nestled between Cotter Road and Adelaide Avenue and a landscape buffer to the Royal Canberra Golf Club to the west (Figure 1).

Demographics of the Project area and surrounds

The population of the ACT as of the 2016 census was 396,857 (ABS, 2017) and is projected to be 500,000 by 2033. As Table 23 demonstrates, the total population of the suburb of Yarralumla is currently 2,890 and the total population of the wider vicinity, including surrounding suburbs of Deakin (2,878), Forrest (1,615) and Curtin (5,238) was 12,621. These suburbs represent 3.2% of the ACT's total population.

The median age and percentage of the population over the age of 65 for these suburbs are substantially higher than results for the total of ACT, which indicates these areas contain an ageing population mostly consisting of professionals and retirees. This is further demonstrated in Table 24, where these suburbs have around 10% higher rate of professional workers living in their suburbs (around 40%) than the ACT average of 30.5%.

Table 23 2016 Demographics (ABS, 2017)

ABS State Suburb	Population	Age Profile		
		0-4 pre-school (%)	65+ older population/ retirees (%)	Median Age
Yarralumla	2,890	4.7	26.4	49
Deakin	2,878	4.7	22.9	45
Forrest	1,615	3.2	19.3	44
Curtin	5,238	5.8	18.8	42
ACT	396,857	6.7	12.6	35

Table 24 Household characteristics (ABS, 2017)

ABS State Suburb	2016 Median Household Income (\$ per week)	2016 Median Rent (\$ per week)	Occupied Private Dwellings (%)	2016 Occupation – percentage of population working as professionals (%)
Yarralumla	2,579	450	84.6	41.7

ABS State Suburb	2016 Median Household Income (\$ per week)	2016 Median Rent (\$ per week)	Occupied Private Dwellings (%)	2016 Occupation – percentage of population working as professionals (%)
Deakin	2,582	490	84.6	41.8
Forrest	3,145	500	82.0	40.7
Curtin	2,255	388	91.4	38.7
ACT	2,070	380	91.9	30.5

An important aspect for this socio-economic impact assessment is household information and statistics. As shown in Table 24, at the time of the 2016 census all suburbs within the proximity of the Project had a median household income higher than the ACT median (\$2,070 per week). The median household rent of the suburbs within the vicinity of the Project also had a higher median rent than the ACT median (\$380). These statistics indicates the Project is located in a fairly affluent area of the ACT region.

The 2016 census information also showed that all private dwellings in the area had relatively high occupancy rates of above 80%, but is lower than the ACT average rate of 91.9%. Relatively high occupancy rates in these suburbs indicate that majority of the land use in these areas is residential. These suburbs and in particular where the Project is located (Yarralumla) have a lower occupancy rate than the ACT region, which is likely due to the amount of land use zoned as Designated Land that is managed under the jurisdiction of the NCA. Yarralumla is located near Capital Hill, where there is significant government land and infrastructure.

The demographic data of Yarralumla suggests that there are few social anomalies in the Project area and surrounding suburbs (such as large populations of younger or older persons or extremely low median incomes or rental prices) that are likely to be exacerbated by the Project.

Sensitive receivers

Table 25 identifies the sensitive receivers which may be impacted by the Project.

Table 25 Potential sensitive receivers in the Project area

Type of sensitive receivers	Comments
Local residents	The closest residential receivers to the Project are: - single and double story residences on Kintore Crescent and Denman Street located around 60 metres north of Dudley Street at the nearest point - apartment blocks located adjacent to the Novar Street roundabout around 40 metres to the east of the Project. The Project does not traverse any residential areas or private residential properties that require acquisition or relocation. There is no direct access from residential properties to Dudley Street. Other residents which use the Project area include: - pedestrians and cyclists (on and off road) - road users (motorists, cyclists, emergency services etc) on Dudley Street
Local businesses	There are no local businesses located adjacent to the Project area. The local centre of Yarralumla is located around 650 metres to the north of the Project via Novar Street. There is a light industrial area to the south of the Project area via Kent Street which includes a variety of business and institutions. Businesses in the vicinity of the Project (including staff and customers) use Dudley Street for access through the area.
Government institutions	Key government institutions near the Project area include:

Type of sensitive receivers	Comments
	- Government House (around two kilometres to the north-west) - Parliament House (around three kilometres to the east). Dudley Street provides access from Adelaide Avenue to Dunrossil Drive (via Cotter Road). This is an important route for dignitaries travelling from central Canberra (e.g. Parliament House) to Government House.
Religious and community centres	The Project is located adjacent to the Yarralumla Uniting Church north of Dudley Street in the eastern extents. Other places of worship in the vicinity of the Project includes St Luke's Anglican Church and Canberra House of Prayer. Known community groups in the area include Yarralumla Residents Association, Pedal Power, Inner South Community Council, National Trust, Geological Society of Australia and SEE-Change Inner South.
Educational facilities	The only educational facility within 500 metres of the Project is Saint Nicholas Greek Australian Pre School and Child Care Centre, which is around 350 metres from the Project at the nearest point.
Entertainment, leisure facilities, and recreational areas	The Project area is located within an area of urban open space which includes the Uriarra Track (a footpath used for access and dog walking) used by local residents on a daily basis. Other recreational facilities in the Project vicinity includes: - Royal Canberra Golf Club (around 300 metres to the north) - The Red Hill Nature Reserve (around one kilometre to the south) - Lake Burley Griffin (around two kilometres to the north) - Weston Park (around three kilometres to the north)

7.4.2 Potential impacts

The Canberra Brickworks Precinct is proposed to be developed into around 380 residential dwellings and would repurpose a highly valued historical amenity. This development would increase the residential population in the immediate vicinity of Yarralumla and would increase traffic flow in the area. A traffic assessment undertaken in 2016 (AECOM, 2016a) determined that Dudley Street is functioning at capacity under existing traffic use conditions. Upgrades are required to allow Dudley Street to operate safely and to meet the design requirements for a 'major collector road' in order to facilitate expected increased traffic flows. A new Access Road is also required to service the Canberra Brickworks Precinct from Dudley Street.

Without the Project, current access points in the exiting residential suburb of Yarralumla (including Denman Street) would not be able to operate satisfactorily with the additional traffic expected to be generated by the Canberra Brickworks Precinct.

The upgrade of Dudley Street in particular will be beneficial to local residents and road users in the area as wider traffic lanes, on road cycling, off road shared path and an intersection arrangement for the new Access Road will improve traffic flow in the area and will provide safer cycling paths.

In the construction and operational phases of the Project, it is expected that there would be a wide range of socio-economic impacts, both positive and negative. This section provides a qualitative analysis of the socio-economic impacts of the Project, with particular focus on identifying impacts that require mitigation measures to reduce the risk of those impacts.

Construction phase

Construction of the Project has the potential to temporarily impact road users, pedestrians, residents, motorists, local businesses and other receivers as a result of:

- temporary changes to road user and active transport access on Dudley Street and surrounds
- temporary impacts to local traffic movements
- small increased truck movements delivering materials and equipment, and transporting waste
- loss of public open space and temporary changes to access of the Uriarra Track
- construction noise, vibration, dust and visual impacts.

During construction access to areas of the urban open space to the south and north of Dudley Street would be temporarily restricted to allow the construction of the Project, including the use of the site compound as depicted in Figure 16. The alignment of the Dudley Street upgrade and Access Road has been situated to avoid the largest area of urban open space to the north of Dudley Street. This has a higher amenity value than the road reserve to the south which is fragmented by the existing Dudley Street and is steeply sloped. This ensures the Project minimises impacts to urban open space and only utilises land as required.

There would be a temporary loss of access to the Uriarra Track across the Project area to allow the construction works to be undertaken safely. A temporary diversion of a section of the Uriarra Track would be provided throughout the duration of construction to maintain access.

The Project has the potential to cause disruption to residences, educational facility users and a number of local businesses and institutes (such as those located to the south of the Project between Kent Street and Denison Street, including The Real Precinct Institute of Australia, St Vincent de Paul Society, Australian Institute of International Affairs, St John Ambulance ACT) due to changes in traffic flows on Dudley Street. This impact is considered to be minor as the construction staging strategy for the Project ensures that Dudley Street remains open to traffic throughout the construction period (as far as practicable) to minimise traffic disruption on this highly used asset. There are no other significant construction related impacts to educational facilities or businesses due to the relatively large distances from the Project area.

The Project is located adjacent to the Yarralumla Uniting Church which may have amenity impacts including construction noise, vibration, dust and temporary visual impacts. Amenity impacts to the Yarralumla Uniting Church would be minimised through regular Project updates and dialogue with the Project team. Through regular communication and ensuring good site housekeeping is maintained,

these impacts are not considered significant. Particularly noise intrusive plant (e.g. mulcher) would be operated in other Project areas (e.g. the site compound located on the western extents) to minimise intrusion. See Section 7.5 for more details on noise impacts and mitigation.

Operational phase

Overall the operation of the Project would provide positive socio-economic benefits to Yarralumla and the ACT, including:

- upgrading Dudley Street to meet the design criteria for a major collector road
- safety improvements for road users on Dudley Street
- providing access to allow the development of the Canberra Brickworks Estate.

The operation of the Project, in particular the Access Road would result in the permanent loss of an area of urban open space and would change the land use of the area to road reserve. While this area has limited recreational value (excluding the use of Uriarra Track,) constructing a new Access Road that bisects the area of open space would fragment this area and limit the amount of useable recreational area. The Project includes the provision for a minor diversion of the Uriarra Track so that access is maintained across the Access Road with a safe crossing point during operation.

There would be changes to the noise environment as a result of the Project with in the introduction of the new Access Road. This is described in more detail in Section 7.5.

The Project would provide access to allow the development of the Canberra Brickworks Precinct which would be developed into around 380 residential dwellings and would repurpose a highly valued historical amenity. These additional residences would increase the housing stock of Yarralumla and provide an economic boost to the area. This would increase the number of residents that use the local amenities and shops.

7.4.3 Mitigation measures

Initial consultation has been conducted with a range of stakeholders including local community, public authorities, and special interest groups as described in Section 5.0. The issues raised have been taken into consideration and incorporated into Project planning and design where feasible.

The Project will be publically exhibited during the REF and Development Application process which would be available on the ACT Environment and Planning website for the statutory period and open for public comment. This mechanism allows for public concerns to be considered in a systematic and comprehensive manner within the existing legislative framework.

A number of safeguards would be implemented to minimise potential impacts on the community with a particular focus on keeping the community informed. These safeguards would be included in the CEMP developed by the Contractor. Mitigation measures would include:

- sustainability criteria for the Project would be established to encourage construction personnel to purchase goods and services locally helping to ensure the local community benefits from the construction of the Project
- a Community Liaison Plan (to be developed by the Contractor prior to construction) would identify all potential stakeholders and the best-practice methods for consultation with these groups during construction. The Plan would also encourage feedback and facilitate opportunities for the community and stakeholders to have input to the Project, where possible
- the community would be kept informed of construction progress, activities and impacts in accordance with the Community Liaison Plan
- contact details for a 24-hour construction response line, Project Infoline and email address would be provided for ongoing stakeholder contact throughout the construction phase
- the temporary diversion of the Uriarra Track would be minimised to the greatest extent possible while ensuring the safety of users is maintained.

Refer to sections 7.1, 7.3, 7.5 and 7.8 for discussion on the potential traffic noise/access, visual amenity, noise, and air quality impacts arising from construction of the Project and the proposed management strategies.

7.4.4 Residual risks

Based on the mitigation measures identified in Section 7.4.3, an assessment of the residual socio-economic risks associated with the Project have been considered (for risks previously identified as being medium or above). Residual risks identified for the socio-economic values are provided in Table 26.

Table 26 Residual risks for socio-economic values

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Community complaints and dissatisfaction in concept development	CS1	The ACT Government has committed to delivering the Project in an open and transparent way, delivering a series of early consultation on the Project's design and releasing the Project's business case. This allowed the community to raise issues early on and have influence in the design of the Project as detailed in Section 5.0. This results in a low residual risk.	Possible (Likely)	Minor (Moderate)	Low (Medium)
Public comment period of REF raises significant issues that delay release of final REF report	CS2	Meetings with EPSDD, NCA and DOEE have been undertaken to discuss the Project design and significant environmental impacts. A community information session has also been undertaken to seek public feedback on the Project design. There is still the potential for issues to be raised during the consultation process, but significant effort has been put into informing the public of the impacts of the Project. This results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)
Increased media attention and political interest affects the community interest or perceptions of the Project in general	CS3	Community consultation for the Project has been undertaken. Identified sensitive receivers were included in consultation sessions at the beginning of Project design. The ACT Government has committed to delivering the Project in an open and transparent way, delivering a series of early consultation on the Project's design which allowed community issues to be raised early in Project development.	Unlikely (Likely)	Moderate (Moderate)	Low (High)

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Development is not consistent with values of retained heritage sites, or areas of natural environmental value	CS4	The Project has sought to minimise impacts to the environmental values of the area and the identified heritage sites (see Section 7.9). All construction zones will be clearly demarcated to avoid impacts on public open space and allow residents to continue using the area as much possible. This results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)
Construction of the Project would result in the temporary loss of public open space and access to the Uriarra track (footpath used for dog walking)	CS5	Existing access for active transport will be retained where possible. The Uriarra Track will be temporarily diverted for a period of construction to ensure there is no interaction between users and construction equipment. This temporary diversion would be minimised to the greatest extent possible while ensuring the safety of users is maintained. This results in a medium residual risk.	Likely (Likely)	Minor (Moderate)	Medium (High)
Operation of the Project would result in the permanent loss of an area of public open space	CS6	Construction of the Project would result in the permanent loss of an area of urban open space and would change the land use of the area to road reserve. While this area has limited recreational value (excluding the use of Uriarra Track) constructing a new Access Road that bisects the area of open space would fragment this area and limit the amount of useable recreational area. The Project includes the provision for a minor diversion of Uriarra Track so that access is maintained across the Access Road with a safe crossing point during operation. This results in a high residual risk	Almost certain (Almost certain)	Minor (Moderate)	High (Very High)

7.5 Noise, Vibration and Lighting

Section Summary

- This Section provides an assessment of the potential noise, vibration and lighting impacts related to the construction and operation of the Proposal to the surrounding area.
- AECOM prepared a Road Traffic Noise Impact Assessment for the Project (AECOM, 2017b) which assesses impacts associated with the operation of the new and modified infrastructure.
- Generally the existing noise environment throughout the Project area is dominated by road traffic noise from Adelaide Avenue / Yarra Glen and Dudley Street to a lesser extent.
- Residential receivers are located to the north (on Denman Street and Kintore Crescent) and east of the Project (on Novar Street). There is a non-residential receiver (Yarralumla Uniting Church)
- Construction activities would generate noise and vibration through the use of plant and machinery (e.g. earthworks, mulchers, trucks, jackhammers etc). Out of hours works (e.g. night works) may be required to allow the safe construction of in-road works and to minimise traffic impacts.
- There may be a requirement for vibration emitting works to be undertaken within the nominated 'safe working' distances to Yarralumla Uniting Church during construction. The potential impacts would be managed through a suite of measures including continuous vibration monitoring.
- During the operational phase of the Project an exceedance of the noise criteria at the Yarralumla Uniting Church has been predicted. This impact is not considered significant however as these exceedances are during times when the church is not likely to be in use (e.g. night time).
- Light pollution is likely to be higher during the construction and operation of the Project due to the possibility of night-time construction activities and increased street lighting with the upgrade of Dudley Street and the provision of a new Access Road. Residents situated along Denman Street are already exposed to street lighting so the increase of street lighting on Dudley Street is unlikely to have a significant impact on residents.
- Noise, vibration and lighting impacts will be effectively managed through a Construction Noise, Vibration and Lighting Management Plan (CNVLMP).

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk #	Likelihood	Consequence	Risk Rating
Intermittent noise and vibration emitted from the equipment required to carry out the proposed construction of the Project impacting residential and non-residential receivers.	NVL1	Possible	Major	High
Long term noise and vibration impacts from the operation of the Project and use of Access Road by new residents of the Canberra Brickworks Precinct	NVL2	Possible	Catastrophic/ Significant	Very High
Local residents in surrounding suburbs exposed to increased levels of noise and vibration due to altered traffic patterns	NVL3	Unlikely	Major	Medium
Increased luminance for residents impacting amenity of sensitive receivers during construction and operation	NVL4	Possible	Moderate	Medium
Lighting impacts to nocturnal fauna	NVL5	Possible	Minor	Low

7.5.1 Investigations

A Road Traffic Noise Impact Assessment was undertaken for the Project (AECOM, 2017b). The assessment included establishing the existing background noise levels and road traffic noise criteria in the vicinity of Project. Surrounding sensitive receivers that may be impacted by the introduction of the

new and modified infrastructure have been identified and mitigation measures have been recommended, where necessary, to reduce and manage noise impacts from the Project. A construction noise, vibration and lighting assessment has also been undertaken to understand the potential temporary impacts to sensitive receivers during the construction activities.

Relevant noise guidelines, policies or standards applicable to the Project includes:

- *AS 2436 Guide to noise control on construction, demolition and maintenance sites*
- British Standard 6472:2008 'Guide to evaluation of human exposure to vibration in buildings'
- *Environment Protection Regulation 2005*
- German Standard *DIN 4150-Part 3 'Structural vibration in buildings – Effects on Structures'*
- Noise Environment Protection Policy, Environment Protection Authority
- Noise Measurement Manual, Environment Protection Authority.

7.5.2 Environmental conditions and values

Existing noise environment

The Project area is located within the southern extents of Yarralumla to the north of Deakin and consists largely of urban open space with the existing Dudley Street travelling from east to west. The closest residential receivers are located to the north of the Project on Denman Street and Kintore Crescent (around 60 metres from the Project at the nearest location) and to the east on Novar Street (around 40 metres from the Project). The Yarralumla Uniting Church is located between Dudley Street and Denman Street.

Road traffic noise from Dudley Street and the infrastructure corridor of Adelaide Avenue / Yarra Glen (which is located to the south of the Project) are the dominant noise sources in the Project area. There is also some noise contribution from more infrequent traffic along Denman Street. The existing noise environment at each individual noise receiver is generally dependent on the proximity to nearby roads.

In the wider vicinity of the Project are the residential receivers to the south in the suburb of Deakin, however the noise environment for these receivers is predominately controlled by traffic volumes on Adelaide Avenue / Yarra Glen).

Background noise monitoring

Unattended background noise monitoring was undertaken at three locations in the vicinity of the Project area to determine existing road traffic noise levels from the surrounding road network. Noise logging was undertaken over a period of nine days from 16 to 25 June, 2017.

A noise logger measures noise levels over the sample period and then determines L_{A1} , L_{A10} , L_{A90} and L_{Aeq} levels of the noise environment. The L_{A1} , L_{A10} and L_{A90} levels are the levels exceeded for one per cent, 10% and 90% of the sample period respectively. The L_{A1} is indicative of typical maximum noise levels. The L_{A90} is taken as the background noise level. The L_{Aeq} is the energy averaged noise level over a defined period. The $L_{A10(18hour)}$ is the noise level exceeded 10% of the time between 6 am and 12 am. This is the road traffic noise index used in the ACT.

Provided below in Table 27 is a summary of the measured noise levels. Noise logging locations are provided in Figure 37. The Road Traffic Noise Impact Assessment provides detailed charts illustrating the logged noise levels over the measurement periods.

Table 27 Road traffic noise logging results

Logger ID	Measurement location	Existing Sound Level, $L_{A10(18hour)}$ dB(A)
NL01	Parkland between Dudley Street and Denman Street, Yarralumla	55
NL02	12 Denman Street, Yarralumla	49
NL03	Yarralumla Uniting Church, Yarralumla	60



Figure 37 Noise logging locations

Road traffic noise criteria

The operational road traffic noise assessment criteria for road development were established within the ACT's *Noise Management Guidelines (Draft, March 1996)* (ACT Planning Authority, 1996). The criteria apply at building facades and within private open spaces. While the guidelines have been superseded by various Codes under the Territory Plan, the criteria are still applied to major road projects as a matter of planning practice. This Project involves the upgrade and minor realignment of an existing carriageway. As such the Project has been assessed as the upgrade of an existing road.

The applicable criteria for the affected sensitive receivers adjacent to a new road carriageway are provided below in Table 28.

Table 28 Maximum traffic noise levels resulting from upgraded roads in existing areas, expressed as $L_{A10(18\text{hour})}$ dB(A)
(From the ACT's *Noise Management Guidelines (Draft)*, March 1996, Table 3.3)

Existing traffic noise level at adjacent buildings ¹	Maximum traffic noise level at adjacent buildings after road works completed
> 63	Equal to existing road
58 - 63	63
< 58	Not more than 5 dB(A) above existing level

Notes: 1 - This noise level incorporates façade reflection.

The *Noise Management Guidelines (Draft)*, (ACT Planning Authority, 1996) recognises backyards, courtyards and similar areas as private open spaces for which an additional criterion of a maximum of 58 dB(A) $L_{10, 18 \text{ hour}}$, measured one metre inside the nearest boundary, must be met. These criteria are applicable to the following three scenarios:

- new development on existing road (in which case any acoustic requirements are the responsibility of the lessee)
- development of new road in new areas
- development of new road in existing areas

While the criteria is not strictly relevant for the redevelopment of an existing road, private open space was assessed within the rear yard of each affected residence.

Construction noise criteria

Section 29 of the ACT Environment Protection Regulation (2005) states that:

“Under section 25 (1), noise is not taken to cause environmental harm in an affected place if it is noise mentioned in schedule 2, table 2.3, column 2 and the conditions (if any) mentioned in column 3 for the noise are met.”

Clause 16 of Table 2.3 of the Regulation then places no conditions on the *“Noise emitted in the course of constructing or maintaining a major road, a dedicated bus way, a railway, or a light rail”*.

The Project would therefore not be subject to numerical noise limits. This means that there would be no substantive numerical noise level restrictions applicable to the construction of the Project.

It is relevant to reference Section 9.11 of the ACT Noise Environment Protection Policy (2010), which expands on the reasoning for the less onerous handling of noise created during the construction of major roads as follows:

The construction and maintenance of roads is central to the economic and social well-being of the community. The Regulation restricts the times at which roadworks can take place to limit noise nuisance while not unduly affecting traffic.

No time restrictions are placed on the construction and maintenance of major roads to enable work to take place during periods of low traffic flows.

Vibration criteria

Vibration can be defined as regularly repeated movement of a physical object about a fixed point. The parameter normally used to assess ground vibrations is the peak particle velocity (ppv) expressed in millimetres per second (mm/s). The usual thresholds for visibly detecting movements of susceptible moving parts is around 0.5 mm/s and the audible rattling of non-secured objects usually occurs when a level of 0.9 mm/s is reached. Some typical ground vibration levels associated with construction activities are shown in Table 29 and perception levels for humans are shown in Table 30.

Table 29 Typical ground vibration levels associated with construction activities

Construction Activity	Typical Ground Vibration Level
Vibratory roller	Up to 1.5mm/s @ 25 m – higher levels can occur but no damages are expected for building at distance > than 12 m.
Hydraulic rock breakers (typical level for a large rock breaker operating in hard sandstone)	4.5 mm/s @ 5m; 1.3 mm/s @ 10m; 0.4 mm/s @ 20m; 0.1 mm/s @ 50m
Compactor	20 mm/s @ 5m; 2 mm/s @ 15m; <0.3mm/s @30m
Bulldozer	1-2 mm/s @ 5m; 0.1 mm/s @ 50m
Truck traffic (smooth surface)	<0.2 mm/s @ 20m
Truck traffic (rough surface)	<2 mm/s @ 20m

Table 30 Human perception of vibrations

Vibration level, mm/s	Degree of perception
0.10	Not felt
0.15	Threshold of perception
0.35	Barely noticeable
1.0	Noticeable
2.2	Easily noticeable
6.0	Strongly noticeable

Vibration intensive activities such as the use of hydraulic hammers must be operated so as to minimise disturbance to the occupants of buildings and avoid the risk of damage to buildings and other structures. The German Standard *DIN 4150-Part 3 'Structural vibration in buildings – Effects on Structures'* provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration. If cosmetic damage is avoided then structural damage will not occur.

The New South Wales Department of Environment, Climate Change and Water (DECCW) publication *Assessing Vibration: A Technical Guideline* recommends safe working distances to minimise disturbance to occupants of nearby buildings and is based on *British Standard BS 6472:2008 'Guide to evaluation of human exposure to vibration in buildings'*. Safe working distances for typical vibration inducing equipment have been developed from project experience and are listed in Table 31.

Table 31 Examples of safe working distances for typical vibration intensive plant

Plant	Rating/Description	Safe Working Distance	
		Cosmetic Damage	Human Response
Vibratory Roller	< 50 kN (Typically 1-2 t)	5 m	15-20 m
	< 100 kN (Typically 2-4 t)	6 m	20 m
	< 200 kN (Typically 4-6 t)	12 m	40 m
	< 300 kN (Typically 7-13 t)	15 m	100 m
	> 300 kN (Typically 13-18 t)	20 m	100 m
	> 300 kN (> 18 t)	25 m	100 m
Small Hydraulic Hammer	(300 kg – 5-12 t excavator)	2 m	7 m
Medium hydraulic hammer	(900 kg – 12-18 t excavator)	7 m	23 m
Large hydraulic hammer	(1,600 kg – 18-34 t excavator)	22 m	73 m
Vibratory pile driver	Sheet piles	2–20 m	20 m
Pile Boring	≤ 800 mm	2 m	N/A
Jackhammer	Handheld	1 m nominal	Avoid contact with structure

Road traffic noise modelling methodology

Road traffic noise levels were calculated using SoundPLAN software, which implements the Calculation of Road Traffic Noise (CoRTN) algorithm. The UK Department of Transport devised the CoRTN algorithm and with suitable corrections, this method has been shown to give accurate predictions of road traffic noise under Australian conditions. The modelling parameters which are included in the model are detailed in the Road Traffic Noise Impact Assessment.

A traffic survey was undertaken from the Project using vehicle tube counts over the noise logging period (i.e. June 2017). Using this data, estimated traffic counts for the Year 2029 was determined for the Project area. The traffic flows which were included in the noise model are detailed in Table 32.

Table 32 Traffic flows for the years 2017 and 2029

Section	Existing - Year 2017		Design - Year 2029	
	Total vehicles (Veh/18hrs)	Heavy vehicles %	Total vehicles (Veh/18hrs)	Heavy Vehicles %
Dudley Street	7,885	4.3	9,791	4.3
Cotter Road	17,937	4.5	21,656	4.5
Adelaide Avenue	27,097	4.8	31,974	4.8

Road traffic noise emission was calculated using the CoRTN algorithm contained within the SoundPLAN 7.4 software road traffic module. Point receivers were modelled 1.5 metres above the ground at the same locations as measurements were taken. The results of the validation of the noise model are presented below in Table 33.

Table 33 Noise model validation

Noise Logger	Location	Measured $L_{Aeq(18hr)}$, dB(A)	Predicted $L_{Aeq(18hr)}$, dB(A)	Difference
NL01	Parkland, Dudley Street, Yarralumla	55.3	55.2	-0.1
NL02	12 Denman Street, Yarralumla	49.3	49.9	+0.6
NL03	Yarralumla Uniting Church, Yarralumla	60.0	60.2	+0.2

The results presented in Table 33 indicate that the noise model is generally over predicting up to 0.6 dB. The CoRTN algorithm is considered to have an accuracy of ± 2 dB(A). While the noise model is slightly over-predicting (resulting in a marginally conservative model), it is well within the acknowledged tolerance of the algorithm. As such the model is considered appropriate for the assessment of the Project.

7.5.3 Potential impacts

Construction phase

Construction noise impacts

Construction of the Project would generate noise which has the potential to impact local residential and non-residential receivers. The most noise intensive construction activities includes:

- establishment and use of site compound and utilities relocations
- vegetation removal, including the use of chain saws and mulchers
- earthworks, including the use of graders, excavators, trucks and rock breakers
- pavement works on the existing Dudley Street including road saws, rock breakers, jackhammers, road profilers, excavators and trucks
- structural works including construction of road and culvert strengthening expected to involve piling rigs, cranes, concrete trucks and rollers/compactors

These noise intensive works are likely to be audible by the sensitive receivers on Denman Street and Novar Street to differing extents. Noise intensive works would be scheduled to be undertaken during standard construction hours (see Section 3.2.3) where possible to minimise disturbance. Where out of hours works (e.g. night works) are required to minimise safety and traffic issues, potentially impacted residential receivers would be notified prior to the works occurring.

During construction, the use of the noise intensive equipment is likely to be for short confined periods only, spread over the 12 months construction period, i.e. not all equipment would be operating simultaneously at all times in any one location with reduced impact.

The use of the construction compound would be a continuous source of noise with machinery and vehicles being used in this location regularly throughout construction. The construction compound is located in an area away from sensitive residential receivers and is unlikely to create significant construction noise impacts.

Works adjacent the Yarralumla Uniting Church has the potential to cause nuisance to the church users. Works undertaken in this location would typically be undertaken during standard construction hours when background noise levels are higher reducing any impacts. Night time works are unlikely to impact the church as it would not be in use. The church office is open on Wednesdays from 12-3pm and Sundays from 9:30am for service.

Consideration will be given to the use of solid hoardings or temporary noise barriers to minimise adverse noise impacts at the eastern construction compound once construction activities have been confirmed by the contractor. Details of this assessment would be incorporated into a Construction Noise, Vibration and Lighting Management Plan (CNVLM) to be prepared prior to construction.

Construction vibration impacts

The ACT does not regulate the assessment of human comfort vibration impacts from construction projects. It is considered that temporary disturbances and infrequent events of short term duration (such as the vibration generated by construction or excavation) are acceptable.

The major potential sources of construction vibration are during vibratory rolling, vibratory piling and when using a rock breaking attachment on an excavator. Rock breaking, rock hammering and sheet piling are also considered to have the potential to cause dynamic loading in some structures.

The separation distance(s) between the proposed works and the nearest receivers would generally be sufficient so that nearby buildings are unlikely to suffer 'cosmetic damage' for most of the proposed construction activities. However, based on the general work zones, some items of construction equipment have the potential to be operated within the recommended 'safe working' distances (as detailed in Table 31) for nearby buildings (e.g. Yarralumla Uniting Church). There are no heritage-listed structures located within the safe working distances.

Where works are required within the safe working distances (as detailed in Table 31), the potential vibration impacts would be managed through a suite of measures including continuous vibration monitoring and notification to the affected occupiers prior to works occurring. Pre-construction dilapidation surveys are recommended for all properties within 100 metres of the Project area.

Operational phase

A noise prediction model for the operation of the Project has been developed using SoundPLAN 7.4 noise propagation software. Provided below in is a summary of the operational noise assessment that modelled existing and future predicted noise levels at the most affected façade of each residential building within the vicinity of the Project.

Table 34 Predicted road traffic noise levels

Location ¹	L _{A10(18hour)} noise level, dB(A)				Exceeds
	2017	2029	Increase	Criteria	
3/16 Woolls Street, Yarralumla	49	50	1.2	54	No
4/16 Woolls Street, Yarralumla	48	49	1.2	53	No
2/16 Woolls Street, Yarralumla	50	51	1.1	55	No
16 Woolls Street, Yarralumla	50	51	1.1	55	No
9 Woolls Street, Yarralumla	47	48	1.1	52	No
11 Woolls Street, Yarralumla	48	49	1.2	53	No
5 Woolls Street, Yarralumla	46	47	1.2	51	No
3 Woolls Street, Yarralumla	45	47	1.1	50	No
1 Woolls Street, Yarralumla	48	49	1.1	53	No
9 Maxwell Street, Yarralumla	48	49	1.1	53	No
11 Maxwell Street, Yarralumla	48	49	1.0	53	No
4 Blakely Row, Yarralumla	46	48	1.2	51	No
6 Blakely Row, Yarralumla	47	48	1.1	52	No
8 Blakely Row, Yarralumla	50	51	1.2	55	No
8 Blakely Row, Yarralumla	47	48	1.2	52	No
20 Abbott Street, Yarralumla	49	51	1.3	54	No
22 Abbott Street, Yarralumla	49	50	1.4	54	No
5 Fraser Place, Yarralumla	56	56	0.9	61	No
3 Fraser Place, Yarralumla	58	59	0.8	63	No
Yarralumla Uniting Church	64	65	1.1	64	Yes
3 Denman Street, Yarralumla	58	59	1.0	63	No
2 Denman Street, Yarralumla	61	62	0.7	63	No
4 Denman Street, Yarralumla	54	55	0.1	59	No
6 Denman Street, Yarralumla	55	55	0.9	60	No

Location ¹	L _{A10(18hour)} noise level, dB(A)				Exceeds
	2017	2029	Increase	Criteria	
19 Abbott Street, Yarralumla	56	57	1.0	61	No
17 Abbott Street, Yarralumla	54	55	1.3	59	No
24 Abbott Street, Yarralumla	53	54	1.1	58	No
12 Denman Street, Yarralumla	53	54	1.0	58	No
14 Denman Street, Yarralumla	52	53	1.0	57	No
16 Denman Street, Yarralumla	52	53	0.9	57	No
18 Denman Street, Yarralumla	52	53	0.9	57	No
20 Denman Street, Yarralumla	52	53	0.8	57	No
22 Denman Street, Yarralumla	50	51	1.1	55	No
12 Maxwell Street, Yarralumla	51	52	0.9	56	No
24 Denman Street, Yarralumla	49	50	1.1	54	No
26 Denman Street, Yarralumla	51	52	0.9	56	No
28 Denman Street, Yarralumla	49	50	1.1	54	No
30 Denman Street, Yarralumla	50	51	1.1	55	No
7 Woolls Street, Yarralumla	46	47	1.2	51	No

Notes: 1 – Results are presented for noise sensitive receivers in Yarralumla only. This is due to the fact that road traffic noise impacting noise sensitive receivers in Deakin is controlled by traffic travelling on Tourist Drive 5.

A single exceedance has been identified at Yarralumla Uniting Church. Noise levels at this receiver are predicted to increase by 1.1 decibel in the future (a combination of both traffic growth and the design change), resulting in a one decibel exceedance of the applicable criteria. A change in noise levels of up to two decibels is typically considered indiscernible and therefore the operational noise impacts as a result of the Project are considered to be minor.

Reviewing the noise logger charts, the maximum one hour noise levels which contribute to the predicted exceedance are during the afternoon peak between 4 pm and 6 pm on weekdays. While the church may be in use at these times, it does not coincide with the main service time (typically Sunday 9:30 am) and the standard office hours (typically Wednesday 12 pm to 3 pm). Based on the noise logging results, noise levels during Sunday service are expected to be 5 dB lower than those presented in Table 34 and hence compliant with the applicable noise criterion. Therefore although a noise exceedance at the Yarralumla Uniting Church has been predicted, it is not expected to have a significant impact.

Private open spaces

Noise contours showing noise levels in private open spaces are provided in the Road Traffic Noise Impact Assessment (AECOM, 2017b). The noise contours highlight that compliance with the private open space criteria would be achieved at all locations, except 1 Fraser Place, Yarralumla. Noise levels at this location already exceed the private open space criteria, and are predicted to increase by less than one decibel. Noise mitigation is not considered to be required as the change in noise would not likely be discernible.

Lighting impacts

The Project involves the modification of Dudley Street including the construction of shared use paths and the provision of a new Access Road. New street lighting would be installed along Dudley Street and the Access Road which will increase the overall street lighting in the area. There would also be the use of temporary lighting during construction to allow out of hours works to be undertaken safely and to improve the safety of road users navigating the temporary diversions around the working areas.

The Project design lighting requirements are as follows:

- the Access Road lighting has been designed to AS/NZS 1158.3 category P4 with a maximum light column spacing of 63 metres alternating between each side of the road. Parallel paths also achieve category P4 without the need for additional light columns

- The lighting at the proposed roundabout will likely be designed to category V5 using the illuminance method for the detailed design and subject to TCCS requirements and approval
- The section of Dudley Street between the roundabout and Cotter Road is to be designed to category V5 in the Detailed Design and subject to TCCS requirements and approval
- The informal Uriarra Track would not be lit except at the crossing point of the Access Road.

The Project area currently has light pollution in the form of existing street lighting, residential development and traffic flow. Light pollution is likely to be higher as a result of the Project during construction and operation. Residents situated along Denman Street / Kintore Crescent are already exposed to street lighting along these streets and consequently the increase of street lighting on Dudley Street is unlikely to have a significant impact on residents.

There are potential lighting impacts on fauna species that utilise the area. The most likely impact would be to non-threatened nocturnal birds, bats and arboreal mammals inhabiting the Project area.

7.5.4 Mitigation measures

Prior to commencement of works, a CNVLMP would be prepared and implemented in accordance with the requirements of the *Guidelines for the preparation of Noise Management Plans for development applications* (EPA, 2014) and the Road Traffic Noise Impact Assessment (AECOM, 2017b).

The following mitigation measures will be implemented to manage potential noise impacts:

- The CNVLMP would outline measures to reduce the noise impact from construction activities. Reasonable and feasible noise mitigation measures which are to be considered, include:
 - regularly training workers and contractors (such as at the site induction and toolbox talks) on the importance of minimising noise emissions and how to use equipment in ways to minimise noise
 - avoiding any unnecessary noise when carrying out manual operations and operating plant
 - ensuring spoil is placed and not dropped into awaiting trucks
 - avoiding/limiting simultaneous operation of noisy plant and equipment within discernible range of a sensitive receiver where practicable
 - switching off any equipment not in use for extended periods e.g. heavy vehicles engines are to be switched off whilst being unloaded
 - avoiding deliveries at night/evenings wherever practicable
 - no idling of delivery trucks
 - keeping truck drivers informed of designated vehicle routes, parking locations and acceptable delivery hours for the site
 - minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios onsite; no dropping of materials from height where practicable, no throwing of metal items and slamming of doors.
- The CNVLMP would include measures to reduce the construction noise and vibration impacts from mechanical activities. Reasonable and feasible noise mitigation options which are to be considered, include:
 - maximising the offset distance between noisy plant and adjacent sensitive receivers and determining safe working distances
 - using the most suitable equipment necessary for the construction works at any one time
 - directing noise-emitting plant away from sensitive receivers
 - regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc

- using non-tonal reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise-sensing alarms for all plant used regularly onsite (greater than one day), and for any out of hours works
- use of quieter and less vibration emitting construction methods where feasible and reasonable.
- Works would generally be carried out during standard construction hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). Any works outside these hours may be undertaken if approved by ACT Government and the community is notified prior to these works occurring
- For construction concentrated in a single area (e.g. eastern construction compound) temporary acoustic fencing/barriers around the site perimeter would be considered where feasible and reasonable to mitigate off-site noise levels
- The construction staging strategy would prioritise the use of the western construction compound rather than the eastern compound (e.g. during the use of vegetation mulchers)
- Night works would be programmed to minimise the number of consecutive nights work impacting the same receivers
- Out of hours works would be minimised as much as practicable (e.g. deliveries of equipment and materials could be made during standard hours, and/or disposal of construction waste may be delayed until on the following day).

The following mitigation measures will be implemented to manage potential vibration impacts:

- to avoid structural impacts as a result of vibration or direct contact with structures, the proposed works are to be undertaken in accordance with the safe work distances outlined in Table 31 and attended vibration monitoring or vibration trials are to be undertaken where these distances are required to be challenged
- if construction works are proposed within the safe working distances, a permanent vibration monitoring system is to be installed around one metre from the building footprint to warn operators in real time when vibration levels are approaching the maximum vibration criteria. This may include the use flashing lights, SMS, or alarm system
- building condition surveys are to be completed for buildings within 100 metres of the Project both before and after the works to identify existing damage and any damage due to the works
- lower vibration generating items of excavation plant and equipment e.g. smaller capacity rock breaker hammers are to be used where feasible

The following mitigation measures will be implemented to manage potential lighting impacts:

- lighting requirements for the Project would be designed to AS/NZS standards and TCCS requirements and approval
- directional lighting would be implemented during construction and light spillage will be minimised using light shields and reducing light heights.
- at night, the strategy for lighting would be to ensure the Project contributes to a safe and legible streetscape. In particular, the lighting required for the Project would be mitigated as follows:
 - all lights would be located at a similar level to the overhead catenary system so to minimise the light spill onto adjacent areas
 - all lights would be directed downwards, with the exception of feature lighting that would always be capped by a surface material
 - light colour would be designed in response to the surrounding context and be selected to complement the surrounding lighting colour.

7.5.5 Residual risks

Based on the mitigation measures identified in Section 7.5.4, an assessment of the residual noise, vibration and lighting risks associated with the Project have been considered (for risks previously identified as being medium or above). Residual risks identified for the noise, vibration and lighting values are provided in Table 35.

Table 35 Residual risks for noise, vibration and lighting

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Intermittent noise and vibration emitted from the equipment required to carry out the proposed construction of the Project impacting residential and non-residential receivers.	NVL1	Implementation of a CNVLMP and the proposed mitigation measures results in a medium residual risk.	Possible (Possible)	Moderate (Major)	Medium (High)
Long term noise and vibration impacts from the operation of the Project and use of Access Road by new residents of the Canberra Brickworks Precinct	NVL2	The operational noise modelling assessment undertaken has determined there is unlikely to be long term noise and vibration impacts from the operation of the Project. This results in a low residual risk.	Unlikely (Possible)	Moderate (Catastrophic/ Significant)	Low (Very High)
Local residents in surrounding suburbs exposed to increased levels of noise and vibration due to altered traffic patterns	NVL3	The operational noise modelling assessment undertaken has determined there is unlikely to be long term noise impacts from the operation of the Project. results in a very low residual risk	Unlikely (Unlikely)	Minor (Major)	Very Low (Medium)
Increased luminance for residents impacting amenity of sensitive receivers during construction and operation	NVL4	Mitigation measures proposed include directional lighting being implemented during construction and light spillage being minimised using light shields and reducing light heights. This results in a very low residual risk.	Unlikely (Possible)	Minor (Moderate)	Very Low (Medium)
Lighting impacts to nocturnal fauna	NVL5	Mitigation measures proposed would include all lights to be directed downwards, with the exception of feature lighting that would always be capped by a surface material. This results in a very low residual risk.	Unlikely (Possible)	Minor (Minor)	Very Low (Low)

7.6 Soils and Geology

Section Summary	
- This Section considers the soil and geological characteristics of the Project area. - Potential impacts of erosion and sedimentation, and contamination are also considered within this section, and mitigation measures for potential impacts have been recommended. - There are areas of high erosion risk south of Dudley Street, in particular where the existing drainage line is located. Erosion control measures would be implemented during construction. - There is a low risk of soil contamination within the Project area. Any unexpected contamination finds would be managed in accordance with an unexpected finds procedure.	

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk #	Likelihood	Consequence	Risk Rating
Inadequate investigation of site geotechnical issues necessitates resulting in additional works, delays to works and contractor claims	SW1	Unlikely	Major	Medium
Disturbance of currently unidentified contaminated soils during construction	SW2	Possible	Major	High
Contamination remediation activities reveal larger extent of contamination than expected	SW3	Unlikely	Major	Medium
Disturbance of soil associated with construction leading to increased soil and sediment erosion	SW4	Likely	Major	Very High
Soil structure decline affects viability of open space areas and health of retained trees	SW5	Possible	Major	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	SW6	Possible	Major	High
Increased potable water use	SW7	Likely	Moderate	High

7.6.1 Investigations

A number of soil, geological and contamination investigations have been undertaken for the Project area and wider Canberra Brickworks Precinct development, including:

- Preliminary (Environmental) Site Investigation Canberra Brickworks (SMEC, 2014)
- Canberra Brickworks: Detailed Environmental and Geotechnical Site Investigation Canberra Brickworks Precinct, Yarralumla, ACT 3002523 (SMEC, 2016)
- Contaminant Management Plan (CMP) Canberra Brickworks Remediation Project Portions of Blocks 1 and 20 Section 120 and Block 1, Section 127 Yarralumla, ACT 2600 (Robson, 2015)
- Geotechnical Investigation – Proposed Road Upgrading Dudley Street, Yarralumla Report (Douglas Partners, 2017)
- CBP Access Road and Dudley Street Upgrade: Contamination Due Diligence Assessment (AECOM 2017c)
- Site Audit of Canberra Brickworks, ACT (LBJ 14/02) Interim Audit Advice #8 From Review of Access Road into Canberra Brickworks Precinct and Dudley Street upgrade (Geosyntec, 2018).

The Project area contains a site listed on the EPA contaminated lands register which further details of the contamination risk included in: Contaminated Land Search Block 1 Section 127 Yarralumla Canberra Central, ACT Government (reviewed in July 2017).

7.6.2 Environmental conditions and values

Regional geology

The Geology of Canberra 1:100, 000 Sheet 8287 (1992) shows that the Project area is underlain by calcareous and tuffaceous mudstone and siltstone of the Late Silurian Yarralumla Formation. The Yarralumla formation is a sequence of tuffaceous siltstone, sandstone and limestone deposited in the Silurian Period, 425 million years ago (SMEC, 2014). The Yarralumla formation is the only fossiliferous, marine unit within the extensive volcanic marker horizon in determining the stratigraphy of the volcanic rocks, and through its fossil fauna, provides evidence of the age of the volcanics.

Soils

The Project area lies on the Williamsdale soil landscape, with undulating rises and local relief typically below 10% in natural terrain. Topsoil within the Project area generally overlies shallow residual soil which extends typically to 0.4-0.8 metres below ground level (SMEC, 2014). Geotechnical investigations along the existing Dudley Street alignment (Douglas Partners, 2017) identified topsoil to a depth of between 0.05-0.2 metres below ground level (top of rock at 0.1-1.3 metres below ground level). Residual soil consists of low to medium plasticity, very stiff to hard, orange brown and red brown clay with varying amounts of well graded, sub-angular medium grained gravels. Residual soil thickness decreases upslope, resulting in several observable outcrops of weathered siltstone bedrock. Alluvial soils are found at the lowest point of the Project area, in an old drainage line now used for drainage beneath Cotter Road.

Erosion risk

The Project area contains a mixture of areas of high erosion risk and areas of very low erosion risk as shown in Figure 38 . The areas of high erosion risk is associated with the drainage line that crosses Dudley Street and drains beneath Cotter Road near to the western construction compound.

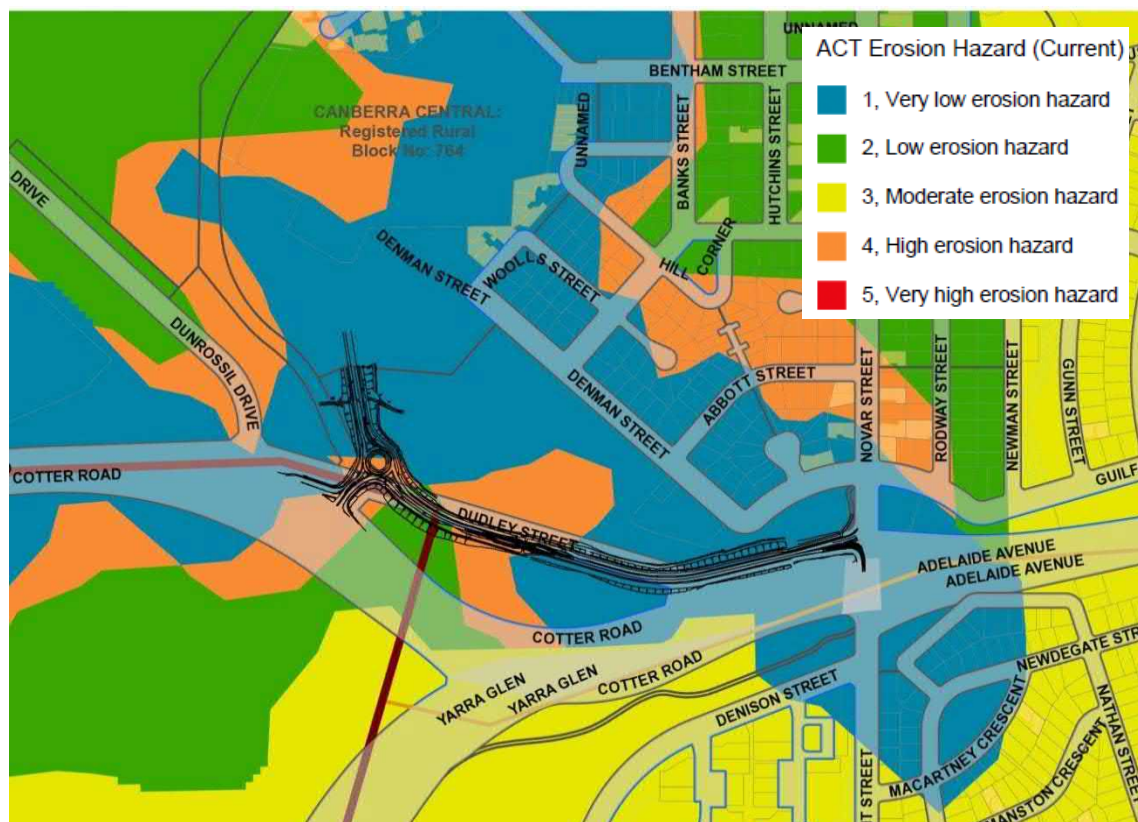


Figure 38 Erosion risk within the Project area (data source: ACTMapi)

Acid sulphate soils

A search of Australian Soil Resource Information System identified there is an extremely low probability of occurrence of acid sulphate soils (ASS) within the Project area (ASRIS 2017). This was supported by the Geotechnical Investigation undertaken by (Douglas Partners, 2017) which determined that there was no presence of ASS within the Project area.

Contamination

A contaminated land search was conducted and identified that Block 1, Section 127, Yarralumla Canberra Central was listed in the Environment Protection Authority (EPA) contaminated sites database as historic landfilling activities undertaken within adjacent Blocks 1 and 20 in Section 102 may have impacted Block 1, Section 127. A Contamination Due Diligence Assessment (AECOM, 2017c) was prepared for the Project area which reviewed previous site contamination investigations conducted and Contamination Management Plan for Canberra Brickworks Precinct (Robson, 2015).

The asbestos reported within the Canberra Brickworks Precinct was confirmed to be capped in an area that did not overlap with the Project area and the assessment concluded that contamination is unlikely to present any significant environmental constraint to the Project.

A former railway line traverses the northern extent of the Project area. Based on aerial photographs provided in SMEC (2014), the railway line is visible from 1951 (first available photograph) until 1979, but does not appear to be operational. SMEC (2014) indicates that the railway line was only operational for a short period in the 1920s and was free of railway infrastructure (track, ballast, sleepers) during the site investigations. SMEC (2014) identified three areas of environmental concern (AEC) applicable to the Project area as detailed in Table 36.

Table 36 Areas of Environmental Concern (SMEC, 2014)

AEC No.	Sources of contamination	Contaminants of potential Concern
29 - Railway line	Treated timber railway sleepers Asbestos from brake pads Vegetation control	Pesticides, including heavy metals, Polycyclic Aromatic hydrocarbons (PAHs)* Asbestos containing materials [ACM] Herbicides
30 – Vehicle tracks (site wide)	Spills and leaks	Total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylenes (BTEX), PAHs
32 – Fill (Road)	Fill at TP02	TPH, BTEX, PAHs, Phenols, polychlorinated biphenyls (PCBs), herbicides, pesticides, asbestos

* Not specifically identified as a CoPC in this AEC but identified as a CoPC associated with timber treatment.

Limited intrusive investigation was undertaken as part of SMEC (2014), which included excavation of five test pits in the vicinity of the Project area:

- TP12, TP13 and TP14 along the Railway Corridor
- TP02 and TP03 in the vicinity of Cotter Road.

Of the five locations, fill was encountered in one test pit (TP02), described as silty cobbles to gravelly sand with traces of brick and bitumen. The presence of fill was considered likely to be associated with road construction activities. SMEC (2014) stated that concentrations of CoPC were below the adopted health investigations levels (HILs) for low-density residential land use and were generally below the laboratory limits of reporting (LOR).

Overall, SMEC (2014) concluded that the potential for contamination in the Project area was low.

Further to this conclusion an EPA Accredited Site Auditor's opinion was sought to confirm that the potential for contamination in the Project area is low. A response was received from the auditor on 23 February 2018 which stated that based on the review of design documents for the Project, it is the Auditor's opinion that the risk of the Project being affected by historical contamination issues from the brickworks operations is negligible. The Auditor's full response is provided in **Appendix D**.

7.6.3 Potential impacts

Construction phase

The Project requires significant earthworks due to the existing topography of the Project area as described in Section 3.2.4. The most significant ground disturbance works would be the construction of the Access Road which would sit (at final level) around two metres below the existing topography.

Erosion and sedimentation

During all stages of construction, there is the potential for soil erosion and sedimentation. Construction activities for the Project would result in considerable disturbance to soils, which have the potential to impact water quality unless appropriately managed through erosion and sediment control measures.

Construction activities which can cause erosion and sedimentation include:

- removal and installation of general fill and earthworks (including trenching)
- movement of heavy vehicles and machinery across exposed earth
- stockpiling of materials at construction sites, including any crushed materials
- vegetation removal, including the removal of planted trees along the alignment.

Any impacts of erosion and sedimentation are intensified when there is greater exposure to rainfall and runoff. There is also potential for rain and wind-induced erosion of unsecured stockpiles and exposed ground. This could result in sedimentation impacts to water bodies downstream of the Project area. Such impacts can lead to an adverse environmental impact on biodiversity.

The implementation of effective localised erosion and sediment control measures aimed at minimising erosion and the volume of sediment which is transported from disturbed areas will ensure soils, geology, vegetation and fauna habitat is adequately protected. It is expected that erosion risks could be adequately managed through the implementation of standard construction erosion and sediment control measures and the development of an Erosion Sediment Control Plan.

Contamination

Excavation also has the potential to expose contaminants, which if not appropriately managed, can present a health risk to construction workers and the community. The exposure of contaminants could also pose an environmental risk if they were to enter nearby waterways through the stormwater infrastructure.

Previous assessments have concluded that the contamination is unlikely to present any significant environmental constraint to the Project. However, if contaminated soils are detected during construction activities they have the potential to disperse into the surrounding receiving environment, including air and water.

There is also potential for activities to result in the contamination of soil through accidental fuel or chemical spills from construction plant and equipment. These impacts would be managed through the development of appropriate construction management and detailed in the CEMP to be prepared prior to construction.

Operational phase

There would be no operational risks to geology or soils as a result of the Project.

7.6.4 Mitigation measures

Management of soil erosion during and following construction is an important consideration in the development of appropriate construction methods during the detailed design stage. Where the need for specific environmental controls is identified, requirements would be set out in the CEMP to describe any additional requirements associated with key elements of the Project. The CEMP will include an Unexpected Finds Protocol to be implemented in the unlikely event that indicators of contamination are encountered.

The following mitigation measures would be implemented to mitigate soil and geology impacts:

- A progressive Erosion and Sediment Control Plan (ESCP) would be developed prior to construction and developed as site conditions change. The ESCP should contain at a minimum:
 - installation/use of siltation fences and other filtering devices to restrict sediment movements to within the work sites and to prevent any movement of sediment off-site
 - installation of a physical barrier such as cut-off drains at the entry or exit to the work area to contain sediment laden runoff within the work area and construction compound
 - location of stockpiles away from drainage lines
 - directing uncontaminated rainwater away from potentially contaminated areas, such as storage and washing areas
 - storage of chemicals within a bunded, roofed area to protect the stormwater system in case of leaks and spills. Maintenance of a spill kit on site if the activity may result in a spillage
 - revegetation of construction areas as soon as practically possible after construction activities have been completed
 - management of stockpiles using of sediment and erosion control measures including sediment fencing and drainage swales, bunding around stockpiles and covers
 - restriction of construction traffic in unsealed areas and, where required, operation of wheel cleaning areas at locations where vehicles leave the construction site. Vehicles to be checked of weeds.
 - the design of erosion and sediment controls during the design phase in accordance with the *'Environment Protection Guidelines for Construction and Land Development in the ACT'* which are available from the EPA website (ACT Environment Protection Authority, 2011).
- existing vegetation on site would be retained as long as possible and only cleared when required for construction
- the drainage line in the southern extents of the Project area would be monitored to ensure sediment is not leaving the construction areas and entering water bodies
- offsite runoff would be diverted around or through the construction areas so it would not mix with onsite construction runoff. This would be achieved using temporary or permanent diversion drains to minimise the volume of flow through the construction area
- disturbed areas would be stabilised as soon as possible following disturbance including that installation of scour protection on any disturbed embankments immediately following excavation
- appropriate sediment controls (e.g. wheel wash facilities) would be provided at site egress points, to prevent the tracking of mud or loose sediment off site
- erosion and sediment control measures would be regularly inspected (particularly following rainfall events) to ensure their ongoing functionality; and would be left in place until the works are complete and areas are stabilised
- works would be avoided during rainfall (or whilst the ground remains sodden) in unsealed areas, where practicable, to minimise vehicle disturbance to the topsoil
- if unexpected finds of contaminated material are identified during construction, it would be managed and either re-used or disposed of appropriately in accordance with all relevant legislation and ACT EPA guidelines.

7.6.5 Residual risks

Based on the mitigation measures identified in Section 7.6.4, an assessment of the residual contamination and soil risks associated with the Project have been considered (for risks previously identified as being medium or above). Residual risks identified for the soils and geology values are provided in Table 26.

Table 37 Residual risks for soils and geology

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Inadequate investigation of site geotechnical issues results in additional works, delays to works and contractor claims	SG1	Various investigations of the soil, ground and contamination risks present in the Project area have been undertaken as detailed in Section 7.6.1.	Unlikely (Unlikely)	Moderate (Major)	Low (Medium)
Disturbance of currently unidentified contaminated soils during construction	SG2	Mitigation measures proposed results in a low residual risk..	Unlikely (Possible)	Moderate (Major)	Low (High)
Contamination remediation activities reveal larger extent of contamination than expected	SG3	The results of the soil and groundwater contamination testing do not indicate the presence of contamination within the Project area. Implementation of contaminated land mitigation measures in the CEMP will reduce the consequence of revealing larger extents of contamination than expected from major to moderate. This results in a low residual risk.	Unlikely (Unlikely)	Moderate (Major)	Low (Medium)
Disturbance of soil associated with construction leading to increased soil and sediment erosion	SG4	Development of an ESCP and the implementation of the proposed mitigation measures results in a medium residual risk.	Unlikely (Likely)	Major (Major)	Medium (Very High)
Soil structure decline affects viability of open space areas and health of retained trees	SG5	Development of an ESCP and the implementation of the proposed mitigation measures results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (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	SG6	Development of an ESCP and the implementation of the proposed mitigation measures results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)

7.7 Water and flooding

Section Summary

- This Section describes the current hydrology and hydrogeology conditions within the Project area, as well as the flooding potential and the changes the Project would have on these values.
- Potential impacts addressed include stormwater and drainage, reduced water quality, changes in groundwater availability and changes in overland flow.
- The Project would change existing flow paths and overland flow in the Project area. During construction, stormwater would be managed by the temporary diversion of local overland flow paths around the construction works. These temporary diversions of local overland flows paths would not have any significant impact on the local stormwater system but would be maintained during the construction period.
- The Project would involve the sealing of the ground surface using concrete, asphalt pavement or similar hard surfaces. This would result in an overall increase in hardstand area, which would reduce the total impervious area of the Project area. However the area to be sealed is relatively small and would contain appropriate drainage diverted to the downstream drainage network so the risk to reducing groundwater recharge is likely to be relatively low.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk #	Likelihood	Consequence	Risk Rating
Local and regional drainage conditions altered	HYD1	Likely	Moderate	High
Increase in flood levels as a result of the Project	HYD2	Possible	Major	High
Changes to existing flow paths and overland flow due to proposed Project	HYD3	Likely	Major	Very High
Potential changes to groundwater availability due to vegetation removal or excavation including impacts on groundwater dependent ecosystems and water users within the catchment	HYD4	Possible	Moderate	Medium

7.7.1 Investigations

Previous environmental investigations which been undertaken for the Project or wider Canberra Brickworks Precinct, relevant to surface water, groundwater and flooding are:

- Preliminary (Environmental) Site Investigation Canberra Brickworks (SMEC, 2014)
- Canberra Brickworks: Detailed Environmental and Geotechnical Site Investigation Canberra Brickworks Precinct, Yarralumla, ACT 3002523 (SMEC, 2016)
- Geotechnical Investigation – Proposed Road Upgrading Dudley Street, Yarralumla Report (Douglas Partners, 2017)

7.7.2 Environmental Conditions and Values

Surface water

Regional hydrology

The Project area is located in the western edge of the Central Molonglo Water Catchment Area and adjacent to the Lower Molonglo Catchment Area. The Central Molonglo Catchment Area is a sub catchment of the Molonglo Catchment Area which comprises around 212,000 hectares within the Murrumbidgee catchment in south-eastern NSW and the ACT. It includes all the land that drains into the Molonglo River and Lake Burley Griffin, including the Queanbeyan River, and tributaries.

Local hydrology

On a local scale, the Project area sits on a minor local topographic high, with the ground surface sloping south and south west towards Yarralumla Creek, which discharges into the Molonglo River.

The Project area is located in the Yarralumla Creek Catchment which is a sub-catchment that transverses across both the Central Molonglo Water Catchment Area and the Lower Molonglo Catchment Area. The Yarralumla Creek Catchment is summarised as follows:

- highly urbanised with only small remnant areas of nature reserve
- older network of stormwater pipes and concrete-lined channels, designed to transfer water out of the area as quickly as possible, result in fast-flowing run-off capable of causing rapid soil erosion
- water flowing from the stormwater drains is of poor quality, containing soil and sediment, organic matter (leaves and garden waste) and animal faeces
- hard surfaces like roofs, roads and paving transport pollutants and nutrients into the stormwater system
- the main waterway, Yarralumla Creek, discharges high levels of sediment and nutrient loads into the Molonglo River

There are no waterways within the Project area, however there is an existing drainage line located in the southwest corner of the Project area between Dudley Street and Cotter Road with a pipe culvert located under Cotter Road. There are two existing culvert crossings on Dudley Street of 750mm and 375mm diameter in size. The Project area generally slopes to the southwest. Overland clear water flow within the Project area has been mapped based on the topography to generally flow south towards Yarralumla Creek.

The largest sub catchment in the vicinity of the Project area flows towards the existing 750mm diameter culvert. There is evidence of clear water and grey flow to the drainage line in the south west corner of the Project area due to high presence of exotic grassland species in this area.

Groundwater

Regional hydrogeology

The Project area is located in the South Canberra Hydrogeological Landscape (HGL) which covers an area of 146 square kilometres that extends from the southern shoreline of Lake Burley Griffin to southern edge of Tuggeranong and from the Lower Molonglo Valley in the northwest to Symonston HGL boundary on the east. The South Canberra HGL receives 600 to 750 mm of rain per annum.

The South Canberra HGL is characterised by a series of sub-catchment based landscapes in Woden, Tuggeranong and around Capital Hill. The catchments are heavily urbanised and there is rapid urban development in the northwest in the Weston Creek and Lower Molonglo Valley areas. There are considerable areas of bare earth in the urban development stage where massive earthworks are being undertaken and infrastructure installed. A feature of all landscapes is the constructed waterways, concrete lined drainage channels and lakes that have been constructed to handle large storm-water flows. These drainage reserves in the lower landscape are relatively wide and add to the green space of the area.

Groundwater in the region occurs in fractured rock aquifers and in unconsolidated sand in thin alluvial and colluvial aquifers. Yields of bores in fractured rock aquifers are in the range 0.1-5l/s and higher yields are obtained in closely jointed rocks along fault zones.

Local hydrogeology

Geotechnical investigations of the Project area (Douglas Partners, 2017) identified that:

- the Project area is not located below the regional groundwater table
- no free groundwater was observed in the boreholes during the field investigation though the occurrence of soft to firm conditions within a reasonably dry weather period indicates the presence of moisture ingress

- groundwater flow direction generally conforms to local topography, with a flow direction predominantly towards the southwest.

Contamination investigations (SMEC, 2014) found that there were no identified sources or potential sources of groundwater contamination in the Project area.

A search of the EPSDD Groundwater Bore database (September, 2017) indicated that there are no groundwater bores located within the Project area, and three registered abstraction and one investigation/ monitoring groundwater bore are located within two kilometres of the Project area.

The Bureau of Meteorology Groundwater Dependent Ecosystems (GDE) Atlas did not identify any GDEs in the Project area.

Flooding and drainage

A search of ACTmapi flood database indicates the Project area is not susceptible to the 1 in 100 year flood level (1% Annual Exceedance Probability (AEP)).

The existing Dudley Street has minimal existing stormwater infrastructure within the road reserve, though there are two drainage culvert crossings:

- A 750 mm diameter pipe located in the centre of Dudley Street to the east of the proposed roundabout
- A 375 mm diameter pipe located in the eastern extents near to the Yarralumla Uniting Church.

Preliminary peak flows have been calculated using the Rational Method and design parameters from the TCCS DSUI. Catchment areas have been delineated using ACTMAPi one metre interval contours detailed survey information. Table 38 presents catchment areas, existing cross drainage stormwater infrastructure, and the 100 year ARI peak design flows within the Project area.

Table 38 Catchments and stormwater flows

Catchment	Area (ha)	Existing culvert size	$Q_{10} (m^3/s)$	$Q_{100} (m^3/s)$	Comments
A	6.60	750 mm diameter pipe	0.55	1.15	Upgrade existing culvert to a 1,350 mm diameter pipe
B	1.8	375 mm diameter pipe	0.10	0.35	Upgrade existing culvert to a 750 mm diameter pipe
C	1.05	-	0.10	0.15	New catchment due to the Access Road
D	2.0	-	0.70	1.0	New pavement area
E	0.15	-	0.05	0.08	New pavement area
F	0.5	-	0.20	0.25	New pavement area

Figure 39 provides a stormwater catchment master plan for the Project.

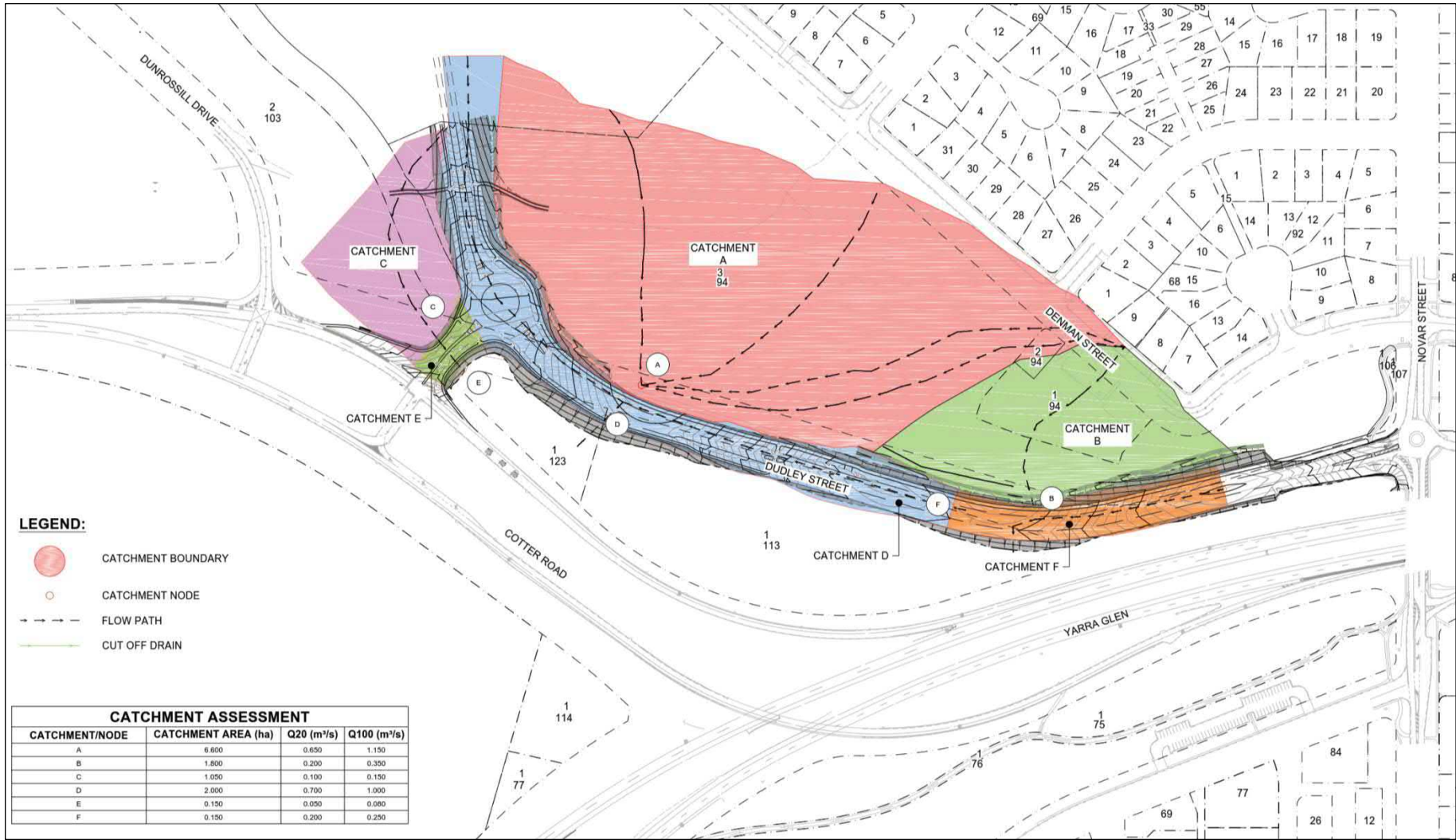


Figure 39 Stormwater catchment master plan

Water quality

Water quality monitoring in ACT catchments is undertaken by a number of organisations under several water quality monitoring programs to serve specific purposes, such as riparian health, recreation or drinking water quality including the Waterwatch, AUSRIVAS and the ACT Water Quality Monitoring programs. Water quality monitoring for Waterwatch is undertaken by local landcare and catchment groups. The Waterwatch data is used to inform various government environmental reports and to provide a picture of the health of ACT waterways.

The Yarralumla Creek Catchment is sampled by Waterwatch under the Molonglo catchment. The closest monitoring point to the Project area is located at YAR400 - Yarralumla Creek at 10m upstream of Cotter Road. Monitoring of water quality at the location has occurred on a monthly basis since January 2013. Table 39 details water quality results for a number of parameters from 2013 to 2017.

Table 39 Water quality standards for the Yarralumla Creek Catchment

Parameter	Water quality standard – Yarralumla Creek Catchment (AQUA/4, urban drains and streams)	Water quality results - YAR400 - Yarralumla Creek @ 10m upstream of Cotter Rd (2013 to 2017 average)
Acidity	pH 6 – 9	7.5
Total phosphorus (TP)	≤100ug/L	59.2 ug/L
Dissolved oxygen (DO)	≥6mg/L	7.6
Turbidity	<10 nephelometric turbidity units	17
Oil and grease	Not visible	Not Visible

(1) Note there is no specific water quality standard for total nitrogen (TN) presented in the EPP Regulation 2005

(2) This table contains parameters which are likely to be affected or generated by the Project and is not a comprehensive list of water quality standards for all parameters listed under the EPP Regulation 2005.

An assessment of existing water quality suggests that for Yarralumla Creek generally pH and DO meet the water quality standards with recorded turbidity values exceeding the standard. Given the high degree of urbanisation in this catchment, it is not surprising that turbidity values exceed the standard. Development in Yarralumla Creek Catchment area has increased significantly over the past 30 years and sediment from development sites and the spreading of weeds are the two most significant issues with high turbidity levels (Molonglo Catchment Group 2015).

7.7.3 Potential impacts

Construction impacts

Without appropriate safeguards, pollutants (fuel, chemicals or wastewater from accidental spills, and sediment from excavations and stockpiles) could potentially reach nearby stormwater drains and flow into waterways.

Activities which would disturb soil during construction work have the potential to impact upon local water quality as a result of erosion and run off sedimentation.

Direct impacts to the underground stormwater network may occur from demolition (of existing Dudley Street carriageway), earthworks and utilities relocation. Appropriate controls would be detailed in the CEMP and established to ensure the drainage points are adequately protected during construction activities.

Moderate to heavy wet weather events may cause localised flooding which could increase the potential for soil erosion and sedimentation impacts. Works would need to ensure that the drains inside the Project area are kept unobstructed during construction. Dewatering activities would be undertaken to minimise downstream impacts.

The majority of the Project will be built on the existing Dudley Street road reserve. This involves sealing the ground surface in some areas using concrete or similar. Sealing the ground surface can reduce the amount of rainfall recharging the aquifer, leading to lowered groundwater levels and reduced access for bore owners and GDEs. The area to be sealed is relatively small compared to the

entire recharge area and, therefore, the risks associated to reducing the amount of rainfall recharging the aquifer are likely to be relatively low.

Water quality impacts

Potential impacts to water quality during the construction phase of the Project could result from:

- increased sediment loading resulting in erosion of disturbed soil surfaces and an increase in turbidity (and an increased potential for the transport of contaminants bound to sediment particles), see Section 7.6.3 for further discussion on erosion
- impacts to waterways outside the Project area, such as the re-suspension and disturbance of fine sediments downstream in Yarralumla Creek and Molonglo River
- contamination of water quality through the spillage of materials such as diesel, lubricating oils or other chemicals which could occur:
 - during refuelling and/or maintenance and washdown of construction vehicles
 - from poorly maintained construction vehicles
 - from the use and storage of hazardous materials on construction sites
- accidental spills during the transportation of hazardous materials to and from construction areas could affect water quality outside of the Project area
- runoff from dust suppression and vehicle washing activities could contribute to elevated sediment loads. Vehicle washing of construction vehicles could also contribute to increased sediment-laden runoff, resulting in increased turbidity and lowered dissolved oxygen levels downstream of the vehicle washing area.

Accidental spills or leakage from construction plant, vehicles and equipment has the potential to contaminate aquifers. Groundwater could become contaminated with sediment and/or construction materials, such as fuels, lubricants and hydraulic oils, during construction activities, resulting in the development of a contamination plume.

Overland flow

Impacts on the local stormwater and drainage regime during construction of the Project could include the temporary interruption of overland flow paths and disturbance to minor drainage lines during a rainfall event. The geotechnical investigation undertaken for the Project concluded that the drainage characteristics of the site may be significantly altered and that temporary and permanent measures will be required during construction to divert stormwater and/or subsurface water flow from the Project area

During construction, stormwater would be managed by the temporary diversion of local overland flow paths around the construction works. These temporary diversions of local overland flows paths would not have any significant impact on the local stormwater system but would be maintained during the construction period.

Aquatic ecology

With respect to potential water quality impacts on aquatic flora and fauna, the closest water body to the Project is the Yarralumla Creek located around 700 metres south of the Project area. There is an existing drainage line located in the southwest corner of the Project area between Dudley Street and Cotter Road with a pipe culvert located under Cotter Road. The Project area generally slopes to the southwest. Overland surface flow has been mapped based on the site contours to generally flow south towards Yarralumla Creek, which discharges into the Molonglo River. As the drainage line and Yarralumla Creek are located in a highly modified landscape, it is unlikely that they support any significant aquatic flora or fauna. Notwithstanding, runoff during construction and operation should be contained within the Project area and not allowed to enter the drainage line and Yarralumla Creek.

Registered bores and Groundwater Dependent Ecosystems (GDE)

There are no registered abstraction bores or GDEs located within the construction corridor, therefore, it is unlikely that any private bore or GDE would be impacted due to construction or operation of the

Project. Some localised short-term drawdown of groundwater levels may occur due to dewatering of excavations during the construction phase of the Project (if required), however, impacts to private abstraction bores are considered unlikely given that most excavations intersect shallow groundwater.

Potential flooding impacts

For the construction phase of the Project the anticipated impacts to flood behaviour are minimal. Flood information available for Yarralumla Creek indicates that the entire Project area is not impacted by flooding up to and including the 1 percent AEP flood event. Therefore, there is unlikely to be any impact to flood behaviour either along the alignment or on adjacent land uses.

Operational phase

Water quality

The Project is unlikely to have a significant impact on the hydrology of the surrounding area. The Project would involve the sealing of the ground surface using concrete, asphalt pavement or similar hard surfaces. This would result in an overall increase in hardstand area, which would reduce the total impervious area of the Project area. This could potentially result in larger peak flows entering the stormwater network downstream of Dudley Street. New larger drainage infrastructure would be installed to manage surface water run-off from the Access Road and widened Dudley Street. The drainage culverts under Dudley Street would be increased in size to minimise the potential for ponding. All works would be designed and undertaken in accordance with the relevant standards and requirements.

Impacts to future water users are not expected to occur as the Project would not impact on any existing groundwater bores.

There would be an increase in vehicles using the upgraded Dudley Street and new Access Road as discussed in Section 7.1, which would lead to a minor increase in the production of vehicle pollutants and chemicals in the Project area though this change is not considered to be significant. Water sensitive urban design measures are required to capture and treat runoff from the Project and to contribute towards improved water quality in the wider catchment.

Potential flooding impacts

The drainage design of Dudley Street and the Access Road has been carried out in accordance with TCCS Design Standards for Urban Infrastructure, adopting the 10 year Average Recurrence Interval (ARI) for the assessment of minor storm event and the 100 year ARI for major storm event.

For the operational phase of the Project the anticipated impacts to flood behaviour are minimal. There is unlikely to be any significant impact to flood behaviour either along the alignment or on adjacent land uses during operation.

Water Sensitive Urban Design

The earthworks and stormwater drainage design for the Access Road and upgrade of Dudley Street provides attenuation on the upstream side of Dudley Street to mitigate impacts on the existing downstream stormwater network which is undersized for the capacity design requirement of 100 year ARI storm event.

The grassed berm, cut-off drains and swales providing attenuation to existing stormwater flows contribute to the water sensitive urban design outcomes to capture and store the runoff, reducing the velocity and quantity of stormwater flows on downstream systems. Bioretention trenches are provided along the western verge area to collect and treat run off from the road area which is not kerbed along Dudley Street. The existing scenario for runoff from the eastern carriageway and verge area will be maintained via overland flow across the open space area to Adelaide Avenue.

7.7.4 Mitigation measures

Appropriate mitigation measures to manage surface water runoff during construction are described in Section 7.6.4 including the development of an Erosion Sediment Control Plan. To manage surface water and groundwater impacts of the Project, the following mitigation measures would be considered during the detailed design of the stormwater management system and during construction:

- stormwater runoff will be captured by the existing stormwater drainage network, where possible
- where existing pipes and overland flow paths are inadequate, oversized pipes in the median would be considered to provide additional storage capacity
- the stormwater management system would be designed to minimise disturbance of areas of ecological value (as described in Section 7.2) where possible in particular areas of natural temperate grassland, golden sun moth habitat and trees
- the stormwater management system would be designed to ensure that no additional runoff from the Project area enters any area of natural temperate grassland or golden sun moth habitat
- spill kits would be provided at various locations through the construction area and regularly topped up to allow for a quick response to accidental spills.

7.7.5 Residual Risks

Based on the mitigation measures identified in Sections 7.6.4 and 7.7.4, an assessment of the water and flooding risks associated with the Project have been considered (for risks previously identified as being medium or above). Residual risks identified for the hydrology, hydrogeology and water quality values are provided in Table 40.

Table 40 Residual risks for hydrology, hydrogeology and water quality

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Local and regional drainage conditions altered	HYD1	Mitigation measures proposed would result in a low residual risk.	Unlikely (Likely)	Moderate (Moderate)	Low (High)
Increase in flood levels as a result of the Project	HYD2	Flood information available for Yarralumla Creek indicates that the Project area is not impacted by the 1 percent AEP flood event. There is unlikely to be any impact to flood behaviour either along the alignment or on adjacent land uses. This results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)
Changes to existing flow paths and overland flow due to proposed Project	HYD3	Mitigation measures proposed would result in a medium residual risk.	Unlikely (Likely)	Major (Major)	Medium (Very High)
Potential changes to groundwater availability due to vegetation removal or excavation including impacts on groundwater dependent ecosystems and water users within the catchment	HYD4	There are no GDEs or registered bores located in the Project area. This results in a very low residual risk.	Unlikely (Possible)	Minor (Moderate)	Very Low (Medium)

7.8 Air Quality

Section Summary

- This Section describes the existing air quality environment of the Project area and the potential air quality impacts the Project
- Representative local air quality for the Project area (measured from the ACT Government monitoring station in Civic in 2016) was relatively good with ambient air quality concentrations for Ozone, PM₁₀ and PM_{2.5} all meeting National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) standards.
- The Project would use construction equipment (e.g. excavators) which may cause dust and particulate to be released reducing local air quality (e.g. through stockpiling, earthworks etc) if not managed appropriately. Through the implementation of dust mitigation measures this risk is considered manageable.
- There would be minimal changes to air quality as a result of the Project.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk#	Likelihood	Consequence	Risk Rating
Heavy vehicle exhaust emissions cause increase reduction in local air quality	AQ1	Unlikely	Moderate	Low
Use of construction equipment (e.g. excavators) causing dust and particulate matter reducing local air quality (e.g. through stockpiling, earthworks etc)	AQ2	Likely	Major	Very High
Increase in vehicle exhaust emissions impact local air quality	AQ3	Likely	Moderate	High
Odour issues through improper waste management and storage	AQ4	Unlikely	Moderate	Low

7.8.1 Environmental conditions and values

The primary contributor to air pollutant levels in the vicinity of the Project is expected to be emissions from motor vehicles along arterial and local roads. Regional air quality can also be influenced by naturally occurring events such as bushfires and dust storms. Ambient concentrations of pollutants within the Project area are expected to be primarily dependent on local and regional weather conditions and overall regional air quality.

Air quality

The ACT Government has been undertaking ambient air quality monitoring in Canberra since the early 1990's. The closest monitoring station to the Project area is the Civic station located around 4.5 kilometres to the north east of the Project area.

To estimate the ambient air quality pollutant concentrations within the Project area, the measured pollutant concentrations have been analysed using data collected at the Civic air quality monitoring station for the year of 2016 (most recent data). Background air quality data for Photochemical oxidant (ozone), PM₁₀ (particulate matter with a particle size less than 10 micrometres (µm)), PM_{2.5} (particulate matter with a particle size less than 2.5 µm) was obtained. The available information is presented in Table 41. In 2016, monitoring of the ambient air quality average concentrations at the Civic station met Ambient Air Quality National Environment Protection Measure standards for Ozone, PM₁₀ and PM_{2.5}.

Table 41 Background air quality data

Year	Photochemical oxidant (Ozone)		Particulates (as PM ₁₀)		Particulates (as PM _{2.5})	
	Max 4-hour average (µg/m ₃)	Max 1-hour average (µg/m ₃)	Daily 24 hour average (µg/m ₃)	Annual average (µg/m ₃)	Daily 24 hour average (µg/m ₃)	Annual average (µg/m ₃)
2016	45	47	36.6	10.1	22.1	5.5

The sensitivity of receptors to air quality impacts is dependent upon the purpose, duration and frequency of the occupancy and the nature of the activities performed within an affected premises. Potentially affected receivers within the vicinity of the Project include residential properties, childcare centres, schools and other areas where people may spend a significant amount of time (such as Yarralumla Uniting Church and community facilities). People who are considered to be particularly sensitive are the young and elderly. The nearest sensitive receivers include the following:

- local residents, particularly those located within streets next to the Project, as well as residents located within streets that provide access for construction vehicles
- various parklands, sporting and recreational facilities and community infrastructure surrounding the Project, such as the Yarralumla Uniting Church, Royal Canberra Golf Club, the urban open space adjacent to the Project; the Uriarra Track and Mint Oval
- Saint Nicholas Greek Australian Pre School and Child Care Centre which is around 350 metres north of Dudley Street at the closest point.

7.8.2 Potential impacts

Construction phase

The key air quality impacts that have the potential to occur during construction would be temporary impacts associated with dust particles and emissions of carbon monoxide, sulphur dioxide, particulate matter, nitrous oxides, volatile organic compounds and other substances associated with the combustion of diesel fuel and petrol from construction plant and equipment.

Anticipated sources of dust and dust-generating activities include:

- operation of scrapers, graders, loaders and excavators as part of general construction works across the entire Project impact footprint
- dust loading and transfers from aggregate material on trucks, loaders and excavators
- the movement of vehicles on unsealed roads
- stockpiling activities
- wind erosion from exposed surfaces at disturbed areas.

The amount of dust generated depends on the properties of the soil material (silt and moisture content), the techniques adopted during any required excavation, demolition, grading and transfer of soils, and the prevailing meteorological conditions. The dispersion of the dust relates to the quantity and drift potential of the particles. Larger particles generally settle out near the source, whereas fine particles can be dispersed over greater distances from the source.

Residential premises and the Yarralumla Uniting Church are likely to be the most sensitive receptors in the Project area and surrounds. The impacts on nearby sensitive receivers decrease significantly with increased distance from the source. Sensitive receptors greater than 200 metres from construction works are anticipated to experience negligible dust impacts. Amenity impacts from dust are usually associated with coarse particles and particles larger than PM₁₀. Amenity concerns may relate to the visibility of plumes from dust sources, and amenity impacts may include dust depositing on surfaces (e.g. washing, window sills, car surfaces) and the potential for the transfer of dust deposited on roofs into water tanks.

The nearest educational facility or child care centre to the Project area is the Saint Nicholas Greek Australian Pre School and Child Care Centre which is over 350 metres at the nearest point. Dust impacts to this sensitive receiver are anticipated to be negligible.

Outdoor and open space recreation facilities greater than 200 metres from the Project, including the Royal Canberra Golf Club and Mint Oval are unlikely to be impacted by dust. The urban open space adjacent to the Project area and users of the Uriarra Track may have the potential to be impacted by dust and other air pollutants generated by the construction of the Project.

Dust and other air quality impacts on these sensitive receptor locations are anticipated to be manageable through standard mitigation measures detailed in Section 7.8.3.

Operational phase

Overall impacts on air quality during the operation of the Project are considered minimal as the Project would not result in a change in land use on Dudley Street and the additional traffic resulting from the use of the Access Road would be offset by changes to vertical and horizontal alignment of Dudley Street which would improve traffic flows and reduce braking.

7.8.3 Mitigation measures

Management of air quality impacts during construction is an important consideration in the development of appropriate construction methods. Where the need for specific environmental controls is identified, requirements would be set out in the CEMP to describe any additional requirements associated with key elements of the Project.

Construction

Ambient dust emissions from wheel-generated dust, excavation, clearing and grading, truck loading and unloading, and wind erosion would be the primary focus of dust control during construction works. Dust mitigation measures that would be implemented during the construction would include:

- apply water (or alternate measures) to exposed surfaces (e.g. unpaved roads, stockpiles, hardstand areas and other exposed surfaces)
- implement measures to modify or suspend dust-generating activities during periods of high wind speeds or whenever dust plumes from the works are visible
- seal regularly trafficked surfaces to minimise dust generation as far as practicable
- confine vehicular access to designated construction routes which minimise haul road lengths
- cover stockpiles when not in use
- remove silt and other material from around erosion and sediment control structures to ensure deposits do not become a dust source
- appropriately cover loads on trucks transporting material to and from the construction site and securely fix tailgates of road transport trucks prior to loading and immediately after unloading
- prevent mud and dirt being tracked onto sealed road surfaces.

Greenhouse gas emissions from vehicles and machinery working on site during the construction phase of the Project should be mitigated by the following:

- methods for management of machinery and equipment emissions are to be incorporated into project inductions, training and pre-start/toolbox talks
- plant and machinery are to be regularly checked and maintained in a proper and efficient condition. Plant and machinery are to be switched off when not in use, and not left idling.
- truck queuing and unnecessary trips are to be minimised through logistical planning of materials delivery and work practices
- ensure all vehicles switch off engines when stationary so there are no idling vehicles
- use locally sourced materials to reduce fuel use

7.8.4 Residual risks

Based on the mitigation measures identified in Section 7.8.3, an assessment of the residual air quality risks associated with the Project have been considered (for risks previously identified as being medium or above). Residual risks identified for air quality are provided in Table 42.

Table 42 Residual risks for air quality values

Description		Residual Risk Assessment			
Potential Impact	Risk#	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Use of construction equipment (e.g. excavators) causing dust and particulate matter reducing local air quality (e.g. through stockpiling, earthworks etc)	AQ2	Through the implementation of dust mitigation measures during construction, this results in a medium residual risk.	Possible (Likely)	Moderate (Major)	Medium (Very High)
Increase in vehicle exhaust emissions impact local air quality	AQ3	Overall impacts on air quality during the operation of the Project are considered minimal as the Project would not result in a change in land use on Dudley Street and the additional traffic resulting from the use of the Access Road would be offset by changes to vertical and horizontal alignment of Dudley Street which would improve traffic flows and reduce braking.	Likely (Likely)	Minor (Moderate)	Medium (High)

7.9 Aboriginal Heritage

Section Summary

- This section describes the Aboriginal heritage values of the Project area, and the potential impacts on these values that may result from the Project.
- There are no expected adverse impacts on Aboriginal heritage items as a result of the Project.
- In the event that previously unidentified archaeological artefacts or sites are located during the course of development within the Project area, an unanticipated discovery plan has been prepared and should be followed to ensure compliance with all relevant legislation and the protection of Aboriginal heritage items.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk #	Likelihood	Consequence	Risk Rating
Potential damage or destruction of known Aboriginal heritage items	HER1	Unlikely	Major	Medium
Potential damage or destruction of unknown Aboriginal heritage items	HER2	Possible	Major	High

7.9.1 Investigations

To determine the Aboriginal heritage values of the Project area, a Stage 1 Aboriginal Cultural Heritage Assessment was undertaken that included a desktop assessment followed by a detailed site survey with Aboriginal knowledge holders (Navin Officer Heritage Consultants, 2014). With this assessment being greater than 18 months since production, as per the *EPSDD Proponents guide to environmental impact statement exemptions*, the report was reviewed by Luke Kirkwood, a qualified Aboriginal heritage specialist who confirmed that the recommendations are still applicable for use in the Project assessment of impacts.

7.9.2 Environmental conditions and values

The desktop assessment conducted by Navin Officer included a literature and database review of the Project area and its greater surrounds including the Canberra Brickworks Precinct. The assessment included searches of the ACT Heritage Register and associated reports held by ACT Heritage. The desktop assessment was used to determine if known Aboriginal heritage sites were located within the Project area, to facilitate site prediction on the basis of known regional and local site patterns, and to place the area within an archaeological and heritage management context.

A number of assessments have been undertaken in the areas surrounding the Project resulting in Aboriginal heritage site finds in the areas surrounding the Project area (refer to the Stage 1 Aboriginal Cultural Heritage Assessment for full details of previous surveys). A summary of surveys undertaken include the following:

- Boot and Bulbeck conducted a cultural resource survey for the Stromlo Forest Management Area in 1990
- Navin Officer (1993) completed an archaeological survey of a parcel of land situated southeast of the confluence of Weston Creek with the Molonglo River, as part of investigations into future land use options appropriate for land north of Cotter Road at Weston.
- Saunders (1995) undertook a preliminary cultural resource survey of the Lower Molonglo River Corridor
- Navin Officer (1999) completed an archaeological assessment of the Department of Defence extension to their Joint Services Staff College Site
- Navin Officer also conducted surveys of Stirling Park, Block 1, Section 128, Yarralumla (Navin Officer Heritage Consultants, 2004), Blocks 2, 3 and 25, Section 44, in Yarralumla (Navin

Officer Heritage Consultants, 2006) and Block 22, Section 32 Yarralumla (Navin Officer Heritage Consultants, 2007)

- In 2008 AASC and CHMA completed a detailed heritage assessment of Coombs, Wright and Environs
- Navin Officer conducted a cultural heritage assessment of Block 5, Section 121 in North Curtin ACT in 2011
- Navin Officer contributed to the Yarralumla Woolshed Conservation Management Plan in 2011. An archaeological field survey of the Yarralumla Woolshed and surrounds was undertaken.

The literature reviews and search of ACT Heritage sites database was undertaken and no Aboriginal sites were identified within the Project area.

Aboriginal heritage survey

Based on the predictive model formulated in the desktop report (Navin Officer Heritage Consultants 2014), a detailed site survey and assessment was undertaken.

The main objectives of the site survey were to:

- consult with Aboriginal stakeholders for the area
- undertake a comprehensive field survey of the Project area
- record and assess sites identified during the monitoring program
- identify impacts to all identified cultural heritage sites and places based on potential changes as a result of the proposed development
- make recommendations to minimise or mitigate impacts to cultural heritage values within the Project area.

Aboriginal consultation was undertaken in compliance with ACT Heritage recommendations, and four Representative Aboriginal Organisations registered were contacted, including:

- the Buru Ngunawal Aboriginal Corporation
- King Brown's Tribal Group (formerly known as Consultative Body Aboriginal Cooperation on Indigenous Land and Artefacts in the Ngunawal Area)
- the Little Gudgenby River Tribal Council
- the Ngarigu Currawong Clan.

Of the four local Aboriginal organisations, the Wally Bell group from the Buru Ngunawal Aboriginal Cooperation participated in the field survey.

The field survey was undertaken on the 5 August 2014 by archaeologist Nicola Hayes and Aboriginal representative Wally Bell. No areas of archaeological potential were identified. Given the location of the area in relation to the past riverine resources associated with the Molonglo River, the Project area is considered to have a relatively low potential for the occurrence of Aboriginal sites.

The Stage 1 Aboriginal Cultural Heritage Assessment concluded that there are no cultural heritage constraints for the Project.

7.9.3 Potential impacts

Construction phase

Construction of the Project would involve excavation and other ground disturbing activities for the provision of a new Access Road and widening of Dudley Street and for trenching for the relocation of services. Ground disturbing activities have the potential to impact Aboriginal heritage sites, if present.

As no known Aboriginal heritage items are located in the vicinity of the Project area and no high risk landscape features are located at or near the Project area, the potential for unknown items to be

present is considered to be low. As such, the Project is unlikely to affect Aboriginal heritage during construction.

Operational phase

There would be no risks to Aboriginal heritage from the operation of the Project.

7.9.4 Mitigation measures

It is recommended that for the unanticipated discovery of Aboriginal sites and burials (during investigation or development works, including excavation and/or other significant ground disturbance), the works be managed through the use of the unexpected finds protocol as outlined by Navin Officer Heritage Consultants, 2014.

7.9.5 Residual risks

Based on the mitigation measures identified in Section 7.9.4, an assessment of the residual heritage risks associated with the Project have been considered (for risks previously identified as being medium or above). Residual risks identified for the heritage values are provided in Table 43.

Table 43 Residual risks for Heritage Values

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Potential damage or destruction of known Aboriginal heritage items	ABH1	As no known Aboriginal heritage items are located in the vicinity of the Project area and no high risk landscape features are located at or near the Project area, the potential for unknown items to be present is considered to be low. As such, the Project is unlikely to affect Aboriginal heritage during construction and operation.	Remote (Unlikely)	Major (Major)	Low (Medium)
Potential damage or destruction of unknown Aboriginal heritage items	ABH2	Procedures to be followed in the unanticipated discovery plan which has been prepared for the Project results in a low residual risk.	Possible (Possible)	Minor (Major)	Low (High)

7.10 Non-Aboriginal Heritage

Section Summary

- This section describes the Non-Aboriginal heritage values of the Project area, and the potential impacts on these values that may result from the Project.
- The Project would be undertaken in the location of the Yarralumla Brickworks railway alignment. This impact would occur outside the curtilage of Yarralumla Brickworks Railway Remnants listed on the ACT Heritage Register. It is recommended that a survey be undertaken that records the orientation and levels of the cutting from the southern boundary of the registered curtilage boundary to the extent of identifiable cuttings to the east, near Denman Street.
- In the event that previously unidentified archaeological artefacts or sites are located during the course of development within the Project area, an unanticipated discovery plan has been prepared and should be followed to ensure compliance with all relevant legislation and the protection of Aboriginal heritage items.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk #	Likelihood	Consequence	Risk Rating
Potential damage or destruction of known non-Aboriginal heritage items	HER1	Almost certain	Moderate	Very High
Potential damage or destruction of unknown non-Aboriginal heritage items	HER2	Possible	Major	High

7.10.1 Investigations

To determine the non-Aboriginal heritage values of the Project area, a desktop assessment followed by a site inspection of the Project area was undertaken on 21 November 2017, by AECOM Senior Heritage Specialist Dr Susan Lampard.

7.10.2 Environmental conditions and values

The Project sits to the south of three sites listed on the ACT Heritage Register:

- Yarralumla Brickworks (Heritage ID 440)
- Westbourne Woods (Heritage ID 444)
- Yarralumla Brickworks Railway Remnants (Heritage ID 1246).

The Project would not impact on the listed curtilage of these three items. However, the Project would impact on part of the former alignment of the Railway line outside the listed curtilage. In order to distinguish between these two parts, the listed portion is referred to by its full listing title and the unlisted section within the Project area is referred to as the railway alignment. As the Project is not within the curtilage of the Yarralumla Brickworks Railway Remnants, a Statement of Heritage Effect is not required, however, an impact assessment has been undertaken in Section 7.10.3.

The Yarralumla Brickworks were established in 1913 on land formerly owned by Frederick Campbell. The Brickworks supplied bricks for the construction of Canberra, with the bricks being delivered to the site of Parliament House and beyond via a railway line. The Brickworks closed in December 1916 due to pressures associated with WWI and a coal strike. The Brickworks reopened in 1921 and was mothballed at various times due to economic pressures associated with the Great Depression, WWII before closing for the final time in 1976. Since then there has been some development around the fringes of the site (Lovell Chen, 2016).

The railway line associated with the Brickworks was completed in 1923 as a 3ft 6 inch (1067 mm) or narrow gauge line for the use of steam engines. The line reused part of the abandoned standard gauge line to Civic Centre by moving the tracks 14.5 inches closer together on the existing sleepers. In the lead up to the opening of Parliament House on 9 May 1927, the railway line was removed. Other sections of the railway line were removed in 1929 (Lovell Chen, 2016). The decision to close the line

may also have been influenced by economics – it being more economical to deliver bricks via lorry than at the opening of the line (ACT Heritage Council, 2013). The timber sleepers were used to fire the kilns of the Brickworks (SMEC, 2014). Lovell Chen (2016) identify that potential archaeological features associated with the railway “may include timber sleepers, iron bolts and metal rails”.

An examination of historical plans of the Project area did not identify any additional structures or features. An examination of the aerial photograph sequence for the Project area, which commences in 1951 (Figure 40), indicated a small structure was present in the vicinity of the works. This structure first appears on the 1958 (Figure 41) aerial, but has been demolished by 1968 (Figure 42). As a small, short-lived structure, it unlikely to have been substantial and it is considered that archaeological evidence is unlikely to have been preserved. No other structures appear on the subsequent aerals. The railway cutting is also clearly evident on the historical aerals.



Figure 40 Excerpt from 1951 aerial



Figure 41 Excerpt from 1958 aerial



Figure 42 Excerpt from 1968 aerial

7.10.3 Potential impacts

A site inspection was undertaken on 21 November 2017 to examine the section of the railway cutting within the Area of Works by AECOM Senior Heritage Specialist Dr Susan Lampard. The site slopes from the north to the south and is vegetated as described in Section 7.2. The Project intersects the railway alignment as it curves towards the north, essentially running up the slope towards the Yarralumla Brickworks. The railway cutting is therefore not overtly evident at this point (refer to Figure 43). No evidence of timber sleepers, iron bolts and metal rails was identified during the site inspection. While no subsurface investigations were undertaken, it is anticipated that the extent of the archaeological expression of the railway alignment would be a disturbance in the soil profile associated with the creation of the cutting. The Project would result in the removal of all evidence of the railway alignment within the Area of Works.

An inspection of the area where the short-lived structure was thought to be located did not identify any remains. This area is outside of the Project area and would not be impacted by the Project.

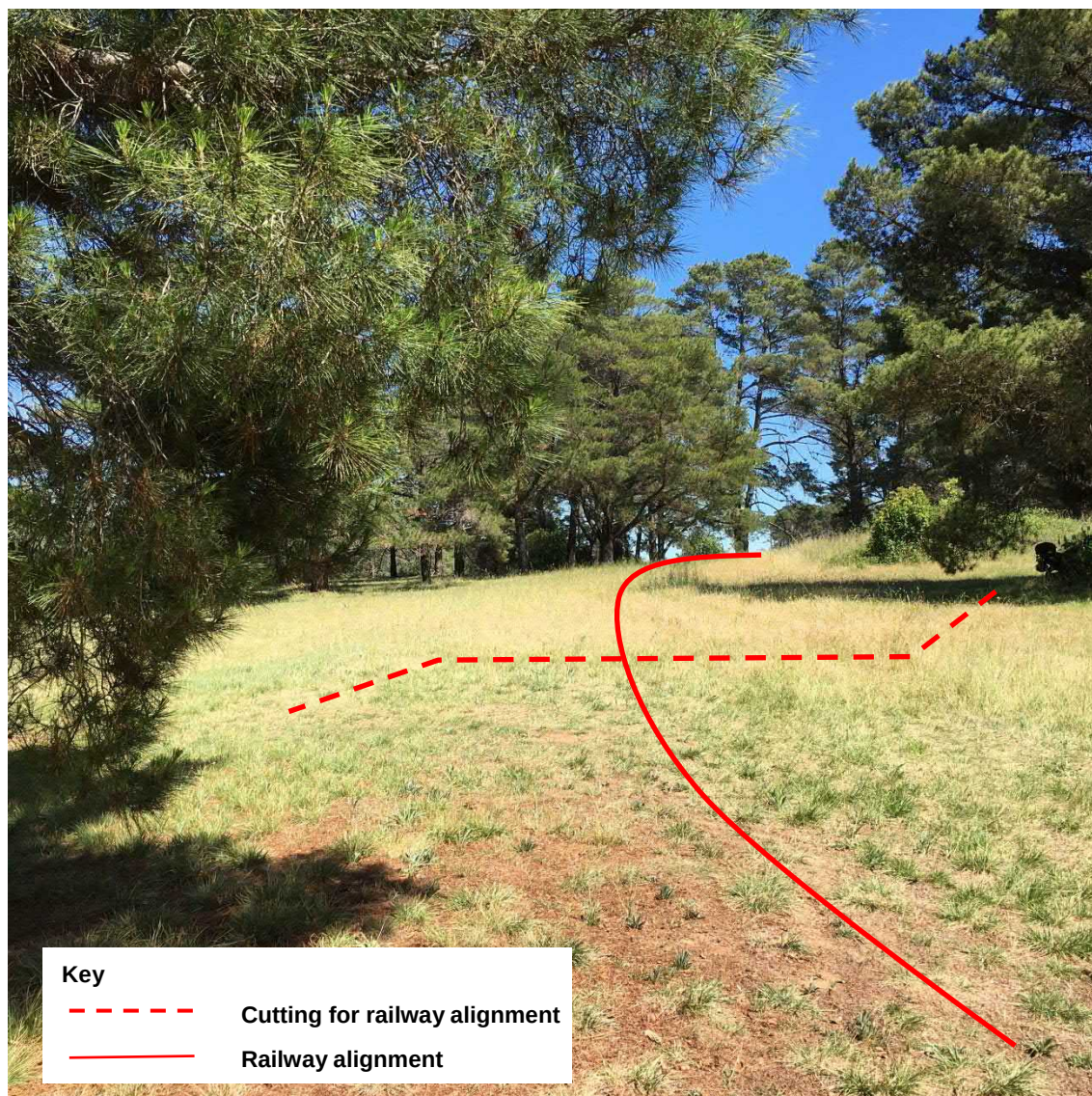


Figure 43 Railway alignment cutting (highlighted) within the Project area. View north west

Heritage significance

The listing for the Yarralumla Brickworks Railway Remnants contains an assessment of the significance of the item within the listed curtilage. This assessment is provided in Table 44, together with an assessment of how the railway alignment contributes to the significance of the listed item. Only the applicable criterion for the Yarralumla Brickworks Railway Remnants are provided. Additionally, Table 44 provides an assessment of the impact of the Project on the heritage significance of the Yarralumla Brickworks Railway Remnants and the railway alignment.

No impacts to the unidentified structure shown on the historical aerial photographs is anticipated as this item is believed to be located outside of the Area of Works.

Table 44 Assessment of Heritage Significance - Railway alignment

ACT Heritage Register assessment	Assessment of railway alignment significance and impacts associated with Project
Criterion (c) it is important as evidence of a distinctive way of life, taste, tradition, religion, land use, custom, process, design or function that is no longer practised, is in danger of being lost or is of exceptional interest	
The Yarralumla Brickworks Railway Remnants meets this criterion. Bricks were first manufactured at the Canberra (Yarralumla) Brickworks in 1913 for use in the construction of major developments across Canberra including provisional Parliament House and the Hotel Canberra. From 1923 – 1927 bricks were transported from the Brickworks via rail across the city to major developments. The railway ceased operation in 1927 and the remnants of the embankment, cuttings and terraces are important as evidence of the process by which bricks used in the construction and development of the new city were transported.	The railway alignment presently supports the significance of the listed item under this criterion in that it demonstrates the continued alignment of the railway line outside of the curtilage. The Project would impact on the significance of the item overall as the alignment would become disjointed, with the listed section to the north being separated from the continuing alignment to the east of the Project area of Works. It is understood that the ACT Heritage Council had originally proposed to list a larger portion of the Railway Remnants, but reduced the curtilage at the request of the then Land Development Authority (Kretowicz 2013). The ACT Heritage Council provided tacit approval for the removal of the unlisted portion when it agreed to reduce the curtilage. Measures to reduce the impacts to the significance of the Yarralumla Brickworks Railway Remnants and railway alignment are provided in Section 7.10.4.
Criterion (f) it is a rare or unique example of its kind, or is rare or unique in its comparative intactness	
The Yarralumla Brickworks Railway Remnants meets this criterion. The Remnants of the former railway are rare in their comparative intactness, an example of one of few surviving remnants of the once extensive rail network used in the early development of Canberra.	The railway alignment presently supports the significance of the listed item under this criterion in that it is part of the comparatively intact alignment, albeit outside the listed curtilage. Measures to reduce the impacts to the significance of the Yarralumla Brickworks Railway Remnants and railway alignment are provided in Section 7.10.4.
Criterion (h) it has strong or special associations with a person, group, event, development or cultural phase in local or national history	
The Yarralumla Brickworks Railway Remnants meets this criterion. The Remnants of the former Yarralumla Brickworks railway have a strong association with the development of Canberra between 1923 – 1927. Bricks (especially those referred to colloquially as 'Canberra Reds') manufactured at the Brickworks were loaded onto timber tip wagons and transported via a narrow gauge rail line to major developments across the city such as Parliament House, the Kingston Powerhouse, Hotel Canberra and buildings in Civic. The railway enabled faster transport of the bricks than the previous use of steam traction engines that hauled heavy iron wheeled trailers on mostly unmade roads. The railway was removed in 1927 prior to the opening of Parliament House. However, it had a strong association with the early development of the new city.	The significance under Criterion h is intangible, being linked to the history of the item. The removal of this small section of the railway alignment would not impact on the historical role the item played in the development of early Canberra.

7.10.4 Mitigation measures

The Project would result in the removal of a portion of the railway alignment. This impact would occur outside the curtilage of Yarralumla Brickworks Railway Remnants listed on the ACT Heritage Register. It is recommended that a survey be undertaken that records the orientation and levels of the cutting from the southern boundary of the registered curtilage boundary to the extent of identifiable cuttings to the east, near Denman Street. It is proposed that the survey cover the extent of the visible remains despite the impacts being limited to a small portion of the railway alignment as once the Project is constructed, the sections will be disjointed and the overall alignment may be difficult to determine at a later date. Further, during ground disturbance, a suitably qualified archaeologist should be on-hand to record the soil profiled across the cutting, if disturbance within the profile associated with the cutting of the railway line is evident.

In the event that previously unrecorded or unanticipated or non-Aboriginal archaeological (objects, artefacts, deposits or relics) are encountered, the unexpected finds protocol as outlined by Navin Officer Heritage Consultants, 2014 will be implemented.

7.10.5 Residual risks

Based on the mitigation measures identified in Section 7.10.4, an assessment of the residual heritage risks associated with the Project have been considered (for risks previously identified as being medium or above). Residual risks identified for the heritage values are provided in Table 43.

Table 45 Residual risks for Heritage Values

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Potential damage or destruction of known non-Aboriginal heritage items	HER1	The implementation of the proposed mitigation measures and the recommendation of undertaking a survey results in a medium residual risk	Almost certain	Minor (Major)	Medium (Very high)
Potential damage or destruction of unknown non-Aboriginal heritage items	HER2	By following the unanticipated discovery plan which has been prepared for the Project results in a low residual risk.	Possible (Possible)	Minor (Major)	Low (High)

7.11 Bushfire Risk

Section Summary

- This Section details the potential bushfire risks associated with the Project.
- The entire ACT rural area is considered to have a high bushfire risk, as are the urban interface areas that are adjacent to forest and grasslands. The entire Project area has been mapped as a Bushfire Prone Area.
- The local topography including slope and aspect are determinants of the parts of the fire (e.g. head, flank, back) that an asset may be exposed to. The Project area is located to the east of the Molonglo Valley that is typically part of the ACT parks and reserves system that support extensive vegetation communities that have the potential to support large bushfires. Lake Burley Griffin forms a natural barrier to the west and north of the Project and beyond the lake there is extensive residential development beyond Capitol Hill indicating that it is not probable for bushfires to spot across the lake from the north and west.
- The two major bushfire risks associated with the Project are:
 - Sparks from construction equipment and vehicles igniting a bushfire
 - Potential loss of life and property as a result of a bushfire during construction
- The preparation and implementation of an Emergency Response Plan reduces the risk of bushfires entering the Project area as well as the potential for construction activities from the Project to ignite bushfires.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk #	Likelihood	Consequence	Risk Rating
Increased risk of bushfire associated with sparks from construction equipment and vehicles	BF1	Unlikely	Catastrophic/ Significant	High
Increased risk of bushfire through vehicle accidents	BF2	Unlikely	Moderate	Low
Potential loss of life and property as a result of bushfire during construction	BF3	Unlikely	Catastrophic/ Significant	High

7.11.1 Environmental conditions and values

Bushfire risk

The ACT Strategic Bushfire Management Plan version 3 (ACT ESA, 2014) is based upon a bushfire risk assessment used across the whole of the ACT. This bushfire risk assessment process has been used to map bushfire prone areas across the ACT of high bushfire risk. The entire ACT rural area is considered to have a high bushfire risk, as are the urban interface areas that are adjacent to forest and grasslands. The Project area is located entirely within an area mapped as bushfire prone area.

Site conditions

Topography

The local topography including slope and aspect are determinants of the parts of the fire (e.g. head, flank, back) that an asset may be exposed to. The Project area is located to the east of the Molonglo Valley that is typically part of the ACT parks and reserves system that support extensive vegetation communities that have the potential to support large bushfires. Lake Burley Griffin forms a natural barrier to the west and north of the Project and beyond the lake there is extensive residential development beyond Capitol Hill indicating that it is not probable for bushfires to spot across the lake from the north and west.

Slope

Slope can affect bushfire behaviour with fires burning faster up slope than down slope, in particular when aligned with the prevailing wind direction. A fire burning up a 10 degree slope will generally spread at double the rate of a fire on level ground (Bushfire CRC, 2009). Likewise a fire burning up a

20 degree slope will generally spread at a rate that is four times the rate of spread across level ground (Bushfire CRC, 2009).

Dudley Street is elevated above Yarra Glen/Adelaide Avenue by around four to six metres and is partially screened by mature trees. The Project area generally slopes to the southwest. The topography of this area has been modified to include the Cotter Road and Yarra Glen/Adelaide Avenue. The new Access Road would require a longitudinal gradient of up to 6% to traverse the crest at the Boundary of Section 94 and 102, into the Canberra Brickworks Precinct. Noting the maximum street longitudinal gradient for a Minor Collector is 12%. For the upgrade of Dudley Street the longitudinal grade would range between 1% to 4%. A maximum slope of 6% within the Project area is unlikely to promote the spread and speed of a bushfire in the area.

Aspect

Aspect is another topographical factor that can affect bushfire behaviour. North facing slopes receive more solar radiation that dries surface fuel faster than on south facing slopes (Bushfire CRC 2009). The Project area has a south-west facing slope, therefore reducing the risk of bushfire.

7.11.2 Potential impacts

Construction phase

Potential sources of impact during construction

The consequence of an ignition event occurring would depend greatly upon a variety of factors including the location of the ignition, availability of fuel, fire danger rating at the time of the ignition (e.g. catastrophic fire danger) and initial response to the incident.

Some of the potential sources of ignition of bushfires resulting from construction of the Project are:

- *Hot works* – Activities that generate both heat and sparks, which are conducted at the construction site, pose a significant risk of igniting flammable material nearby if these activities are not conducted in accordance with standard work procedures or other hot works licences/permit requirements. Activities such as welding and grinding would have the potential to result in bushfire ignition. The potential risk associated with these works would increase when these activities are undertaken in or adjacent to long dry grass.
- *Construction vehicles and motor vehicles* – The risks associated with vehicles (e.g. construction plant or motor vehicles) include the collision of a vehicle with a power pole or infrastructure that could result in either a spark, arc from a power supply or fire from spilt fuel being ignited. There is also a risk associated with vehicles driving through long grass that may be ignited either from a spark or due to the hot vehicle exhaust system. Construction machinery (such as graders or dozers) has the potential to ignite flammable material due to the generation of a spark from striking a stone or from electrical equipment on the vehicle.
- *Interaction with existing services* – Excavation associated with the Project has the potential to sever power, gas or fuel lines that are buried and to dislodge overhead power lines, resulting in potential ignition of a fire.
- *Chemical fire* – The inappropriate storage or isolation of incompatible or flammable chemicals from potential ignition sources including static electricity may cause a chemical fire or explosion. The failure to clean up a flammable chemical spill or address leaking containers could also lead to a potential fire. Flammable chemicals would also need to be secured to prevent arson.
- *Electrical fault* – Equipment used during Project construction, if not maintained in proper working order would present a risk of generating a bushfire through a static discharge or arcing of equipment. This equipment would include generators, power tools, portable lighting, heaters, air conditioners and any powered device.
- *Landscaping* – Mulch storage may present a bushfire risk if a large volume of material is stored in stockpiles for an extended period of time. The ability of mulch to self-combust, the production of methane (includes the potential for explosion) under favourable conditions and the potential for arson attack, all contribute to the potential bushfire risk associated with storing mulch. Mulch may be used as a landscaping material or it may be generated during the

Project's construction phase when removing and chipping of existing vegetation along the route.

Sources of potential bushfire risks

- *Human activity/arson* - A malicious act (e.g. arson) is considered to be the greatest bushfire risk threatening the Project, whether the attack is located within adjacent bushfire prone land or at a Project area where the fire may escape to become a bushfire. Project Contractors would need to manage security at the Project area (such as through appropriate security fencing) to minimise the risk of an arson attack being successful.
- Other potential causes of ignition associated with human activities would include the inappropriate actions of individuals such as discarding lit cigarettes and matches, placing hot metal into a general waste bin or failing to correctly dispose of materials that are subject to spontaneous combustion, e.g. solvents.

Operational phase

Sources of potential bushfire risks

- *Power lines* - damage to wires or poles may occur as a result of:
 - vehicles colliding with an overhead line equipment pole, causing it to come down
 - trees or tree branches along the Project alignment causing a breakage to, or arching of, overhead wiring.
- *Lightning* - the potential for a lightning strike is the only common natural cause of bushfires in the ACT.

Bushfire risks to the Project

The primary potential impact of a bushfire on the Project would be damage to Project infrastructure and the remote possibility of injury or death to Project staff, residents in the immediate surrounding areas, pedestrians and the public utilising the infrastructure and open space.

As the entire Project area is within mapped bushfire prone area there is a risk of the Project area experiencing a bushfire, especially coming from the Molonglo Valley in the north-west.

Bushfire risks initiated by the Project

The following section provides a brief discussion regarding the potential impacts a bushfire ignited due to operation of the Project. The type of bushfire that is most likely is a grassfire, although woodland does occur at the Project alignment interface in several locations but is restricted in its extent. Due to the predominance of grassland, the heat expected to be generated by a Project related fire is lower than that associated with bushfires in woodland or forested areas.

The potential impact of a Project initiated bushfire (subject to the conditions present at the time of ignition) would include:

- potential damage to existing infrastructure outside the Project footprint (power lines and other utilities services etc.)
- impact (including total property damage) to existing buildings adjacent to bushfire prone land in areas such as Yarralumla, Curtin, and Deakin.
- impact to existing habitat and individuals of threatened species which currently occupy identified bushfire prone land
- potential human injury or fatality.

7.11.3 Mitigation measures

Prior to the commencement of works, the contractor would develop an Emergency Response Plan that would include the following mitigation measures:

General measures

- bushfire protection measures and requirements would be included within the site induction and toolbox talks for contractors working on the Project
- electrical equipment and other plant and machinery would be maintained in operational order that is fit for purpose and to prevent potential sparks
- all legislative requirements regarding safe work procedures would be met, including chemical handling and storage
- communications protocols would be established between the Project and emergency services during construction and included in the Emergency Response Plan.
- all vehicles/mobile plant entering site would be fitted with fire extinguishers
- no open fires would be permitted within the construction areas (e.g. burning of removed vegetation).

Construction Compound Sites

- temporary project buildings would be constructed in accordance with Australian Standards AS 3959 – Construction of buildings in bushfire prone areas
- temporary site buildings would be located away from trees
- trees that are proposed to be retained within the identified asset interface areas would have the lower branches trimmed to a height of two metres above the ground
- weeds would be managed at the site to ensure that they do not constitute a fire hazard.

Hot Works

- hot works would not be permitted on days when a Catastrophic fire danger has been declared
- areas where hot works are to be conducted would be cleared of flammable vegetation and materials in all directions to a distance of five metres (where practicable)
- a spotter would be used when hot works are conducted in areas where flammable materials cannot be removed and a fire fighting equipment would be present when conducting hot works
- a post work check of any hot works would be conducted after completion
- the management of potential impacts associated with hot works would be included as part of the Emergency Response Plan.

Landscaping

- retained vegetation would be watered regularly during the bushfire season to retain moisture, in particular on days of forecast high or above fire danger
- mulch would be placed in landscaped areas as soon as is possible to reduce the on-site storage time
- stockpiled mulch would be kept in small piles to reduce the likelihood of self-combustion.

Waste management

- construction waste would be removed from the site in a timely manner so as not to cause a fire risk or obstruct emergency vehicle access
- unauthorised access to waste receptacles would be prevented, i.e. locked covers and/or fencing to prevent public access or fires being lit.

7.11.4 Residual risks

Based on the mitigation measures identified in Section 7.11.3, an assessment of the residual bushfire risks associated with the Project have been considered (for risks previously identified as being medium or above). Residual risks identified for the bushfire risk values are provided in Table 46.

Table 46 Residual risks for Bushfire Risk values

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Increased risk of bushfire associated with sparks from construction equipment and vehicles	BF1	With the implementation of mitigation measures this results in a medium residual risk.	Remote (Unlikely)	Catastrophic/ Significant (Catastrophic/ Significant)	Medium (High)
Potential loss of life and property as a result of bushfire during construction	BF3	With the implementation of mitigation measures this results in a medium residual risk.	Remote (Unlikely)	Catastrophic/ Significant (Catastrophic/ Significant)	Medium (High)

7.12 Utilities and infrastructure

Section Summary

- This Section describes the potential impacts on existing and proposed utilities/infrastructure located within the Project area.
- There are numerous electrical, drainage, communication and signalling services within the footprint of the Project.
- Potential utilities impacts include the temporary disruption to services during utilities works, requirement to install new utilities and accidental damage to utilities. Ongoing consultation between the contractor and property owners would occur to provide sufficient notification of any interruptions to services throughout the construction period

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk #	Likelihood	Consequence	Risk Rating
Temporary services disruption during utility works as part of the Project	U1	Almost certain	Minor	High
Restricted opportunities to connect to existing road network	U2	Remote	Major	Low
Accidental damage to utilities and other essential infrastructure	U3	Unlikely	Catastrophic/ Significant	High
Accelerated maintenance and upgrade of roads and infrastructure due to increased use	U4	Unlikely	Moderate	Low

7.12.1 Investigations

A utility investigation was undertaken in October 2017 (Steger, 2017) to confirm the location of underground services. The utility investigation was essential to ensuring engineering constraints were adequately understood and considered in the design development and to fully understand potential Project impacts.

7.12.2 Environmental conditions and values

There are numerous electrical, drainage, communication and signalling services within the footprint of the Project. Services to be impacted by the Project would need to be relocated to enable utilities to remain operational during the Project.

Water supply infrastructure would require relocation or adjustment including an existing 150 mm diameter water main which currently crosses the location of the proposed roundabout which would be relocated north to cross the Access Road. A 150 mm diameter water main would also be relocated in the eastern extents of the Project close to the Dudley Street / Novar Street intersection.

Aboveground High Voltage electrical cables cross Dudley Street in the western extents of the Project area. These overhead cables would need to be undergrounded to allow for construction of the Project. In order to facilitate the undergrounding of the electrical cable, the existing pole located on the north-eastern side of the Cotter Road median strip will be removed and relocated to the south western side. Two five by five metre pits with a two metre wide access path are to be excavated to allow under boring machinery to access the required areas. Under boring will then be undertaken from one pit to the other by crossing Dudley Street at the Dudley Street/Cotter Road intersection and then change direction and continue to the northeast towards the main project area underneath the proposed roundabout to the north eastern boundary.

The gas main which crosses Dudley Street in the eastern extents of the Project area near to the Dudley Street / Novar Street intersection would require relocation as the level of groundcover of this utility is reduced. Telecommunications cables (underground) along the northern verge of Dudley Street

would also be disturbed by the Project and would require relocation. To facilitate the relocation of the telecommunications cables, under boring will be undertaken in two locations – at the northern end of Project boundary and at the southern end adjacent the Yarralumla Uniting Church. One five by five metre pit with a two metre access path at the northern end of the Project site would be excavated for the under boring works.

New services are to be provided along the Access Road and Dudley Street including electricity and telecommunications to service the proposed Canberra Brickworks Precinct. Other services such as power for street lighting along the Access Road and Dudley Street would also be provided.

A range of other utilities are located on or adjacent to the Project area, including a High Voltage (aboveground) electrical cable located in the eastern extents of the Project area near to the Dudley Street / Novar Street intersection.

7.12.3 Potential impacts

Construction impacts to underground and overhead services and utilities would include potential for injury to construction workers or the wider community in the unlikely event that utility services are accidentally damaged during excavation, plant movement or general civil works.

If the utilities and services within the Project area cannot be protected during relocation, users of these services (including residential and commercial properties) may experience short disruptions. Disruption in disconnecting and reconnecting utility services to individual landowners and occupiers would be kept to a minimum.

The extent and timing of these impacts and any works required to relocate or replace services would be confirmed during detailed design in consultation with the relevant utilities providers and impacted stakeholders. To minimise disruption of services to properties affected by the Project, replacement services (where required) would be provided prior to disconnection of existing services. Ongoing consultation between the construction contractor and property owners would occur to provide sufficient notification of any interruptions to services throughout the construction period.

7.12.4 Mitigation measures

During construction there will be ongoing consultation between the contractor and property owners to provide sufficient notification of any planned interruptions to services throughout the construction period. Where unplanned interruptions to services occur due to accidental damage, the construction contractor will inform affected property owners and provide temporary alternative services as appropriate.

7.12.5 Residual risks

Based on the mitigation measures identified in Section 7.12.4, an assessment of the residual utilities/infrastructure risks associated with the Project have been considered (for risks previously identified as being medium or above). Residual risks identified for the utilities/infrastructure values are provided in Table 47.

Table 47 Residual risks for Utilities/Infrastructure Values

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Temporary services disruption during utility works as part of the Project	U1	Detailed site surveys of utilities infrastructure have been undertaken to identify affected services. Affected residents will be notified of potential temporary loss of services during construction. This results in a medium residual risk.	Almost certain (Almost certain)	Minimal (Minor)	Medium (High)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Accidental damage to utilities and other essential infrastructure	U3	Detailed site surveys of utilities infrastructure have been undertaken to identify affected services. Where unplanned interruptions to services occur due to accidental damage, the contractor will inform affected property owners and provide temporary alternative services as appropriate. This results in a low residual risk.	Remote (Unlikely)	Major (Catastrophic/ Significant)	Low (High)

7.13 Waste and Resources

Section Summary
- This Section identifies the potential impacts associated to the management of resource use and waste produced during the construction of the Project. - Construction of the Project would require the use of a range of resources such as electricity, water, fuel, concrete and paving materials. Other resources would be required for infrastructure such as signals, signage, fit out of the bus stops and landscaping. Bulk materials required for the Project include: diesel, concrete, structural steel, asphalt, general fill material, water and PVC ducts. - Waste generated would likely include demolition waste, surplus building materials, hazardous chemical wastes, liquid wastes, excavated spoil and vegetation, wastewater and general waste. - The mismanagement and storage of waste material produced during construction, and excessive resources used in the construction of the Project are potential risks to the Project. - By considering waste and resource targets and strategies during the detail design phase of the Project and implementing mitigation measures to avoid, re-use and dispose of waste during construction these risks are minimised dramatically, impacts of the Project would be minimised.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk#	Likelihood	Consequence	Risk Rating
Waste materials produced during construction of the Project not stored or managed effectively	WR1	Possible	Major	High
Excessive resources used in the construction of the Project	WR2	Possible	Moderate	Medium

7.13.1 Environmental conditions and values

The consumption of resources and production of waste are integrally linked in construction projects. By minimising resource consumption, waste production is reduced as is the immediate impact on the surrounding environment. Resource and waste management is vital with waste management addressing the following management hierarchy:

- avoidance of unnecessary resource consumption
- resource recovery (including reuse, reprocessing, recycling and energy recovery)
- disposal.

Construction of the Project would require the use of a range of resources such as electricity, water, fuel, concrete and paving materials. Other resources would be required for infrastructure such as signals, signage, fit out of the bus stops and landscaping.

7.13.2 Potential impacts

Demand on resources

Construction of the Project would increase demand on local and regional resources, but would not result in resources becoming scarce or in short supply within the Canberra or greater regional area.

Waste

The construction of the Project would generate various types of wastes and increase waste to landfill during the construction phase. Waste would be managed in accordance with ACT EPA Guidelines and would include the following:

- demolition waste from existing structure (including concrete, asphalt and bricks)
- surplus building materials
- hazardous chemical wastes
- liquid wastes (including waste fuels, paints, oils and chemicals)
- excavated spoil and cleared vegetation
- wastewater (including site run-off and water used for dust suppression)
- building material wastes (including metals, timbers, plastics, packaging, fencing etc.)
- electrical wiring and conduit waste (from electrical connections)
- sewage from construction site facilities
- possible contaminated materials
- general waste, including food scraps generated by construction workers.

Minimal waste and resource use is anticipated to occur during operational of the Project.

Hazardous material use during construction

During construction, potentially hazardous materials would be stored and used on-site at the proposed construction compound and other ancillary work areas. Potentially hazardous materials that may be required to be stored on-site during construction would include fuels, chemicals, lubricating oils, cement, epoxy, paints or other hazardous liquids and materials required. The refuelling and maintenance of construction plant and equipment would be undertaken within designated areas at the construction compound, and typically using specialised refuelling contractors equipped with appropriate spillage response equipment and training.

Potentially hazardous materials would be transported to and from construction sites on public roads. Spills and leaks during transportation may result in the contamination of land and waterways outside of the Project impact footprint. This risk would be managed through the use of contractors who are certified to transport those potentially hazardous materials and have adequate environmental management procedures to address risks associated with spills and leaks during transportation.

Any hazardous waste arising from construction of the project would be removed and disposed in accordance with relevant ACT EPA guidelines.

7.13.3 Mitigation measures

The following mitigation measures would be implemented to minimise waste and resources impacts:

- sourcing locally available materials where appropriate
- investigating opportunities to re-use or recycle other construction and demolition waste, and apply the waste hierarchy (avoid, minimise, re-use/recycle, dispose) throughout construction
- treating any wastewater collected prior to discharge, in accordance with current standards

- chipping leaf material and small branches of native vegetation for use as mulch in temporary erosion and sediment controls, revegetation or landscaping works
- disposing all other green waste from vegetation removal to a green waste recycling facility
- maintaining work sites in a tidy state, and appropriately disposing of all general litter (including food scraps, plastics, glass bottle)
- providing reuse and recycling training and infrastructure at construction sites
- 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.

7.13.4 Residual risks

Based on the mitigation measures identified in Section 7.13.3, an assessment of the residual waste and resources risks associated with the Project have been considered. Residual risks identified for the waste and resources values are provided in Table 48.

Table 48 Residual risks for waste and resources values

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Waste materials produced during construction of the Project not stored or managed effectively	WR1	Through the implementation of the proposed mitigation measures this results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)
Excessive resources used in the construction of the Project	WR2	Through the implementation of the proposed mitigation measures this results in a low residual risk	Unlikely (Possible)	Moderate (Moderate)	Low (Medium)

7.14 Climate Change

Section Summary

- This Section describes the climate change and the potential impacts the Project may have on climate change.
- The key risk of climate change for the Project is identified to be the potential failure of consideration of climate change during the design, resulting in unmitigated climate change vulnerability during construction and operation. Given the small scale of the Project, it is unlikely climate change impacts would be significant.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk#	Likelihood	Consequence	Risk Rating
Failure to consider climate change during design results in unmitigated climate change vulnerability	CC1	Unlikely	Moderate	Low

7.14.1 Environmental conditions and values

The dynamic nature of the climate system indicates a need to focus attention on how to adapt to the changes in climate and understand the limitation of 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, whereby the rainfall expected to occur in a 100-year average recurrence interval flood event would occur more frequently.

7.14.2 Potential impacts

Greenhouse gas emissions

An increase in greenhouse gas emissions, primarily carbon dioxide, would be expected during construction of the Project due to exhaust emissions from construction machinery and vehicles transporting materials and personnel to and from construction work area.

Given the small scale of the Project and the short term temporary nature of the individual construction works, it is considered that greenhouse gas emissions resulting from the construction of the Project would be minimal.

Climate change

Predicted future climate conditions

Climate change projections are published by the Commonwealth Scientific and Industrial Research Organisation and the Office of Environment and Heritage NSW for years 2030, 2070 and 2090. 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 49. The following provides a summary of the climatic changes that are considered likely to affect the Project:

- warming is projected to intensify in the ACT with an increase in average temperatures and a decrease in cooler nights
- temperature extremes are expected to change, with the annual average number of days over 35°C, in Canberra increasing to potentially twice as many by 2070
- frost risk days (minimum temperatures under 2°C) are projected to decrease across the ACT region and could halve by 2090
- average yearly rainfall is likely to stay fairly stable in the ACT, however the rainfall is expected to increase in summer and autumn, and decrease in winter and spring

- due to the projected overall increase in temperatures, days of extreme heat and drier conditions, the risk of high fire danger days and bushfire is projected to increase
- an increase in extreme rainfall events, with storm events and wind speeds becoming more intense across the region
- small changes for solar radiation and relative humidity by 2030, with a high confidence there will be increased winter and spring radiation (related to decreases in cloudiness associated with reduced rainfall) along with a projected decrease in relative humidity later in the century.

Table 49 Summary of the 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

Potential impacts to the Project

The key risk of climate change for the Project is identified to be the potential failure of consideration of climate change during the design, resulting in unmitigated climate change vulnerability during construction and operation. Due to the small scale of the Project, it is unlikely climate change impacts will be significant and would be mitigated by the proposed measures detailed in Section 7.8.3.

Operational Impacts

Overall impacts on air quality during the operation of the Project are considered minimal as the Project would not result in a change in land use. The Project would also facilitate increased access to public transport.

7.14.3 Mitigation measures

There are four possible approaches in responding to climate change:

- *Avoid* – avoid locating assets in vulnerable areas
- *Adapt* – design and/or design standards to operate in predicted climate conditions
- *Defend* – install defences at or around critical infrastructure
- *Retreat* – develop and implement plans to relocate from the vulnerable area

The climate change adaptation principles to be incorporate during the detailed design and operation of the Project include:

- consideration to designing the drainage infrastructure and culverts to accommodate increased intensity of runoff caused by changes in rainfall (droughts and intense rainfall events). Consideration in the detailed design to adapting or upgrading this infrastructure at a future date. This provides options in the future (with greater certainty regarding rainfall projections) to design further adaptation measures to manage potential increased surface water runoff and localised flooding.
- regular inspections of the infrastructure. Should excessive deterioration be identified, minor or more regular maintenance activities may be required within the design life of the project.
- inspection of infrastructure after storm, bushfire or heatwave events to determine damage and appropriate maintenance requirements.
- Selection of materials to prevent accelerated degradation of infrastructure. Additionally, the design would take into account the impact of extreme or prolonged heat events on materials.

7.14.4 Residual risks

There were no risks previously identified as being medium or above. The residual risk of #CC1 risk rating remains low.

7.15 Cumulative impacts

Section Summary

- This Section describes the existing or potential projects which may be carried out concurrently and in close proximity to the Project. The potential impacts as described in other sections of this assessment (e.g. traffic, noise and amenity) may be greater than would be expected if each project was undertaken in isolation.
- The Canberra Brickworks Precinct development would be carried out by DOMA group and its contractors and may be carried out concurrently with the Access Road and Dudley Street Upgrade (the Project). A separate EBPC Act Referral (2017/8074) has been submitted for the proposed action of developing the Canberra Brickworks Precinct.
- The Cotter Road duplication stage 2 project is currently being delivered by TCCS around one kilometre from the proposed Project. It is likely that this project would be complete prior to the start of construction of the Project. Though there may be instances where commuters who regularly travel along Cotter Road and Dudley Street are more sensitive to the construction impacts such as traffic disruption as a result of 'construction fatigue'.
- The Development Application finder in ACTmapi was searched on 11 April 2018 which identified three residential development projects currently approved within one kilometre of the Project.
- Traffic disruption associated with the construction phase of the Project is not anticipated to have a significant impact on the surrounding road network as access would continue to be provided along Dudley Street during construction.
- Consultation would occur with the NCA, TCCS, SLA, other appropriate ACT Government departments, and any identified developers prior to construction to minimise potential cumulative impacts. Specific mitigation measures would be determined and incorporated in construction Traffic Management Plans and the CEMP.
- It is anticipated that the cumulative impacts would be manageable.

Description			Pre-mitigation Risk Assessment	
Risk Scenario	Risk#	Likelihood	Consequence	Risk Rating
Increased sensitivity of community to Project impacts due to other projects occurring concurrently	CM1	Possible	Moderate	Medium

7.15.1 Existing or potential projects

Cumulative impacts occur when two or more projects are carried out concurrently and in close proximity to one another. The impacts may be caused by both construction and operational activities and can result in a greater impact to the surrounding area than would be expected if each project was undertaken in isolation.

While the Project (as described in Chapter 3.0) undertaken by ACT Government would provide the publicly funded access to allow the development of the Canberra Brickworks Precinct, DOMA Group are the proponent responsible for the development of the Canberra Brickworks Precinct. A separate EBPC Act Referral (2017/8074) has been submitted for the proposed action of developing the Canberra Brickworks Precinct. The construction of the Canberra Brickworks Precinct development may overlap with the construction of the Project. There is a preference for the construction of the Project to commence prior to the precinct development in order to allow an appropriate access via the new Access Road for the construction vehicles undertaking work on the precinct development, thereby minimising disruption from construction traffic (including site decontamination works) for the residents of Yarralumla.

Cotter Road is currently being duplicated by TCCS around one kilometre from the Project area however it is likely that this major road development would be completed prior to the commencement of the Project. There may be instances where the commuters who travel along Cotter Road and Dudley Street are more sensitive to the impacts such as traffic as a result of 'construction fatigue'.

The Development Application finder in ACTmapi was searched on 05 April 2018 which identified three residential development projects currently approved within one kilometre of the Project.

Potential cumulative impacts may occur as a result of construction activities being carried out simultaneously with the projects listed above or other projects. Potential impacts could include:

- increased traffic travelling through the Project area and surrounding road network and associated delays for road users
- increased construction noise and vibration levels
- reduced visual amenity
- greater sensitivity to impacts from the project through 'construction fatigue'.

Consultation would occur with the NCA, TCCS, SLA, other ACT Government departments, and any identified developers prior to construction to minimise potential cumulative impacts. Traffic associated with the construction work is not anticipated to have a significant impact on the surrounding road network as access would continue to be provided along Dudley Street during construction. Based on this assessment, it is anticipated that the cumulative impacts would be negligible, provided that mitigation measures in Section 8.2 are implemented.

7.15.2 Mitigation measures

Consultation with relevant stakeholders identified in Section 7.15.1 would be undertaken during construction planning where required, to ensure that potential cumulative impacts are able to be minimised.

Additional mitigation measures identified as necessary as a result of the consultation would be included in the construction Traffic Management Plan and CEMP for the management of traffic and noise during construction. Potential cumulative impacts associated with the Proposal would be further considered as the design develops and as further information regarding the location and timing of potential developments is released. See Section 8.2 for a full list of mitigation measures.

7.15.3 Residual risks

There were no risks previously identified as being medium or above. The residual risk of #CM1 risk rating remains medium.

8.0 Environmental management

This Chapter of the REF identifies how the environmental impacts of the Project are to be managed through environmental management plans and mitigation measures. Section 8.2 provides a summary of the proposed mitigation measures for the Project to minimise the impacts of the Project, as identified in Chapter 7.0. A summary of the residual risk ratings is provided which incorporates these mitigation measures.

8.1 Environmental management plans

A CEMP for the construction phase of the Project and would provide a centralised mechanism through which all potential environmental impacts relevant to the Project are to be managed, and outline a framework of procedures and controls for managing environmental impacts during construction.

The CEMP would incorporate as a minimum all environmental mitigation measures identified below in Section 8.2, any conditions from licences or approvals required by legislation, and a process for demonstrating compliance with such mitigation measures and conditions.

8.2 Mitigation measures

Mitigation measures for the Project are listed below in Table 50. These proposed measures would minimise the potential adverse impacts of the Project identified in Chapter 7.0 should the Project proceed.

Table 50 Summary of proposed mitigation measures

No.	Mitigation measure
General	
1.	A Construction Environmental Management Plan (CEMP) is to be prepared by the Contractor that includes a robust model for monitoring and reporting against conditions of approval that have arisen from the EPBC Act Referral and REF approval process with the ACT Government and DOEE. The CEMP is to be prepared prior to the commencement of construction.
2.	Prior to the commencement of construction, all contractors are to be inducted on the key Project environmental risks, procedures, mitigation measures and conditions of approval.
3.	Site inspections to monitor environmental compliance and performance are to be undertaken during construction at appropriate intervals.
Traffic and transport	
4.	A CTMP would be prepared by the nominated contractor in consultation with the ACT Government and provided to TCCS. The CTMP would be the primary management tool to manage potential traffic and pedestrian impacts associated with construction. The CTMP, at a minimum, would include: • procedures for preparing and implementing Traffic Control Plans for any detours or traffic controls to manage temporary road disruptions • details of adequate road signage to inform road users and pedestrians of the works • procedures to maximise safety and to maintain accessibility for pedestrians and cyclists • procedures identifying adequate sight lines and providing stop/go staff to allow for safe entry and exit from the construction site • parking locations for construction workers away from residential areas (e.g. at site compound) and details of how this will be monitored for compliance • routes to be used by heavy construction-related vehicles to minimise impacts on local streets by using Dudley Street, the Kent Street bridge and the surrounding arterial road system • scheduling of works/deliveries to avoid peak commuter and school times and limiting works in the road carriageway as much as practicable • measures to manage traffic flows around the area affected by the Project, including as required regulatory and direction signposting, line marking and variable message signs and all other traffic control devices necessary for the implementation of the CTMP.

No.	Mitigation measure
5.	Provide advance notice of upcoming works to permit drivers to avoid travel or adjust speed and safely negotiate past the work site on Dudley Street.
6.	Advise local businesses, residents, bus operators and emergency service providers of the upcoming works.
7.	Monitor the performance of all Project traffic arrangements during construction.
8.	Schedule works with the potential for traffic disruption, such as utility adjustments along the trafficked pavement outside of peak commuting periods in order to minimise road user delays. Works impacting on traffic lanes to be undertaken off peak (or at night).
9.	Secure work zones to prevent unauthorised access, including pedestrian access with site perimeter fencing and secured gate(s), as required, in particular to prevent access outside work hours.
10.	Avoid traffic lane closures and diversions during peak hours where possible.
11.	Implementing temporary speed restrictions as appropriate, in consultation with TCCS.
12.	Ensure that any work undertaken near Cotter Road does not disrupt traffic movements along Cotter Road; the construction of new pavement adjacent to the eastbound carriageway of Cotter Road may require out of hours road works to minimise disruption.
Biodiversity	
13.	Construction methodologies would be developed during design and by the Construction contractor with the aim of minimising the Project footprint where feasible and reasonable.
14.	All workers would be provided with an environmental induction prior to commencing work onsite. This induction would include information on the protection measures to be implemented to protect vegetation, penalties for breaches and locations of areas of sensitivity.
15.	Exclusion zones would be established to protect vegetation and fauna habitat outside of the approved clearing limits, including the threatened ecological communities. Vegetation to be retained is to be clearly defined on ground and 'no-go zones' clearly signposted and fenced to prevent unauthorised clearing and vehicular and/foot traffic or materials storage. During the early phases of the Project, flagging would be used along the north and south boundary of the site to create a visual indication of ecologically sensitive areas and minimise the potential for unauthorised access from vehicular and foot traffic. The flagging would be replaced with ATF temporary fencing (or similar) prior to the main construction works.
16.	A temporary diversion of the Uriarra Track would be provided for the duration of construction to encourage foot and bicycle traffic to avoid the golden sun moth habitat areas.
17.	A suitably qualified ecologist or environmental scientist would check for the presence of flora and fauna species and habitat on site before clearing begins including the presence of threatened species, bird nests and arboreal mammals.
18.	A suitably qualified ecologist or environmental scientist would be on site during habitat removal; i.e. the felling of woodland habitat and removal of surface rock and debris.
19.	In order to control the potential impacts of weeds and disease, the following measures would be implemented: • ensure machinery, equipment and other plant are washed down prior to entry to the impact area to avoid the spread of weeds and other pathogens • minimise the overall disturbance of soils where possible to avoid providing further disturbed ground for colonisation by weeds • minimise the import or export of soil material from the site where possible to avoid the inadvertent movement of weed seed and where practical, preserve top soil from excavation for reuse later over the top of excavations areas • remove weeds immediately within the Project area and dispose without stockpiling, (disposal of weed-contaminated soils at appropriate weed disposal facilities).

No.	Mitigation measure
20.	Further to dust mitigation measures outlined in Section 7.8, particular attention will be given to dust control during the golden sun moth breeding season (generally mid-October to early January, depending on local climate conditions).
21.	In the event of any tree to be retained becoming damaged during construction, the Contractor would immediately notify the ACT Government nominated Project Manager to coordinate the response which may include contacting an arborist to inspect and provide advice on remedial action, where possible.
22.	Opportunities to retain the large pine trees located within the proposed site compound area would be investigated by the Contractor.
23.	Disturbed areas with known native grasses including food plants for golden sun moth would be revegetated with 'C3' native grasses as appropriate, such as indigenous Wallaby Grasses.
24.	The Biodiversity Offset Strategy (described in Section 7.2.5) would be implemented.
Landscape and visual	
25.	Specific design measures for construction ancillary to prevent crime, based on principles of crime prevention through environmental design.
26.	The urban design of the Access Road addressing the design of the adjoining Canberra Brickworks Precinct to ensure a consistent landscape and views.
27.	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 and to be contingent with the development of the Canberra Brickworks Precinct.
28.	Installation of screen hoarding and/or shade cloth screens around compound locations and working areas.
29.	Minimisation of tree and vegetation removal.
30.	Avoidance of temporary light spill beyond the construction site where temporary lighting is required (e.g. during night time works).
31.	Rehabilitation of disturbed areas as soon as practical following works in specific areas.
32.	Removal of graffiti (as required).
33.	Landscaping and weeding of grassed areas within the Project area to continue as per existing arrangements to minimise areas of overgrown vegetation.
34.	Traffic management and provision of parking for construction site vehicles within the construction working area to minimise parking impacts on surrounding roads.
35.	Ongoing maintenance and repair of constructed elements.
36.	Replacement of damaged or missing constructed elements.
37.	Long term maintenance (and replacement as necessary) of tree planting within the Project area (e.g. along Access Road) to maintain visual filtering and screening of external views.
38.	Soft and hard landscape works maintenance.
Socio-economic	
39.	Sustainability criteria for the Project would be established to encourage construction personnel to purchase goods and services locally helping to ensure the local community benefits from the construction of the Project.

No.	Mitigation measure
40.	A number of safeguards would be implemented to minimise potential impacts on the community with a particular focus on keeping the community informed. These safeguards would be included in the CEMP developed by the Contractor and will include: • a Community Liaison Plan (to be developed by the Contractor prior to construction) would identify all potential stakeholders and the best-practice methods for consultation with these groups during construction. The Plan would also encourage feedback and facilitate opportunities for the community and stakeholders to have input to the Project, where possible • the community would be kept informed of construction progress, activities and impacts in accordance with the Community Liaison Plan • contact details for a 24-hour construction response line, Project Infoline and email address would be provided for ongoing stakeholder contact throughout the construction phase.
Noise, Vibration and Lighting	
41.	Prior to commencement of works, a CNVLMP would be prepared and implemented in accordance with the requirements of the <i>Guidelines for the preparation of Noise Management Plans for development applications</i> (EPA, 2014) and the Road Traffic Noise Impact Assessment (AECOM, 2017b).
42.	The CNVLMP would outline measures to reduce the noise impact from construction activities. Reasonable and feasible noise mitigation measures which are to be considered, include: • regularly training workers and contractors (such as at the site induction and toolbox talks) on the importance of minimising noise emissions and how to use equipment in ways to minimise noise • avoiding any unnecessary noise when carrying out manual operations and operating plant • ensuring spoil is placed and not dropped into awaiting trucks • avoiding/limiting simultaneous operation of noisy plant and equipment within discernible range of a sensitive receiver where practicable • switching off any equipment not in use for extended periods e.g. heavy vehicles engines are to be switched off whilst being unloaded • avoiding deliveries at night/evenings wherever practicable • no idling of delivery trucks • keeping truck drivers informed of designated vehicle routes, parking locations and acceptable delivery hours for the site • minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios onsite; no dropping of materials from height where practicable, no throwing of metal items and slamming of doors.
43.	The CNVLMP would include measures to reduce the construction noise and vibration impacts from mechanical activities. Reasonable and feasible noise mitigation options which are to be considered, include: • maximising the offset distance between noisy plant and adjacent sensitive receivers and determining safe working distances • using the most suitable equipment necessary for the construction works at any one time • directing noise-emitting plant away from sensitive receivers • regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc • using non-tonal reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise-sensing alarms for all plant used regularly onsite (greater than one day), and for any out of hours works • use of quieter and less vibration emitting construction methods where feasible and reasonable.
44.	Works would generally be carried out during standard construction hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). Any works outside these hours may be undertaken if approved by ACT Government and the community is notified prior to these works occurring.

No.	Mitigation measure
45.	For construction concentrated in a single area (e.g. eastern construction compound) temporary acoustic fencing/barriers around the site perimeter would be considered where feasible and reasonable to mitigate off-site noise levels.
46.	The construction staging strategy will prioritise the use of the western construction compound rather than the eastern compound (e.g. during the use of vegetation mulchers).
47.	Night works would be programmed to minimise the number of consecutive nights work impacting the same receivers.
48.	Out of hours works would be minimised as much as practicable (e.g. deliveries of equipment and materials could be made during standard hours, and/or disposal of construction waste may be delayed until on the following day).
49.	To avoid structural impacts as a result of vibration or direct contact with structures, the proposed works are to be undertaken in accordance with the safe work distances outlined in Table 31 and attended vibration monitoring or vibration trials are to be undertaken where these distances are required to be challenged.
50.	If construction works are proposed within the safe working distances, a permanent vibration monitoring system is to be installed around one metre from the building footprint to warn operators in real time when vibration levels are approaching the maximum vibration criteria. This may include the use flashing lights, SMS, or alarm system.
51.	Building condition surveys are to be completed for buildings within 100 metres of the Project both before and after the works to identify existing damage and any damage due to the works.
52.	Lower vibration generating items of excavation plant and equipment e.g. smaller capacity rock breaker hammers are to be used where feasible.
53.	Lighting requirements for the Project would be designed to AS/NZS standards and TCCS requirements and approval.
54.	Directional lighting would be implemented during construction and light spillage will be minimised using light shields and reducing light heights.
55.	At night, the strategy for lighting would be to ensure the Project contributes to a safe and legible streetscape. In particular, the lighting required for the Project would be mitigated as follows: - all lights would be located at a similar level to the overhead catenary system so to minimise the light spill onto adjacent areas - all lights would be directed downwards, with the exception of feature lighting that would always be capped by a surface material - light colour would be designed in response to the surrounding context and be selected to complement the surrounding lighting colour.
Soils and Geology	
56.	Existing vegetation on site would be retained as long as possible and only cleared when required for construction.
57.	The drainage line in the southern extents of the Project area would be monitored to ensure sediment is not leaving the construction areas and entering water bodies.
58.	Offsite runoff would be diverted around or through the construction areas so it would not mix with onsite construction runoff. This would be achieved using temporary or permanent diversion drains to minimise the volume of flow through the construction area.
59.	Disturbed areas would be stabilised as soon as possible following disturbance including that installation of scour protection on any disturbed embankments immediately following excavation.

No.	Mitigation measure
60.	A progressive and live Erosion and Sediment Control Plan (ESCP) would be developed prior to construction. The ESCP should contain at a minimum: • installation/use of siltation fences and other filtering devices to restrict sediment movements to within the work sites and to prevent any movement of sediment off-site • installation of a physical barrier such as cut-off drains at the entry or exit to the work area to contain sediment laden runoff within the work area and construction compound • location of stockpiles away from drainage lines • directing uncontaminated rainwater away from potentially contaminated areas, such as storage and washing areas • storage of chemicals within a bunded, roofed area to protect the stormwater system in case of leaks and spills. Maintenance of a spill kit on site if the activity may result in a spillage • revegetation of construction areas as soon as practically possible after construction activities have been completed • management of stockpiles using of sediment and erosion control measures including sediment fencing and drainage swales, bunding around stockpiles and covers • restriction of construction traffic in unsealed areas and, where required, operation of wheel cleaning areas at locations where vehicles leave the construction site. Vehicles to be checked of weeds. • the design of erosion and sediment controls during the design phase in accordance with the 'Environment Protection Guidelines for Construction and Land Development in the ACT' which are available from the EPA website (ACT Environment Protection Authority, 2011).
61.	Appropriate sediment controls (e.g. wheel wash facilities) would be provided at site egress points, to prevent the tracking of mud or loose sediment off site.
62.	Erosion and sediment control measures would be regularly inspected (particularly following rainfall events) to ensure their ongoing functionality; and would be left in place until the works are complete and areas are stabilised.
63.	Works would be avoided during rainfall (or whilst the ground remains sodden) in unsealed areas, where practicable, to minimise vehicle disturbance to the topsoil.
64.	If unexpected finds of contaminated material are identified during construction, it would be managed and either re-used or disposed of appropriately in accordance with all relevant legislation and ACT EPA guidelines.
Water and flooding	
65.	Stormwater runoff will be captured by the existing stormwater drainage network, where possible.
66.	Where existing pipes and overland flow paths are inadequate, oversized pipes in the median would be considered to provide additional storage capacity.
67.	The stormwater management system would be designed to minimise disturbance of areas of ecological where possible in particular areas of natural temperate grassland, golden sun moth habitat and trees.
68.	The stormwater management system would be designed to ensure that no additional runoff from the Project area enters any area of natural temperate grassland or golden sun moth habitat.
69.	Spill kits would be provided at various locations through the construction area and regularly topped up to allow for a quick response to accidental spills.

No.	Mitigation measure
Air Quality	
70.	Ambient dust emissions from wheel-generated dust, excavation, clearing and grading, truck loading and unloading, and wind erosion would be the primary focus of dust control during construction works. Dust mitigation measures that would be implemented during the construction would include: • apply water (or alternate measures) to exposed surfaces (e.g. unpaved roads, stockpiles, hardstand areas and other exposed surfaces) • implement measures to modify or suspend dust-generating activities during periods of high wind speeds or whenever dust plumes from the works are visible • seal regularly trafficked surfaces to minimise dust generation as far as practicable • confine vehicular access to designated construction routes which minimise haul road lengths • cover stockpiles when not in use • remove silt and other material from around erosion and sediment control structures to ensure deposits do not become a dust source • appropriately cover loads on trucks transporting material to and from the construction site and securely fix tailgates of road transport trucks prior to loading and immediately after unloading • prevent mud and dirt being tracked onto sealed road surfaces.
71.	Greenhouse gas emissions from vehicles and machinery working on site during the construction phase of the Project should be mitigated by the following: • methods for management of machinery and equipment emissions are to be incorporated into project inductions, training and pre-start/toolbox talks • plant and machinery are to be regularly checked and maintained in a proper and efficient condition. Plant and machinery are to be switched off when not in use, and not left idling. • truck queuing and unnecessary trips are to be minimised through logistical planning of materials delivery and work practices • ensure all vehicles switch off engines when stationary so there are no idling vehicles • use locally sourced materials to reduce fuel use.
Aboriginal Heritage	
72.	For the unanticipated discovery of Aboriginal sites and burials (during investigation or development works, including excavation and/or other significant ground disturbance), the works be managed through the use of the unexpected finds protocol as outlined by Navin Officer Heritage Consultants, 2014.
Non-Aboriginal Heritage	
73.	A survey is to be undertaken that records the orientation and levels of the cutting from the southern boundary of the registered curtilage boundary to the extent of identifiable cuttings to the east, near Denman Street. The survey will cover the extent of the visible remains.
74.	During ground disturbance, a suitably qualified archaeologist should be on-hand to record the soil profiled across the cutting, if disturbance within the profile associated with the cutting of the railway line is evident.
75.	In the event that previously unrecorded or unanticipated or non-Aboriginal archaeological (objects, artefacts, deposits or relics) are encountered, the unexpected finds protocol as outlined by Navin Officer Heritage Consultants, 2014 will be implemented.

No.	Mitigation measure
Bushfire Risk	
76.	Prior to the commencement of works, the contractor would develop an Emergency Response Plan that would include the following mitigation measures: • Bushfire protection measures and requirements would be included within the site induction and toolbox talks for contractors working on the Project. • Electrical equipment and other plant and machinery would be maintained in operational order that is fit for purpose and to prevent potential sparks. • All legislative requirements regarding safe work procedures would be met, including chemical handling and storage. • Communications protocols would be established between the Project and emergency services during construction and included in the Emergency Response Plan. • All vehicles/mobile plant entering site would be fitted with fire extinguishers. • No open fires would be permitted within the construction areas (e.g. burning of removed vegetation). • Temporary project buildings would be constructed in accordance with Australian Standards AS 3959 – Construction of buildings in bushfire prone areas. • Temporary site buildings would be located away from trees. • Trees that are proposed to be retained within the identified asset interface areas would have the lower branches trimmed to a height of two metres above the ground. • Weeds would be managed at the site to ensure that they do not constitute a fire hazard.
77.	Hot works will be undertaken in accordance with the following measures: • Hot works would not be permitted on days when a Catastrophic fire danger has been declared. • Areas where hot works are to be conducted would be cleared of flammable vegetation and materials in all directions to a distance of five metres (where practicable). • A spotter would be used when hot works are conducted in areas where flammable materials cannot be removed and a fire fighting equipment would be present when conducting hot works. • A post work check of any hot works would be conducted after completion. • The management of potential impacts associated with hot works would be included as part of the Emergency Response Plan.
78.	Landscaping will be undertaken in accordance with the following measures: • Retained vegetation would be watered regularly during the bushfire season to retain moisture, in particular on days of forecast high or above fire danger. • Mulch would be placed in landscaped areas as soon as is possible to reduce the on-site storage time. • Stockpiled mulch would be kept in small piles to reduce the likelihood of self-combustion.
79.	Waste management will be undertaken in accordance with the following measures: • Construction waste would be removed from the site in a timely manner so as not to cause a fire risk or obstruct emergency vehicle access. • Unauthorised access to waste receptacles would be prevented, i.e. locked covers and/or fencing to prevent public access or fires being lit.
Utilities and infrastructure	
80.	During construction there will be ongoing consultation between the contractor and property owners to provide sufficient notification of any planned interruptions to services throughout construction.
81.	Where unplanned interruptions to services occur due to accidental damage, the construction contractor will inform affected property owners and provide temporary alternative services as appropriate.

No.	Mitigation measure
Waste and Resources	
82.	Sourcing locally available materials where appropriate.
83.	Investigating opportunities to re-use or recycle other construction and demolition waste, and apply the waste hierarchy (avoid, minimise, re-use/recycle, dispose) throughout construction.
84.	Treating any wastewater collected prior to discharge, in accordance with current standards.
85.	Chipping leaf material and small branches of native vegetation for use as mulch in temporary erosion and sediment controls, revegetation or landscaping works.
86.	Disposing all other green waste from vegetation removal to a green waste recycling facility.
87.	Maintaining work sites in a tidy state, and appropriately disposing of all general litter (including food scraps, plastics, glass bottle).
88.	Providing reuse and recycling training and infrastructure at construction sites.
89.	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.
Climate Change	
90.	The climate change adaptation principles to be incorporate during the detailed design and operation of the Project include: • Consideration to designing the drainage infrastructure and culverts to accommodate increased intensity of runoff caused by changes in rainfall (droughts and intense rainfall events). Consideration in the detailed design to adapting or upgrading this infrastructure at a future date. This provides options in the future (with greater certainty regarding rainfall projections) to design further adaptation measures to manage potential increased surface water runoff and localised flooding. • Regular inspections of the infrastructure. Should excessive deterioration be identified, minor or more regular maintenance activities may be required within the design life of the project. • Inspection of infrastructure after storm, bushfire or heatwave events to determine damage and appropriate maintenance requirements. • Selection of materials to prevent accelerated degradation of infrastructure. Additionally, the design would take into account the impact of extreme or prolonged heat events on materials.
Cumulative impacts	
91.	Consultation will occur with the NCA, TCCS, SLA, other ACT Government departments, and any identified developers prior to construction to minimise potential cumulative impacts. Traffic associated with the construction work is not anticipated to have a significant impact on the surrounding road network as access would continue to be provided along Dudley Street during construction.

8.3 Residual risk assessment

Following the implementation of the mitigation measures for the Project listed in Table 50, a summary of the residual risks is provided in Table 52.

Table 51 Summary of the residual risks (with mitigation)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Traffic volume increases in the Project area during construction and operation not anticipated or understood	T1	A Traffic and Transport Impact Assessment (AECOM, 2017a) has been undertaken for the Project which has assessed the expected traffic volume increases likely to be generated by the Project.	Unlikely (Possible)	Major (Major)	Medium (High)
Temporary loss of access and traffic disruptions (e.g. temporary diversions) during construction	T2	The preparation of a CTMP which incorporates the proposed mitigation measures will ensure access and traffic disruptions are considered and minimised as much as practicable. This would reduce the risk from very high to low.	Possible (Almost certain)	Minor (Moderate)	Low (Very High)
Temporary traffic management measures during construction are not suitable and result in near miss incidents, crashes, injuries or death	T3	The preparation of a CTMP which incorporates the proposed mitigation measures will ensure access and traffic disruptions are considered and minimised as much as practicable. This would result in a medium residual risk.	Remote (Unlikely)	Catastrophic/ Significant (Catastrophic/ Significant)	Medium (High)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Traffic volume increases in the Project area and wider road network as a result of the Project	T4	There would likely be an increase in traffic demand on Dudley Street as a result of the access to the Canberra Brickworks Precinct which would put additional pressure on nearby intersections. The upgrades to Dudley Street would assist traffic movements along Dudley Street in the short and medium term. Future improvements to these intersections may be required in the long term.	Possible (Likely)	Minor (Minor)	Low (Medium)
Presence or extent of threatened species and ecological communities not identified	E1	The Project area has been surveyed numerous times in recent years. Threatened species have been recorded and a Referral to the Commonwealth regarding the Project's impact on these species has occurred. The surveys undertaken provides a good deal of certainty that all threatened species and ecological communities have been identified and mapped in the Project area, therefore reducing the risk from high to medium.	Remote (Unlikely)	Catastrophic/ Significant (Catastrophic/ Significant)	Medium (High)
Incursion of vehicles into areas of environmental significance causing damage to or destruction of habitat	E2	Through the implementation of mitigation measures such as the establishment of exclusion zones around vegetation and fauna habitat to be retained, and the implementation of 'no-go zones' clearly signposted and fenced to prevent unauthorised clearing and vehicular and/foot traffic, the residual risk is medium.	Unlikely (Possible)	Major (Major)	Medium (High)
Clearing of trees and other vegetation causing impacts including loss of amenity, loss of habitat, increased erosion and water runoff	E3	Through the implementation of the proposed mitigation measures and the biodiversity offset strategy the Project impacts will be minimised or offset. The residual risk is high	Likely (Almost certain)	Moderate (Catastrophic/ Significant)	High (Significant)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Vegetation clearing activities during construction disturb native animals and increase the potential for vehicle strike	E4	Through the implementation of proposed mitigation measures such as having a suitably qualified ecologist or environmental scientist for the presence of flora and fauna species and habitat on site before clearing begins including the presence of threatened species, bird nests and arboreal mammals, results in a low residual risk.	Unlikely (Possible)	Moderate (Moderate)	Low (Medium)
Project activities facilitate spread of exotic flora into adjacent areas, leading to weed establishment	E5	Specific mitigation measures to control the spread of weeds have been proposed which would result in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)
Project attracts additional vermin and pest species, which result in greater competition for resources with native species	E6	Through the implementation of standard mitigation measures and appropriate waste management this results in a very low residual risk.	Remote (Unlikely)	Moderate (Major)	Very Low (Medium)
Clearing of vegetation results in a loss of connectivity through fragmentation in the landscape, or obstructing local movement corridors	E7	Project impacts will be offset as described in Section 7.2.5 which results in a very low residual risk.	Unlikely (Possible)	Minor (Moderate)	Very Low (Medium)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Clearing of protected trees that have not been approved to be cleared	E8	Through the implementation of mitigation measures such as the establishment of exclusion zones around vegetation and fauna habitat to be retained, and the implementation of 'no-go zones' clearly signposted and fenced to prevent unauthorised clearing this results in a medium residual risk.	Unlikely (Possible)	Major (Major)	Medium (High)
Impacts on Matters of National Environmental Significance (MNES)	E9	The Project disturbance footprint has been designed to minimise impacts to MNES as feasible and reasonable and would be further refined during the detailed design phase of the Project. Impacts to MNES would occur as a result of the Project, however through the implementation of an offset strategy the overall Project impacts would be compensated reducing the consequence to minor.	Almost certain	Minor (Catastrophic/ Significant)	High (Significant)
Impacts to aquatic ecology	E10	The closest water body to the Project is the Yarralumla Creek located around 700 metres south of the Project area. There is an existing drainage line located in the southwest corner of the Project area with a pipe culvert located under Cotter Road. Overland surface flow has been mapped to generally flow south towards Yarralumla Creek. As the drainage line and Yarralumla Creek are located in a highly modified landscape, it is unlikely that they support any significant aquatic flora or fauna resulting in an overall low risk.	Remote	Minor (Major)	Negligible (Low)
Loss of soil seed bank and other native plant propagules	E11	Topsoil would be reused onsite where possible. This results in a low residual risk.	Likely (Almost certain)	Minimal (Minor)	Low (High)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Visual impacts during and following construction not anticipated	LV1	This Section provides an assessment of the likely visual impacts during and following construction. The construction sites would be managed in accordance with the CEMP prepared for the works. This would result in a low residual risk.	Negligible (Possible)	Moderate (Moderate)	Low (Medium)
Views available to occupants of nearby sensitive receivers are altered	LV2	Tree losses have been minimised during design development. Mitigation measures as defined in Section 7.2.4 would minimise visual impacts of the Project, resulting in a high residual risk	Likely (Likely)	Moderate (Major)	High (Very High)
Community complaints and dissatisfaction in concept development	CS1	The ACT Government has committed to delivering the Project in an open and transparent way, delivering a series of early consultation on the Projects design and releasing the Project's business case. This allowed the community to raise issues early on and have influence in the design of the Project as detailed in Section 5.0. This results in a low residual risk.	Possible (Likely)	Minor (Moderate)	Low (High)
Public comment period of REF raises significant issues that delay release of final REF report	CS2	Meetings with EPSDD, NCA and DOEE have been undertaken to discuss the Project design and significant environmental impacts. A community information session has also been undertaken to seek public feedback on the Project design. There is still the potential for issues to be raised during the consultation process, but significant effort has been put into informing the public of the impacts of the Project. This results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Increased media attention and political interest affects the community interest or perceptions of the Project in general	CS3	Community consultation for the Project has been undertaken. Identified sensitive receivers were included in consultation sessions at the beginning of Project design. The ACT Government has committed to delivering the Project in an open and transparent way, delivering a series of early consultation on the Projects design which allowed community issues to be raised early in Project development. This results in a low residual risk.	Unlikely (Likely)	Moderate (Moderate)	Low (High)
Development is not consistent with values of retained heritage sites, or areas of natural environmental value	CS4	The Project has sought to minimise impacts to the environmental values of the area and the identified heritage sites (see Section 7.9). All construction zones will be clearly demarcated to avoid impacts on public open space and allow residents to continue using the area as much possible. This results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)
Construction of the Project would result in the temporary loss of public open space and access to the Uriarra track (footpath used for dog walking)	CS5	Existing access for active transport will be retained where possible. The Uriarra Track will be temporarily closed for a period of construction to ensure there is no interaction between users and construction equipment. This temporary closure would be minimised to the greatest extent possible while ensuring the safety of users is maintained. This results in a medium residual risk.	Likely (Likely)	Minor (Moderate)	Medium (High)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Operation of the Project would result in the permanent loss of an area of public open space	CS6	Construction of the Project would result in the permanent loss of an area of urban open space and would change the land use of the area to road reserve. While this area has limited recreational value (excluding the use of Uriarra Track) constructing a new Access Road that bisects the area of open space would fragment this area and limit the amount of useable recreational area. The Project includes the provision for a minor diversion of Uriarra Track so that access is maintained across the Access Road with a safe crossing point during operation. This results in a high residual risk	Almost certain <i>(Almost certain)</i>	Minor <i>(Moderate)</i>	High <i>(Very High)</i>
Intermittent noise and vibration emitted from the equipment required to carry out the proposed construction of the Project impacting residential and non-residential receivers.	NVL1	Implementation of a CNVLMP and the proposed mitigation measures results in a medium residual risk.	Possible <i>(Possible)</i>	Moderate <i>(Major)</i>	Medium <i>(High)</i>
Long term noise and vibration impacts from the operation of the Project and use of Access Road by new residents of the Canberra Brickworks Precinct	NVL2	The operational noise modelling assessment undertaken has determined there is unlikely to be long term noise and vibration impacts from the operation of the Project. This results in a low residual risk.	Unlikely <i>(Possible)</i>	Moderate <i>(Catastrophic/ Significant)</i>	Low <i>(Very High)</i>

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Local residents in surrounding suburbs exposed to increased levels of noise and vibration due to altered traffic patterns	NVL3	The operational noise modelling assessment undertaken has determined there is unlikely to be long term noise impacts from the operation of the Project. results in a very low residual risk	Unlikely (Unlikely)	Minor (Major)	Very Low (Medium)
Increased luminance for residents impacting amenity of sensitive receivers during construction and operation	NVL4	Mitigation measures proposed include directional lighting being implemented during construction and light spillage being minimised using light shields and reducing light heights. This results in a very low residual risk.	Unlikely (Possible)	Minor (Moderate)	Very Low (Medium)
Lighting impacts to nocturnal fauna	NVL5	Mitigation measures proposed would include all lights to be directed downwards, with the exception of feature lighting that would always be capped by a surface material. This results in a very low residual risk.	Unlikely (Possible)	Minor (Minor)	Very Low (Low)
Inadequate investigation of site geotechnical issues results in additional works, delays to works and contractor claims	SG1	Various investigations of the soil, ground and contamination risks present in the Project area have been undertaken as detailed in Section 7.6.1.	Unlikely (Unlikely)	Moderate (Major)	Low (Medium)
Disturbance of currently unidentified contaminated soils during construction	SG2	Mitigation measures proposed results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Contamination remediation activities reveal larger extent of contamination than expected	SG3	The results of the soil and groundwater contamination testing do not indicate the presence of contamination within the Project area. Implementation of contaminated land mitigation measures in the CEMP will reduce the consequence of revealing larger extents of contamination than expected from major to moderate. This results in a low residual risk.	Unlikely (Unlikely)	Moderate (Major)	Low (Medium)
Disturbance of soil associated with construction leading to increased soil and sediment erosion	SG4	Development of an ESCP and the implementation of the proposed mitigation measures results in a medium residual risk.	Unlikely (Likely)	Major (Major)	Medium (Very High)
Soil structure decline affects viability of open space areas and health of retained trees	SG5	Development of an ESCP and the implementation of the proposed mitigation measures results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (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	SG6	Development of an ESCP and the implementation of the proposed mitigation measures results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)
Local and regional drainage conditions altered	HYD1	Mitigation measures proposed would result in a low residual risk.	Unlikely (Likely)	Moderate (Moderate)	Low (High)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Increase in flood levels as a result of the Project	HYD2	Flood information available for Yarralumla Creek indicates that the Project area is not impacted by the 1 percent AEP flood event. There is unlikely to be any impact to flood behaviour either along the alignment or on adjacent land uses. This results in a low residual risk.	Unlikely (Possible)	Moderate (Major)	Low (High)
Changes to existing flow paths and overland flow due to proposed Project	HYD3	Mitigation measures proposed would result in a medium residual risk.	Unlikely (Likely)	Major (Major)	Medium (Very High)
Potential changes to groundwater availability due to vegetation removal or excavation including impacts on groundwater dependent ecosystems and water users within the catchment	HYD4	There are no GDEs or registered bores located in the Project area. This results in a very low residual risk.	Unlikely (Possible)	Minor (Moderate)	Very Low (Medium)
Heavy vehicle exhaust emissions cause increase reduction in local air quality	AQ1	Greenhouse gas emissions from vehicles and machinery working on site during the construction of the Project would be mitigated through the measures identified. Overall impacts on air quality during the operation of the Project are considered minimal as the Project would not result in a change in land use on Dudley Street and the additional traffic resulting from the use of the Access Road would be offset by changes to vertical and horizontal alignment of Dudley Street which would improve traffic flows and reduce braking.	Remote (Unlikely)	Moderate	Very Low (Low)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Use of construction equipment (e.g. excavators) causing dust and particulate matter reducing local air quality (e.g. through stockpiling, earthworks etc)	AQ2	Through the implementation of dust mitigation measures during construction, this results in a medium residual risk.	Possible (Likely)	Moderate (Major)	Medium (Very High)
Increase in vehicle exhaust emissions impact local air quality	AQ3	Overall impacts on air quality during the operation of the Project are considered minimal as the Project would not result in a change in land use on Dudley Street and the additional traffic resulting from the use of the Access Road would be offset by changes to vertical and horizontal alignment of Dudley Street which would improve traffic flows and reduce braking.	Likely (Likely)	Minor (Moderate)	Medium (High)
Odour issues through improper waste management and storage	AQ4	Through the implementation of waste and resource mitigation measures during construction, this results in a very low residual risk.	Remote (Unlikely)	Moderate	Very Low (Low)
Potential damage or destruction of known Aboriginal heritage items	ABH1	As no known Aboriginal heritage items are located in the vicinity of the Project area and no high risk landscape features are located at or near the Project area, the potential for unknown items to be present is considered to be low. As such, the Project is unlikely to affect Aboriginal heritage during construction and operation.	Remote (Unlikely)	Major (Major)	Low (Medium)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Potential damage or destruction of unknown Aboriginal heritage items	ABH2	Procedures to be followed in the unanticipated discovery plan which has been prepared for the Project results in a low residual risk.	Possible (Possible)	Minor (Major)	Low (High)
Potential damage or destruction of known non-Aboriginal heritage items	HER1	The implementation of the proposed mitigation measures and the recommendation of undertaking a survey results in a medium residual risk	Almost certain	Minor (Major)	Medium (Very high)
Potential damage or destruction of unknown non- Aboriginal heritage items	HER2	By following the unanticipated discovery plan which has been prepared for the Project results in a low residual risk.	Possible (Possible)	Minor (Major)	Low (High)
Increased risk of bushfire associated with sparks from construction equipment and vehicles	BF1	With the implementation of mitigation measures this results in a medium residual risk.	Remote (Unlikely)	Catastrophic/ Significant (Catastrophic/ Significant)	Medium (High)
Increased risk of bushfire through vehicle accidents	BF2	With the implementation of mitigation measures and the use of traffic barriers this results in a very low residual risk.	Remote (Unlikely)	Moderate	Very Low (Low)
Potential loss of life and property as a result of bushfire during construction	BF3	With the implementation of mitigation measures this results in a medium residual risk.	Remote (Unlikely)	Catastrophic/ Significant (Catastrophic/ Significant)	Medium (High)

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Temporary services disruption during utility works as part of the Project	U1	Detailed site surveys of utilities infrastructure have been undertaken to identify affected services. Affected residents will be notified of potential temporary loss of services during construction. This results in a medium residual risk.	Almost certain <i>(Almost certain)</i>	Minimal <i>(Minor)</i>	Medium <i>(High)</i>
Restricted opportunities to connect to existing road network	U2	The design of the project is based on the connection of the Access Road to the existing road network at Dudley Street.	Remote	Minimal <i>(Major)</i>	Negligible
Accidental damage to utilities and other essential infrastructure	U3	Detailed site surveys of utilities infrastructure have been undertaken to identify affected services. Where unplanned interruptions to services occur due to accidental damage, the construction contractor will inform affected property owners and provide temporary alternative services as appropriate. This results in a low residual risk.	Remote <i>(Unlikely)</i>	Major <i>(Catastrophic/ Significant)</i>	Low <i>(High)</i>
Accelerated maintenance and upgrade of roads and infrastructure due to increased use	U4	Further traffic growth will occur as a result of the Canberra Brickworks Precinct, adding about 1,200 vehicles per day to the eastern end of Dudley Street (i.e. about 13% more traffic). There will also be background growth on Dudley Street with further development and growth in Yarralumla and Deakin, as well as a change in trip patterns as a result of further development of Molonglo. The improved infrastructure provided by the Project will offset the potential additional maintenance requirements through the addition of more vehicles.	Remote <i>(Unlikely)</i>	Minimal <i>(Moderate)</i>	Negligible
Waste materials produced during construction of the Project not stored or managed effectively	WR1	Through the implementation of the proposed mitigation measures this results in a low residual risk.	Unlikely <i>(Possible)</i>	Moderate <i>(Major)</i>	Low <i>(High)</i>

Description		Residual Risk Assessment			
Potential Impact	Risk #	Discussion	Overall likelihood (previous likelihood)	Overall consequence (previous consequence)	Residual risk rating (previous rating)
Excessive resources used in the construction of the Project	WR2	Through the implementation of the proposed mitigation measures this results in a low residual risk	Unlikely (Possible)	Moderate (Moderate)	Low (Medium)
Failure to consider climate change during design results in unmitigated climate change vulnerability	CC1	Due to the small scale of the Project, it is unlikely climate change impacts will be significant and would be mitigated by the proposed measures	Unlikely	Moderate	Low
Increased sensitivity of community to Project impacts due to other projects occurring concurrently	CM1	There may be instances where commuters who regularly travel along Cotter Road and Dudley Street are more sensitive to the construction impacts such as traffic disruption as a result of 'construction fatigue'. There is also a potential for cumulative impacts as a result of the Canberra Brickworks Precinct being carried out concurrently with the Project. Specific mitigation measures would be developed in consultation with the relevant stakeholders with safeguards incorporated into the CTMP and CEMP.	Possible	Moderate	Medium

9.0 Conclusion

This REF has been prepared to assess the environmental impacts associated with the construction and operation of the Project under the provisions of:

- Department of Environment and Energy request for additional information required for its assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Referral 2017/8072) received on 15 December 2017
- Environmental Planning and Sustainable Development Directorate (EPSDD) requirements for EIS Exemption in accordance with Section 211 of the *Planning and Development Act 2007* and other relevant legislation
- National Capital Authority Works Approval.

The alignment of the Project falls within different administrative authority areas and therefore not all components of the Project would require the same level of statutory and development assessment considerations. To meet the various levels of development assessment that have been identified, a comprehensive assessment of the overall Project has been prepared which assesses the impacts of the Project on both land managed by the NCA and the ACT Government, and to support the Commonwealth requirements under the EPBC Act.

This REF identifies the potential environmental benefits and impacts of the Project and outlines the mitigation measures to reduce the identified impacts.

The following key impacts have been identified should the Project proceed:

- temporary traffic disruptions (e.g. temporary diversions) during construction
- impacts on Matters of National Environmental Significance
- clearing of trees and other vegetation causing impacts including loss of amenity, loss of habitat, and increased erosion and water runoff
- temporary loss of access to the Uriarra Track (a footpath used for recreational purposes, e.g. dog walking) during construction
- use of construction equipment (e.g. excavators) causing dust and particulate matter reducing local air quality (e.g. through stockpiling, earthworks etc)
- temporary noise and vibration impacts to local residents and the community during construction
- disturbance of soil associated with construction leading to increased soil and sediment erosion
- changes to existing flow paths and overland flow due to proposed Project
- views available to occupants of nearby sensitive receivers are altered
- permanent loss of an area of public open space to allow the construction of the Access Road.

This REF has been prepared having regard to the preliminary risk assessment undertaken to ensure that the assessment takes into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the Project.

Should the Project proceed, potential associated adverse impacts would be appropriately managed in accordance with the mitigation measures outlined in this REF, and any conditions of approval imposed. This would ensure the Project is delivered to maximise benefit to the community and minimise any adverse impacts on the environment.

In considering the overall residual impacts outlined in this REF, provided the measures and commitments specified in the REF are applied and effectively implemented during the design, construction and operational phases, the identified environmental impacts are considered to be acceptable and manageable.

10.0 References

- Australian Archaeological Survey Consultants (AASC) and Cultural Heritage Management Australia (CHMA) (2008). *Coombs, Wright and Environs Detailed Heritage Assessment* Report No. 0901 for ACTPLA
- Australian Bureau of Statistics (ABS) (2017). *Australian Demographic Statistics, March 2017*.
- ACT Government, Environment and Sustainable Development, (2012). *ACT Planning Strategy – Planning for a sustainable city*.
- ACT Government Environment Protection Authority (2011). *Environment Protection Guidelines for Construction and Land Development in the ACT*.
- ACT Government Emergency Services Agency (2014). *Strategic Bushfire Management Plan v3*.
- ACT Government (2015), *ACTmapi: Significant Species, Vegetation Communities and Registered Trees Map*, ACT Government, Canberra.
- ACT Heritage Council (2013) *Yarralumla Brickworks Railway Remnants*. ACT Heritage Register
- ACT Planning Authority (1996). *Noise Management Guidelines (draft)*.
- ACT Planning Authority (2009). *Water use and catchment General Code*
- AECOM (2016a) *Site Investigation – Traffic, Transport and Carparking*
- AECOM (2016b) *Site Investigation Report (Stage 1)*
- AECOM (2017a). *Traffic and Transport Impact Assessment – Access Road and Dudley Street Upgrade*
- AECOM (2017b). *Canberra Brickworks Access Road and Dudley Street Road Traffic Noise Assessment*.
- AECOM (2017c). *Contamination Due Diligence Assessment - Canberra Brickworks Precinct (CBP) Access Road and Dudley Street Upgrade*.
- Arts, Heritage and Environment (AHE) (2005) *A vision Splendid of the Grassy Plains Extended: ACT Lowland Native Grassland Conservation Strategy Action Plan No.28*, ACT Government, Canberra.
- ASRIS (2017). *Australian Soil Resource Information System*.
- Bali, R. (2005). *Discussion Paper - Compensating for Edge Effects*. Sydney, Ecosense Consulting for the NSW Roads and Traffic Authority.
- Bushfire CRC (2009). *Victorian 2009 Bushfire Research Response – Final Report October 2009*
- Canberra Nature Map (2017). ACT Government, Canberra
- Canberra Ornithologists Group (COG) (2017). *Canberra Birds: Bird Info*.
- Cardno (2016) *Concept Design Report – CBP Access Road and Dudley Street Upgrade*. Prepared for Land Development Authority October 2016.
- Commonwealth of Australia (2012)
- Department of Environment, land, Water and Planning (DELWP) (2016). *National Recovery Plan for Spotted-tailed Quoll Dasyurus maculatus*, Australian Government, Canberra.
- Department of the Environment and Energy (DOEE) (2012). *EPBC Act Environmental Offsets Policy*.
- Department of the Environment and Energy (DoEE) (2017) *Species Profile and Threats Database*.
- Douglas Partners (2017). *Report on Geotechnical Investigation – Proposed Road Upgrading Dudley Street, Yarralumla*. Prepared for AECOM Australia Pty Ltd
- EPSDD (2017). *Proponent's Guide To Environmental Impact Statement Exemptions*.
- Forman, R. T. T., D. Sperling, et al. (2003). *Road Ecology. Science and Solutions*. Washington, Island Press.

Geosyntec (2018) *Site Audit of Canberra Brickworks, ACT (LBJ 14/02) Interim Audit Advice #8 From Review of Access Road into Canberra Brickworks Precinct and Dudley Street upgrade* Geosyntec Project: GSY0008. Letter to the ACT Government Infrastructure Finance and Capital Works

Kretowicz, E. (2013) *Yarralumla Brickworks Railway Remnants plan slashed as LDA proposes new development*. Canberra Times 17

Longcore, T, & Rich, C. (2004). *Ecological light pollution*. The Ecological Society of America

Lovell Chen (2016). *Archaeological Assessment: Canberra Brickworks & Environs, Denman Street, Yarralumla, Canberra*. Prepared for Land Development Agency, March 2016.

Molonglo Catchment Group (2015). *Molonglo Catchment Strategy 2015-2030*.

[National Occupational Health and Safety Commission \(NOHSC\) \(2005\)](#). Code Of Practice For The Safe Removal Of Asbestos 2nd Edition

Navin K. & K. Officer (1993) *Landuse Assessment North Cotter Road, Weston, ACT*. .Archaeological Component. Report to Gutteridge Haskins & Davey Pty Ltd.

Navin Officer Heritage Consultants (1999) *Cultural Resource Assessment Part Block 1195, Weston Creek, ACT*. Report to Connell Wagner Pty Ltd.

Navin Officer Heritage Consultants (2006) *Blocks 2, 3 and 25, Section 44, Yarralumla, Canberra, ACT: Cultural Heritage Assessment*. Report to the National Capital Authority

Navin Officer Heritage Consultants (2007). *Cultural and Natural Heritage Assessment Block 22, Section 32 Yarralumla, ACT*. Report to the National Capital Authority.

Navin Officer Heritage Consultants (2011) *Diplomatic Mission Estate North Curtin, ACT: Cultural Heritage Assessment*. Report to Brown Consulting (ACT) Pty Ltd.

Navin Officer Heritage Consultants (2014) *Stage 1 Aboriginal Cultural Heritage Assessment*, August 2014

Roads and Maritime, (2013), *Environmental Impact Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment*, Sydney

Robson, (2015). *Contaminant Management Plan (CMP) Canberra Brickworks Remediation Project Portions of Blocks 1 and 20 Section 120 and Block 1, Section 127 Yarralumla, ACT 2600*. Robson Environmental Pty Ltd, 2 December 2012

Rowell, A. (2010), *Preliminary Assessment of Ecological Values of Land in Yarralumla, Curtin and Deakin, ACT*, unpublished report prepared for the National Capital Authority, Canberra. Rowell, A. (2011), *Yarralumla Brickworks Site and Surrounds, Golden Sun Moth and Natural Temperate Grassland Survey*, unpublished report prepared for the Land Development Agency, Canberra.

Rowell, A. (2012), *Environmental Assessment of Blocks for Proposed Diplomatic Subdivision (Stirling Ridge, near Old Canberra Brickworks, and Land Adjacent to Federal Golf Club)*, unpublished report prepared for the National Capital Authority, Canberra, Draft, March 2012..

Saunders, P. (1995) *Preliminary Cultural Resource Survey of Lower Molonglo Corridor, ACT*. A Report to the Department of Environment Land and Planning

SMEC (2014) *Preliminary (Environmental) Site Investigation: Canberra Brickworks*. Prepared for Land Development Agency.

Umwelt (2014) *Canberra Brickworks and Environs Ecological Assessment*, unpublished report prepared for the Land Development Agency, Canberra

Umwelt (2016) *GSM Survey and Ecological Assessment of Dudley Street Road Reserve*, briefing note to Irena Sharp of the Land Development Agency, Canberra.

Umwelt (2017). *Impact Assessment Report, Canberra Brickworks Access Road and Dudley Street Upgrade Area, Yarralumla, ACT*, September 2017.

Umwelt (2018) *Offset Strategy Dudley Street Upgrade and Canberra Brickworks Precinct Access Road Construction, Yarralumla, ACT*, March 2018.

Appendix A

Response to DOEEs request for further information Dec'18

Appendix A Response to DOEE's request for further information

Table 52 provides a matrix to guide the Department of Environment and Energy in locating information as part of the preliminary documentation package as requested on 15 December 2017.

Table 52 DOEE information request compliance matrix

1. Referral Information, Planning and Conservation Measures	How has this been addressed?
<i>You must resubmit all referral documentation as part of the PD. The package you submit will be published as submitted (barring potential exemptions for confidential information) and must be complete in itself to allow full consideration by the Minister (or delegate) or interested stakeholders.</i>	Noted. This REF provides additional information as requested by DOEE as part of their letter received on 15 December 2017.
<i>If any documents submitted in the referral package have been updated, you must note the update and submit the current version. Similarly, if new information has emerged that impacts the referral material, please also submit that additional information.</i>	No changes to previously submitted documents. The Offset Strategy (Umwelt, 2018) provides further details on the impact assessment for EBPC Act listed species.
<i>Please confirm all zoning arrangements currently applying to the proposed development area and any proposed offset areas. This information must include, though should not be limited to:</i>	Covered below.
• the zoning status of the proposed development site and any proposed offset sites	See Section 1.3 for the zoning status of the proposed development site. Letter received from Conservator of Flora and Fauna dated 19/01/2018 requesting a draft Territory Plan Variation be prepared to amend the public land overlay for the proposed offset site to establish a nature reserve.
• copies of any relevant plans, policies, or other documents from the ACT Government or National Capital Authority that cover the proposed development site and any proposed offset sites (where these are extremely large documents, such as the Territory Plan and the National Capital Plan, copies of the relevant sections will be acceptable).	This REF provides a consolidated assessment of the potential impacts of the Project and identifies the relevant plans, policies, or other documents which are applicable to the various aspects of the Project.
<i>Please also outline any requirements imposed, or expected to be imposed, by other government agencies.</i>	See Section 1.3 and 8.2 for details of the land administration in the Project area and a summary of the proposed mitigation measures. This REF will be submitted to EPSDD concurrently with the submission to DOEE. NCA Works Approval application to follow DOEE / EPSDD approval.
2. Proposed Mitigation and Avoidance Measures	How has this been addressed?
<i>Please provide full descriptions and information about any and all proposed avoidance, mitigation and management measures. This must include but should not be limited to the following:</i> • The reasons those measures are considered appropriate • An assessment of alternative development layouts that avoid or	See Section 8.2 which provides a summary of the proposed mitigation measures. A full and detailed impact assessment of the potential Project impacts is provided in Chapter 7.0.

<i>reduce the direct and indirect impacts to matters of national environmental significance</i> <i>• An assessment of the expected or predicted effectiveness of the mitigation and management measures to protect matters of national environmental significance</i> <i>• An assessment of the likely difference in conservation outcomes produced by current land zoning protections and any proposed mitigation or management measures</i> <i>• The cost of any proposed mitigation and management measures and a discussion of how those measures will be funded in perpetuity (and by whom).</i> <i>Please ensure it is clear how these measures address specific impacts to protected matters, and discuss relevant conservation advices, recovery plans and threat abatement plans.</i>	The Need for the Project and consideration of alternatives is provided in Chapter 2.0. Further mitigation specific for the offset site is included in the Offset Strategy (Umwelt, 2018). Management of the offset site and the associated costs would be delivered by ACT Government into perpetuity. The site is currently owned and maintained by ACT Government. A Territory Plan Variation is currently being processed which would change the offset site to a 'nature reserve' zoning to protect this area from future development.
3. Outcomes-based Conditions	How has this been addressed?
<i>If you wish to pursue outcomes-based conditions under the Outcomes-based Conditions Policy (2016) and Outcomes-based Condition Guidance (2016), please provide information on the outcomes to be achieved for matters of national environmental significance. Outcomes need to be specific, measurable and achievable, and based on robust baseline data. Please justify why outcomes-based instead of process-based condition are appropriate for this action.</i> <i>If you wish to pursue outcomes-based conditions, please also explain the specific environmental outcomes to be achieved, with justifications. Justifications should refer to all relevant recovery plans, conservation advices, threat abatement plans, etc.</i> <i>For each proposed outcome, please explain:</i> <i>• The likelihood the outcome will not be achieved</i> <i>• How measurable progress towards the outcome would be, and how it would be measured</i> <i>• Appropriate baseline data by which the outcome can be defined and justified</i> <i>• The likely impacts on matters of national environmental significance that would be ameliorated through the outcome</i> <i>• Proof of your (or the future site manager's) willingness and ability to achieve the outcome</i> <i>• The level of overall scientific knowledge and scientific uncertainty about the protected matter, and whether there is a sufficient knowledge to judge whether the outcome is an appropriate condition</i> <i>• The program of independent periodic audits that will be used to monitor progress towards the outcome. If outcomes-based conditions are accepted, this will be a binding commitment</i> <i>• Likely level of control you will have over achievement of the outcome</i> <i>• The appropriateness of any surrogates or alternative indicators for protected matter outcomes</i> <i>• The proposed management program that will be used to achieve the outcome, including but not limited to performance indicators, periodic milestones, proposed monitoring, adaptive management measures, and record keeping, publication, and reporting processes.</i> <i>Please note that not every project is suitable for outcomes-based conditions, and the Minister (or delegate) will make the final determination about the outcomes-based condition are appropriate.</i>	Refer to the Offset Strategy (Umwelt, 2018) for details.

4. Offsets	How has this been addressed?
<i>If you are considering using environmental offsets, please provide details of the proposed offsets and the specific impact to a matter of national environmental significance that you propose to offset. You will need to demonstrate how the offset package meets the requirements of the EPBC Act Offsets Policy.</i>	Refer to the Offset Strategy (Umwelt, 2018) for details.
<i>Please note, you will need to demonstrate that offsets are 'like for like' for each matter of national environmental significance impacted by the action and include the rationale and justification for all values used in the EPBC Act Offsets Policy calculator tool.</i>	Refer to the Offset Strategy (Umwelt, 2018) for details.
<i>Proposals for offset areas should include detailed discussions of proposed management measures for each area. For any proposed offset sites, please provide a discussion of the difference in protection provided by current zoning arrangements versus the protection to be provided by proposed offset mechanisms.</i>	Refer to the Offset Strategy (Umwelt, 2018) for details.
<i>The preliminary documentation package must include a statement about the proposed management measures' cost effectiveness, and how they will be funded in perpetuity. Proposals for offset areas must describe the legal mechanisms that will be used to secure the offset site(s) in perpetuity. The preliminary documentation package must also provide assurance those mechanisms will not be removed or substantially modified without the consent of the Department.</i>	Refer to the Offset Strategy (Umwelt, 2018) for details.
<i>Offsets should directly contribute to the ongoing viability of the matter of national environmental significance the project impacts, and deliver an overall conservation outcome that improves or maintains the viability of the matter compared with what would likely have happened if neither the action nor the offset had taken place.</i>	Refer to the Offset Strategy (Umwelt, 2018) for details.
5. Economic and Social Matters	How has this been addressed?
<i>Please provide information about the proposed action's economic and social impacts. This should include but not be limited to the following.</i> <i>• Costs (e.g. disruption to existing community infrastructure or environmental features) as well as benefits (e.g. increased housing or employment)</i> <i>• Consideration of different scales where relevant (e.g. local versus national)</i> <i>• Specific dollar or other numerical values where relevant.</i>	See Section 7.4.
6. Environmental Record of Person(s) Proposing to Take the Action	How has this been addressed?
<i>Please provide 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 the person proposing to take the action. Alternatively, for an action for which a person has applied for a permit, the person making the application. If the person proposing to take the action is a corporation, please provide details of the corporation's environmental policy and planning framework.</i>	Nil.

Appendix B

Protected matters search tool results

Appendix B Protected matters search tool results

Table 53 Listed Threatened Flora Species identified in the PMST

Species (<i>Scientific Name</i>)	EPBC Act Status	NC Act Status	Likelihood of occurrence
Austral Toadflax (<i>Thesium australe</i>)	Vulnerable	-	Unlikely
Basalt Peppercress (<i>Lepidium hyssopifolium</i>)	Endangered	-	Potential habitat
Black Gum (<i>Eucalyptus aggregate</i>)	Vulnerable	-	No
Button Wrinklewort (<i>Rutidosia leptorrhynchoides</i>)	Endangered	Endangered	Potential habitat
Canberra Spider Orchid (<i>Caladenia actensis</i>)	Critically endangered	Endangered	No
Ginninderra Peppercress (<i>Lepidium ginninderrense</i>)	Vulnerable	Endangered	Unlikely
Hoary Sunray (<i>Leucochrysum albicans</i> var. <i>tricolor</i>)	Endangered	-	No
Murrumbidgee bossiaea (<i>Bossiaea</i> grail)	-	Endangered	No
Omeo storksbill (<i>Pelargonium</i> sp. <i>Striatellum</i> (G. W. Carr 10345))	Endangered	-	No
Pale pomaderris (<i>Pomaderris pallida</i>)	Vulnerable	-	No
Small purple-pea (<i>Swainsona recta</i>)	Endangered	Endangered	No
Tarengo leek orchid (<i>Prasophyllum petilum</i>)	Endangered	Endangered	No
Tuggeranong lignum (<i>Muehlenbeckia Tuggeranong</i>)	Endangered	Endangered	No

Table 54 Listed threatened fauna species identified in the PMST

Species (<i>Scientific Name</i>)	EPBC Status	NC Act Status	Likelihood of occurrence
Birds			
Australian Painted Snipe (<i>Rostratula australis</i>)	Endangered		Nil
Bar-tailed Godwit (<i>Limosa lapponica baueri</i>)	Vulnerable		Nil
Brown Treecreeper (<i>Climacteris picumnus</i>)		Vulnerable	Nil
Curlew Sandpiper (<i>Calidris ferruginea</i>)	Critically endangered		Nil
Eastern Curlew (<i>Numenius madagascariensis</i>)	Critically endangered	-	Nil
Glossy Black-cockatoo (<i>Calyptorhynchus lathamii</i>)	-	Vulnerable	Nil
Hooded Robin (<i>Melanodryas cucullata</i>)	-	Vulnerable	Nil
Little Eagle (<i>Hieraaetus morphnoides</i>)	-	Vulnerable	Likely
Northern Siberian Bar-tailed Godwit (<i>Limosa lapponica menzbieri</i>)	Critically endangered	-	Nil
Painted Honeyeater (<i>Grantiella picta</i>)	Vulnerable	Vulnerable	Nil
Regent Honeyeater (<i>Anthochaera phryia</i>)	Critically endangered	Endangered	Nil
Scarlet Robin (<i>Petroica boodang</i>)	-	Vulnerable	Nil

Species (<i>Scientific Name</i>)	EPBC Status	NC Act Status	Likelihood of occurrence
Superb Parrot (<i>Polytelis swainsonii</i>)	Vulnerable	Vulnerable	Unlikely
Swift Parrot (<i>Lathamus discolor</i>)	Critically endangered	Vulnerable	Unlikely
Varied Sittella (<i>Daphoenositta chrysoptera</i>)	-	Vulnerable	Unlikely
White-winged Triller (<i>Lalage sueurii</i>)	-	Vulnerable	Nil
Fish			
Macquarie Perch (<i>Macquaria australasica</i>)	Endangered	Endangered	Nil
Murray Cod (<i>Maccullochella peelii</i>)	Vulnerable		Known in nearby Lake Burley Griffin
Murray River Crayfish (<i>Euastacus armatus</i>)	-	Vulnerable	Known in nearby Lake Burley Griffin
Two-spined Blackfish (<i>Gadopsis bispinosus</i>)	-	Vulnerable	Nil
Frogs			
Green and Golden Bell Frog (<i>Litoria aurea</i>)	Vulnerable		Nil
Yellow-spotted Tree Frog (<i>Litoria castanea</i>)	Endangered		Nil
Insects			
Golden Sun Moth (<i>Synemon plana</i>)	Critically Endangered	Endangered	Known
Perunga Grasshopper (<i>Perunga ochracea</i>)	-	Vulnerable	Unlikely
Mammals			
Greater Glider (<i>Petauroides Volans</i>)	Vulnerable	-	Nil
Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)	Vulnerable	-	Flyover only
Koala (<i>Phascolarctos cinereus</i>) (combined populations of Queensland, New South Wales, and the ACT)	Vulnerable	-	Unlikely
Spotted-tail Quoll (<i>Dasyurus maculatus maculatus</i>) (south-east mainland population)	Endangered	Vulnerable	Likely
Reptile			
Grassland Earless Dragon (<i>Tympanocryptis pinguicollis</i>)	Endangered	Endangered	Unlikely
Pink-tailed Worm-lizard (<i>Aprasia parapulchella</i>)	Vulnerable	Vulnerable	Nil
Striped Legless Lizard (<i>Delma impar</i>)	Vulnerable	Vulnerable	Unlikely

Table 55 Migratory species identified

Species (<i>Scientific Name</i>)	EPBC Status	Likelihood of Occurrence
Bar-tailed Godwit (<i>Limosa lapponica baueri</i>)	Migratory wetland bird	No
Black-faced Monarch (<i>Monarcha melanopsis</i>)	Migratory terrestrial bird	No
Common Sandpiper (<i>Actitis hypoleucos</i>)	Migratory wetland bird	No
Curlew Sandpiper (<i>Calidris ferruginea</i>)	Migratory wetland bird	No
Eastern Curlew (<i>Numenius madagascariensis</i>)	Migratory wetland bird	No

Species (<i>Scientific Name</i>)	EPBC Status	Likelihood of Occurrence
Fork-tailed Swift (<i>Apus pacificus</i>)	Migratory marine bird	Flyover only
Latham's Snipe (<i>Gallinago hardwickii</i>)	Migratory wetland bird	No
Osprey (<i>Pandion haliaetus</i>)	Migratory wetland bird	No
Pectoral Sandpiper (<i>Calidris melanotos</i>)	Migratory wetland bird	No
Rufous Fantail (<i>Rhipidura rufifrons</i>)	Migratory terrestrial bird	No
Satin Flycatcher (<i>Myiagra cyanoleuca</i>)	Migratory terrestrial bird	No
Sharp-tailed Sandpiper (<i>Calidris acuminata</i>)	Migratory wetland bird	No
White-throated Needletail (<i>Hirundapus caudacutus</i>)	Migratory terrestrial bird	Flyover only
Yellow Wagtail (<i>Motacilla flava</i>)	Migratory terrestrial bird	No

Appendix C

Landscape and visual impact assessment methodology

Appendix C Landscape & visual impact assessment methodology

L VIA magnitude / sensitivity descriptors

Magnitude				
	High	Moderate	Low	Negligible
Construction	A clearly evident or continuous change in landscape characteristics affecting an extensive area, which is likely to fundamentally change the character of the landscape	A considerable change in landscape characteristics, frequent or continuous and over a wide area or a clearly evident change, but over a restricted area	A barely perceptible change in landscape characteristics over a wide area, or a considerable change over a restricted area, but would not fundamentally change the character of the landscape	No change in landscape characteristics
Operation	Clearly perceptible changes in views at intermediate distances seen for moderate periods of time, or changes in prominent elements seen for long periods of time	Minor changes in views at moderate distances seen for moderate periods of time, or moderate changes in views visible for a short durations	Change which is barely visible, at a very long distance, or visible for a very short duration. The change only makes up a small proportion of the overall view	Change is not visible
Sensitivity				
	High	Moderate	Low	Negligible
Construction	A landscape with distinctive character and low capacity to accommodate the type of change envisaged	A landscape where its character, pattern and scale may have some capacity to accommodate a degree of the type of change envisaged	A landscape where its character, pattern and scale is likely to have the capacity to accommodate the type of change envisaged	A landscape where its character, pattern and scale are tolerant of the type of change envisaged, and the landscape has capacity to accommodate change
Operation	High number of observers, where viewers are specifically focussed on the landscape. Views to and from places with heritage or other significance	Moderate number of viewers where the viewer would be somewhat focussed on the landscape for extended periods of time	Low number of viewers with interest in the landscape, or moderate number of viewers where their attention would not be predominantly focussed on the landscape	Very occasional numbers of viewers with only a passing interest in their surroundings

Magnitude and sensitivity risk matrix

Risk Matrix				
Sensitivity	High	Moderate	Low	Negligible
Magnitude				
High	High	Moderate High	Moderate	Negligible
Moderate	Moderate High	Moderate	Moderate-Low	Negligible
Low	Moderate	Moderate-Low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Sensitivity and magnitude

The sensitivity of the landscape is assessed based upon the extent to which it can accept change of a particular type and scale without adverse impacts upon its character. Sensitivity varies according to the type of development and nature of the landscape.

The most sensitive receptors may include:

- users of outdoor recreational facilities
- communities where the development results in changes in the landscape setting or valued views enjoyed by the community
- occupiers of residences with views affected by the Project.

The number of viewers is also considered when assessing sensitivity of the landscape.

The magnitude of change affecting landscape character or visual receptors depends on factors such as the nature, scale and duration of the particular change that is expected to occur. In the landscape, the magnitude of change would depend on factors such as the extent of loss, change or addition of a feature, or changes in the backdrop, or outlook from a landscape that affects its character. The impact on a view would depend on factors such as the extent of visibility, degree of obstruction of existing features, degree of contrast with the existing view, angle of view, duration of view and distance from the Project.

Appendix D

Site Auditor Response – Interim Audit Advice #8

Appendix D Site Auditor Response – Interim Audit Advice #8

23 February 2018

Gerard Coffey
Senior Project Manager
Civil Infrastructure Delivery, Infrastructure Finance and Capital Works
Chief Minister, Treasury and Economic Development Directorate
ACT Government
By email: Gerard.Coffey@act.gov.au

Subject: Site Audit of Canberra Brickworks, ACT (LBJ 14/02)
Interim Audit Advice #8 From Review of Access Road into Canberra Brickworks
Precinct and Dudley Street upgrade
Geosyntec Project: GSY0008

Dear Gerard,

1 INTRODUCTION

Geosyntec Consultants Pty Ltd (Geosyntec) was engaged by the ACT Government Infrastructure Finance and Capital Works (IFCW) to provide EPA Accredited Site Auditor (Auditor) services in accordance with the ACT *Environment Protection (EP) Act 1997* in relation to the design of a new access road alignment for the Canberra Brickworks property and upgrading of Dudley Street in Yarralumla, ACT (the site). As part of the provision of these services, the Auditor was engaged to provide an independent review of design documents for the proposed road alignment, and to comment on the potential implications of the alignment from a contamination perspective.

This letter has been provided as interim advice and, in keeping with guidelines endorsed under the EP Act 1997, you are advised that this letter does not constitute a Site Audit Report or Site Audit Statement and does not pre-empt the conclusion that may be made at the end of the audit process. This letter will be referred to by, and form an appendix to, the Site Audit Report. This interim advice is subject to the limitations as presented in Section 5.

2 SCOPE OF REVIEW

The Auditor's review of the contamination status summary letter included reference to the requirements/ provisions of the following policy and guidelines made or endorsed under the EP Act 1997:

- ACT EPA, 2009. Contaminated Sites, Environment Protection Policy (EPP);
- NSW EPA (2017) Contaminated Land Management – Guidelines for the NSW Site Auditor Scheme (3rd Edition) (the Auditor Guidelines);

- NSW EPA (September 1995) Sampling Design Guidelines (the Sampling Guidelines);
- NSW DEC (March 2007) Guidelines for the Assessment and Management of Groundwater Contamination (the Groundwater Guidelines);
- NSW Office of Environment and Heritage (OEH, 2011) Guidelines for Consultants Reporting on Contaminated Sites (the Reporting Guidelines); and
- National Environment Protection Council (NEPC, 1999) National Environment Protection (Assessment of Site Contamination) Measure (as amended May 2013, herein referred to as the ASC NEPM 2013).

3 PROPOSED DEVELOPMENT FOOTPRINT

As part of the Canberra Brickworks Precinct (CBP) redevelopment, a new access road is proposed off Dudley Street via a new roundabout arrangement. This will extend to the north to access the future CBP development area. The project also includes the upgrading of Dudley Street. The following figures are attached in relation to the access road project:

- The access road project boundary (AECOM ref. 60533438, sheet no. 20-0000-CN-0066, Rev. A, dated 24 October 2017); and
- Environmental constraints and vegetation assessment plan (AECOM ref. 60533438, sheet no. 20-0000-CN-0044, Rev. A, dated 24 October 2017).

4 CONTAMINATION STATUS OF THE PROJECT ALIGNMENT

The former Canberra Brickworks has been the subject of multiple stages of environmental investigation, to assess the suitability of the land for future redevelopment, and to manage legacy contamination issues at the site. A particular area of environmental concern at the site was an informal landfill located to the west of the main brickworks infrastructure, which was characterised as containing a substantial volume of asbestos containing materials (ACM). The area, referred to as the “asbestos dump” was partially remediated in 2015, with the majority of bulk ACM removed from the site. However, an area of fill remained in-situ including a portion characterised as containing ACM fragments. Due to the uncertainty at the time about the future precinct redevelopment, the decision was made to manage the contaminated fill material in place through the installation of an engineered capping layer, with the fill to be addressed at a later date in conjunction with the precinct redevelopment plan.

The presence of the contaminated fill material resulted in the site being added to the EPA’s contaminated sites register, with a notation against the following affected blocks:

- Block 1 Section 102 Yarralumla
- Block 20 Section 102 Yarralumla
- Block 1 Section 127 Yarralumla

While the landfilled area only affected a small portion of these blocks, the “contaminated site” designation on the EPA register is applied to the total block as a means of identifying the hazard in relation to any future development on the blocks. The Dudley Street upgrade road alignment is located to the south of the Canberra Brickworks precinct boundary in an area of limited historical development, and approximately 350 m south of the landfilled area. However, the road alignment intersects the southern extremity of Block 1 Section 127 to which the contaminated site designation applies, and it was therefore identified as a potential environmental constraint. Having reviewed all the historical reports relating to the assessment and management of the asbestos dump area, the Auditor can state with confidence that the Dudley Street upgrade road alignment is located well to the south of the contamination issue that resulted in the contaminated land designation of Block 1 Section 127 Yarralumla and is therefore not considered to be adversely affected by this issue.

In addition, several historical soil investigation locations are located in close proximity to the road alignment, including test pits TP01 to TP04, and TP09 to TP13, from the SMEC (2014) preliminary site investigation. A review of the test pit logs for these locations, and the analytical results for the soil samples collected from these locations, indicated that no potential contamination issues of concern had been identified in the vicinity of the road alignment. The test pit logs documented natural soil profiles, and the reported contaminant concentrations were either below the laboratory limit of reporting (LOR) or were below sensitive land use criteria where detected.

Accordingly, it is the Auditor’s opinion that the risk of the proposed Dudley Street upgrade road alignment being affected by legacy contamination issues from the brickworks operations is negligible.

5 LIMITATIONS

This advice has been prepared in accordance with the NSW EPA (2017) Contaminated Land Management – Guidelines for the NSW Site Auditor Scheme (3rd Edition), and other relevant guidelines made or endorsed under the EP Act 1997.

The comments and opinions provided in this document were based on the Auditor’s independent review of information prepared and provided by others. While applicable audit standards include a validation of reasonably verifiable information, not all of the information provided to the Auditor can be reasonably verified. (For example, the accuracy of field logs, the location of samples, and the consistent compliance by third parties with applicable methodologies is not subject to reasonable verification.) The necessity to rely on third party information results in an inherent level of uncertainty with respect to the audit that exists despite the Auditor’s compliance with appropriate professional standards of care. In addition, the documents supplied to the Auditor for review as part of this audit may contain limitations statements. Accordingly, the opinions and advice developed on the basis of those documents is, by extension, subject to those same limitations.

It is also recognised that the guidelines regarding sampling design for site investigation and validation of remediation are statistically based, and it is possible for unidentified contamination to exist on a site where investigation and/or remedial validation has been performed despite compliance with applicable guidelines. The Auditor accepts no responsibility for unidentified contamination encountered subsequent to investigation, remediation and validation that was performed in substantial compliance with the relevant guidelines made or endorsed under the EP Act 1997.

6 CLOSURE

If you have any questions or comments about this interim advice please do not hesitate to call Lange Jorstad on 0447 249 250.

Sincerely,

A handwritten signature in blue ink that reads "Lange Jorstad". The signature is written in a cursive, flowing style.

Lange Jorstad, PhD, RPGeo
NSW EPA Accredited Site Auditor (No. 1001)

GSY0008_Yarralumla Brickworks_IAA8

Appendix E

Submissions Report

Appendix E Submissions Report

Submissions Report

Access Road and Dudley Street Upgrade

Submissions Report

Access Road and Dudley Street Upgrade

Client: Infrastructure Finance and Capital Works

ABN: 66 676 633 401

Prepared by

AECOM Australia Pty Ltd

Level 2, 60 Marcus Clarke Street, Canberra ACT 2600, Australia
T +61 2 6201 3000 F +61 2 6201 3099 www.aecom.com
ABN 20 093 846 925

23-Oct-2018

Job No.: 60533438

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

© AECOM Australia Pty Ltd (AECOM) (AECOMAECOMAECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety. AECOMAECOMAECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOMAECOMAECOM. AECOMAECOMAECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOMAECOMAECOM's experience, having regard to assumptions that AECOMAECOMAECOM can reasonably be expected to make in accordance with sound professional principles. AECOMAECOMAECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Quality Information

Document Submissions Report
60533438

Ref p:\cbr\60533438\4. tech work area\4.3\3.0 draft\submissions
report\submissions report_rev02\submissions report_access road and
dudley street upgrade_rev.02.docx

Date 23-Oct-2018

Prepared by Danica Tagaza

Reviewed by Richard Farmer

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
1	19-Oct-2018	Draft	Cameron Granger Project Manager	Signed in original
2	23-Oct-2018	Final	Cameron Granger Project Manager	

Table of Contents

Glossary and abbreviations	i
Executive Summary	ii
1.0 Introduction	1
1.1 Background	1
1.2 Review of Environmental Factors (REF)	4
1.3 EPBC Act Controlled Action Assessment	4
1.4 PD Act Section 211 Draft EIS Exemption Application	4
1.5 NCA Works Approval	5
1.6 Submissions Report	5
2.0 Consultation	5
2.1 EPBC Act consultation	5
2.2 PD Act Section 211 Draft EIS Exemption consultation	6
3.0 EPBC Act submissions	6
3.1 Consideration and response to community submissions	6
4.0 PD Act Section 211 submissions	23
4.1 Consideration and response to community submissions	23
4.2 Consideration and response to entity submissions	26
5.0 Future consultation	27
6.0 Conclusion	27
7.0 References	29

List of Figures

Figure 1	Project layout and surrounding environment (<i>subject to detailed design</i>)	2
Figure 2	Proposed works area and indicative construction compound	3

List of Tables

Table 1	Responses to community submissions made under the EPBC Act preliminary documentation assessment process	7
Table 2	Corresponding EPBC and Section 211 submission numbers	23
Table 3	Responses to community submissions made under the PD Act Section 211 EIS Exemption process	24
Table 4	Responses to entity submissions made under the PD Act Section 211 draft EIS Exemption process	26

Glossary and abbreviations

Term	Meaning
ACT	Australian Capital Territory
ACTXXX	Submissions made under the PD Act Section 211 EIS Exemption public display period
AECOM	AECOM Australia Pty Ltd
CBP	Canberra Brickworks Precinct
DOEE	Commonwealth Department of Environment and Energy
EPBC Act	Commonwealth <i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EPBCXXX	Submissions made under the EPBC Act public display period
EIS	Environmental Impact Statement
EPSDD	Environment, Planning and Sustainable Development Directorate
ESCP	Erosion and Sediment Control Plan
GSM	Golden Sun Moth
MNES	Matters of National Environmental Significance
NCA	National Capital Authority
Novar Street roundabout	The roundabout intersection of Dudley Street / Novar Street / Adelaide Avenue off-ramp / Kent Street, referred to in this report as Novar Street roundabout
NTG	National Temperate Grassland
Offset	Measures that compensate for the residual impacts of an action on the environment, after avoidance and mitigation measures are taken.
PD Act	<i>ACT Planning and Development Act 2007</i>
Project	The construction and operation of the Access Road and Dudley Street Upgrade
Proponent	The company that has put forward the Project for development, in this instance the ACT Government
REF	Review of Environmental Factors
SLA	Suburban Land Agency
TCCS	Transport Canberra and City Services
TEC	Threatened Ecological Community
YUC	Yarralumla Uniting Church

Executive Summary

Overview of the Access Road and Dudley Street Upgrade

The ACT Government is the Proponent for the delivery of an Access Road and Dudley Street Upgrade (the 'Project'), which will provide improvements to Dudley Street to allow it to safely service the current (and proposed) traffic levels and to provide the publically funded access to service the proposed Canberra Brickworks Precinct development area.

Review of Environmental Factors

The ACT Government, as the Proponent for the Project, has undertaken a Review of Environmental Factors (REF) to assess a range of environmental and social impacts associated with the Project and has been prepared to address the requirements of:

- Commonwealth Department of Environmental and Energy (DOEE) request for additional information required for its assessment under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Referral 2017/8072) received on December 2017
- Environmental Planning and Sustainable Development Directorate (EPSDD) requirements for EIS Exemption in accordance with Section 211 of *Planning and Development Act 2007* (PD Act) and other relevant legislation
- National Capital Authority (NCA) Works Approval.

EPBC Act assessment under preliminary documentation

A referral was submitted to the DOEE under the EPBC Act due to the potential significant impacts to Matters of National Environmental Significance (MNES). Following review of the referral, the DOEE advised the ACT Government that it considered the Project to be a 'controlled action' in accordance with Section 75 of the EPBC Act and requires assessment under preliminary documentation.

The preliminary documentation by which the Project will be assessed, which includes the REF, is required to be published for public consultation on the potential impacts of the proposed action for a period of 10 business days and during this time third parties are welcome to comment on the Project.

The preliminary documentation was made available for comment from Thursday 13 September to Thursday 4 October 2018. During this time 12 submissions were received.

PD Act Section 211 draft EIS Exemption application

An Environmental Impact Statement (EIS) is required for any development application in the impact track under the PD Act, unless an EIS exemption has been applied for and is granted by the Minister for Planning and Land Management. The REF was provided for the information of EPSDD as supporting documentation for a request for an exemption from requiring an EIS for the development of the Project.

In deciding whether to grant an EIS exemption, the Minister must consider any submissions received during the consultation period (a minimum of 15 business days) for the draft EIS exemption application. Any public submissions which are received are published and provided to the Proponent. From there, the Proponent lodges a revised application, considering any community submissions made as well as entity comments made within the consultation period.

The draft EIS exemption application was made available for comment from Monday 17 September to Monday 8 October 2018. During this time five community submissions and 10 entity submissions were received.

Purpose of this report

The purpose of this report is to provide a response to the submissions received as part of the public exhibition of the preliminary documentation for the assessment of the controlled action under the EPBC Act and for the community and stakeholder submissions received as part of the public exhibition of the draft EIS exemption application under Section 211 of the PD Act.

Conclusion

This report documents the issues identified in the submissions received during the public exhibition of the preliminary documentation to be assessed under the EPBC Act and the display of the draft EIS exemption application to be assessed under Section 211 of the PD Act and outlines the ACT Government's responses to these issues. Most of the community submissions were concerned about:

- the broader traffic network including use of the Project to access local roads in Yarralumla and the need to focus on other areas of congestion within the road network as a priority
- impact to biodiversity specifically to the Golden Sun Moth and Natural Temperate Grasslands
- safety issues that may arise as a result of the Project design and the lack of safe routes that prioritise pedestrians (e.g. raised pedestrian crossings and traffic lights).

1.0 Introduction

1.1 Background

The Australian Capital Territory (ACT) Government is committed to making it easier to get around Canberra by delivering an integrated public transport network and better road infrastructure. Investing in roads provides more transport options for Canberrans and improves the safety for road users.

The ACT Government is responsible for delivering an Access Road and Dudley Street Upgrade (the 'Project') to provide improvements to Dudley Street to allow it to safely service the current (and proposed) traffic levels and to provide the publically funded access road to service the proposed Canberra Brickworks Precinct development area.

Dudley Street provides a link from north western Canberra to the suburbs of Yarralumla and Deakin. It connects Cotter Road to the roundabout intersection of Dudley Street / Novar Street / Adelaide Avenue off ramp / Kent Street (Novar Street roundabout). A traffic assessment undertaken in 2016 determined that Dudley Street is functioning at capacity under existing traffic use conditions. Upgrades are required to allow Dudley Street to operate safely and to meet the design requirements for a 'major collector road'.

The Canberra Brickworks Precinct is located in the central Canberra suburb of Yarralumla, approximately five kilometres from the Canberra Central Business District (CBD). The Canberra Brickworks Precinct is proposed to be developed into around 380 residential dwellings and would repurpose a highly valued historical amenity. A new Access Road is required to service the Canberra Brickworks Precinct from Dudley Street and is a predevelopment requirement. The development of the Canberra Brickworks Precinct is not part of this Project would be undertaken as part of a separate Proposal (by the DOMA Group).

A feasibility design, concept design, preliminary sketch plan and detail design have been developed for the Project which have identified improvements for Dudley Street and proposed an alignment for the new Access Road to service the Canberra Brickworks Precinct, including a new intersection from Dudley Street. The Project has been optimised during each of these design stages to minimise ecological and community impacts, while meeting design objectives and road design requirements.

The key features of the Project, as shown in Figures 1 and 2, include:

- upgrading Dudley Street
- construction of a new roundabout intersection between Dudley Street and the new Access Road
- construction of a new Access Road travelling north from the new roundabout intersection on Dudley Street to the proposed Canberra Brickworks Precinct
- off road shared path to the north of Dudley Street
- provisions to maintain pedestrian access along the Uriarra Track, including a minor diversion to provide sight distance and a pedestrian refuge for safe crossing
- ancillary works including utilities diversion and/or relocation, earthworks, drainage modifications, provision of new street lighting, upgrades to kerbs and landscaping.

There is a commitment for the Project to be completed prior to the development of the Canberra Brickworks Precinct so that it can provide access for estate development construction vehicles, including decontamination works. This would negate the need for construction vehicles to access the estate development via the residential street network.

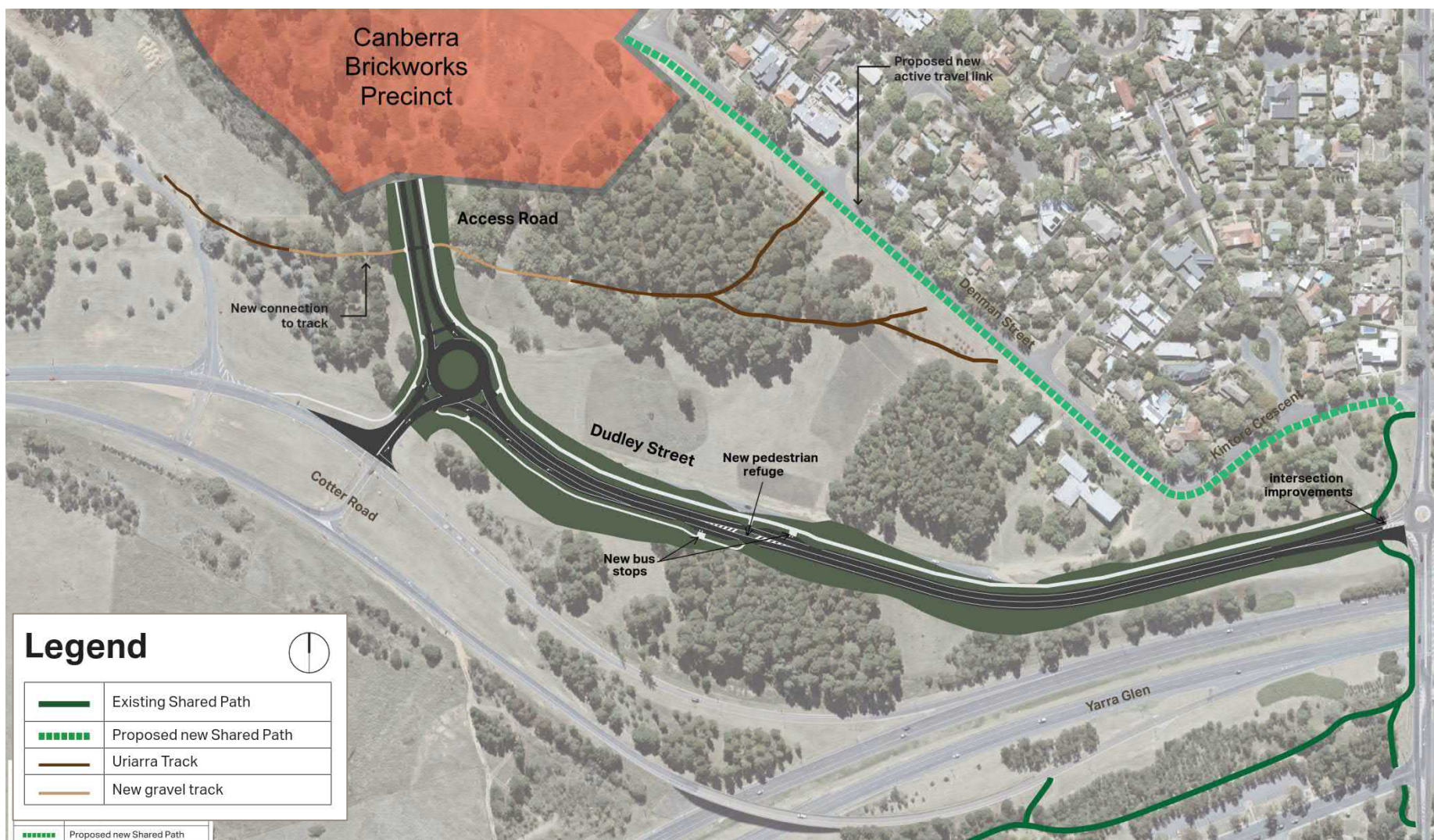


Figure 1 Project layout and surrounding environment (subject to detailed design)

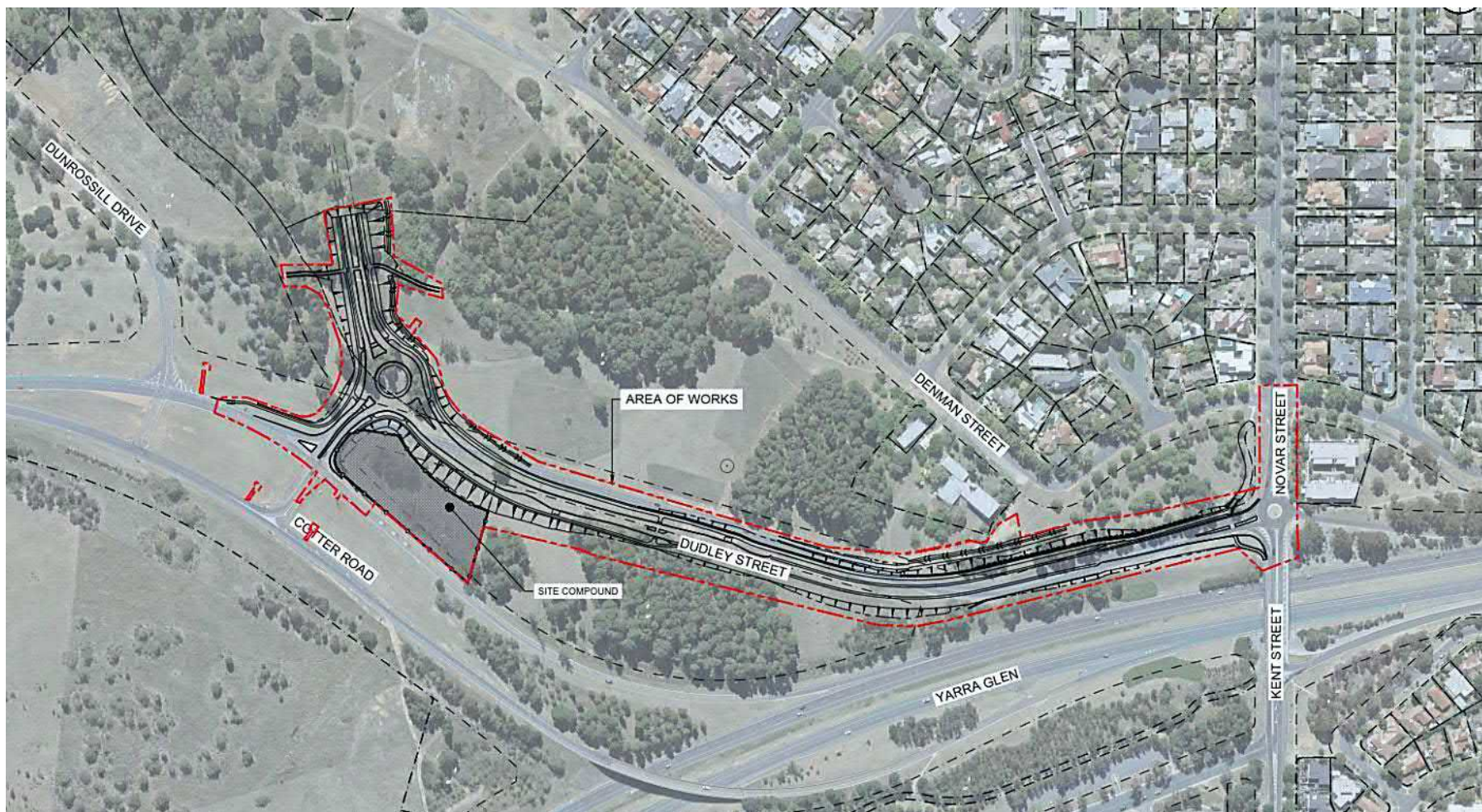


Figure 2 Proposed works area and indicative construction compound

1.2 Review of Environmental Factors (REF)

A Review of Environmental Factors (REF) has been prepared for the Project by AECOM Australia Pty Ltd (AECOM) on behalf of the ACT Government. The REF assesses a range of environmental and social impacts associated with the Project and has been prepared to address the requirements of:

- Commonwealth Department of Environmental and Energy (DOEE) request for additional information required for its assessment under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Referral 2017/8072) received on December 2017
- Environmental Planning and Sustainable Development Directorate (EPSDD) requirements for EIS Exemption in accordance with Section 211 of *Planning and Development Act 2007* (PD Act) and other relevant legislation
- National Capital Authority (NCA) Works Approval.

As the alignment of the Project falls under different administrative authorities, not all components of the Project would require the same level of statutory and development assessment consideration. To meet the various levels of development assessment that have been identified, a comprehensive assessment of the overall Project has been prepared which assesses the impacts of the Project on both land managed by the NCA and the ACT Government, and to support the Commonwealth requirements under the EPBC Act.

1.3 EPBC Act Controlled Action Assessment

A referral was submitted to the DOEE under the EPBC Act due to the potential significant impacts to Matters of National Environmental Significance (MNES) including:

- the critically endangered golden sun moth (GSM)
- natural temperate grassland (NTG) of the south eastern highlands, a threatened ecological community (TEC).

Following review of the referral, the DOEE advised the ACT Government that it considered the Project to be a 'controlled action' in accordance with Section 75 of the EPBC Act and requires assessment under preliminary documentation. The decision was based on the relevant controlling provisions within the Act, which for this Project are:

- Threatened ecological communities and threatened species (Section 18 and 18a).

As a consequence, the Project requires assessment and approval by the Commonwealth Minister of Environment and Energy (or delegate) under the EPBC Act, before it can proceed.

The preliminary documentation by which the Project will be assessed, which includes the REF, is required under subsection 95A(3) of the EPBC Act to be published for public consultation on the potential impacts of the proposed action. The information was made available for comment for a period of at least 10 business days.

Public comments were sent to the ACT Government for an opportunity to address issues raised. From there, the Proponent's preliminary documentation is revised which takes into account public comments and then provided to the minister to inform the decision to approve, approve with conditions or not approve the proposed action.

1.4 PD Act Section 211 Draft EIS Exemption Application

An Environmental Impact Statement (EIS) is required for any development application in the impact track under section 123 of the PD Act, unless an EIS exemption is granted. A proponent may apply for an EIS exemption for any Project that would trigger an EIS.

Under section 211 of the PD Act, the Minister has discretion to grant an exemption if satisfied that recent studies have adequately addressed the expected environmental impacts of the Project, whether or not the recent studies relate to the particular development Project. The REF was provided for the

information of the EPSDD as supporting documentation for a request for an exemption from requiring an EIS for the development of the Project.

In deciding whether to grant an EIS exemption, the Minister must consider any submissions received during the consultation period for the draft EIS exemption application. The draft EIS exemption application undergoes a public consultation period for a minimum of 15 business days. Any public submissions which are received are published and provided to the Proponent. From there, the Proponent lodges a revised application, considering any community submissions made as well as entity comments made within the consultation period.

1.5 NCA Works Approval

NCA Works Approval requirements have not been discussed in this report. As per NCA requirements, the NCA Works Approval is to be submitted following an assessment decision from the DOEE.

1.6 Submissions Report

This report has been prepared to provide a response to the submissions received as part of the public exhibition of the preliminary documentation for the assessment of the controlled action under the EPBC Act as well as the submissions received as part of the public exhibition of the draft EIS exemption application under Section 211 of the PD Act. This Submissions Report sets out to:

- summarise issues raised in all submissions received
- respond to these issues and provide further assessment as required.

This Submissions Report will be provided to the DOEE and EPSDD as part of the assessment processes.

2.0 Consultation

During the development of the REF various community and stakeholder activities occurred including:

- several meetings with individual key stakeholders including the Suburban Land Agency (SLA), Yarralumla Uniting Church, NCA, DOEE, utilities authorities, DOMA Group, SEE Change, Walter Burley Griffin Society, Pedal Power ACT and the Yarralumla Residents Association
- inter-directorate discussions between Environment Planning and Sustainable Development Directorate (EPSDD), Chief Minister, Treasury and Economic Development Directorate (CMTEDD) and Transport Canberra and City Services (TCCS)/Transport Canberra
- community information session on 28 November 2017 at the Yarralumla Uniting Church.

2.1 EPBC Act consultation

The preliminary documentation and the notice inviting public comment was placed on public exhibition from Thursday 13 September 2018 to Thursday 4 October 2018 in the following locations:

- Woden Library, Corinna Street and Furzer Street, Phillip ACT 2606
- Environment, Planning and Sustainable Development Directorate; Dickson Shopfront, Ground Floor South, Dame Pattie Menzies House, 16 Challis Street, Dickson ACT 2602
- Department of Environment and Energy, 51 Allara Street, Canberra ACT 2601
- the [Transport Canberra and City Services \(TCCS\) website](http://www.tccs.act.gov.au/roads-paths/current-projects/city-inner-north-and-inner-south/canberra-brickworks)¹.

The notice inviting public comments was advertised in the Canberra Times on the 13 September 2018.

¹ <http://www.tccs.act.gov.au/roads-paths/current-projects/city-inner-north-and-inner-south/canberra-brickworks>

2.2 PD Act Section 211 Draft EIS Exemption consultation

Concurrent with the public exhibition period for the DOEE EPBC Act controlled action assessment process, the draft section 211 EIS exemption application, which included the REF as supporting documentation, was published for public comment on the [EPSDD website](#)² for a period of 15 business days from Monday 17 September to Monday 8 October 2018. Entities were also consulted during this time.

3.0 EPBC Act submissions

A total of 12 submissions were received during EPBC Act public consultation period. Submissions included feedback on a range of issues in relation to the Project, the key issues included:

- impact on golden sun moth (GSM) and natural temperate grassland (NTG)
- limited scope of work
- design of the Project and potential safety issues that may arise.

Yarralumla Uniting Church

During the public consultation period, the one stakeholder provided the ACT Government with three submissions. The first submission requested a meeting with representatives of the ACT Government to gain a more detailed understanding of the Project. A meeting was held between the stakeholder and the ACT Government where the stakeholder provided a list of points of discussion (second submission). During the meeting a number of the stakeholders concerns were discussed and resolved. Following the meeting a third submission was provided to the ACT Government.

3.1 Consideration and response to community submissions

A summary of all issues raised in the submissions and associated responses are provided in Table 1.

²

http://www.planning.act.gov.au/topics/design_build/da_assessment/environmental_assessment/exemption_from_requiring_an_eis_s211/canberra-brickworks-precinct-access-road-and-dudley-street-upgrade

Table 1 Responses to community submissions made under the EPBC Act preliminary documentation assessment process

No.	Submission no.	Issue/s raised	Responses
1	General		
1.1	EPBC004	Concern that the cost of the Project outweighs the benefits to customers.	Traffic counts undertaken in 2015 identified that Dudley Street had daily movements of 7,487 vehicles per day while its design capacity is currently for 6,000 vehicles per day. Upgrades are required to allow Dudley Street to operate safely and to meet the design requirements for a 'major collector road'. Dudley Street is currently only six metres wide and does not have a sealed shoulder to cater for traffic incidents or breakdowns. With the Canberra Brickworks Precinct development and the future development of Molonglo Valley, there will be increasing pressure on Dudley Street which is already at capacity. The Project would increase the width of Dudley Street to 10 metres and would cater for 9,000 vehicle movements per day. Chapter 2 of the REF provides a detailed discussion on the strategic justification and need for the Project, having regard to the objectives of the ACT Government planning strategies and the specific objectives of the Project. Justification for the Design and Construction funding for the project was also the subject of two ACT Government Business Cases compiled in accordance with The Capital Framework.

No.	Submission no.	Issue/s raised	Responses
1.2	EPBC002, EPBC004, EPBC010, EPBC011, EPBC012	Concern that upgrades to the Novar Street roundabout (including signalisation) should take priority over the Project or be included as part of the Project, and that road connections in the area require more substantial works to improve traffic flow than proposed as part of the Project.	Refer to the response 1.1 for the justification for the Project. As noted in Section 7.1.3 of the REF, traffic modelling of the Novar Street roundabout and Kent Street / Denison Street intersection identifies that these intersections are near capacity. The increased traffic demand on Dudley Street in the next 10 years (e.g. through the development of Molonglo) would put additional pressure on these intersections. Upgrades to these intersections are included on the TCCS future infrastructure upgrade programs and are currently being considered in the 2019/20 budget process.
1.3	EPBC009, EPBC011	Concern that the Project is being progressed in isolation of the work to upgrade the Novar Street roundabout to improve walking and cycling safety.	Refer to response 1.2 above. There are currently no pedestrian or cycling facilities on Dudley Street. The Project will promote active travel through the use of on-road cycle paths and off-road shared paths. The off-road shared Project will provide a new access for pedestrians and cyclists through the area. The on-road cycle lanes provided will connect to existing cycle lanes on Cotter Road, Adelaide Avenue and Yarra Glen.
1.4	EPBC004, EPBC011	Concern that the Project will become obsolete once the 'Mint Interchange' is built.	The 'Mint Interchange' is on the TCCS future infrastructure upgrade program and will be considered for inclusion in future budgets in the medium term. Upgrades to Dudley Street and the provision of an access road to the Canberra Brickworks Precinct are required, independent of the benefits that would be provided by the Mint Interchange, to meet the Estate Development Code guidelines for a major collector road. Traffic modelling also predicts that there will be increasing pressure on Dudley Street which is already at capacity with the development of the Canberra Brickworks Precinct and the future development of Molonglo Valley,

No.	Submission no.	Issue/s raised	Responses
1.5	EPBC006	A request that a full environmental impact statement should be carried out.	A Referral to the Department of Environment and Energy (DOEE) was submitted for the Project recommending that the proposed action (the Project) be considered a controlled action due to significant impacts on Matters of National Environmental Significance under the EPBC Act. The Minister's delegate determined that the Project was a controlled action and requires assessment under preliminary documentation. The Project requires assessment and approval by the Minister (or delegate) under the EPBC Act, before it can proceed. Territory Planning approvals, including an section 211 exemption from an EIS, are being progressed as a separate process.
1.6	EPBC011	Concern about the long-term sustainability of Canberra for future generations in relation to the state of planning for the Canberra Brickworks.	This is considered outside the scope of this project and will be addressed by the Canberra Brickworks Precinct EPBC submission and development approval process.
1.7	EPBC011	Concern that the ACT Government has made commitments to sustainability, whole-of-government integrated planning but that these commitments have not been applied to this Project.	Section 4.2.3 of the REF describes the Statement of Strategic Direction that forms part of the Territory Plan and includes Principles for Sustainable Development. Table 7 of the REF presents a summary of the relevant Sustainable Development Principles, including environmental, economic and social sustainability principles, and how they have been addressed within the Project. The preferred design option has been selected to maximise accessibility and transport efficiency, reduce energy consumption, support the preferred pattern of development, promote safety and safeguard environmental quality. Section 5.2 of the REF describes the stakeholder engagement that has been carried out during the development of the Project, including consultation with the Suburban Land Authority who is responsible for the Canberra Brickworks Precinct. Further consultation with ACT Government agencies has been undertaken as part of the Section 211 application submitted for this Project. See Section 4.0 for further details.

No.	Submission no.	Issue/s raised	Responses
1.8	EPBC011	Request that adaptation to a changing climate must be factored into surface infrastructure and transport (e.g. via the location of services and providing shelter at stops, to minimise people's exposure to heat, rain and wind).	Section 7.14.3 of the REF describes the climate change adaptation principles to be incorporated during the detailed design and operation of the Project. It is noted that the provision of shelters is anticipated to occur when the public transport network in the area becomes operational.
1.9	EPBC005	Enquiry into whether the Project in any way will affect the Manse property facing Denman Street.	It is not anticipated that the Project will have an impact on the Manse property.
2	Construction		
2.1	EPBC005	Concern about construction activities disturbing quiet enjoyment.	Mitigation measures to reduce the noise and vibration impacts are outlined in Section 7.5.4 of the REF. Measures to mitigate potential impacts during construction would be further developed as part of the Construction Environmental Management Plan (CEMP) to be implemented prior to construction. EPSDD are responsible for the CEMP approval and TCCS will be responsible for ensuring implementation.
2.2	EPBC005	Concern that the Uriarra Track will become inaccessible during construction and the timing of this.	Access along the Uriarra Track would be maintained during construction. A temporary diversion of the Uriarra Track would be provided for the duration of construction to encourage foot and bicycle traffic to avoid the golden sun moth habitat areas.

No.	Submission no.	Issue/s raised	Responses
2.3	EPBC005	Concern that the Contractor would use the vacant land associated with the Yarralumla Uniting Church for construction activities such as dumping of spoil, parking, etc.	Works in this area are limited to utilities relocations. A temporary site fence would be installed on the boundary of the construction areas to restrict construction activities to be within the proposed work area (see Figure 2).
2.4	EPBC005	Request to ensure that construction work will not be carried out on Sunday.	Construction work would generally be carried out during standard construction hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturday). Any work outside these hours would only be undertaken if approved by the ACT Government in consultation with the potentially affected sensitive receivers. Any such agreement shall be documented, a copy kept on-site and made readily available for inspection throughout the duration of the work. Works outside these hours may be required in an emergency to avoid loss of lives, property and/or to prevent environmental harm.
2.5	EPBC005	Request to ensure that no construction vehicles are parked on the footpath outside Denman Street frontage of the Yarralumla Uniting Church or on any Church land.	The Project would not impact on the Yarralumla Uniting Church car parking facilities during construction. Construction worker vehicles would be accommodated within the construction compound and/or Project area (see Figure 2). There would be no construction vehicle parking within local roads.
2.6	EPBC005	Enquiry into whether construction traffic would use Denman Street to gain access/egress to/from the Project site.	Access to the work area would be via Dudley Street. Construction worker vehicles would be accommodated within the Project area (see Figure 2).
2.7	EPBC005	Enquiry into when construction work would begin and the estimated completion date.	Subject to the required approvals, it is anticipated that construction will begin in 2019 and take around 12 months to complete.
2.8	EPBC005	Enquiry into when the location of the second construction compound would be finalised.	There is only one construction compound planned for the Project (see Figure 2).

No.	Submission no.	Issue/s raised	Responses
2.9	EPBC005	Enquiry into where the new fencing would be constructed.	As part of the Project, appropriate vehicle barrier fencing would be constructed to assist in preventing vehicles from accessing the Yarralumla Uniting Church via an informal access off Dudley Street. This would improve traffic safety and reduce impacts to the adjoining environment. The formed access from Kintore Crescent would not be impacted by the Project.
2.10	EPBC005	Enquiry into whether pipes/services running under unleased Territory land would be affected and how would they be protected.	Section 7.12 of the REF describes the potential impacts on existing and proposed utilities/infrastructure within Project area. There are numerous electrical, drainage, communication and signalling services within the footprint of the Project. Ongoing consultation between the Contractor and the property owners/affected stakeholders to provide sufficient notifications of any interruptions to services throughout the construction period. Existing unaffected services would be kept safe during construction.
2.11	EPBC005	Request to ensure liaison within the Yarralumla Uniting Church to ensure that noise, vibration and dust will be minimised during funerals or like events and that contract conditions will oblige the Contractor to take all reasonable precautions to minimise noise dust and vibration.	Refer to responses 2.1 and 2.4.
3	Traffic and transport		

No.	Submission no.	Issue/s raised	Responses
3.1	EPBC003, EPBC005, EPBC010	Enquiry into whether vehicles travelling along Cotter Road will be prevented from using the new access road as access to Denman Street and other Yarralumla residential streets, such as through providing physical barriers.	The configuration of the internal road network within the Canberra Brickworks Precinct will be determined by the Suburban Land Authority and the nominated contractor as part of the Estate Development Plan, noting that there is no through road planned through the Canberra Brickworks Estate to Yarralumla. Development of the Canberra Brickworks Precinct is likely to generate about 3,000 vehicles per day when fully developed. It is anticipated that around 80% of this traffic or 2,400 vehicles per day would access the Precinct via Dudley Street. The remaining traffic (about 600 vehicles per day) would access via Denman Street/Kintore Crescent.
3.2	EPBC004	Concern around the voracity of the road traffic projections and that the stakeholder believes that the Project would increase congestion at the entrance of Dunrossil Drive under the current plan.	As noted in Section 7.1 of the REF, detailed traffic counts and traffic modelling were undertaken to model and further understand the implications of the Project on the local and regional traffic network. The Project itself is unlikely to affect the amount of traffic using Dudley Street and it would assist with traffic movements along Dudley Street in the short and medium term. No changes to traffic movements at the entrance to Dunrossil Drive have been identified in the Access Road and Dudley Street Upgrade Traffic and Transport Impact Assessment (AECOM, 2017),
3.3	EPBC004, EPBC009, EPBC011, EPBC012	Concern that the new Dudley Street roundabout is not necessary and that a signalised T-intersection would meet Project objectives while having a smaller construction footprint.	As noted in Section 2.3.4 of the REF, options for the intersection of the access road and Dudley Street were assessed during the feasibility study (AECOM, 2016), Concept Design (Cardno, 2016) and Preliminary Sketch Plan design (AECOM, 2018). This included various options including a T-intersection and a roundabout option. The options were modelled using the intersection modelling program SIDRA Intersection 7.0, to determine their operational performance as a function of the adjacent intersections. Following the initial feasibility study the concept design and preliminary sketch plan designs concluded that the roundabout arrangement provided optimum intersection operational efficiency while minimising impacts to MNES.
4	Biodiversity		

No.	Submission no.	Issue/s raised	Responses
4.1	EPBC004	Concern that the 5.58 ha Project area is excessive relative to the 16 ha footprint of the Canberra Brickworks Precinct that the new access road will service. A smaller footprint would reduce the environmental impact.	The Canberra Brickworks Precinct development and the Access Road and Dudley Street Upgrade (the Project) are two separate Projects (though it is noted that they are interconnected). The existing traffic volumes and the Roads ACT Road Hierarchy map prescribe that Dudley Street is a 'major collector road'. In order to meet current Estate Development Code guidelines for a major collector road, the typical cross section of Dudley Street must meet a minimum carriageway width of 10 metres. Dudley Street is currently six metres wide and does not have a sealed shoulder. Upgrades to Dudley Street are required independent of the need for providing access to the proposed Canberra Brickworks Precinct development.
4.2	EPBC004, EPBC011	Suggestion that environmental impact can be mitigated by eliminating or downsizing the Dudley Street portion of the Project.	As noted in Chapter 2 of the REF, upgrades to Dudley Street are required independent of the need for providing access to the proposed Canberra Brickworks Precinct development. The design of the Project has been developed over a number of design stages to form the preferred design which meets the project objectives and balancing between cost/operational functionality and minimising environmental/community impacts were feasible and reasonable. A number of improvements to the design which have been implemented to avoid or minimise impacts to MNES as listed in Section 2.4 of the REF.
4.3	EPBC004, EPBC006, EPBC011	Concern that the Project will have a significant impact on the Golden Sun Moth (GSM) and Natural Temperate Grassland (NTG).	Section 7.2 of the REF includes a summary of the ecological Impact Assessment Report (Umwelt, 2017) that has been undertaken for the Project. Section 7.2 also presents detailed mitigation measures to be implemented to avoid/minimise potential impacts to biodiversity, including an Offset Strategy to be implemented to compensate for the loss of matters of national environmental significance (MNES) protected under the EPBC Act.

No.	Submission no.	Issue/s raised	Responses
4.4	EPBC004	Request that there be a greater commitment to the rehabilitation of the Project site.	Section 7.2.4 of the REF describes mitigation measures that will minimise or remove identified biodiversity impacts that have been determined with a view primarily to protecting potential threatened species within the Project area. This includes revegetating disturbed areas with 'C3' native grasses as appropriate.
4.5	EPBC004, EPBC005, EPBC006, EPBC011	Concern that the proposed offset site is inappropriate and/or that offset proposals are often problematic (including in terms of keeping track of, and maintaining, cumulative offsets well into the future).	The suitability of the proposed offset site has been assessed against the current Commonwealth and ACT Offset policies which includes using the Commonwealth's offset calculator. Section 7.2.5 of the REF and Chapter 6.0 of the Offset Strategy describes the suitability of the proposed offset site. Section 5.0 of the Offset Strategy describes the responsibilities for the management of the offset, including who will manage, monitor and report on the offsets under the EPBC Act, as well as funding for ongoing management. Funding for the offset site, establishment of infrastructure such as fencing and remediation of the site was secured in a 2018/19 budget allocation <i>Canberra Brickworks Precinct Environmental Offsets</i>.
4.6	EPBC004, EPBC011	Concern that the targets for future growth of the GSM are inadequate.	As noted in Chapter 6.0 of the Offset Strategy, the target has been developed in consultation with the ACT Government Conservation and Research Branch, in addition to the future land manager of the site, and is considered to have a moderate to high likelihood of being successful. Setting realistic targets will help to ensure the commitment can be achieved.
4.7	EPBC004	Request that pedestrian access from Denman Street to the proposed bus stops be incorporated into the Project to mitigate further impact to GSM and NTG.	Access from Denman Street to the proposed bus stops would be provided via the proposed off-road shared paths along the Access Road and Dudley Street. As noted in Section 2.4 of the REF, the Project has been designed to minimise impact to MNES where possible

No.	Submission no.	Issue/s raised	Responses
4.8	EPBC010	Request for further mitigation efforts to be made to ensure protection of GSM and NTG.	Refer to response 4.3, 4.4 and 4.7.
4.9	EPBC011	Concern that the proposed design does not deliver on minimising disturbance to the Canberra Brickworks Precinct's current terrain, soil structure and hydrology to ensure protection of the GSM and NTG.	A feasibility design, concept design, preliminary sketch plan and detail design have been developed for the Project which have identified improvements for Dudley Street and proposed an alignment for the new Access Road, including a new intersection from Dudley Street. The Project has been optimised during each of these design stages to minimise ecological and community impacts, while meeting design objectives and road design requirements. This has included optimising the gradient of the proposed Dudley Street upgrade to more closely match the existing ground level and therefore minimise the size of the embankments required by the proposed design (therefore reducing the footprint of the Project and ground disturbance). Section 7.2 assesses the impacts to biodiversity in the area including impacts to GSM and NTG. Section 7.6 and Section 7.7 of the REF describes the soil and geological characteristics of the Project area and the current hydrology, hydrogeology and flooding conditions within the Project area, as well as the changes the Project would have on these values. Mitigation measures are proposed within each of these sections and are summarised in Section 8.2 of the REF.
4.10	EPBC011	Suggestion that destruction of the GSM and NTG can be reduced by reducing the amount of land and habitat disturbed (e.g. ensuring that any upgrade of Dudley Street completely covers the existing roadway, instead of building a new road and paths largely alongside it, having the Project's work storage off-site or in areas not containing NTG or GSM).	The majority of the Project will be built on the existing Dudley Street road reserve as noted in Section 7.7.3 of the REF. The alignment of the Dudley Street Upgrade has been moved south so that the higher quality habitats north of Dudley Street are avoided (while taking into consideration the steep slope on the southern side of Dudley Street). A site construction compound is required for the Project and would be located south of Dudley Street in the western extents of the Project area between Dudley Street and Cotter Road. This location has been selected to minimise environmental impacts, such as traffic/noise impacts and is located within areas of low quality habitat for GSM and NTG.

No.	Submission no.	Issue/s raised	Responses
4.11	EPBC011	It is understood that Yarralumla sites are better habitats for GSM and NTG than the proposed offset site in Mitchell.	Refer to responses 4.4 and 4.5.
4.12	EPBC011	Concern that changing the alignment of the Uriarra Track would require unnecessary earthworks and destruction of the GSM population and habitat.	Section 2.3.6 of the REF describes the process for determining the preferred Uriarra Track modification option. Community feedback was taken into consideration and the preferred option was considered to be a balance between cost and functionality while minimising environmental impact.
5	Noise and vibration issues		
5.1	EPBC004	Request that noise mitigation be provided to the Yarralumla Uniting Church regardless of whether the Project proceeds.	Noted.
6	Safety		
6.1	EPBC004, EPBC010, EPBC011, EPBC012	Safety concerns regarding the intersection of the Uriarra Track and the Access Road as it will require pedestrians to give way to vehicles, contrary to the Canberra Brickworks Precinct objectives. A request was made that a raised pedestrian crossing be installed at this intersection.	The design of the proposed Uriarra Track crossing of the Access Road allows for adequate sight lines (i.e. views of oncoming traffic). The need for a raised pedestrian crossing will be reviewed as part of the final detailed design of the Project.

No.	Submission no.	Issue/s raised	Responses
6.2	EPBC008	Suggestion that zebra crossings be included across all motor vehicle approaches so that the roundabout can be made consistent with the Planning Minister's Statement of Planning Intent which states <i>'The community and stakeholders emphasised the need to adopt a placemaking approach that focuses on pedestrians first, cyclists second, public transport third then private vehicles when planning, designing and managing public spaces and development.'</i>	The need for zebra crossings will be reviewed as part of the detailed design of the Project.
6.3	EPBC009, EPBC011	Request to provide safe routes prioritising pedestrians across roadways by wombat crossing or traffic lights as well as connected and generous, preferably separated, off road paths for walking and cycling. There is concern that wider paths are needed than what is proposed.	As per Section 3.1 of the REF, the Project would include the provision of upgraded bus stops including associated path networks and the provision of an off road shared path north of Dudley Street. Refer to Figure 16 in the REF. The design of the Project meets the required design standards outlined in Section 3.1.3 of the REF.
6.4	EPBC009, EPBC011	Request to include paths to connect bus stops to the following points of interest: • Kent Street (for people accessing the bus stop from Deakin West) • Denman Street • Yarralumla Uniting Church	Refer to response 4.2, 4.9 and 6.3.

No.	Submission no.	Issue/s raised	Responses
6.5	EPBC011	Request to include shared paths connecting the Canberra Brickworks Precinct with other community paths and existing cycling routes.	Refer to response 1.3 and 6.3. It is anticipated that the Canberra Brickworks Precinct would provide connections as the estate development progresses.
6.6	EPBC011	Request for effective traffic management to restrain vehicle speed, deter through traffic and create safe conditions for road users as required under the Estate Development Code.	Refer to response 3.1 and 6.3.
6.7	EPBC012	Concern that the Novar Street roundabout is particularly unsafe and the new Dudley Street roundabout would present risks for people cycling.	Refer to response 6.1, 6.2 and 6.3.
6.8	EPBC012	Concerns regarding the pedestrian refuge proposed at Dudley Street bus stop as it downgrades priority that should be given to people crossing the roads.	Refer to response 6.1, 6.2 and 6.3.
7	Community and stakeholder engagement		
7.1	EPBC009, EPBC010, EPBC011	Concern that there was not enough widespread consultation and that community consultation is being ignored.	As noted in Section 5 of the REF, various stakeholder and community consultation has occurred throughout the development of the Project design. This included a community information session which provided the opportunity for stakeholders and members of the public to discuss the Project with key members of the Project team and representatives of the Suburban Land Authority.

No.	Submission no.	Issue/s raised	Responses
7.2	EPBC007	- Concern that the National Trust has not been consulted as a stakeholder despite contributions to Canberra Brickworks Precinct and a longstanding interest in the site - Concern that there is no response from ACT Heritage regarding the Project. - Concern that Engineers Australia who has identified the former railway easement as an important part of ACT heritage appears to not have been consulted.	As noted in Section 5 of the REF, various stakeholder and community consultation has occurred, including a community information session which provided the opportunity for stakeholders and members of the public to discuss the Project with key members of the Project team and representatives of the Suburban Land Authority.. A response from the ACT Heritage Council was received as part of the Section 211 EIS draft Exemption application process. See Table 4 for a summary of the submission received from ACT Heritage Council. As noted in Section 7.10 of the REF, the Project would not impact on the listed curtilage of the three sites (Yarralumla Brickworks, Westbourne Woods and Yarralumla Brickworks Railway Remnants) listed on the ACT Heritage Register located north of the Project. Mitigation measures are proposed to minimise impacts to potential heritage items including an unexpected finds procedure in the event that the Project identifies previously unidentified heritage items.
8	Cultural values		
8.1	EPBC007	Concern that the former railway easement which is a heritage listed place appears to have not been considered or commented on followed by a request to consider options for a lesser impact on the railway.	Refer to response 7.2.
8.2	EPBC007	Request that cultural landscape and heritage values need to be considered further before proposal proceeds.	An Aboriginal cultural heritage assessment was undertaken to determine the Aboriginal heritage values of the Project area, the results are presented in Section 7.9 of the REF. A Non-Aboriginal cultural heritage assessment was also undertaken to determine the non-Aboriginal heritage values of the Project area, the results are presented in Section 7.10 of the REF. Mitigation measures are proposed to minimise impacts to potential heritage items, as noted in Section 8.2 of the REF. This includes an unexpected finds procedure in the event that previously unidentified heritage items are found.

No.	Submission no.	Issue/s raised	Responses
8.3	EPBC009, EPBC011	Request that the current alignment of the Uriarra Track be maintained - users value this historic alignment and maintaining this will continue to encourage walking.	Refer to responses 2.2, 4.12 and 6.1.
9	Canberra Brickworks Precinct objectives		
9.1	EPBC004, EPBC009, EPBC010, EPBC011	Concern that the Project compromises the Objectives of the Canberra Brickworks Precinct.	The Project supports the development of the Canberra Brickworks Precinct through providing access from the development site to the broader road network. It is also noted that this a separate project to the Canberra Brickworks Precinct and therefore the Canberra Brickworks Precinct objectives may not be appropriate and/or relevant to this Project. Section 2.1.3 of the REF describes the Project-specific objectives for the Access Road and Dudley Street Upgrade.
9.2	EPBC009, EPBC011, EPBC012	Concern that the Project does not demonstrate how active and public transport attractive, safe and accessible choice in the Precinct (Objective 2g)	Refer to response 6.3.
9.3	EPBC010	Concern that the Access Road does not prioritise the Uriarra Track as stated in Objective 4a.	Refer to response 4.12.
9.4	EPBC010, EPBC011, EPBC012	The safety of the pedestrians and cyclists should be a priority - apply the road user hierarchy identified in the ACT Active Travel Framework.	Refer to responses 6.1, 6.2 and 6.3.

No.	Submission no.	Issue/s raised	Responses
9.5	EPBC010	Concern that the location of the bus stops is not conducive to public transport being used by residents or visitors to the CBP as per Objective 2g.	Refer to response 6.3. The location of the bus stops complies with the Estate Development Code where at least 90 per cent of dwellings proposed for the estate are within 800 metres of a bus stop on an existing or proposed frequent network.
9.6	EPBC011	Concern that there is no mention of the Canberra Brickworks Precinct objectives or Community Parameters Perspective Report in REF.	Refer to response 9.1.
9.7	EPBC011	Concern that the Project does not minimise disturbance to current terrain, geological features and landscape scale assets and enhance the woodlands as significant assets and as a windbreak and sound barrier (Objective 3b).	Refer to responses 4.9 and 9.1.
9.8	EPBC011	Concern that the Project does not retain and improve the continuous woodland loop, part of which is the Uriarra Track, in its natural state without requiring people who are walking/cycling to cross a primary access road (Objective 4a).	Refer to responses 2.2, 4.12 and 6.1.
9.9	EPBC011	Concern that the Project does not demonstrate ongoing engagement with the community, including the Community Panel (Objective 8).	The Community Panel was established for the Canberra Brickworks Precinct project, not this Project. Refer to responses 9.1 and 7.1. Section 5.4 of the REF also describes ongoing consultation to be undertaken as part of the Project, including during Project implementation.

4.0 PD Act Section 211 submissions

A total of five community submissions and 10 entity submissions from ACT Government stakeholders were received during the PD Act Section 211 draft EIS exemption public consultation period and are discussed further in the following sections.

4.1 Consideration and response to community submissions

Five community submissions were received during the PD Act Section 211 draft EIS exemption public consultation period.

Four of these submissions were also submitted under the EPBC Act and therefore presented the same concerns as those discussed in Table 1. To prevent duplication of information, these issues and responses have not been repeated in the section however the corresponding Section 211 and EPBC Act submissions have been presented in Table 2.

Table 2 Corresponding EPBC and Section 211 submission numbers

Section 211 Submission Number	EPBC Act Submission Number
ACT002	EPBC004
ACT003	EPBC010
ACT004	EPBC006
ACT005-1 and ACT005-2	EPBC011

Additional issues that were raised in the Section 211 draft EIS exemption community submissions and responses are presented in Table 3.

Key issues raised in community submissions include:

- impact on golden sun moth (GSM) and natural temperate grassland (NTG)
- design of the Project and potential safety issues that may arise
- disturbance to amenity of the Yarralumla area.

Table 3 Responses to community submissions made under the PD Act Section 211 EIS Exemption process

No.	Submission no.	Issue/s raised	Responses
1	General issues		
1.1	ACT011, ACT004, ACT005-1	Object to the Project for EIS exemption.	Noted.
1.2	ACT001	Concern that the clearing of trees and other vegetation will cause loss of amenity, loss of habitat, and increased erosion and water runoff, temporary diversion of a section of the Uriarra Track and will cause permanent loss of an area of public open space.	Section 7.0 of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the Project and Section 8.0 of the REF identifies how the environmental impacts identified in Section 7.0 are to be managed.
1.3	ACT005-1	The REF does not provide the full range of alternatives considered in developing the proposal. In particular, it does not include the signalised simple T intersection proposed by community groups during discussions.	Section 2.3 of the REF assesses the different options that were considered for the Project. The option of a signalised T-intersection (Option C9) is discussed. Section 2.4 of the REF presents the justification for the preferred option.
2	Soil and water		
2.1	ACT001	Concern that the clearing of trees and other vegetation will cause increased erosion and water runoff that will inevitably end up in Lake Burley Griffin.	Section 7.6.4 of the REF presents mitigation measures to manage soil erosion during and following construction. A progressive Erosion and Sediment Control Plan (ESCP) would be developed prior to construction and developed as site conditions change. The ESCP would be included as part of the Construction Environmental Management Plan.

No.	Submission no.	Issue/s raised	Responses
3	Socioeconomic		
3.1	ACT001	Concern that the Project has the potential to impact the suburb's quiet environment through the construction of a high traffic volume road.	The Project itself is unlikely to affect the amount of traffic using Dudley Street and it would assist with traffic movements along Dudley Street in the short and medium term. Section 2.0 of the REF discusses the need for the Project, including upgrading Dudley Street to allow it operate safely and meet the design requirements for a major collector road. A Traffic and Transport Impact Assessment (AECOM, 2017) was undertaken for the Project, which included the collection of traffic counts and traffic modelling undertaken to understand the implications of the Project on the local and regional traffic network. Section 7.5.3 of the REF describes the potential noise impacts of the Project during construction and operation and Section 7.5.4 presents mitigation measures to be implemented to minimise these impacts.

4.2 Consideration and response to entity submissions

Ten entity submissions were received during the PD Act Section 211 draft EIS exemption public consultation period. A summary of the issues raised in the entity submissions and associated responses is provided in Table 4.

Table 4 Responses to entity submissions made under the PD Act Section 211 draft EIS Exemption process

Entity	Summary of issue/s	Response
Transport Canberra and City Services (TCCS) (as the land custodian)	No comments.	Noted.
Conservator of Flora and Fauna	No comments.	Noted.
ACT Heritage Council	No comments in relation to the Project being assessed. Advice provided regarding the heritage considerations for the future extension of the access road was provided.	Noted. Advice provided to Suburban Land Authority in their role leading the development of the Canberra Brickworks Precinct for information.
Health Protection Service	No comments. Support for implementation of an Unexpected Finds Protocol in managing contamination encounters.	Noted.
Parks and Conservation Service (as land custodian)	No comments in relation to the Project being assessed. Request for future and consultation for the preparation of conditions of approval as they relate to the management of the offset.	Noted. The ACT Government are working with Parks and Conservation as part of the development of the offset site including the Offset Strategy.
ACT Environment Protection Authority	All contamination assessments and remedial works associated with the development of the former Brickworks site and related infrastructure are subject to an independent audit. The adequacy of the AECOM contamination assessment included in the documentation must be reviewed by the appointed auditor and auditor interim advice provided before the EPA can comment further on the draft EIS exemption application.	The appointed site auditor has reviewed the proposed scope of work and Project documentation and has provided an auditor interim advice as included in Appendix D of the REF.

Entity	Summary of issue/s	Response
Planning Policy	Request for TCCS to ensure that the road is 'futureproofed' and has taken into consideration Light Rail, future likely development in North Curtin and redevelopment of West Deakin. Planning Policy are also interested to know the design interdependencies between the Project and the future 'Mint Interchange' that is under reconsideration.	Refer to response 1.2 and 1.3 in Table 1. The design does not preclude light rail or future developments in North Curtin or West Deakin.
Place Management	No comments.	Noted.
ACT Fire and Rescue	No comments.	Noted.
TCCS (2)	TCCS do not object to removal of trees to facilitate this project as no high quality trees are propose to be removed. However they do note that it would be desirable to realign the Dudley Street Upgrade to retain the larger pine trees on the southern side of the road extension as removing these trees will have a significant impact on the aesthetics of this group of trees and their removal will leave it quite open and exposed to wind throw that could lead to tree failure in the future.	To minimise impacts to Golden Sun Moth and Natural Temperate Grassland (both identified as EPBC Act MNES), impacts to the pine trees on the southern side of Dudley Street Upgrade are required. Moving the road alignment north to avoid impacts to pine trees has greater impacts on the higher quality habitats of GSM and NTG as described in Section 2 of the REF. No changes to the proposal are therefore able to be made.

5.0 Future consultation

Should the Project be approved, the Project team would keep the community and other key stakeholders informed of the progress, including identifying further issues as they arise, and developing additional mitigation measures (as required) to minimise the impacts of the Project. The interaction with the community would be undertaken in accordance with a Community Liaison Plan to be developed prior to the commencement of construction by the Contractor.

6.0 Conclusion

The REF assessment assessed a range of likely environmental and social impacts associated with the construction and operation of the new Access Road and Dudley Street Upgrade.

The Project was deemed to be a controlled action and is currently being assessed under the EPBC Act by preliminary documentation. As part of the assessment, the preliminary documentation, including the REF, is required to be published for public consultation. The preliminary documentation was made available for comment from Thursday 13 September to Thursday 4 October 2018. During this time 12 submissions were received.

Concurrent to this, the ACT Government has applied for an EIS exemption under Section 211 of the PD Act. As part of this process, the draft EIS exemption application is required to be published for public consultation. The draft EIS exemption application, which included the REF, was made available for comment from Monday 17 September to Monday 8 October 2018. During this time 5 community submissions and 10 entity submissions were received.

This report documents the issues identified in the submissions received during the public exhibition of the preliminary documentation to be assessed under the EPBC Act and the display of the draft EIS exemption application to be assessed under Section 211 of the PD Act and outlines the ACT Government's responses to these issues. Most of the community submissions were concerned about:

- the broader traffic network including use of the Project to access local roads in Yarralumla and the need to focus on other areas of congestion within the road network as a priority
- impact to biodiversity specifically to the Golden Sun Moth and Natural Temperate Grasslands
- safety issues that may arise as a result of the Project design and the lack of safe routes that prioritise pedestrians (e.g. raised pedestrian crossings and traffic lights).

7.0 References

AECOM, 2016. *Site Investigation Report (Stage 1)*, Canberra.

AECOM, 2017, *Traffic and Transport Impact Assessment – Access Road and Dudley Street Upgrade*, Canberra.

AECOM, 2018, *Review of Environmental Factors Access Road and Dudley Street Upgrade*, Canberra.

Cardno, 2016. *Concept Design Report – CBP Access Road and Dudley Street Upgrade*. Prepared for Land Development Authority October 2016.

Umwelt, 2017. *Impact Assessment Report, Canberra Brickworks Access Road and Dudley Street Upgrade Area*, Canberra.

Umwelt, 2018, *Offset Strategy Dudley Street Upgrade and Canberra Brickworks Precinct Access Road Construction*, Canberra.